Interview of William (Bill) Norred

Interviewed by:
James L. Pelkey

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Bill Norred: . . . exposure to a "real company" in the data communications business. I cannot remember the name of the guy that founded it. I think he came from Western Union, but this guy George Fritkin would know, and he would be a good source of some of the people your looking for in the real early part, because these guys developed some early modems and early multiplexers. They were certainly pre-ADS, not by much, but they were one of the first start-ups in the data communications business.

Jim Pelkey: You were just commenting on George --

Norred: Fritkin, F R I T K I N.

Pelkey: Who is now at Micom?

Norred: He's at Micom as vice-president of engineering or one of the groups.

Pelkey: And the company you think was Tel-Tec?

Norred: It was definitely Tel-Tec. It was spelled T E L - T E C --

Pelkey: In Silver Springs, Maryland?

Norred: -- and it later became Syntek, S Y N T E K, and I think ultimately it was acquired by Penrol.

Pelkey: That would make sense.

Norred: -- Through that period, and it was after that George came to Micom for a very short period of time. The reason why I know about Tel-Tec is that American Data Systems was actually in negotiations, at one time, to acquire Tel-Tec in its earlier days, and that's where I met George Fritkin. I cannot think of the guy's name who was president.

Pelkey: Maybe George can help me.

Norred: George would be good. It would be a good insight into this, because George has been in the trenches of data communications a number of years before I was.

Pelkey: I'd love to talk to him.

Norred: He knows some of the real roots, because if you go back, there's also another gentleman that I'll mention that you may want to talk to that was also involved, who is one of the characters in our business, a gentleman by the name of Ted Noe. Ted Noe also was tied in with that same group, either by company or friendship. He is no longer with the company, but he founded a company called Arc Communications, which was ultimately acquired by Paradyne. Ted Noe is another one. He lives in Florida -- I'm trying to think of exactly -- I could probably give you a phone number that would reach Ted Noe. I've met over the years and have known for 20 years or so in this business.

Pelkey: I'm really trying to track that '60s period because there is so much -- the modem business was clearly Defense and NASA, but where the multiplexer ideas came from --

Norred: The real multiplexers, the beginning, I really believe that, for all intents and purposes, the first one that was commercially viable was the Tel-Tec, it was a frequency division multiplexer, because when American Data Systems, who I feel was the first company to have a big success in the time division multiplexer. We introduced a character oriented, character interleave multiplexer, and this multiplexer was designed by Art Wilkes, who you, I assume, talked with.

Pelkey: I haven't talked with him yet. He's agreed to sit with me.

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Norred: Ok, because Art Wilkes, when ADS got started, was with Scantlin Electronics, which is now Quotron. They just changed the name. Scantlin was always in the brokerage business in one manner or the other, but when ADS was founded, which was in 1968, somewhere are February through June --

Pelkey: And who were the founders?

Norred: The founders were Art Wilkes, who was the president, myself, I was vice-president of manufacturing, although I took over the engineering side relatively shortly thereafter, and the third gentleman was Robert Schaaf. In fact, if you ever want to talk to Robert, I can give you his number. I still am in communications with Robert Schaaf. Bob was with ADS for about three years. He was the first to leave. Art was the next, and I was the one that stuck it out to the bitter end.

Pelkey: And what prompted you to start the company.

Norred: It was totally a relationship that I had developed with Art Wilkes in college. When Art and I had continued to communicate with each other, and I was in El Paso, and he called me one day and said: "I'm thinking about starting a company. Would you like to participate in it?" I said: "Yes. What are you going to do?" He said: "We're going to make modems and multiplexers," and I said: "What's a modem? And what's a multiplexer?" He and I had communicated somewhat --

Pelkey: So you went to college together.

Norred: We went to college together and were roommates in college.

Pelkey: Then you had been out for a couple of years working?

Norred: I forget what year Art graduated.

Pelkey: Where did you go to college?

Norred: At the time we went it was Texas Western; University of Texas at El Paso. Art left there to go to work on AT&T's management program, and stayed with AT&T until such time as he went to work at Scantlin. I think he was here in Los Angeles, and then went to work for Scantlin.

Pelkey: So that's where he became exposed to the ideas?

Norred: His exposure, to the best of my knowledge, was more related to what he did at Scantlin, I believe, although he went to Scantlin and developed a line of frequency division multiplexers, which was the very beginning. That's when the whole idea of more economic ways of putting multiple data over a phone line -- there was competition, and I want to say Linkirk was that competition that built the frequency division multiplexer, and this guy Ted Noe, he left, or was involved in that other company's frequency division multiplexer, and went and started his own company, which was Arc, in the frequency division multiplexing area. Art had developed a product line of frequency division multiplexers for Scantlin, and that's where Bob Schaaf was located as well. I think Bob, though, didn't have much to do with data communications. I think he had more to do with mobile communications. Scantlin had a mobile product line of some kind.

Pelkey: Scantlin is spelled?

Norred: S C A N T L I N. Jack Scantlin, who is also one of the people that's not so much directly tied to data com, but certainly Jack Scantlin ultimately -- I'm not sure exactly how Scantlin evolved, but as I say they got involved in the brokerage end of the business, and then they became Quotron. Everybody knows who Quotron is.

Pelkey: Now, when you introduced your character interleave TDM, that was a big hit.

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Norred: It was a big hit mainly because the timing of it was coupled with the timesharing industry really starting to emerge. That was late '68, early '69, and that was really the beginnings, from what I recall, when IBM in particular, and General Electric was the other major supplier at that time, those were the two -- in fact GE Timeshare was part of that, and then IBM had the service bureau, which ultimately was sold off to CDC. Our first major order was with the IBM Timeshare --

Pelkey: SBC?

Norred: SBC. That was our big starting point, in terms of time division multiplexers. That was a huge order for a starting company.

Pelkey: Now, had you been in communications with them before and knew about the spec?

Norred: Bob Schaaf could answer that. It was my belief that there may have been some knowledge of that SBC business, but I really don't think so. I know there was some customer identified that we were talking to whenever the company got started that probably were some carry-overs of Art's involvement at Scantlin trying to sell FDM. The time division multiplexer was vastly more efficient than the frequency division multiplexer, and as a result, there was a big need. The timesharing industry was really the first time that we were starting about putting a large number of ports on a single computer.

Pelkey: Now the link at this point was, what, 1200 bits per second?

Norred: No, actually, most of our links were 4800, and the dominant supplier at that time, of course, was Racal-Milgo. Racal-Milgo, for all intents and purposes, in the beginnings around '69, was the dominant supplier of high-speed modems. They had this manually equalized 4800 bit per second modem, and Bell also had - -

Pelkey: Of course, at this time -- was it Milgo or -- what was the name of the subsidiary that they ran their business under for many years? Was it CSI?

Norred: I don't remember. Well, actually, Racal-Milgo, you're correct in that what became Racal-Milgo as we know it today was really the data communications company that they acquired, and I think the rest of it, which was military related, perhaps -- the data communications side became the company.

Pelkey: By the acquisition they made.

Norred: With the acquisition. I've even forgotten the names of most of the people back there. I knew most of them during that period. I know must of the ones that we installed would either have a Bell modem at 2400 bits per second, a Bell 201 in fact at 2400, or a Racal-Milgo at 48. That was state of the art at that time. ADS was, in many respects, a very fortunate company, in that we were at the forefront of the explosion, and frankly, for a couple of years, it didn't seem like we could do anything wrong. To me the company ultimately failed primarily because of three major factors. One was lack of management experience. None of us had had any real experience, with the exception of maybe Bob Schaaf had perhaps had a little more, of running a company. Secondly, when the company did ultimately fail, and it really began to see real financial problems in the early '70s --

Interruption in the Interview

Norred: -- So I was talking about the three factors. One, that the timesharing industry -- just tremendous amount of growth. Everybody was getting into the business, and then all of a sudden we had the big collapse. There was a bit of a beginning of an economic problem in the early '70s, and that, coupled with an overgrowth, the next thing we knew we found the company, and I'll fill in some gaps in between this, but we suddenly found ourselves with a lot of companies cancelling orders, and it was just a very bad situation in that sense. The third reason was the failure of our automatically equalized modem to work effectively on real phone lines. Frankly, just the background of that, I don't remember the exact timing, but we found out that Rockwell, under a military contract I believe with the Army or the Air Force or

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someone, was developing a fully automatically equalized modem for the military, and we developed some relationships with them, and we ended up with a license to manufacture that modem. Actually, I think we were about two years ahead of anybody else at that time, in terms of automatically equalized modems, and Rockwell also made an investment in the company at the same time. There was -- I think this was around 1970.

Pelkey: That was an important event in the history, Rockwell, in essence, getting into the business.

Norred: Well, I've since thrown away all of that documentation.

Pelkey: And it was Rockwell that had a military contract to build this --

Norred: They were under a military contract. I'll tell you a guy you could talk to, and we can find you a number -- there's a lot of people here in Los Angeles that were involved with Rockwell that I know. There's one guy that used to be at ADS, but he's retired, a guy by the name of Owen Morgan, who was involved very much in the earlier phases. There was another gentleman -- Oh, goodness, I've forgotten the names over the years -- but Owen Morgan would be one guy. He's sort of retired, but I know we could get you a number. It's the kind of thing you would probably want to do by phone. There was another engineer, but I can't remember it.

Pelkey: Do you recall how you learned about this Rockwell situation?

Norred: Bob Schaaf might remember. It wouldn't surprise me if it had to do with us trying to sell Rockwell something. I remember -- actually, I'm not so sure someone in the company that had to do with Rockwell being -- it was almost in a newsletter. I think I remember somebody reading about it in an internal Rockwell newsletter talking about how they had developed this product, and somebody happened to run across it. Now that I think about it -- boy this was a long time ago -- I think that's how it came about, and I can't remember who it was. We just made the contact with them and started some open discussions with them about this modem.

Pelkey: So you ended up with the rights to manufacture this modem?

Norred: We paid -- it seems like we paid about $2 million -- for a license and rights to this modem, and then Rockwell made an investment in the company which actually helped us pay for the investment, and they ended up with a substantial equity position in the company.

Pelkey: Up until then, how had you been financed?

Norred: Actually, ADS was originally financed by -- if you want the whole gory detail -- whenever I agreed with Art to come out and start the company, he had two gentleman, Black and Strong, a local manufacturer's rep organization -- Mike Black and Milt Strong and there was another gentleman, in fact they put a lot of money into this speaker company, Infinity Speakers, totally unrelated -- but I actually, my wife and I had moved out here. When I arrived, Art told me that the money had fallen through. I said: "That's fine. I'm moving in with you," and I actually lived in his den for a number of months. In fact, the first multiplexer was built in his garage. We were working on it right in his garage. The money that got ADS started was from an attorney who lived next door to Art, by the name of John Kinmouth, and John Kinmouth got a lot of his friends together and they raised, if I remember correctly, the initially equity was around $100,000 to start American Data Systems. In fact, that was the only equity the company had in the beginning, and I think Rockwell was the next infusion of equity until -- I'm sorry. White-Weld also, there was about a $3 million investment by White-Weld.

Pelkey: Do you recall how that came about?

Norred: John Kinmouth, this attorney, took an active roll in the financial side of the company. If I remember correctly, and I frankly didn't get too involved in it during that time, but I think he made all of the

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contacts. Actually, ADS grew very rapidly. That was another aspect that -- I think we reached almost 400 people in a little under two years.

Pelkey: You introduced your product at the end of '68 --

Norred: I'm guessing at that, but that seems about right, because we started -- I know I moved out here in February of '68. I know that we spent some time developing the product. It probably was introduced a little before that. I had, up until not too long ago, all of the financial records, and I finally just threw them in the trash can not too long ago, but I had no idea that --

Pelkey: So you start shipping your product at the end of '68?

Norred: I would say the end of '68 we started shipping the time division multiplexer.

Pelkey: So you had modest sales in '68, and a handful of people?

Norred: Oh, it would be total guess, but I would say, at the end of '68, we probably had between 30 and 50 employees.

Pelkey: Then what happened in '69?

Norred: In '69, we got involved in a number of different areas. I believe it was '69 that we probably got involved in the high-speed modem with Rockwell, probably at least the mid to latter part of '69. We also began development of products in just about every area. We literally -- we went into -- as I said, we were up to almost 400 people in, from what I recall, could be as short as 18 months, but certainly was no more than two years, of which an enormous amount of those were R&D people. It was kind of interesting because ADS -- that's what I was always intrigued about the company -- of having the opportunity, if it hadn't had those three major problems going for it, in my mind, today, could have been back. If any one of those three factors hadn't happened, I think today we'd probably be one of the biggest companies in data communications, because it was first in many areas. It was the leader in the time division multiplexer area in the beginnings. The first real competition that showed up after that was General DataComm.

