

An Interview with

PAUL A. STRASSMANN

OH 172

Conducted by Arthur L. Norberg

on

26 May 1989

New Canaan, CT

Charles Babbage Institute
Center for the History of Information Processing
University of Minnesota, Minneapolis
Copyright, Charles Babbage Institute

Paul A. Strassmann Interview

26 May 1989

Abstract

Straussmann begins the interview with a discussion of the mainframe products of Xerox Data Systems (XDS), formerly Scientific Data Systems (SDS). From his perspective as Chief Computer Executive at Xerox, he describes the interaction between XDS and Xerox's established copier business. Straussmann describes the growth of Xerox Palo Alto Research Center (Xerox PARC) and the development of the Alto and Star computers. Straussman recalls Xerox's decision to move away from computers and into integrated information technology. He concludes the interview with his comments on the changing economics of information technology for end users.

PAUL A. STRASSMANN INTERVIEW

DATE: May 26, 1989

INTERVIEWER: Arthur L. Norberg

LOCATION: New Canaan, Connecticut

NORBERG: I am in the home of Mr. Paul A. Strassmann, New Canaan, Connecticut for the second interview on the Xerox Data years. Can we pick up where we left off the last time, Paul, and can you tell me a few things about your early tasks at Xerox when you were brought in by Mr. Flaven?

STRASSMANN: The first task that I received upon joining Xerox on May 1, 1969, was to fly up to Boston to the Spring Joint Computer Conference, and have a good look at a Sigma 7 computer which was being exhibited for the first time. The objective here was to learn enough about the machine so I could fulfill the mission under which I was hired. As I remarked in the last discussion, Xerox hired me with the specific objective to eliminate within one year all IBM equipment in the corporation worldwide. As I recall, there was something like 35 to 39 IBM mainframes spread throughout the corporation. My objective was to get rid of them plus the huge Univac 1108. I flew up on the second day of my employment to Boston, went to the floor of the exhibit hall, and for the first time I saw a Sigma 7 computer running teletype terminals in time-sharing mode.

NORBERG: Was SDS already owned by Xerox at that point?

STRASSMANN: On May 3rd it was already owned by Xerox at that point, and on the exhibit floor the SDS label on the Sigma 7 had a paste over which said Xerox Data Systems.

NORBERG: So what happened now? You have this task. You look at this machine. What did you think of it?

STRASSMANN: I was very impressed by the machine because the machine had virtual memory. It had a very high speed random access disk, a large diameter, random access disk, which was swapping partitions at a prodigious rate.

I talked to the people who were demonstrating the machine and started asking questions like, "How fast does the COBOL compiler run?" since most of my code was either 7010 autocode or COBOL. Well, the Sigma 7 did not have a COBOL compiler, although I was told it would be available imminently. After the original euphoria of looking at virtual memory operating faster and better serving teletype machines, I started asking details about printers. And the printers in the SDS book were plotter printers which were low performance serial printers, which of course, would in no way accommodate any decent commercial application. A closer look at the tape drives revealed that these were really incremental tape drives suited for logging applications -- not for the sort of sorts that were fairly commonplace in large computer installations in those days. So after kicking the tires around and after the initial euphoria, I met the Vice President of Marketing of Scientific Data Systems, Lou Perillo. And Lou Perillo offered me a terrific deal. This was very prevalent, by the way, of the SDS kind of people. He offered me this floor machine, which he called a creampuff. I did not know what a creampuff was in those days, but my friends quickly acquainted me that a creampuff is an expression used by used automobile salesmen to con somebody into buying a shiny car that doesn't have much of an engine. At any rate, Perillo said, "We are going to maximize profits for the Xerox Corporation now that we have paid a billion dollars, by saving the freight difference between Boston to California to a destination in Rochester." And would I sign an order for this machine, which was only 3.2 million dollars? I just bought the machine right on the floor for the sole reason that I wanted to get my clutches on the machine so that I could really put it through paces and see what kind of a situation did I get myself into. Parenthetically, I want you to know that that creampuff Sigma 7 from the Boston Spring Computer Conference was a one of a kind machine. It was wired just to perform that particular function at the Spring Joint Computer Conference. And it took me eleven months and total retrofitting and exchange of all the circuit boards inside the Sigma before that Sigma was even operational for normal time-sharing. It was a sort of interesting lesson into dealing with the Scientific Data Systems organization, and the first exposure to many similar incidents yet to come.