Pelkey: And they showed up when?

Norred: My guess would be the end of 1969, '70 time frame. We had the first automatically equalized high-speed modem at 4800 bits per second in the marketplace. We actually had one of the first, if not the first, 2260 IBM controller replacements -- in other words, a CRT device and the controller that would be compatible with the IBM system to replace -- this was pre-everybody else getting into the 3270 business. This was back when it was 2260. We had taken a Selectric Typewriter and modified it as a terminal to give us a terminal capability that would be compatible with a teletype or an IBM 2741 -- I think that's what it was called, the terminal in those days -- that could sit on the desk, whereas the IBM unit was a big, huge unit, or you used a teletype. Timesharing really only had two terminals. It was the IBM 2741 or the teletype running at 10 characters per second, or the other one running at 15 characters per second. Teletype later on came out with some 30 character per second stuff. In those days, nearly everything was either 110 bit per second, or 134.5 which was the IBM. 300 was just in the earlier days. CRTs were just coming. We were developing a line of CRT terminals. We also developed the first large front end data communications controller that was, in those days, a relatively big machine in that its architecture was nearly identical to IBM's 360 series, in that the instruction sets were compatible, and it was a very large front-end processor. The idea was that we would literally provide everything from the computer interface all the way out to the terminal, except the telephone lines. In fact, I'll never forget running this big multi-page ad, based upon the American Flag, that showed we provide everything but the computers and the telephone lines. I kept those for years. I might -- you know, I just moved from my office recently and I think what may have happened -- no I don't recall seeing that. I kept, for years, a binder on ADS. You know what I think has happened to it, we stored it over at Micom and it got lost in all of our

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warehousing stuff, but I had a box of archive stuff. If I run across it, because I used to have a bunch of ads and stuff that I kept.

Pelkey: Where did you advertise in those days?

Norred: The big magazine in those days was Datamation. Datamation was THE magazine, in terms of advertising, almost exclusively. There were no data communications publications per se.

Pelkey: Data Communication hadn't come out yet?

Norred: No, they were many, many years after that.

Pelkey: Viatron was kind of --

Norred: Well, Viatron was the big growth splash paper tiger, or whatever, during that period. I remember going to trade shows.

Pelkey: They did, what, the RAIR Terminal, the Remote Access Interactive Response type terminal?

Norred: The whole Viatron thing was so bizarre that -- well, we used to get a lot of laughs out of Viatron in some respects, but you never did know whether they were going to make it or not.

Pelkey: You must have been profitable in 1969, '70?

Norred: Well, if I remember, we did about a million the first year, we did somewhere between four and five million --

Pelkey: The first year being '69?

Norred: Well, actually '68, the more I think about it. That's why I said I haven't thought about it until now, but I know that the sales were like 1.5, then, I remember in the third year because I used to keep it pinned on my wall, a forecast of around 32 million in our third year, and I think we ultimately did about three or four or something, but that was 1970 when the world came to a screeching halt. One of the reasons was the modem. Just coming back to the modem a little bit, but we actually shipped somewhere close to between 200 and 400 modems to the field, these automatically equalized modems, to find out that, even though we had done some beta testing, they seemed to work great and everybody was very happy -- in fact, the very first ones were shipped to United Airlines, and they were expecting to buy hundred of these things, because it was a major problem to have to have a manually equalized modem, because every time the phone line characteristics changed you had to go back and re-equalize it. One fundamental flaw that we had in the modem that really set us back at least a good year, year and a half, was that it did not behave well in the presence of frequency translation. This is where you put in 1,000 hertz signal at one end and it comes out the other end of the phone line at 1,003, or 1,010, where it literally shifts the frequency spectrum. It didn't work well in that circumstance and it did not work well against what we call phase jitter. Those were two of the parameters that, not having a lot of knowledge in the modem world, that we failed to adequately understand, and the modem was not terribly good at adapting to it. It adapted very well to phase delays, which is where the automatic equalization was so effective, and it took us another -- we shipped a lot to the field and got a lot back. We were shipping 400 and expected that we would ship 4,000 in a relatively short period of time, in the next year or so, because all these were really sort of onesy-twosy to customers who were trying it to say: "Boy, we have a big requirement," and unfortunately the modem just didn't work well. That really hurt very bad, because we had a lot of inventory and were looking forward to -- modems, in those days, 4800s, were selling for around $6,000.

Pelkey: I'm confused on one point: If Rockwell had, in fact designed and built this modem, and you had bought the commercial rights to sell this modem, why were the issues of not understanding this frequency shift and phase jitter --

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Norred: To be honest, I don't know.

Pelkey: Because you're taking on the onus as something you did wrong, as opposed to the design you got from Rockwell.

Norred: I certainly do because I think we failed to understand what the real parameters were out there in the real world of modems. You have to recognize that one of the things that most people overlook in the data communications industry is that, in my opinion, you don't learn it until you've been out there in the trenches. You go out there and you spend the kind of long nights and problem solving -- that's where you really learn it. The number of times that people have made announcements and they've introduced high-speed modems that are going to literally move the world forward by leaps and bounds, and they didn't work at all, and the companies disappeared, there's lots of them. People can make them work over a twisted wire pair in a lab, but you get out in the real world, and there are -- let me tell you, there's nothing more complex than a phone line, because it's constantly changing, and that makes it very difficult to simulate a phone line; it makes it very difficult to understand all the parameters. Now, today it's a lot different, because through the school of hard knocks, everyone's learned all the characteristics. Things like companders. There's companders on voice lines that, for a long time, they did the compander to what they called diode matrices. Well, each one had slightly different characteristics, and if the line had companders on it, you could never predict what the characteristics would be. That aspect of it, I think, was probably the one financially more critical. I've always felt that, having management with more experience, we would have dealt better with the situation, and ultimately Rockwell just became disenchanted with the company. When they got involved in 1970, they cut back the company substantially, and we got out of the terminal business. They put money in the company. They in effect took over the management of the company. They were, approximately, a 49% owner at that time, and we got out of every business -- we did stay in the front-end processor business, because we had a very large contract with southern services. This was the big east coast utility. In fact, we installed a very large system of our front-end processors in conjunction with IBM that, in its day, probably was the largest, highest throughput front-end processor. This was a little bit pre -- now, the real big front-end processor company - - ComTen, which was not called ComTen prior to that time -- in fact, we became a big OEM supplier to ComTen. We supplied our multiplexer as front ends to the ComTen unit. ADS had two multiplexer series: one called the 660, which was the one that was the very successful one, and ultimately the 670, which was the one that replaced that. By the time the 670 actually made it to market, even though it was a very good product, the company was pretty much out of business and the company did go out of business shortly thereafter. The 670, however, ended up being bought by Case in England, which is really the beginnings of Micom.

Pelkey: When did this happen?

Norred: Honestly, I have to think for a minute. It's '73.

Pelkey: So from '70 to '73, ADS was in kind of survival mode.

Norred: It was in a mode of continuing to be reasonably successful in its time division multiplexer business, continuing to sell its modem, but nowhere near the scale that had been expected, because by the time we got our modem fixed Racal-Milgo, I believe, and Codex -- in fact, Codex actually came to the market first with an automatically equalized modem. In fact, ADS, which Art Carr may have told you, we came very close to buying Codex. They were in desperate problems, near bankruptcy. In fact, Art Carr and those guys deserve a lot of credit for having fought through that thing and pulled Codex out of, literally, 'out of business.'

Pelkey: Do you remember when those contacts between Art Carr and ADS took place?

Norred: I would have to guess they would be late -- early 1970 would be my guess.

Pelkey: It was that early on?

Norred: If you talked with Art, I would have thought he would have recalled when --

Pelkey: His memory is as fuzzy as yours.

Norred: They were in big trouble. They were literally days from going out of business. They were looking for anybody, and we took a long look at the company, but I think our problems begin to happen about at the same time or shortly thereafter, and I think that may have curtailed --

Pelkey: There was due diligence, in essence, that went on between the two organizations. They learned about the Rockwell relationship at that point in time.

Norred: Well, the Rockwell relationship preceded us having any discussions with Codex. It was during that same period of time. I remember going to a trade show and seeing Codex having a 9600 bit per second automatic dial modem. It was this monstrous modem --

Pelkey: The AE-96.

Norred: -- that nobody could probably make work or buy. It was also very expensive, but it was the forerunner of this guy -- did he tell you about David Forney?

Pelkey: G. David Forney.

Norred: I don't know what happened to David.

Pelkey: He's still there.

Norred: He's still at Codex? I came very close to going to work for Codex after ADS closed. I talked a long time with Art Carr and Jim Storey about actually -- I didn't know what I was going to do after ADS closed. I came very close to going to work for Codex.

Pelkey: This would have been '73?

Norred: This would be '73.

Pelkey: Before I get into '73, at this point in time, the independent companies --

Norred: Around '70 there were a lot of companies emerging.

Pelkey: Modem companies were starting to emerge left and right, I gather.

Norred: Well, General DataComm was one that emerged in that time. Certainly Rixon became a more significant factor. In fact, now that you mention it, Rixon, it's my belief, actually probably developed the first time division multiplexer, for the military. In fact, a lot of these people -- I kept saying Linkirk -- may have in fact come from Rixon rather than Linkirk, but Linkirk was involved in there too. If you go all the way back, I think you're going to find there was about five or six people that, even Wiggins, was part of. I think Wiggins came from GTE-Linkirk. I think that's where he got his exposure.

Pelkey: Bob's agreed to meet with me. I haven't talk to him yet.

Norred: I don't know where Bob Wiggins is these days.

Pelkey: I do, and he's agreed to sit with me.

Norred: That's good. I think that will be very helpful, too, on some of those early periods. That was one. There was another paper flash called DynaTech.

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Pelkey: Collins was in the business at that point.

Norred: Collins was sort of in the business. We had an interesting relationship by our very nature of being with Rockwell, and Rockwell having acquired Collins. During that same period, we tried to work together in a number of situations. In fact, that was Rockwell's original intention when they finally decided to do something with ADS, was really to more or less liquidate the company and sort of roll it into either Collins, or do something with the asset aspects. Then they finally just decided to put it into Chapter 10 and walk away from it.

Pelkey: What about Stelma?

Norred: We were always aware of Stelma, but we always perceived Stelma as the company that was much more mill-spec oriented. They always kept coming to market with a product but just never seemed to go anywhere with it. They were not really in the main stream of the commercial end of data communications. I think that ADS, by timing, was very fortunate to really be in the mainstream of the commercial side. General DataComm came from the telephone side, and their whole market was much more driven, even though we considered them a very significant competitor in our end of the business, because of Chuck Johnson's background in the telephone side, their equipment design and everything they did, and as a result, we didn't compete very well with the people that were more telephone equipment oriented, even though we won some business there. It was very difficult for us because we just never did understand what telephone equipment was all about, or how to sell into that particular marketplace.

Pelkey: Now, were you aware of Carterfone?

Norred: Carterfone was, from our viewpoint, not a terribly dominant anything. The ultimate Carterfone decision, which I think a lot of people relate to as the beginning of the data communications industry, Carterfone to us didn't really reflect much of anything. In our market, everything was in fact already tariffed. You could get high-speed modems. You could put your own modem on a dedicated phone line. Dial-up was typically always provided by the modems from Bell, the 103 series modems, and that's the way the timesharing industry was built. They used to build these huge cabinets of Bell modems for the dial-in, so it only started to evolve because it affected the dial-in characteristics of the data communications industry and opening that up. But we never really got involved -- we did develop 2400 bit per second modems, and one of the things I should also mention that was interesting is that ADS, in conjunction with Rockwell, closed, at that time, the largest modem order that had ever been closed, for an automatically equalized 4800 bit per second modem for facsimile, and as a result, we had the first all MOS LSI 4800 bit per second, almost two or three years before anybody else had it. That modem -- I'm trying to think of the Japanese company that it was done for -- but it was sort of a joint deal with Rockwell. Rockwell did the manufacturing because they were in the semiconductor business; they did the design of the chips. We supported them with the basic design of the modem. Even though we had acquired it from Rockwell, a lot of the people we had hired from Rockwell -- and it was sort of a joint effort of working together. In fact, one name comes to mind. If you wanted to talk to him, it was a very significant name during that period, a guy by the name of Tex Thomas, who was with Rockwell. He was very instrumental in the design group. There were a number of spin-offs from Rockwell. A company called HighCom. Has that name come up?

Pelkey: No.

Norred: HighCom was another company that started up in the modem business in that same early '70s period, and the guys that did it were this one doctor from Rockwell that, as far as I know, may be the president of HighCom. HighCom ultimately had some Japanese money in it. (Leafing through some papers) Let me just scan through . . . of ADS. In the early '70s. The '71, '72 time frame is when Prentice got started. They also built an FDM multiplexer. In fact, that's where they got their start, was actually renting and leasing FDM multiplexers. There was another one that just crossed my mind. Prentice was certainly involved in those days. It's amazing how many companies that are in the non-local networking side that -- all of them emerged through what I call surviving the early '70s, and there were not a lot of

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companies past that point that really got into this end of the business, other than Micom. Micom was really the only one that emerged during that period.

Pelkey: Jumping ahead, I'm led to believe that to a large extent, that was a function of AT&T in the early '70s announcing DDS.

Norred: Well, I personally didn't buy that.

Pelkey: Venture capitalists and so on wouldn't fund start-ups.

Norred: It goes back to when DDS was introduced, everybody said it would put all the modem people out of business. It didn't put anybody out of business.

Pelkey: But it did stop new entrants because they couldn't get money. Who would enter a business that's going to be gone?

Norred: That, I would have to agree with you, would have an effect. John Fanaletti was with -- that's another name. If you talk to this guy Ted Noe, who is a great storyteller, knows everybody in the industry. You really should make an effort to talk to Ted Noe. He knows Paradyne inside and out. He knows all the people pre-Paradyne.

Pelkey: So, from your perspective, it was really more the timesharing business --

Norred: ADS, in my opinion, was totally driven more --

Pelkey: The data communications businesses emerged because of the timesharing business, and the timesharing business was really, because you had low speed terminals --

Norred: Well, you had this sudden need, that we had all these timesharing computers, and they could handle multiple ports -- multiple in those days was still 30 to 50 if I recall -- 2703 front-ends, they could only support so many terminals in the same building, and all of a sudden, if you could dial into these things, there was a tremendous market opportunity, and the problem of using dial-in lines was one thing, but if they wanted to go to a distant city, it was very expensive, because you literally had to have a line per port. These front-end processors had no switching capability, no contention capability. They were literally like hard-wired connections to the front end.

Pelkey: So the time division multiplexer was really an economically driven purchase.

Norred: Oh, totally. In fact, even in those days, the thing would pay for itself in like six months, compared to the phone line costs.

Pelkey: The data rates were so slow and low on these teletype terminals and these character terminals --

Norred: Tom McShane was another gentleman from Vadic who was one of the key people, along with -- I guess he's president of the company now -- Ken Maxwell, and Tom McShane. Another name that's kind of interesting, because he bought the assets of American Data Systems, was Gilbert Margeth, who is up in Livermore. Livermore Data Systems was another little company in those days making acoustic couplers. Livermore, for years, sold acoustic couplers to IBM related to timesharing, and in fact they did reasonably well. They were one of the first acoustic couplers.

Pelkey: Anderson-Jacobsen was the dominant one.

Norred: Right. Livermore was a little more of the Cadillac of the industry, but Gib, who I got to know reasonably well, he actually bought the assets of ADS, and we consulted with him at Micom in the earlier days. Here's --

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Pelkey: So it was really that the timesharing business -- the need on the part of the user community to connect these remote devices that -- connecting one on one to a port was just a very costly way. So people who recognized this, if you put a TDM out there with a higher speed modem, it just made a whole lot of economic sense.

Norred: It was simply that we had all this computing power and they had a need that -- one of the first companies, in fact it was the very first installation at ADS for time division multiplexers was a company called Allen-Babcock, and Allen-Babcock was one of the early timesharing companies. They were fortunate enough at Allen-Babcock that their programmers were, in fact, the original programmers that worked with IBM to develop what they called Call 360, which was their timesharing system. Those people at Allen-Babcock we ultimately hired at ADS, all of the software people. In fact, the guy's name that's going through my mind who'd be an interesting guy to talk to, who worked for Allen-Babcock as the data communications guy, his name was Sid Chaplin. I know Sid, I'm pretty sure, still works for TRW. He was the communications guy at Allen-Babcock that actually installed their first network. I remember working with Sid. In fact, we hired Sid at American Data Systems as well, and he was sort of our systems guy. Then he went back to TRW.

Pelkey: One of the questions was, where was AT&T? Why wasn't AT&T innovating in TDMs? Why weren't they pushing the state of the art?

Norred: I think they weren't pushing the TDM because the TDM caused them to get rid of phone lines.

Pelkey: They weren't motivated because they were going to lose revenue by innovating all of this?

Norred: That was my opinion. I think also, the time it took Bell Labs to respond. You have to realize that was in the dominant days of monopoly, and it wasn't until Carterfone that we began to see any situation where they had any potential -- were they very excited about the time division multiplexer? I'm sure they were not, would have been my guess. The aspects of -- it was the beginnings of finger pointing. In fact, one of the great characteristics of the ADS multiplexer was that we put in a lot of diagnostics to help the customer try to identify where the problems were, because we used to make this comment that we were in the worst of all worlds; we were caught between IBM and AT&T, and if there was something wrong, you know that we were going to be the first guy pointed at no matter what you did. So the ADS multiplexer was very characteristic, because it had all these lights on the front. It had hundreds of lamps on the front of this thing. In fact, it used to get so hot, people used to joke about being able to fry eggs on the front panel, and in fact we tried to do without fans for years, but we finally had to give up and put fans in the unit because it would just get so hot that the front panel would almost melt. It literally had all these 28-volt lamps in it, but it was the beginnings of diagnostics. I wish I had some of those old photographs. I never really thought about until just now that I do not have that binder with me, because I kept that thing for years. In fact, I just cleaned out a bunch of old original Micom stuff and threw it away.

Pelkey: When we get up later into Micom, and we talk about LAN and data PBX, please remember the part about AT&T wanting to introduce the TDM, because it changed the nature of their economics, in terms of looking at it from the perspective of where you were at a later point in time.

Norred: John Jerenco, UDS. I think John Jerenco may have been the president and founder. I can't remember. No, his name was Smith. Grumbles would remember. George is another one the great story tellers of the data communications business. Tell George hello. I haven't talked to George in some time.

Tape Side Ends

Norred: …for input into the computer, typically with cards, or, in timesharing, through a terminal. There wasn't anything else in between, and the remote batch terminal devices were, in many respects, all card driven; the old IBM cards, and then they had a printer. The RGA was a printer and a card reader and maybe a terminal as they grew, but -- I was trying to think of some of the names of the companies that -- IBM had an RGA type device, and there were a number of companies -- Texas, there was a company in Texas, out of Dallas, that was one of the big suppliers of RGAE terminals. I'll tell you another, if you want

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to talk to him, if he's still there -- Another significant company is Computer Sciences. CSC was a major factor during those times also, of companies that were actively involved in the timesharing industry that continued to evolved it. In fact, we thought at ComTen, they think, in many respects, they almost put ComTen on the market, because they decided to use ComTen as a front end to their computer for timesharing. ADS was a big supplier of multiplexers to them and certainly they were a significant customer of Micom's in the earlier days, and the guy's name -- it's again, an 'in the trenches' kind of guy -- well, maybe I'll run across it in a minutes. I haven't talked to those guys in years.

Pelkey: So in '68, you had the euphoria of the public markets. A lot of people had been making money with similar situations, such as Scientific Data Systems when Xerox bought it out.

Norred: Well, we never saw much of Scientific Data Systems in the marketplace. Most of the mainframes that were timeshare oriented originally were either GE, and mostly GE with its own network, or IBM. We'd see SDS a little bit, and RCA came out with a system a little bit. There were some Univac systems, but the vast majority of it was all IBM.

Pelkey: Were you aware of what was happening with the Arpanet process at this point in time?

Norred: Well, Arpanet was something we always perceived as very military oriented. We had very little involvement in any aspect of Arpanet, nor did we see it as having any significant impact in the market, frankly. It was one of those things that was, maybe, a little bit before its time. There's always been a characteristic about the data communications industry that it was very much an evolutionary kind of business. It was never revolutionary, because people never realized -- if you talk to some of these people who lived in the trenches -- to get a network up was an enormous process, because you were dealing with all these different vendors, including AT&T, and once you got it up and running, you didn't want to change anything. It was something that, you didn't care what came out, as long as it was up and working and running, if you did change, it was going to come very, very slowly, because one, the timesharing industry was a service that couldn't afford to be down. Once they got it up, they had to maintain it up, and any transitions that were taken were taken very, very slowly, so a lot of technology would come to the market and not be accepted for various reasons, and also just whether the company was going to be there; secondly, whether it was a proven product, and I know that many times, it's true today, there are customers that are buying three to five year old products at higher prices than what you can get something today, but they continue to buy it because they're familiar with it, it works, don't change it. There's a significant element of that, so a lot of the new things -- just like whenever DDS came out, we never perceived it as being -- we worried about it and we thought it was going to be great for our business, in many respects, particularly Micom later, because it got us away from the modem business. I always swore, after having gone through ADS, that I never really wanted to be in the modem business. In fact, it took us a long time at Micom to decide to actually get in the modem business, and we did it not to get in it to be a big element of it, but to provide -- it was an integral part -- and that sort of evolved us into this end-user kind of market. I'm going to think of that guy's name at CSC. He'd be a good one to talk to.

Pelkey: At that point in time, RS-232 had been a standard, right?

Norred: Oh, yeah, RS-232 was definitely a standard, even pre-'68, to the best of my knowledge. It wasn't much of a standard, frankly. That was the other thing about the data communications industry is that standards were only partial standards. Everyone interpreted it differently. It was one of the biggest problems of building equipment and learning about it, the fact that there were so many aspects, again, that you only learned by being in the trenches.

Pelkey: Every manufacturer's equipment that you would hang out there would have some different characteristics. So after '70, when ADS suffered, Rockwell came in shortly thereafter, took over the management, gave you some more money, and the situation limped along until about '73, when --

Norred: When they finally decided -- well, the problem was that the company had so much debt that, as a result of the interest on the debt, it was causing the company to lose lots of money. If you could take the debt away, it was a very profitable business at that time, but with the debt, Rockwell just finally got

tired of it. They saw that they didn't want to put more money in it. They didn't see it working its way out of it. They couldn't find anybody to buy it. As a result, particularly being the size it was, because we actually had a lot of relatively high-up people involved with ADS. There were people like Don Williams who, at that time, I believe, was president of Autonetics, the electronics group, we had people like Wally Booth who was the CFO of Rockwell, on our board, we had a number of relatively high Rockwell people looking at this company, at one time, as being a real opportunity for some real growth areas, and it just never materialized and I think they ultimately just lost interest and wanted to get out the quickest, easiest, simplest way, and they put it in Chapter 10.

Pelkey: Was there any big meeting or event where they finally made the decision.

Norred: No, there was a board meeting. It wasn't a decision.

Pelkey: Now you were president at this point?

Norred: No, I was never president of ADS. The president, at that time, was a guy by the name of Schroeder, who was a Rockwell person. Just slightly prior to that, the person who was president of -- at least I believe he was president -- a guy by the name of David Day. He was also a Rockwell person.

Pelkey: You were doing engineering and manufacturing?

Norred: What I had at that time -- I had always had engineering and manufacturing, almost from the very beginning, not quite, and I had picked up just about everything with the exception of sales. I pretty much had all the marketing support responsibility and customer service in the final year, but nearly everything except for that. You can talk to Art about it. It would be interesting to hear his side of the story, but Art had been gone from the company for about a year before it closed, and then Rockwell finally, I believe, decided that he really wasn't the right guy to run it, and bought his stock out and bought him out, and Art was gone. Then they brought in their own -- I'm almost certain, at that time, it was David Day, and then subsequently -- even another gentleman that took a personal interest in it was Beall, who is now CEO of Rockwell. We had a number of people --

Pelkey: You weren't lacking for attention.

Norred: No, we had lots of attention.

Pelkey: Now, you had a relationship where Case was distributing your products.

Norred: Case was ADS's European distributor for the ADS products.

Pelkey: And Case started up in '69?

Norred: I'm not sure -- I don't know whether you're going to talk with Roger Evans --

Pelkey: I have.

Norred: He should have been able to tell you because he was one of their early people. He wasn't there from the very beginning, but -- it would have to be around '69. That would be my guess.

Pelkey: And you met Roger through Case?

Norred: I met Roger through Case in that I had started to work with Roger a little bit toward the end of ADS, when Case had already had one major order for the ADS 660 multiplexer that they sold to the British Post Office, and they were in the process of selling the new generation product, the ADS 670, to the Post Office when ADS closed.

Pelkey: And that was '73?

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Norred: This is '73.

Pelkey: Because that British Post Office order Case was about to win when ADS was going under, prompted them to want to get the manufacturing rights which, in fact, really was better for them, because they really wanted to be able to manufacture those in England in order to be able to help win the contract.