NORBERG: So you got this thing back to Rochester. What did you do then?

STRASSMANN: The next thing I did was to organize a special staff that would be responsible for conversion. Very

quickly I concluded that I would have to make my conversion effort as a visible project totally separate from the normal MIS expenditures, and set up the conversion operation as a separate profit center. That, in fact, was a very smart decision, because as the conversion extended, it ultimately aborted after three years of spending perhaps as much as 25 million dollars of incremental expense above the cost of equipment. The conversion team that worked for me started actually assuming some development tasks so that the stated mission of Xerox Data Systems, namely, its entry into commercial data processing, would be feasible.

NORBERG: Now, let me get something straight here. When you brought the machine back to Rochester, did you then have to acquire a staff to put the machine through its paces, and if so, where did you acquire them from?

STRASSMANN: Well, when I became the Chief Computer Executive of Xerox there was a substantial staff already in place. There were over 300 data processing people split among the various comptroller organizations. Very early in the game a move began to start moving people involved in data processing away from reporting to divisional comptrollers, and put them under corporate central control. I was corporate and so I found this effort of conversion a very opportune way to accelerate the trend towards consolidation of control over computer technology throughout the corporation.

NORBERG: Was SDS kept as a separate subsidiary of Xerox at the time?

STRASSMANN: Yes, SDS was kept as a totally separate autonomous profit center. And that principle was very closely stated very early in the game, although a large number of key SDS executives became promoted to come to corporate in Stamford and take over senior corporate positions. None of those SDS transplants survived more than a year.

NORBERG: So XDS was a development and manufacturing facility to sell anywhere?

STRASSMANN: Anywhere, it had its own marketing organization and its own service organization. It was totally autonomous at the inception. There was no sharing of anything, whether marketing or otherwise, although very extensive meetings were being held to explore ways of gaining synergy, since one of the reasons why the price of a billion dollars was justified in the purchase of SDS was that corporate management pointed out that substantial synergies would become available through the combination of the various resources of SDS and Xerox.

NORBERG: All right. So your only contact, then, with XDS was as a potential client of theirs.

STRASSMANN: SDS was already in a slump; there was a defense buying slump starting actually late into 1968. SDS had a substantial drop in orders in 1969. And the only way SDS was going to make their profit plan for 1969 was to ship a substantial amount of equipment at list price -- let me repeat it -- at list price . . .

NORBERG: At list price. I heard you [laugh].

STRASSMANN: . . . internally to Xerox. And since I was the purchasing agent for that kind of an effort, there was a tremendous amount of communication between me and the top levels of SDS.

NORBERG: But no one in SDS reported to you.

STRASSMANN: Nobody in SDS reported to me, although the data processing manager of SDS had, by definition, a dotted-line functional relationship to me and became automatically a member of my systems advisory committee, which I immediately set up to steer all information processing throughout the corporation worldwide.

NORBERG: While you were playing around with this first Sigma 7, and during this 11 months while you were trying to get to operate in a satisfactory manner for your objectives, did you buy any more Sigma 7s?

STRASSMANN: Oh yes, we purchased a number of Sigma 7s, because we needed to ship them. We needed the sales for the subsidiary to reach its financial target. The Sigma 6 machine and the Sigma 7 were fairly good time-sharing machines. On a cost performance basis, in fact, after you disallow for the maintenance problem it had, and failures on paper in terms of cost performance, it was the best time-sharing machine by a wide mile in those days because of the very skillful blending of its technology and the operating system which was a time-sharing operating system. So we brought a large number of machines into our research center to give time-sharing access to our researchers. In addition to that, since there was an enormous backlog in information processing on the administrative side of the house, I brought in Sigma time-sharing equipment as a way of getting the finance people off my neck, because financial analysts and Xerox were very heavy users of all sorts of pricing models. We had a large crop of MBAs who loved to run precursors of Lotus spreadsheets. And, as the bureaucracy evolved, we had virtually hundreds of people looking for computing power, and it provided basically matrix multiplication. The Univac 1108 was totally saturated. It was the biggest Univac 1108 anybody ever had any place. It had something like 24 tape drives and God knows what else on it. So the first target then was to get rid of the 1108. The software that was running, however, on the Sigma machines was FORTRAN, which is not what financial analysts used. Just by happenstance, there was a man by the name of Ian Sharp in Toronto who developed a very good version of APL. And for a number of behavioral reasons, financial analysts in the early 1970s and late 1960s loved APL as a way of doing their arcane stuff. One of the reasons, I suspected, why this was so is that APL was totally undocumentable. In other words, nobody could read anybody else's APL code. Even if you wrote your own APL, you had a hard time figuring out what code you wrote yourself after you went away for a month. And I think that APL became the preferred tool because each financial analyst became a unique possessor of his hunk of code. So there was this enormous expansion of APL usage. I licensed the APL software from Ian Sharp. We put in lots of Sigmas, including some Sigmas into Ian Sharp, which by the way, provided the revenue and the base for today a very large Canadian company that still provides global services.