Norred: In fact, they were very close. Roger was the key person responsible for that order. The way I remember it coming about is they were very close to getting the order, and then when ADS went out of business, it came as obviously a total shock to everybody, including myself. We didn't really expect them to do that. In fact, if anything, the company certainly could have survived as a Chapter 11 company, but Rockwell, I think, just got tired of it. When that happened, I know that the Case people very quickly contacted me. We began to work together in trying to seek out a solution. In fact, I was wearing almost two hats, because I was consulting to the receiver and dealing with some of the assets, and also working with Case to assist them in trying to acquire the assets, and literally, I know Roger Evans was here and, almost as a final ditch effort, we made a proposal to the receiver to buy half of the inventory and to acquire a non-exclusive manufacturer's license for the product line, and he accepted it. In fact, it was -- one of the reasons I didn't think it would happen, I think we were down -- I don't remember what the time deadline was, but anyway -- I remember the actual agreement was actually typed by the receiver attorney late in the afternoon, around four or five o'clock, or even after five o'clock. Having that in place, then I created Micom, in effect, to work with Case to, finish or complete the inventory, consult with them, also to assist them in doing their manufacturing, setting up their manufacturing --

Pelkey: So Micom bought out of the receivership?

Norred: I didn't. Case actually bought it. Case actually did all the transactions directly with the attorney, and then Micom then entered into a contract, contractual agreements and orders and so on, with Case, to finish the inventory. In other words, we bought a lot of raw materials, worked with them in whatever capacity was necessary to assist them in the sale to the British Post Office, or whatever had to be done. Then we manufactured product for them for a period of time under contract, and then worked with them however we could work with them to help them with manufacturing, and provide them with drawings and support things. Then they ultimately took over the manufacturing themselves, but for about the first two years, or maybe a little beyond that, we were supplying, but as time went on it was less and less, because they had no manufacturing capability prior to this time, and they set up their manufacturing to pick up the manufacture of the ADS 670.

Pelkey: Do you recall a meeting at the Woodland Hills Holiday Inn the night before you went into receivership, you and Roger?

Norred: Well, this is where it's going to get kind of interesting, because there may be some differences of opinions of some of the earlier days of Micom, between Roger and I, to be perfectly frank.

Pelkey: When I started this whole process, I said: "I want to get the facts straight." I can talk to five different people about a given incident and get five different stories. So I've come to the conclusion that --

Interruption in interview

Norred: And I know Roger has even quoted that: "As time goes on, fiction may become fact and vice versa." Certainly, it's kind of interesting, because we were having great difficulty when this happened. Micom did not have a name before the bankruptcy. There was no -- in fact, the company wasn't even perceived at that time. The bankruptcy happened. In fact the bankruptcy happened before Case even came over here. That was already done. Then we were over negotiating with the receiver trying to figure out what could be done at that point in time. I remember this guy Schroeder flying over to the UK either

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the day before or the day after the bankruptcy to tell Case what had happened, and he flew right back; just to tell them in person that the company had gone out of business and: "Sorry about that, fellows." Following that, I know we were down to the point where we had reached the agreement with the receiver, and now it was time to work out some sort of relationship between Case and what became Micom, and we couldn't come up with a name. It was out of desperation that I ended up going with Micom, which was a name that I had come up with during that time but never really quite liked, but finally decided on it. Quite frankly, Roger didn't have anything to do with the selection of the name Micom.

Pelkey: Roger's recollection was that there was a Woodland Hills Holiday Inn.

Norred: That's probably true.

Pelkey: And you and he, that night, agreed to put a company together so that you could demonstrate the manufacturing rights and support, and out of frustration you said: "Let's call it My Company," and that was the genesis of Micom.

Norred: Yeah, that's true. What I was going to get to is exactly how that evolved, but I didn't. Everybody kept thinking it was -- in fact the very first name for it, which I'm not sure I'd want to put in print, for Micom was IHR Consultants, and IHR Consultants had two meanings, and I'm not sure which one came first. One was Integrity, Honesty and Reliability and the other one was I Hate Rockwell. That was really the name we went by. In fact, I think I've still got some IHR business cards somewhere. That was a very short period of time. We played around with names like Xanadu Systems and all sorts of things, but Micom -- and it literally did not have any relationship -- he's accurate in saying it was "My Company." I was always coming up with names that had no relevant meaning, but ultimately turned out to be interesting names. In fact, everybody always used to tell me: "What a fantastic name that was." I've got another one now that I'm playing with, that's my new company --

Pelkey: Quor?

Norred: That's an ok pronunciation. We pronounce it Cor, C O R, Cor. It's so hard to come up with names these days that are unique and short, because we want to be able to use it --

Pelkey: That's very clever graphics, by the way.

Norred: Do you like that?

Pelkey: Absolutely, very much.

Norred: I'm very pleased to hear that.

Pelkey: I've looked at it numerous times. I really like that.

Norred: You don't know how much I appreciate that, because we have spent . . .

Interruption in interview

Norred: . . . we ran across it, the other day, the original Micom logo, and I remember drawing it with my 30 60 degree triangle, and about 3 years ago at ADS, we suddenly realized that we didn't have a standard logo any longer. In fact, it was Roger that actually -- it actually had a different design, and Roger closed it in and made it much more readable, frankly, but it was basically the same shape. Well, they concluded that the angle was not 30 degrees at all, it was 28.76 or something, because somewhere it had gotten distorted through camera process, and so we finally had this great debate and it all started because they put a new sign up on our new building and Simi and I took one look at it and I said: "That's not the logo, fellows. Get it down," and they went back to their reference drawings and they had even distorted it even worse, and so we finally had to create a master, and we chose from about three. They

found they had so many different versions, but right now, in fact I just got it today, I've gotten my masterpiece of artwork which we're putting away in the safe.

Pelkey: So it was '73, roughly early of the year?

Norred: Boy, I would have to --

Pelkey: And arrangement was struck between you and Case. No at that point in time, you are for some number of years now --

Norred: I can run you through the background during that time of Micom. What my plan was, was literally I felt like it was just a business opportunity, with no real business plan whatsoever, to support Case for a period of time. I owned 100% of the company. I put a little cash into it. I think I put $20,000 into it just so it would have a little equity on the balance sheet, and the company literally was a company in support of Case. We did, however, take, by way of a license arrangement that we had, I think vis-a-vis Case, using some of the technology of the ADS product line, developed our own product line called the Micom something or other 2010. In fact, I do have that documentation I was looking -- Roger didn't like it because he said it wasn't legible, but I actually kind of liked it. (Leafing through some papers) Anyway, that was the 70 series. Here's the 50. This was the beginnings of -- these were all products that were actually developed prior to when Roger came over. I sort of consider when Roger came over the beginnings of the real company.

Pelkey: Which was, what, May of '76?

Norred: Yeah, that sounds about right. These were all products that we developed -- (still leafing through papers) there's what it was. This was the first one, the 2010. In fact, this was the very first brochure of Micom. It was an awful brochure, but what it was is it took the basic hardware, with some changes -- it was intended to be a minicomputer front end. In other words, the minicomputer manufacturers were all very poor at data communications products. So what I decided was that there was a market opportunity to interface, and so what we did is we designed an interface for what was really a time division multiplexer to a parallel interface into the computer, ok. By having this, we had all this ability. We had all these remote multiplexers and we could do all this very powerful networking with a very simple interface. The only flaw in it was -- we did sell a few to a few little smaller ones; we tried to sell it to Data General and we tried to sell it to everybody -- was lack of software support at this point, and we never really were very strong in software. We recognized it, but never made any attempt to resolve it, and as a result, we never went anywhere. But it was really sort of, in some respects, the beginnings of the whole minicomputer world, in that we did different things like, as a front end, it could be used as a front end communications controller. It was really the hardware element of dealing with all of these different line speeds and getting it to the point that it was now a parallel character that you could bring in on your bus.

Pelkey: Now was this the first of this kind of product?

Norred: I think it probably was.

Pelkey: You had been doing stuff for the IBM front end, so you had been exposed to things of this kind.

Norred: No, this market was very -- certainly that's why we went there, because I was more readily experienced. And this 2010 was really nothing more than the ADS 670 with some different interfaces, and we changed some voltages around to make it more readily -- I call it the curse of Art Wilkes, but the original ADS 660, the logic voltage wasn't between zero and five volts, it was between +7 and +12, and he did that because he could eliminate one transistor that would drive all these lamps on the front panel. We got rid of one transistor per lamp, and we literally had 500 or 600 lamps, and so by putting the logic and referencing the +5 to +12, we got rid of one transistor, and it was the curse of having logic. Every time you take your scope probe and touch, the ground of the scope probe and you touch it to either, you'd wipe out the system. It was awful. This was really the beginnings of Micom.

Pelkey: Now, when you went to sell this, because you were trying to sell this other than to Case, you kind of went to the Vadic reps.

Norred: We had reps. In fact, yeah, that's sort of the beginning of all the reps at Micom. We tried to get them to sell this product to people, and we sold some to -- our sales were trivial. Still most of our sales were to Case.

Pelkey: But, at this point in time, the rep organizations were starting to appear.

Norred: Yes.

Pelkey: The rep organizations that were starting to come into being were the old instrumentation reps as I understand.

Norred: I remember one of our first reps here was Jim Moxon, Moxon Electronics, that ultimately became one of the biggest, and then ultimately went out of business, but much later on. They grew to be one of the largest reps in the US, and he was one of our reps for this product. In fact, they sold more than anybody else, mainly because they were local and we could support them better.

Pelkey: He was down here.

Norred: Yeah, here in California. There was a rep in New York that we had, and we had maybe one other rep, but for all intents and purposes, it wasn't until Roger really began to develop a rep organization that it really evolved. I think it was more by coincidence that the reps were there than any grand plan. We had very little business planned. We at that time were literally operating more as having these products that we sort of developed on the side, that we could afford to pay for in conjunction with our business with Case. We tried to get Case to sell this product, which they did make some attempt to, but like us, were not terribly successful. We did a number of other products that really were the beginnings of where Micom was, and that's this one, which was called the 5040. The first iteration was an 8080 based communications controller. It was really -- no one in the market had really designed, in the beginnings of the microcomputer revolution, a product that was really communications oriented. So we took a lot of the hardware that we had, even before this product, and used it to provide a small box that was microcomputer based --

Pelkey: It was microcomputer based?

Norred: Yes, that again, could be used in a lot of different applications. It could be programmed to do a computer port with lots of terminals, or it could be used in -- what we had going for us in the early days of Micom was a very good understanding of all the different types of interfaces that were required, and how you dealt with those, just from the experience of ADS. That was one of the major advantages that we had at that time.

Pelkey: Now when did this product come out?

Norred: We actually introduced this product by '74.

Pelkey: I see you have a polled modem network.

Norred: In fact, it might have a date on it if I look. Well, polled networks were certainly big things even prior to this. We were just throwing applications -- we had no software for this thing whatsoever. We were literally selling it as a piece of hardware, but it was sort of the beginnings of Micom's microcomputer based product line, because this design, this 5040, when we upgraded it to a Z-80, literally the same identical modules were used in the data PBX. The data PBX used the modules right out of this thing.

Pelkey: And you were interested in building a data PBX in '75, '76?

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Norred: Frankly, the interest in the data PBX came from, when I was working with Case, I continued to look at opportunities of products that I could develop and sell to Case.

Pelkey: And they were doing the Gandalf.

Norred: They were selling and marketing the Gandalf data PBX. I took one look at the product and I said: "I really think we could do a heck of a lot better product, if nothing else, mainly because we could use microcomputer technology to drive that product, and therefore also see some additional cost savings." One of the biggest problems you have in the data communications industry is, once you get a product well entrenched, competition came come along and replace it and you can't necessarily duplicate it, because you've got such a large installed base. I actually, if I recall, proposed building a data PBX for Case. They showed some interest in it, but it wasn't until after '76 that we -- I sort of call Micom as being in three phases of development. The first phase was the Case support period, in which we dabbled and diddled around with some microcomputer based products as well as some other communications interface products that we tried to sell, not terribly successfully, frankly. Then we entered into the phase where we -- at the end of that phase, this was about two and a half years into the company, that I owned the company, I had made some money, I had decided that I wanted to get out of the data communications business, and I literally looked at buying into another business, because I could see the Case thing coming to an end. I said: "Maybe what I should do is, I never did like the data communications business in the first place, looking at the business" -- and I looked at all sorts of business as far fetched as the ceramics business, I'm talking about dishes and plates -- and then finally decided that, around 1974, '75, maybe what we should do, because some of the products were starting to look interesting, maybe what we should do is get serious about it and raise some venture capital and get into the data communications business in a more serious vein. Frankly, '74, '75 was, I believe, the all time low ebb for venture capital. Frankly, I don't recall even having maybe more than one meeting with anybody that had any interest in investing in Micom at that time. I couldn't get any attention from anybody, and I think because it was the low point of venture capital investments, we didn't represent on our business plan anything particularly unique or new, we looked like a “me too.” By my nature, I suspect, the number that we presented were conservative and we tended to meet our numbers, and most venture capitalists, in my mind, always take it, divide it by three and then by two or something, so were unsuccessful. The decision I took at that time was, well, if we can't raise any money, we have reasonable cash flow, we have no bank debt, not even a line of credit, we chose then to go after what I call the custom phase of our business. In other words, the strategy was, in many respects, to find people who would be willing to pay us for the development of a data communications product that they couldn't buy on the open market, but needed badly enough that they were willing to pay somebody else to design it and manufacture it for them, and we did that. The first one of those was a company called Datran. I don't know if you recall Datran in the history. Datran played a very significant roll in Micom. We had business with -- the odds and ends of people buying what we called the 2010, at that time, in small numbers. In fact, even the work we were doing with Datran led us to some additional product later on. Then the other product that we had, which I should also mention at this time, because it's in this same time period, we called the 4001, initially. Now, the 4001 was a time division, broadband multiplexer, designed for Case, to plug into the ADS, or then Case 670 multiplexer, which allowed it to multiplex synchronous channels as well as asynchronous. It was, at the time, kind of innovative, because the whole multiplexer common logic was on one printed circuit board module, and we had only three slots to fit this thing into in the Case multiplexer. We took that product and made it into a broadband multiplexer product. Now, it didn't go to T1 rates, but it went up to like 400 kilobits, but the market then was primarily the Bell -- it was 230.4 kilobits, whatever that was. It was 230.4 and 64 kilobits, those were the primary speeds in those days, and that's where it was designed. It was designed to be a multiplexer that went in that marketplace. So we had that product line as well to sell. In fact, we were selling those products to Case, and we were also selling them here locally, but very limited, because we literally didn't have a formal company. We had virtually no service. We had very limited marketing support, but there were customers, like Computer Sciences, who I think frankly own one of everything that Micom ever made, including a voice response system. I can tell you a story about the voice response. We were literally in --

Pelkey: Anything that you could build that people would buy.

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Norred: Well, certainly when Roger came over, in the earlier days, we used to joke about our catalog being a blank piece of paper, and we'd fill it out as required in front of the customer. So during this time, we had this contract with Datran. I was trying to think in terms of pre-Roger and post-Roger.

Pelkey: His view is that he came over here, and then Datran went.

Norred: Very shortly after Roger got here, I always say: "Bad things happen in threes." Micom, at that time, was looking very promising -- very promising in that we were starting to develop a closer relationship with Case. Case was intending to make an investment in Micom, to give us some capital. We were going to work together to sell some of the Case products in the US. At that time I felt there was a very strong probability that Case might buy Micom, but if we were successful we might buy Case -- who knows what would happen? It was a joint relationship. I convinced the managing director of Case, at that time, to consider having Roger come over and look after their investment in Micom. There was a very significant need for someone of Roger's capabilities. In fact, I had very high respect for Roger and I used to always say: "Roger was the only conservative marketing person I've ever met," and he fit very well into a very conservative company. I think Roger was looking at it as an opportunity to come to the US as well, and so we set this relationship, and everything was looking very good, and then, I can recall very clearly, looking out the window one day and seeing Derek Lovell, who was the joint managing director of Case, coming up the parking lot to Micom, and I wasn't expecting Derek. He was there to give me the good news that they had run into some financial difficulties that they hadn't anticipated and they would not be making the investment in Micom, and that, because of their financial difficulties, going to be curtailing or eliminating a substantial number of the development contracts that we had with them to develop product for them. I think it was shortly thereafter, in that same time frame, I don't know which one occurred first, that Datran went bankrupt, and Datran was about 80% of our receivables at that point in time.

Pelkey: $100,000 or more?

Norred: It was around $100,000, I think. In those days, that was about 80% of our receivables, so we, having no bank debt, and then having 80% of your receivables had just gone out of business, it's kind of tough to go out and find debt, so Roger and I -- Roger signed up to hand in there and not go back --

Pelkey: Was that a big discussion between you and he at that point?

Norred: I don't recall it as being a big discussion, to be honest. I'm sure it was --

Pelkey: Had he been over here for a while before this all happened?

Norred: Roger would know better than I, but it was a relatively short period of time, because I don't think they had even -- they may have moved into a townhouse.

Pelkey: Roger's recollection is that it was one month later.

Norred: Yeah, that sounds right. They could have still been living in the motel from what I remember. I know it was a very short period of time, and I know he had moved his family over, and it was, I'm sure, a very negative time, but I recall very clearly Roger making the commitment that he was prepared to follow it through.

Pelkey: Did you make him a shareholder at that point?

Norred: There was always a commitment to a shareholder position, and shortly thereafter -- there was always a commitment, and I couldn't begin to recall what the commitment is, but when we found the financing, it was after the refinancing, when the John Thorntons got involved, that was when I, in effect, sold Roger some amount of my stock.

Pelkey: You said threes. Case and Datran, what was the third one?

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Norred: Well, it was Case on two accounts: one, not making the investments, second cancelling the development contracts.

Pelkey: Now, at this point in time, you went out and you looked for money seriously.

Norred: We had a very short period of time. We had some cash, but not, without the ability to have any financing, we had a very short period of time to actually come up with some real investors.

Pelkey: You went to venture capitalists again?

Norred: No we didn't. Well, I take that back. We did go up to talk to Kleiner Perkins; I remember that.

Pelkey: You talked to Vadic?

Norred: Yeah. I remember making a big hit with Kleiner Perkins because at that time they were making the investment in Tandem and they asked me what I thought of it and I thought it would be a disaster, but --

Pelkey: Can't be right on everything.

Norred: Anyway, what do I know about computers?

Pelkey: You went to Vadic?

Norred: We went to Vadic because we knew the people at Vadic.

Pelkey: And because of the channels of distribution.

Norred: And, I can't remember, there was another local group that we talked to. We had anticipated that -- and it was through -- I remember the guy's name. His name was Pete Retzinger. Pete Retzinger was sort of a financial consultant, and he put us in touch, for a finder's fee, with WaveTech, and WaveTech, I believe, had just made a couple of acquisitions. John Thornton, I believe, presented it to the board, and the board declined to consider making an investment in Micom at the time, and that was turned down. Then, I believe, he asked permission to personally make the investment, and he personally made the investment in Micom, which we negotiated with John. In effect, John and some people he was involved with, ended up with 51% of the company for agreeing to loan us, I believe, $250,000.

Pelkey: Roger recalls that it was $21,000 plus a $180,000 loan guarantee.

Norred: I don't think that's exactly correct. I think the $21,000 may be accurate, because I had $20,000 into it and I wanted John to have some cash into it, so there may have been $21,000 put into it. I can't remember for certain. I couldn't even remember that. I'd have to go back to the corporate records, but I remember the line of credit being $250,000, and it wasn't a loan guarantee, because I remember very clearly receiving checks written by John that I deposited in the bank. There was a revolving note arrangement, and we did, in fact, pay off John completely, within about six months, and then ended up with a line of credit with the bank, so he actually had his money out of it, I believe, within six months. It was a very short period of time.

Pelkey: Now Art remembers a conversation between you and him in which you subsequently told him that Codex was next on the list to talk to.

Norred: Well, there were a number of people in the industry that would have kept us from going out of business. It's possible -- I honestly don't recall any direct communication --

Pelkey: His recollection was they would have put money in you in a flash.

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Norred: Yeah, I think that's -- I think we may have had some discussion with them. I know that they were on our list of people to talk to. We felt most of the people we talked to were people to acquire us. It wasn't what we really wanted to do, but if that's what it came down to, we were certainly prepared to do it, because we didn't want the company to go out of business. We had a reasonable backlog at that time. I remember, we had a contract with IBM and we were on the beginning phases, I believe, of the first contract with a company called Reynolds & Reynolds, and we also --

Pelkey: So your recollection is that contract was in place at that point?

Norred: The IBM one was. Reynolds & Reynolds? There were two phases of the Reynolds & Reynolds contract.

Pelkey: This is a very important contract, as I recall, from Roger's perspective.

Norred: There were two contracts with Reynolds & Reynolds. The first contract was to build a little communications controller. I know this: I had started the discussions with Reynolds & Reynolds prior to Roger's arriving, because I remember turning it over to him. Certainly, Roger was responsible for the contract for what ultimately became the hardware for the Data Concentrator, but prior to that --

Pelkey: Was that that contract, that you handed over to him?

Norred: I say handed over because Roger assumed the responsibility for the marketing; he was the one that was heavily involved when the Data Concentrator contract -- I will come back to that. Let me just try to get this straight. I know that I had started to talk to this guy from Reynolds & Reynolds prior to Roger's coming, but shortly thereafter, because we were still in our first building which was over on Corisco, and we moved into the new building right after Roger came. We were working with them about doing a product, and the first product we did was sort of a little switch, and that product, I believe, was actually under way slightly before Roger came here, but this was built around this 5040 product line. That was the intelligent box. It was, in fact, our first contract where we were actually writing some software to go in that. Then, I'm sure the communication began, because I know the product wasn't delivered until after Roger came on board. Then, as the ongoing aspects, we, having done this one product, another requirement came up from Reynolds & Reynolds for a remote cluster controller for terminals to go into their basic timeshare systems. We bid it thinking we would win it. We bid it on the 5040 hardware, and they came back and told us we weren't even in the ballpark price-wise. That's when I went back to the drawing board and came up with this real low cost, cheap and dirty little plastic box with one printed circuit board to get this business. That hardware ultimately became the hardware for the Data Concentrator.

Pelkey: To me, that product is one of the most important products at some level. Let me share with you Roger's perspective.

Norred: I suspect Roger will be pretty close, but I'll be interested to hear it.

Pelkey: His perspective is that fairly early, he made a call on Gibraltar Savings in Los Angeles. Gibraltar Savings was the critical account, to him, in terms of them wanting to use a time division multiplexer.

Norred: Yeah, I sort of recall the Gibraltar Savings thing because it was one of the first reasonable accounts that we might -- they wanted multiplexers and a lot of different things.

Pelkey: And he had this thing with them wherein error correcting was critical. They did some calculations, and every document, statistically, going to have errors in it, and that his reaction was that it just blew his mind, listening to this person who wanted to do this sort of thing, and his reaction was that he walked away saying that if we could solve this problem, we had a real business here. From talking to this guy, he realized there were a lot of other firms wanting to do the same thing. He got to talking to the systems integrator who was pitching minis with their multiplexers at another place, part of the pitch was

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that these remote terminals acted just like they were connected locally, because they had this magical EIE interface. He was shocked by this experience. Then he came back and talked to you and you had been struggling with the concept of going after the statmux business, looking at Codex but seeing it as a big systems business that was very expensive; you really thought about this company called 99-Com that you were thinking about doing, and the reaction of the two of you was that if you could come up with a platform for this statmux product, that you might go do it. In fact, he went out and got the Reynolds & Reynolds contract to do what became the platform, and you bid it really low in order to get this job, and then you had to keep throwing chips out, and you stuck a Z-80 in it in order to get the cost content low enough to satisfy this contract, and at the end, you still had enough functionality to do what became the Data Concentrator.

Norred: Yeah, we had to change it slightly, but -- that's interesting, because it jogged my memory a little bit. Certainly, this product that we did for Reynolds & Reynolds -- when the hardware was developed, it was not intended to be a concentrator. It was, literally, a port sharing device. In fact, it was called the buffered line-splitter. I remember the product. It's interesting, because I think Roger is accurate. I, for example, would not have been aware of the Gibraltar thing because the way I recall a lot of it was, that the other element that added to this, and I assume he mentioned it, is that we also saw that Reynolds & Reynolds, who was putting in all these small timesharing systems, took a decision internally, at one time, to say: "We want to support this next level of dealer, and rather than put a computer there, what we really need is a little intelligent controller that we can link back in . . .

Tape Side Ends

Norred: It's interesting how a product that you think is never going to do anything ultimately becomes -- there, it was incorporated in May of '73. (Reading from a document) There were our company strengths: expertise in design, implementation and marketing of data communications systems. Technically maximize functionality to individual customers and minimize telephone line costs.

Pelkey: Would it be possible to get a copy of this?

Norred: Yeah, I'd like to read through it, but in principal, I don't see why not. This was the proposed structure. It never materialized in this way. I remember that. Fitzwilliams was chairman of the board of Case. Our product line was the 2010. The concept was actually very good. If we had solved the software problem here, it could have been -- except for the fact that it puts you very much in the systems business.