NORBERG: This is a Xerox company?

STRASSMANN: No, Ian Sharp is a private company, a husband and wife team, who are sort of APL hackers. And by a series of happenstances, especially though very generous Xerox cash flow, we became perhaps the largest user of APL time-sharing in the world for a period of one or two years. The advantage, of course, of pursuing that strategy was that I provided XDS with a very satisfactory level of orders, which at least allowed corporate management to say that we were installing XDS equipment at a rapid rate internally. The political aspect of this that was attractive was the fact that I was able to get comptroller staffs off my neck, because in APL I didn't have to do any programming. So much of the backlog, whenever that existed, the user started doing their own user programming because of generous facilities that became available. And once the user does their own programming, the pressure on the MIS director diminishes radically. Needless to say, people did some very unnatural applications of APL, but they were happy and I was happy, so much of the conflict that existed in the early 1970s, the mid-1970s, was that there was a rise in user dissatisfaction against the central MIS establishment, but admirably resolved by giving thousands of terminals throughout Xerox and building one of the early data networks in Webster County.

NORBERG: What effect did this have on your standing within the company?

STRASSMANN: Well, my standing was greatly enhanced by this sort of thing, and the reason was that I was able to concentrate on the real issue, which was that Xerox was only able to get less than 70% of their invoices out at the end of the month. You may or may not be aware, in those days copying machines had meters on them. And the billings scheme necessitated the customer to return a meter card. This was like an electric company. Due to a large number of problems, of disputes about meter readings, and the fact that credits were being issued against the meter readings whenever a service man read the machine just to test. The billing system was just a total nightmare. Compounding the billing system, of course, was the fact that in those days Xerox may have had perhaps the most complicated commission system for its sales force in order to sell the right kind of machines at the right pricing plan. And there were just hundreds of pricing plans, and all kinds of deals and allowances, and group purchases, what have you. In fact, this thing got so complicated that competitors advertised that the machine may not be as good, but our billing system is simple. The administrative burden of just invoicing people was just enormous. And

therefore, more than a quarter of the invoices never made it out. So I started concentrating on straightening out the billing system. For that I couldn't trust XDS equipment and I retained IBM. Parenthetically, I want to mention that this is one of the things that really reflects on IBM as a custom-oriented company in the late 1960s and the 1970s was when Flaven announced that Strassmann will get rid of every single piece of IBM equipment within 12 months worldwide inside Xerox, IBM responded by doubling their support, which is an indication of the sort of orientation that the IBM Corporation had in those days. So, while we were bringing in XDS equipment in large quantities into the corporation in the established modes and also greatly increasing the software repertoire of XDS by putting in special communication protocols for running large networks and bringing in APL, the bread and butter applications, which were accounts receivable -- not accounts payable -- payroll, and shareholder disbursement I conservatively left on IBM equipment. In fact, I greatly increased my expenditures for IBM equipment.

NORBERG: When you say they doubled their support, what does that mean? What sort of support did they provide?

STRASSMANN: The usual arrangement with IBM is that each installation is worth a number of points. This goes back to the Tab days. A point is a dollar's worth of monthly rental. A typical rental for a big mainframe in those days was 10,000 to 12,000 per month, going all the way up to \$30,000 for the really big machines. By and large, for every 10,000 points you could expect what was called an SE, a Service Engineer. This was not a maintenance engineer; this was a systems engineer, who helped you with installing new software, debugging the operating system, doing feasibility study. And the usual arrangement was that the MIS director could always bargain with IBM as to the level of the support that would be provided. So-called "safe" accounts usually got less than the average; namely, one person per 10,000 points. So-called "target" accounts sometimes got two to three times as much. I ended up with about 70 people for whom I didn't pay a penny. About half were doing pre-sales work, pre-installation work, because we were upgrading equipment all the time. About half of them did feasibility studies and proposals, and half of those were really available to me to do tasks that I just didn't have the budget to do -- very often to do advanced technology work, which, of course, IBM found profitable to donate, because advanced technology then ultimately

generated revenue.

NORBERG: Can you give me an example of advanced technology in this sense?

STRASSMANN: The big issue in 1970-1971 was installing a new requirements planning package so that we could schedule new requirements planning for our plants in Webster, so that the manufacturing and the lead times could be rolled out so we could see whether the incoming components were really in sync with the fluctuations in the manufacturing schedules, so that we could actually coordinate in-bound materials and out-bound materials, but mostly in-bound components because Xerox was buying substantial portions of the components for copying machines such as electrical motors, switches, lenses, so on and so forth, from a huge network of vendors who were bidding for various components. While we were talking about making as many as 50 models of equipment in the product line, we had to order parts averaging 5000 parts per model per shift. So you had to have a planning horizon by shift 52 to 68 weeks out for every model component number. These were production runs that used to start running on a Thursday night. In order to do a weekly schedule, we assembled all the inventory status, did a forecast of what the production schedule in yield would be on Thursday, Friday, and if you worked weekends, on Saturday. You had to look at all the in-bound that had come in during the week plus what was in the trucks to be delivered on Thursday and Friday. And then, taking all of the purchasing changes that took place during the intervening week in terms of new orders placed or engineering changes that may have canceled an order, and then start a run Thursday night. It went all the way through the weekend. In fact, it was scheduled to be finished on a Saturday afternoon but if there was a problem during the run, you had to use Sunday as a buffer. These were enormous runs; these were 12 to 20 tape sorts. You had to consolidate inputs from engineering and purchasing. It was the state of the art in those days. These were not on-line. When I started doing this kind of work, this was mostly a tape-driven kind of environment. Disk drives only came later on. Now the advanced technology was to make sure that you limited the delay between written input so that at cut-off point you had the latest information. So we had to go and take the 365, because the 360 67s which were supposed to be time-sharing were not worth a damn.

NORBERG: Why not? Why weren't they worth a damn?

STRASSMANN: Well, they couldn't support too many terminals. And they were very expensive machines. I needed machines that could do these big tape sorts. In other words, I had lots of COBOL sequential code which was very hard to maintain. So part of the technology that I got involved in early in 1970 and 1971 was to, in fact, modify the operating system. Those were the days when large computer installations did modify their own operating systems so that in fact it was a teleprocessing monitor. IBM did much of that work. Of course, they used that experience then to feed back to their organization for the next releases. There was this huge, complex interaction between my own staff and the IBM staff concerning software because, I had to get the pick-list out to the plant Monday morning. And we had a real tough factory manager. He couldn't stop the plant, because he didn't have tickets in the baskets, and we actually had to produce tickets from every bin and for every part that went to the manufacturing plant.

TAPE 1/SIDE 2

STRASSMANN: As you could see, to do manufacturing scheduling in a production environment to run a plant in the early 1970s was a mammoth undertaking involving thousands of tasks. It was a manufacturing process which had to be timed in time-motion study, and priced out. And then you had to look at all the bottlenecks and see which piece you could automate, so you could gain another 15 minutes a year, or another 30 minutes a year, or reduce the error rates, because in the early 1970s, it was lucky when everything got done Monday morning. So we had to do quality improvement. And that was all done with IBM equipment.

NORBERG: Now, why couldn't you do this simultaneously or separately with SDS? Why couldn't they have supplied the same sort of high technology interaction for advanced technology that you just described that you were getting from IBM?

STRASSMANN: Well, first, the COBOL compiler and the operating system. The SDS operating system was a time-sharing operating system. The jobs were batch processing sequential jobs. Late in 1969 Xerox made a contract with the French firm CII, which subsequently got merged into Bull, to develop a Xerox operating system for commercial purposes - XOS. In fact, the announcement of the XOS as a business operating system was featured late in 1969 on double-page spreads of *The Wall Street Journal*. That system was slated to be beta-tested by myself. And, in fact, starting in 1970, some of the peripherals which are necessary to run XOS in the commercial department, printers and tape drives, were basically the tape drives that I started buying as OEMs. In order to make an apparent reduction in my bill to IBM I had to go to plug compatibles very quickly. So I became a very large purchaser of plug compatible disk drives. I was one of the early buyers of SDC tape drives, which then, under my contract jointly with SDS we also put on what we called the Sigma 8, and Sigma 9, which were supposed to be the commercial machines. So there was a tremendous interaction between my operation. By that time, I had something like a hundred people just doing the facilitation of installing SDS into Xerox, picking applications where we could maximize the visible inventory of XDS equipment inside the corporation.