Pelkey: Which you were resistant to do because of the money. You were in the software business in the sense that you were using microprocessors. What were you using, a Z-80?

Norred: No, we were using the 8080, but we went to the Z-80 very quickly after that.

Pelkey: So you were programming 8080, you just weren't --

Norred: We were actually programming the Z-80 actually in some respects. Roger is incorrect in saying -- I believe we were using the Z-80 prior to the hardware we did for Reynolds & Reynolds. It was almost parallel. In fact, I know it was because the product we did for Reynolds & Reynolds prior to that product was Z-80 driven.

Pelkey: The software you weren't into was the software that sat on the minis?

Norred: Right.

Pelkey: That talked to the box you were building. We were talking about this Reynolds & Reynolds and how that project related to the Data Concentrator platform.

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Norred: The reason why I was looking for it is that I actually designed -- we never implemented it but I spec'd it out and came up with a design for -- an error controller, just a single channel error controller, that we ultimately did implement at Micom much, much later, back in around 1974. CSC started work on a product of that type, knowing that error problems in computer timesharing actually, in ADS days, they had started to look for that kind of product, and that's why I concluded there was in fact, some day, going to be a market. I remember I proposed it to Case, an error controller, even back around the '74 time frame, using this type of hardware. Anyway, the other thing that I recall, whether Roger related to it, was the aspect of -- if they were going to implement this new generation second tier, we suddenly realized that -- I think it was Roger who was making the comment -- we were asking Reynolds how many of these products would they need. They said: "Well, certainly we're going to need at least 1,000." To us, 1,000 of anything was just mind-boggling. You just didn't sell 1,000 of anything in our business. That's where the interest also began to be very strong in the statmux. Even though Reynolds & Reynolds never did buy one, they were, from my viewpoint, the people that really brought home that there was going to be a very major market for this low- end multiplexer, which we called 'concentrator,' rather than 'statistical multiplexer.' In fact, 'concentrator' is the name that we've always used, mainly because I always considered it -- in fact I think it was Infotron that actually coined the term 'statmux.' We had always called it a concentrator. Actually, at ADS, we developed a software based concentrator. It was one of our product lines. It never went anywhere. It was too expensive for not much throughput, base on somebody's minicomputer. I can't remember what it was.

Pelkey: So Reynolds & Reynolds -- was there a conscious effort between you and Roger, realizing there's an opportunity for this Data Concentrator, and that if you got somebody else to build --

Norred: As I said, the way I recall it happening, and I'm sure there's more that went through Roger's mind than I was aware of, was primarily the people that really brought it to our attention that there was a real market opportunity with the emergence of minicomputers being used and timesharing type applications, was literally a repeat of what happened in the late 60s, except that it was now the minicomputers that were bringing low-cost timesharing to market, versus the mainframes that were bringing it to market for the first time, that we started to have this need to put a cluster of terminals in a remote location, tied in to these small timesharing systems, because the minicomputers were becoming powerful enough that they could support these multiple terminals. I honestly don't recall how it actually evolved, other than I know that when we found out that Reynolds potentially was a customer, we began to develop, on our own, a data concentrator product.

Pelkey: This was late '76?

Norred: Boy, I couldn't tell you when that would be. I could go back to this business plan, which was done in '76, and there wasn't the slightest mention of a data concentrator in it. There was a product of some similarity, but -- you also have to recognize there was a significant influence of Case, because Case was very far along in building a software based concentrator. Case had done quite a bit of work in two directions. One, they developed a message switch; and they had also begun to develop a software based concentrator, based on the Data General computer during that time. So there was an element of work being done by Case, by other people, in a minicomputer base, but nobody had really moved forward by using the technology in -- and there was another aspect that was always a real problem, and I really believe it held back so much of the perceived ability to use a software based concentrator or statmux in the asynchronous market: we always had this great fear that, if we tried to utilize the link much more efficiently, such that we were literally allowing ourselves to take in data that's maybe five to ten times greater than what we could put down the link, what happens if we run out of memory? Do we just throw the data away? That was the biggest problem of why these kinds of products were not being developed in some respects. It's kind of interesting that it took the minicomputer segment to start to deal with this, because the minicomputers didn't have computer front-ends to deal with this, but they began to develop techniques of selling 'stop terminal.' It was the beginning of things like 'X-On X-Off' control, or Data Terminal Ready being drop control, that said: "Stop, terminal," that really allowed the Data Concentrator to be a viable product. Up until that time, we could not stop the flow of data. As a result, you could easily build a scenario that says you're going to run out of buffer, and when you're out of buffer, you're going to start throwing data down the tubes. It was that breakthrough, in my mind, that was the biggest, most

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significant element of why we could build a concentrator and make it a viable product. Now, when we started dealing with Reynolds & Reynolds, talking about this issue, they understood it, but they had sufficient control over their own operating system, even though they were buying it from someone else, they were like 80% of that company's output, to deal with this issue in a way that we wouldn't have the problem. But, it was also, we began to realize thereafter, that, for example, Hewlett Packard, which is one of the major suppliers, used this X-On X-Off control, and Data General, the other major supplier at the time, used Data Terminal Ready as flow control, and I can't remember what DEC used. DEC, interestingly enough, during that time, was not a dominant player in the very early phases of that marketplace. It ultimately became a very dominant player, but it was really Hewlett Packard, as much as anybody, that was the leading supplier of minis as small timesharing systems during that period. I think Roger's right. There's no question that, when we began to see this thing, I know Roger got very excited about the market potential, and it, of course, had surprised us all, whenever we finally got into it.

Pelkey: At this point, having gone through the ADS experience, did you see the parallels to what happened in the late '60s?

Norred: No.

Pelkey: You were just so busy doing products?

Norred: No, not at all. We were dealing in a totally different world. I'd like to thing it was by grand plan, but so many of the aspects of Micom we were able -- to use Roger's quote: "If we can't fix it, feature it," that so many of the characteristics -- in fact, I give Roger a lot of the credit for positioning us in that marketplace and, in effect, dealing with our weaknesses in a very positive way, in that we all knew that data communications companies in general, I've always felt it was a very difficult business, because to be successful, you nearly have to ultimately think you're going to be in the systems end of the business. To be in the systems end of the business, you have to develop a major service organization. You've got to have a major sales organization. You've got to get to what I call 'the systems level plateau' that you can support those things before you can really build a big company. Well, we always recognized that it was going to be a very difficult thing for us to do, other than do it like everybody else; use third party maintenance, use reps, you struggle through and you deal with the years of growth, and it's difficult because you can really just not bring enough resources into the company to just do it cold turkey, and as a result, the fact that our product was small enough that we could replace it completely and take advantage of the fact that we didn't have a service organization, but we could ship them a replacement product, was a brilliant ploy on Roger's part, in terms of how we dealt with that. We took it was being a situation that we could actually convince the customer he was better off getting a complete replacement than having the service guy show up with the wrong parts, and by making it small enough - - it wasn't that it was planned that way, it's just the way it was, since it was a fall out of a previous product -- but having it so small -- and, interestingly enough, the way the product was built, it didn't make any sense to service it in the field anyway. The thing was literally built like Japanese transistor radios. In many respects, you don't go have customers unplug modules to repair it.

Pelkey: Roger's view is that the two of you got really excited about the product when you found out there was a real market, and when you realized that the Codexes and the other people in the statmux market, your strategy was so different, being there with a $2,000 end user price and a small box --

Norred: By the same token, of our market, we found that reps, and ultimately distributors, were better at selling this product than direct salespeople were, because of the selling price and the type of customers we were calling on. So we were able to take advantage of two weaknesses that turned out to be strengths against the competition.

Pelkey: During this time, were there moments when you got really excited?

Norred: No, I don't think so.

Pelkey: It was that you had been through so much that --

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Norred: No, I don't think that had anything to do with it either. I think it was, as it always had been, it was 'take it every day, one at a time,' and we never really -- certainly, the growth of the Data Concentrator was so far beyond our expectations. We ran for almost three years trying to figure out ways to get manufacturing big enough to deal with the orders. It was that kind of fortunate situation. As we began to get into it and began to realize that, whether it be by plan or by luck, so many of our weaknesses were strengths.

Pelkey: Now, when Roger proposed this fancy ad with the orange juice can and, as he describes it, a whole year's budget was a brochure --

Norred: That's the absolute truth.

Pelkey: Was that a big decision for you? You were president at this point.

Norred: Well, the way it happened was, Roger, who is a very good salesman, had concluded that, to overcome a lot of our weaknesses in size and credibility, that it was very important to us to present an image that may be way beyond what we really were. He had met this -- literally Roger did all the advertising, and he continued to do all of our advertising for many years -- this local art director who worked with him. There were --

Pelkey: He told me this story, but was that a big decision for you?

Norred: Well, it was a big decision in that -- part of that decision, and the reason why I agreed to go along with it in the amount of money we were going to spend, is because we all began to realize the potential. I think we all began to recognize how important it was to put together an image, and it took a lot more money than what we had to spend at the time, but it made so much sense in terms of where we were in the marketplace. There were two documents that were very instrumental in Micom's success, both of which Roger produced. One was the orange juice brochure, secondly was the buyer's guide. Those two documents literally were, as far as I'm concerned, as much as anything, the heart of the success.

Pelkey: When you first saw the orange juice can, the concentrator ad, what was your reaction? Did you think this was a good ad?

Norred: Oh, yeah. It's kind of interesting how we got there, and where it all happened, who knows at this time. There was a brochure put together by general automation, and I gave it to Roger, and I said: "You know, Roger, this is really a class ad. They use a lot of fruit in it, as well as a lot of other thing," and he agreed. I remember him putting it on his shelf, because Roger is very good at keeping things that he likes around his office. It was after that this guy -- in fact, it was my belief that it was really the art director that came up with the concentrator concept --

Pelkey: It was.

Norred: Totally because we decided to call it a concentrator, and as a result of this guy just probably being dumb, put together the concentrator with the orange juice can.

Pelkey: Let me jump ahead a little bit now. Clearly that part of your business was just going phenomenally well. The next big product for you was the data PBX.

Norred: We got into the data PBX, again, through one of our custom products. Roger and I -- and I cannot remember the timing, whether it was pre or post Roger or about the same time -- but anyway, we got this contract with ITT to develop, in effect, a teletype switch. What they had a great problem with is that ITT in New York had this huge telex switch, and they had a need to be able to connect up to different ports on different locations so they could, in effect, monitor and test this thing. What we did is we proposed -- we were very good at custom products at that time, and I remember generating the technical

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side of the proposal for this thing because they had it out for bid, and we said: "This is the way we're going to do it," and we drew up all these fancy diagrams, and in effect, it was the architecture of the data PBX. We actually had developed that product and installed it for ITT, and that product evolved into the data PBX, but to be perfectly honest, I don't even remember how we got from A to B in the data PBX. I know that we developed it on the basis of taking our 5040 controller and developing the switching module which caused all the switching to take place. I remember, it was a product that was built for ITT with, almost by pointing, not by drawings, and we subsequently installed three of them, because we ended up building two more for them.

Pelkey: '78 must have been an incredibly enjoyable year of your life. In '79, it strikes me that the next two events of Micom, from your perspective rather than Roger's, was one, raising the venture capital and; two, Steve Frankel coming aboard.

Norred: Well, we can talk about each of those. The venture capital thing came about, from what I recall, as much as anything, by way of Dave Goodman. John Thornton brought Dave Goodman and a guy by the name of Marty Ortlieb, his attorney, on board, and they each had a small percent of stock, and John had the balance. Dave Goodman, I call him a retired venture capitalist and certainly very knowledgeable in the venture capital industry. We started to get a lot of people calling us about wanting to invest in the company, because they were seeing that we were an emerging company, and I remember the guy that was most persistent was Stu Greenfield of Oak. Stu was talking to us. At the same time we began to say to ourselves: "Well, maybe it isn't inappropriate." The driving force, as much as anything, wasn't to bring money into the company. It was so Roger and I could both sell some stock and put a little away before we screwed the company up. There was also an element of listening to the people -- it would be important to us to get other people involved that could help us. That, as much as anything, and the continued pressure to invest in the company, we finally decided to sit down and do it. It was kind of interesting because I don't think we ever even produced a business plan. In fact, the decision -- we actually agreed to make an all-day presentation to all the venture capitalists we had chosen, which were Greylock, Oak, Hambrecht & Quist, and Fidelity, and I remember we had, in our little tiny conference room, this meeting where we made this presentation --

Pelkey: All of them present?

Norred: All of them present, and the word was that at the end of the day, they had to make the decision to make the investment. They all went away and caucused and came back and said: "Yes, we'll make the investment."

Pelkey: Roger's recollection was you wanted to pick one.