NORBERG: One thing occurs to me. Couldn't you have used, say, a Sigma 5 instead of a Sigma 7 to get the same sort of batch processing?

STRASSMANN: The Sigma 5 was a small, scientific machine. I bought ultimately 60 Sigma 5s, but we used them purely as a front-end, as a TV teleprocessing front-end. I ended up with 140 Sigma machines.

NORBERG: And how many IBM machines, as a comparison?

STRASSMANN: Well, in order to reduce the apparent number of IBM machines we went to a few big IBM machines.

NORBERG: I should think that IBM would be very happy with that.

STRASSMANN: IBM was very happy, and IBM revenues throughout this period went up. When I took over the Xerox account the total budget for MIS inside Xerox was 39 million dollars per year. It was the 1969 outgoing budget. When I left as the chief computer executive for Xerox and became vice president of Strategic Planning for all the electronic businesses, which was late in 1977, my budget was 242 million a year.

NORBERG: Now, so that I understand that figure well enough, is that a higher rate of increase than in other large companies, say General Motors or General Mills, or something like that?

STRASSMANN: Well, you must understand, Arthur, in those days the way computer budgets were made, they basically were ratios of revenues. Those were primitive days of how people looked at computer budgets. Basically what happened, everybody started with MIS budgets just less than 1% of revenues in the 1960s. The retail companies, the Krogers, and the distribution companies, settled at less than 1% of sales. Manufacturing companies went from 1-1/2 to 3%. Xerox was at 3.7% of the company.

NORBERG: That's a good comparison.

STRASSMANN: Yes. General Motors, by the way, (I have no numbers) was always high to begin with. General Motors was always close to 3%. And after it had acquired EDS that number went to an ungodly number -- well over 4%, but that's another subject. The Xerox percentage went up dramatically after the acquisition of XDS. Part of the fact was that I was paying this price for all XDS equipment as a way of keeping the revenue base of XDS good looking.

NORBERG: What is the point of that?

STRASSMANN: I am just giving you history.

NORBERG: I realize that, but what is the point of that when you are actually taking it out of one pocket and putting it into another?

STRASSMANN: Well, the point was that Xerox paid a billion dollars for SDS and the underlying idea behind acquisition of SDS goes back to the model of evolution of technology that was acquired, in my opinion mistakenly, by the corporation from the Chester Carlson days, if I may digress into that. The entire top management of Xerox, particularly the number one man on the top, Peter McCardell, was extraordinarily overwhelmed by the wealth that got unleashed by xerography. The cash flow and the stock appreciation was legendary, and people made money beyond even the most excessive levels of aspiration. The myth that became embedded in the corporation was that somehow xerography was a miraculous invention that was brought to life by Xerox, by a few people at Xerox, who were convinced that this was the right thing. And it was brought to life despite everybody's opposition and rejection of xerography. The myth was basically that if you have a sufficiently radical and innovative new way of doing things, the world will come to you, buy it, and pay a premium price. And even if you miss a few of those, the one that will come through as long as you gamble for very high odds with an innovation that nobody else wants to have, the payoffs are going to be enormous. It was a high risk kind of a view of technology. Now, since you know, Arthur, that I have been an avid student of the history of xerography, had connections in Chester Carlson's family, and so forth, that is not the way I have interpreted the evolution of the Haloid Company. Now, it is true that Chester Carlson as a lone inventor persisted despite all the odds, but what made the Haloid Company adopt and accept and understand what Chester Carlson had to offer, and what the others couldn't, was that the Haloid Company, basically, was a supplier of photographic paper and devices to people who were making photostatic copies. The underlying sales force was marketing a product called a Rectograph, which was a specialized camera which made the Xerox method of making photocopies much more automated, much quicker, and much easier than anybody else's. The Xerox sales force had a deep understanding of the behavior of court stenographers, and patent attorneys, and all of those people who were used to copying. The Xerox sales force, and particularly the wonderful chairman of Haloid, the precursor company, Joe Wilson, had a deep customer understanding of the utility of copying, because they had visibility of the customer, and because they actually visited a small number of customers who were making these