Norred: That could be right, I don't recall that.

Pelkey: And they all came back and said --

Norred: That was somewhat true in that we said we probably just wanted one, and it was sort of agreed to split it. I think that was Dave Goodman's idea, now that you mention it. You know, Dave Goodman would be a good guy to talk to. I'm sure his name has come up. Dave Goodman has a tremendous memory. He'd be a good guy to talk to about some of the early aspects. You may be right about that, because I couldn't remember for sure.

Pelkey: Then they came back and they all wanted in.

Norred: They all wanted in, and they agreed -- there were really, I think --

Pelkey: They split it and you raised the amount a little bit, and H&Q would subvert its roll to Greylock.

Norred: Well, I think two of them were at equal levels, and then two at lower levels.

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Pelkey: Right, Fidelity and H&Q played second to Greylock and Oak.

Norred: That's right, and we were off and running.

Pelkey: Data Concentrator actually started shipping in '77?

Norred: That's as good a guess as any.

Pelkey: Do you recall if it was first half or second? It was in fiscal '78, which could have been --

Norred: Because then you were calendar of '77, after March, sometime in March of '77. I don't have the slightest idea.

Pelkey: The second one was Steve Frankel. It seemed to me that was an important juncture in the history of the company, because you were running engineering at that point.

Norred: I had done all the design, not because I was capable, but because I was the only guy there. In fact, at ADS, I didn't do a lot of design. I did in the final portion. I did some design work on the multiplexer, but up until that time, I was running manufacturing and engineering, but I had done very little design during that period. In fact, I had no knowledge of logic, computers, or anything else at all when we started ADS. I had come from a company that was a tech support company for the Apollo moon program, and I was site engineer, which means I was responsible for where they test the lunar module, which means I was responsible for everything from sweeping the floors up through the storage of rocket propellants. In fact, they hired me to be TV engineer for the TV cameras and the movie systems and the intercoms and stuff like that when I went to work for that company, because there was really no background.

Pelkey: So you made the decision to get somebody in to run engineering.

Norred: Well, we were obviously growing, and we had to find somebody soon. The company was just growing too big. In fact, I think that Steve wrote us a letter. He was working at Tran at that time, and had heard about us, and had written a letter, and he wanted to get involved. I turned it over to Steve very willingly.

Pelkey: Then the next thing was going public.

Norred: '81.

Pelkey: That was very successful.

Norred: Yeah, we were very fortunate that we were one of the very last companies that hit the window. That was probably one of the heaviest IPO periods in the history of small high-tech companies going public.

Pelkey: The data PBX, now, is out, and it's starting to become a more important part of your business --

Norred: The data PBX product was out, certainly long before we went public. I can't remember -- it would be interesting to look at what the date was for the PBX. I know it was a product about which we had great debates concerning whether we should be in the business.

Pelkey: Yes, I would think, because it was so new -- the selling of it and the requirements to sell it and support it were different.

Norred: In those days, we didn't worry ourselves too much about those things. We just went out and did it, not worrying about -- (Leafing through some papers) It doesn't say. This was starting to become a more important part.

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Pelkey: You were starting to experience growth of this product in '81 because it strikes me that the next big event in Micom's history was really the PC beginning to impact the data PBX sales.

Norred: I'll tell you how you can tie it in some respects; I know we became a factor when Infotron decided to develop a statmux, because --

Pelkey: They wanted to come after you with --

Norred: I'll never forget, I think it was Jim Hahn I was talking to at a trade show, and he said that it wasn't the data PBX -- you see, they had a front end switch -- a port selector they called it. It wasn't a data PBX, it was a port selector. In fact, we called ours a port selector for years. It wasn't until we decided to market it into the local area network that we started calling it a data PBX; we gave it a new name. But, I remember him making the comment that it wasn't so much that they minded us selling a switch, it was all the other products we were selling along with it, which I didn't think still was a very significant market factor, but it was obvious that they had to do something to compete more directly with us, and that's when they came out with their own statmux, during that time. They had a switch and we didn't. In fact, now that I think about it, I think CSC was somewhat instrumental in the data PBX as well, from a market standpoint, because they also were getting ready to buy a lot of these Infotron switches, in fact did buy some, and I think that was also pretty instrumental. Seems like we used to stay very close with CSC, in terms of what was going on. They were our customer that was very close in providing a lot of input to us and the direction we went. In fact, I know we developed the very first of our Micro-500 error controller -- CSC was amongst the first customers for that product as well. That was just a subset of the Data Concentrator that we came out with later.

Pelkey: In fact, there was an event that strikes me as earlier than this, before we get into the PC data PBX issue. You started OEMing the Codex modem to incorporate into your statmux. I guess you actually got it from UDS.

Norred: Well, ultimately we did. The original contact was with Codex.

Pelkey: Were you involved in those negotiations?

Norred: To some degree. I remember at a trade show, Art Carr, Roger and I over in one corner of this very noisy place -- we may have had a breakfast meeting, and we were telling him that we wanted to buy thousands of modems. In fact, it may turn out to be the biggest single order for modems that Codex ever got. I know it was a very big order. Originally, I don't think they took us very seriously, because we told them what kind of price we had to have, and they really couldn't get there, from what I remember, and it was ultimately UDS, because they had acquired UDS. I can't remember now how the technology evolved down to there.

Pelkey: Roger's reaction, when he first mentioned it to Art, that Art kind of said: "Well, I'm in a hurry, I've got to get going," and then all of a sudden he said: "What kind of volume are you talking about?" Then, you mentioned the volume, and all of a sudden Art said: "Wait a minute, how many of these things are you selling," because they thought they were a very big customer of your, because they were OEMing your product. They thought they were a significant part of your business. Then when you told them the number, they started to realize that they weren't that big a part of your business.

Norred: They actually were for a short period of time. At one time, we were running 40 or 50% of our business OEM in the Concentrator. It wasn't for very long, though, because the end-user side of the business really started to take off by leaps and bounds. But at one time our business was at least 40% being OEM to Codex, General DataComm; I don't think we were shipping too many to Paradyne at that point in time.

Pelkey: Do you remember another meeting shortly after you announced the Data Concentrator, a famous, controversial figure in the industry made a call upon you?

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Norred: Mr. Ed Botwinick. Yeah. Ed wanted to --

Pelkey: Ed remembers it as well, and Roger remembers it.

Norred: I remember Ed calling the first time, and we pretty much said we didn't have any interest. I can't remember -- I think he did come out and maybe talk with us.

Pelkey: He said he was just in the neighborhood –

Norred: Yeah, and then some time later, he sent out -- I can't remember who the guy was, but I never will forget -- we were really starting to look pretty good then. In fact, we were on a ramp that was getting dangerously close, on a ramp rate, to what Timeplex's sales were, and I remember the guy that Ed sent to talk to me about, again, the possibility of perhaps acquiring the company, and I think it was about 15 or 20 minutes into the conversation, he said: "You know, I don't know what I'm doing here."

Pelkey: You hired a lot of Timeplex people at some point.

Norred: We really didn't.

Pelkey: There was some kind of a --

Norred: We hired, just prior to our public offering, a handful of Timeplex people, mainly because -- we didn't go after them, they came to us. We did hire a few people, but it was a very small number. It wasn't a large number; I mean, three or four was the number that I recall, and it was as a result of that that Ed, in my opinion, took it onto himself to see what he could do to annoy us.

Tape Side Ends

Pelkey: Another big event that strikes me is the issue of the data PBX becoming an important part of your business and, after '82 and the PC, the LAN business --

Norred: I should tell you the background of the data PBX. When we began to sell quite a few of the data PBX's, we began to realize the magnitude of what we were getting ourselves into from a support and maintenance standpoint. I can remember very clearly having four or five installed and feeling very good about the product line. We woke up one day having 50 installed, issuing a new software release, and finding out that we didn't have a single customer that we could use as a reference; that we were in big trouble. In fact, I took over the product line as product manager at that point in time. We were literally in big problems. We had major problems with customers. The thing was not working well. The software had problems in it. It's the typical problem of --

Pelkey: This is pre '79?

Norred: It was the stage when we had 40 or 50 units installed and we were starting to develop a reasonable backlog for the product line. It was at that time we at least brought in some people to become the product managers. We began also to staff the engineering side to deal with some of the technical problems because we still had some technical problems associated with the product in larger configurations, and we were starting to see larger configurations for the first time. Up until that time the configurations were relatively small. There's no question that we had to get very serious with the product. In fact, there were discussions on more than one occasion, two that I can recall, where we came very close, and it was almost my recommendation, to get out of the business, to literally kill the product line, because the concentrator product line was doing so well, it had so many things going for it being a product rather than a system oriented product, and I think that every time we got to the point where we were going to kill the product, we got another order for 50 or something. It was that kind of situation. We were getting so many orders for it that it was very tough to cut it off.

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Pelkey: So it was becoming a very successful product, and it was changing the character of your company --

Norred: Well, it was changing the character of the company. We had to go out of our way to come up with a strategy that would allow it to fit into our strategy.

Pelkey: Having direct salespeople out there who supported the reps - -

Norred: It didn't fit the kind of market totally, even though there was no question that a lot of our customers that bought data PBX's would buy concentrators, but it was not the dominant reason for wanting to have the data PBX.

Pelkey: Now, the LAN business started to impact the data PBX business.

Norred: As time went on, after we saw major growth in the data PBX, to the point where we clearly became the number one supplier in the data PBX business --

Pelkey: Which is probably now '82, '83 --

Norred: '82, '83 time frame, exactly, that we saw major growth in that product line. In fact, it was also during that time that LANs became known as technology, even though they weren't being very well sold. It was still a total unknown. There was a lot of confusion being created. In fact, Roger probably told you, his approach to it was to really take advantage of all that confusion, promote the product for the first time as a LAN product. That's when we changed the name of it from a 'port selector' to a data PBX, and looked at it in a different light, because we had a lot of advantages that you could use to sell. Then, I guess it would be fiscal '85 when we got hit the most, because I can remember one quarter that our revenue dropped from one quarter to the next in the data PBX area by a major amount, and it was the first time that we really saw the impact.

Pelkey: That was before your purchase of Interlan?

Norred: Yes.

Pelkey: And you bought Interlan in '84 or '85?

Norred: I think you're right. It could have been fiscal '85, calendar '84.

Pelkey: Calendar '84, and you started to see the impact of the LAN business. And you weren't hearing this through your distributors, because your distributors and your reps by now are 'fat cats.'

Norred: Oh, I think we were hearing it. It wasn't just the LAN impact either. There were a lot of other factors going on in the minicomputer business. You have to also recall -- my opinion is that I have a very clear feeling that the microcomputer had a much greater impact on that business than the LAN business did. One of the issues that we did not do an adequate job of dealing with is recognizing that the microcomputer was a revolution, not an evolution, and we didn't deal with it in a revolutionary kind of way. There's very few things in the history of data communications that don't evolve relatively slowly, but the impact that the PC had on the computing/data communications industry as a whole I think far exceeded anybody's expectations, especially IBM's. As a result, it caused the minicomputer business to do some bad things. I think, as much as anything, the slowdown initially came more from the effect on the computing side than it did on the LAN side. Now, ultimately, the LAN side had an impact because the minicomputer manufacturers recognized, all the manufacturers recognized, that local area networks were going to be the network of dominance in interconnecting the PC's to everything, and as a result, it was all caught up in that area, but I never really looked at it as LAN, per se, because we really didn't find many customers that we could walk into that would say: "I'm not buying your data PBX because I'm buying a LAN."

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Pelkey: Was the issue of buying Interlan a big issue for you?

Norred: Yes, it was a very big issue. There was a lot of debate as to whether we should do it, and from my viewpoint -- in general, if it had been a sole decision on my part, I doubt very seriously we would have acquired any company, because it really wasn't my nature to acquire companies.

Pelkey: Now in '83 -- Frankel left in '84?

Norred: I honestly don't remember. He was with the company for approximately five years.

Pelkey: Steve's recollection of some of this is that he wanted to be in the LAN business. Roger wanted to do a voice PBX project.

Norred: Well, when we began to see all this happening, in terms of where the company went forward from that point, there was a lot of discussion about what should we do? Should we build off of the data PBX technology and direction and get into the voice business and combine the voice and data together? To be honest, do I recall Steve pushing for the LAN business? Not a lot, to be honest. I know that we had some very long discussions about the voice PBX business and concluded it was just a business that we had no business being in. There were just too many obstacles, and it was also the time that the other companies were already starting to see some slowing in the growth, and we just felt we were not likely to be in a position to be a significant factor in that marketplace.

Pelkey: So then you purchased Interlan.

Norred: We purchased Interlan, as much as anything, and the convincing factor that caused me to decide that we should do Interlan, was the fact that we felt that the window of opportunity may be very narrow. Whether we could develop our own products in sufficient time to be a factor in the marketplace.

Pelkey: Were you trying to develop anything internally at this point?

Norred: No, not of any significance. Only under the context of what we were developing along the data PBX line. The data PBX, in all fairness, grew to be a very powerful networking product, because we had the ability to interconnect multiple units in a major system using T1 links to interconnect them, so we had a lot to offer from an overall networking standpoint of taking local area networks and combining them into a wide area network. I know we began to look a little bit at doing some things in the local area networking area, but we really had nothing under development of any significance that I can recall at all.

Pelkey: At that point in time, I guess it's '85 now, when Micom, after the Interlan acquisition, Micom became a very different company.

Norred: Well, there was --

Pelkey: You had been the darling of Wall Street. You were as predictable as the sunrise. You were considered one of the best managed companies in America. You were in the box business. I remember you, in '81 at the Alex Brown conference, saying: "We're not a systems company, we're in the box business." But the business changed very much. It became a systems business increasingly --

Norred: A lot of things happened during that period. One is that I got further away personally from the business direction and spent too much time supporting the financial community, increasingly giving Roger more responsibility for the company. One of the weaknesses that we had was a lack of proper strategic planning, and it was somewhat of a -- it's not the sort of thing that's been my nature -- but there was a disagreement between Roger and me. My attempts to implement strategic planning didn't go very far, because Roger really never believed in it. It wasn't necessarily all bad, because our focus was so much on supporting the customer today -- that was where our emphasis was -- and we had been so successful doing that, it was difficult for me to fault it, until we had to deal with a revolutionary change in the marketplace. If it had been evolutionary, we would have been wound through like clockwork, but that was

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a weakness that, in hindsight, would never have happened if we had it to do over again for two reasons: one, I wouldn't have let it happen; and secondly, Roger himself now recognizes the error of our ways --

Pelkey: Right, he does.

Norred: -- and it was a very difficult situation to deal with. On the one hand, when you've been very successful and the things you've been doing were working very well from a management standpoint, to be suddenly faced with dealing with a revolution, and looking back, if there was a major element it was not dealing with those changes in a revolutionary kind of way rather than an evolutionary kind of way, and it was at that stage, of recognizing that we were going to have to deal with it, that I did a lot of soul searching on my part and concluded that I wasn't sure I was really up to it. I'm not sure that I would look at it as being fun.

Pelkey: In terms of the concept of this book, the issue of how we create technological industries, here's a company that was very, very innovative. By your own nature, you are very conservative person in the way you manage and look at things, but this process of how innovative companies become conservative and fail to generate the next new idea and the next level of innovation -- the people who learn how to manage innovation the first time all too often don't become the innovators the next time around. You did the Data Concentrator and then the data PBX, which you dominated with a superior product, but in terms of investing into more R&D, you, I think, made decisions relative to your income statement --

Norred: It's kind of interesting. I knew what was going on and I wasn't very happy with it in total, and it gets back a little bit to the roll that Roger played increasingly, from a management standpoint, that the most important thing that you have in front of you today is making the customer happy. I've never totally agreed with that 100%. My feeling is that you've got to take some element of your resources and apply it to the future. We always found ourselves so resource short that we were never able to do that, and my attitude was that it wasn't a resource issue at all, it was a discipline issue. Inevitably, you may not be able to do everything you wanted to do with your resources because you'll never have -- and my attitude always was -- you never have enough resources to do everything you want to do, and I think, in some respects, Roger's feeling was, at that time, that "I've got to take all the resources I've got and work on the problems that I've got right in front of me today without regard to tomorrow." That's luxury, and I never really believed in that completely. I always felt we should be taking some amount of our resources on the future, so that when the time comes, just like today, I think they are now finally doing it at Micom, I wanted to put a little money into ISDN, just to get familiar with it, even if the product was a failure, I'm going to be so many years ahead of everybody else that didn't do it. You've got to keep doing those things, and I think that compounded our problems when in came time to doing some other things. We did talk about doing some local area networking products internally. We did talk about doing some T1. We had the basis of a T1 product for years and years. This multiplexer which we still sell quite a bit of every year had the guts of a T1 multiplexer. In fact, when I designed it, I always knew some day we'd probably take it to T1 rates, yet it never got evolved into a T1 product because we could never really figure out a way to find the resources to do it.

Pelkey: Of all the mistakes that could be laid at your feet, missing the T1 multiplexer, in retrospect, would have to be the one that you must --

Norred: Well, yes and no, because, in all fairness, this is where -- since I left the CEO, Roger has obviously taken a very clear direction to go into the systems business. I wouldn't have done that, personally. I felt it was a mistake. I still believe there is more than sufficient opportunity in the product side of the business to be a successful company. It may not necessarily be the same and it certainly would have to involve an element of the LAN business, but I've always believed that it really isn't necessarily too late to get into any market, if you're good enough at it, and I think that when we acquired Interlan, we felt we were not good enough to come in this late to get in the business, and yet I turn right around and I look at all the companies; the Novels, the Excelans, the other companies that we looked at at that point in time, saying: "These guys don't have a lot going for them," and yet look at them today. I picked up a document today where Novel is outselling IBM in the marketplace, and as a result I say to myself: "I don't buy that. I never have bought that, that you can't get there." I felt that I wanted us to get

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into the T1 business, and we started down that direction. I wanted to get into it by starting off being the dominant supplier -- I always thought there was a market opportunity for 56 kilobit products, because in many respects, I sit around here and I say to myself, much like we saw in the earlier days: "Who is buying T1 today?" I used to look at Micom as a company and say: "Our customers are not much different than Micom. How many T1 links does Micom have? Zero. How many T1 links does Micom need?" Take it back. When we had a plant over here, I kept threatening our guys that if they didn't come up with a product soon, I was going to go buy one from Timeplex to put in, because I could justify one from our facility right up the street, which is now moved over to there because we had all these blasted voice links. It had nothing to do with data, it was strictly a voice issue, and of course that's where the T1 market started, as far as I'm concerned. Probably still a major aspect of where T1 came from. So the voice side was not a technology that we were terribly familiar with. In fact, it was me that was pushing Mike Barker to get into the voice business and learn something about it that got us into the voice products that we have today. I said: "We've got to learn something about that." In fact, there was absolutely nothing in any business plan we had to get into that voice product, and I kept telling Mike: "I really think you ought to be looking hard at the voice technology area. We'll learn something." Our problem was always that we didn't know how to do the interfaces to the PBXs and all that stuff, and we were looking at it as black magic. I said: "It's not black magic. You've got to get into the trenches and learn it, or hire somebody that knows it," and it was out of that evolved a number of products, because what I wanted to do was -- I said: "We do need at Micom a powerful 56 kilobit multiplexer that I can put a significant number of voice lines on. It's going to take voice compression to do that. If there's 1,000 big companies out there that can buy T1s, there's got to be 5,000 small companies that might be buying 56 kilobit," and the only flaw in that was it seemed like everybody kept coming back and telling me you can get a T1 as cheap as you can get a 56 kilobit. I said: "Well, that's madness. That's not going to happen forever, because if that is, I'll go into the business of buying T1 links and selling off 56 kilobit links." It didn't make any sense to me at all. It really gets back to something that we never really pursued, and I'm still disappointed we didn't pursue it today. It gets a little bit like the statmux business. It's an educational process. People bought statmuxes not because they thought they needed a statmux, it was an educational process. There are a lot of people out there today that could be using 56 kilobit in lots of applications that doesn't move us into large networks, large systems. The problem with the systems business is -- the data PBX we could justify because it was in one location, mostly. T1 is never in one location. It's in every city in the world. That is a serious systems business to be in, and I've often worried about -- I'll certainly agree with window of opportunity in this particular marketplace -- because we are starting to see a substantial slowing in the growth of the T1 companies. I think it's already overcrowded, and I think it's going to be a difficult business to be in. It doesn't mean you can't be successful at it. There may be some niches, and I think the good news is that there are some pretty bright people, including Roger, and I think there are ways that they can find some niches in the marketplace, providing they decide not to go compete head-on with all the established guys. Right now, I don't see how they can avoid that. It seems like the direction they're going. So, there are certainly mistakes that were made relative to not dealing with the changes in the marketplace. I certainly felt very good about the company up until that point in time, and began to see some of the strategic issues that we failed to deal with.

Pelkey: This issue of innovative companies continuing to innovate, at some level you came to define Micom as a product company, and at some level the marketplace was beginning to move more towards the systems business as the complexity of the products, and the deregulation of AT&T, the emergence of DEC competing with IBM and the customer base was being forced, with so many vendors, they were looking increasingly to fewer and fewer vendors controlling more and more during this period of time, at least in the Fortune 1000. In your market, where you had defined it as a minicomputer market, you could have avoided all of that --

Norred: I think our market was more defined -- it was a much smaller customer.

Pelkey: Below the Fortune 1000 or the branch offices --

Norred: And it was during our growth in that I really began to appreciate and respect how nice it is to have a business that had 10,000 customers instead of 1,000 customers.

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Pelkey: And somehow, either because of the LAN acquisition or for whatever reasons, the process of being able to continue to grow a company to more than a $200 million company in a product business in that heartland stopped, or in the transition of the market, you kind of flattened out as so many companies have. Codex is the only real example of one that has burst through it.

Norred: What is Codex's sales these days?

Pelkey: Between five and six.

Norred: They're the only company -- I used to make the comment that I've never seen a successful systems company in the data communications business. No one has really achieved that, except maybe Codex, and even there -- I don't know enough about them to really come to a conclusion, but if they're at that kind of revenue, I'd have to say they've achieved a reasonable degree of success. I think they were the only company that I ever gave much chance to do it. I thought Paradyne did at one time, and I think barring the SEC Social Security issue, they potentially could have as well.

Pelkey: They were really buying their way into the business, at some level.

Norred: I think Codex is buying its way into the business in some respects.

Pelkey: Paradyne changed the nature of the modem pricing in leased-line.

Norred: Well, frankly these guys were all making too much money and sooner or later that has to happen.

Pelkey: Paradyne was just the first one that did it.

Norred: That's the great thing about our system. You can only rip off the customer for so long.

Pelkey: The modem guys, Vadic and UDS, how they missed Hayes. How they let Hayes become larger than those guys? Can you imagine that?

Norred: Novel is another one in my mind.

Pelkey: Novel to me is over in the LAN column. Hayes, in your own marketplace, your own product category.

Norred: We were never in low speed modems. We tried to get into it. Vadic, I've always felt has either been very smartly and very strictly disciplined in their business direction, or just blind.

Pelkey: I would agree with that. Is there something that we haven't touched on with regard to ADS and Micom?

Norred: Oh, I'm sure there are a lot of other things, but I think in general we've touched on most of the aspects. If you pick up some other pieces and you want to give me a call, don't hesitate to do it.

Pelkey: The other phenomenon during this period of time was DCA -- it was early in the statmux and it really didn't do much, and all of a sudden they make this little acquisition of this board level company and history overtakes them.

Norred: Certainly, DCA had a statmux before we did. They had the first microcomputer based statmux. DCA did before we did.

Pelkey: Is your recollection that they had their product out before Codex had their statmux out?

Norred: You talking about the 6000? Yes, I'm almost certain they did.

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Pelkey: And earlier than Infotron had one as well?

Norred: Oh yeah, long before Infotron.

Pelkey: Do you remember anything about Western Union's demise?

Norred: Not much. George Fritkin, the guy I mentioned earlier from Micom might be of some help in that area, the reason being, the good news about George, he's an east coast guy. We used to say that there can never be a successful data communications company on the west coast. ADS was really the first one. The only other company we haven't mentioned at that's in more recent times are the guys up in Goleta, Com Design. They really were a pretty latecomer in this area.

Pelkey: They just wanted to duplicate --

Norred: Certainly, Micom was very much an influencing factor in that.

Pelkey: Their roll model was Micom. Most of the people who came after you really misjudged, at some level, your cost structure and pricing and margins --

Norred: And how we were marketing the product.

Pelkey: So therefore they built a higher cost product and never really came after you in a really constructive way.

Norred: It's one of the big problems we've always had in this business; I think it's been engineering rather than marketing driven, and engineers tend to feature things, and therefore add costs. It was also a great difficulty in Micom to find other people that would think the same way that I did, because I used to spend hours trying to figure out how to get rid of just one IC. Cost was very, very important to me, personally, in any product we designed. I'm sure we broke a lot of the design rules in order to build products at very low costs, and we had as a strategy to be the lowest cost supplier, and I think we pretty much did that for a long time.

Pelkey: That was an incredible accomplishment. Thank you very much for your time.

END OF THE INTERVIEW

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