copies when this process came about, namely xerography, which is a silver-free kind of a reproduction process. They had almost an instinctive understanding what kind of a machine and what kind of marketing it would take to get that sort of machine embedded into that utility stream whereas Kodak looked at xerography as just another photographic process. There was too much gear around it, too much equipment, and too big a box to fit the Kodak view of the world. And to IBM, who was making impact printers, to make images didn't make any sense. And I don't know why RCA didn't see, but obviously RCA had no contact with the real world of the office world making copies. So my view of the reason why xerography was successful inside of Haloid was that they had Joe Wilson and a small number of marketing people who understood the customer needs and were able to empathize with the values, and therefore come in with correct pricing, correct figuration, and hitting the customer at the right time. Now, it was still a marvelous thing to do, because in retrospect, the probability of somebody hitting the optimum configuration with a brand new technology was rather remote, but there was a little luck, and there was a little imagination. But foremost, it was the 25 years of heritage selling Rectograph machines which made the Xerox machine not a brand new revolution, the way it was represented, sort of, just immaculate conception out of nowhere, but it was an evolutionary step from Haloid. The people who made its success then became the new principals of Xerox. They found it very favorable to perpetuate this myth because of the patent attack and to maintain a patent monopoly. To emphasize the patentability, and the uniqueness, and what I call the "immaculate conception" view of it is an entitlement for the profits. In other words, the story of maximizing at tremendous risk -- Joe Wilson mortgaged his house in order to pay for development. The dramatization of this tremendously daring exploit became very profitable and very desirable, especially because the anti-trust people immediately began sniffing around, "How can you make so much money with a hundred-percent market share?" So you must understand the myth -- it had lots of reinforcing, and also was a vindication for lots of people being able to say, "Well, look, we were starving for such a long time, so now we are all multimillionaires, but we are entitled to it because we were the heros. We were the Magellans." That became so imbued, that view, this daring, bold new architecture, new ways of looking at computing. In other words, SDS had a different architecture than anybody else -- had a virtual memory system which was actually taken out of the Berkeley operating system, and it was a brash company. Boy, was that a brash company! And, those were our kind of people. "Okay, we have taken care of xerography; let's take on IBM. We are going to have an architecture the likes of which

nobody else has. And we are going to take over computing." As a matter of fact, I still have quotations -- out of *Forbes* magazine, some of the principals -- they're out there saying, "Well, it will be us and IBM, because nobody else will be left." It was that kind of a view -- that kind of a brash view. And it was that kind of a view of multibillion dollar revenue in very short order that fueled the exuberance, and the price, and the approach to XDS.

NORBERG: Continue with that. What effect did that have back on the company now when it came to bringing SDS into the company, understanding how to manipulate it into a better profit position. You started that description by talking about trying to keep their profit picture looking bright. Well, that you can do only for a short term while you're buying up the equipment and putting it into another division of your company. I asked you why one wanted to keep that picture looking bright. How do you do it in the long term?

STRASSMANN: Well, in the long term, of course, the hope was that XDS executives would want to share this vision that Xerox had. XDS really bought the idea that "We are going to destroy IBM." It was very appealing. That was our operating system, and our technology. You must understand that Xerox was University of Rochester, and University of Indiana and RPI -- Rensselaer Polytechnic Institute. It's a fairly conservative company sprinkled with people who ran away from Ford. XDS was Berkeley, anti-establishment, and, "Let's go and do IBM in, and Xerox is willing to pay for it." What a joyride! Those guys delighted in coming to staff meetings at Stamford in these blue suits with those florescent colors with a tie. McGurk once showed up with a tie that was a frog, a green frog. The anti-establishment accentuation of coming to a board meeting without a tie, and so forth. You must understand the spirit of that thing. Cultures are made out of those kind of demonstrations.

Well, what happened is that in 1972 Archie McCardell became president of Xerox, and Peter McCullough became chairman. Archie McCardell was an ex-financial vice president from Ford Motor Company. The stock went up to 72 and wavered. Where is the next computing machine? And so, although you went into XDS as the next adventure as seen by McCullough, the rest of the organization suddenly started discovering that there were cash problems, there were receivable problems. "Strassmann is telling us this thing doesn't work, and we were misrepresented." The law

and order crowd came in, the counter-revolution. The first thing we did we installed our own financial guy, Leon Burk, in XDS, because things were on the books that had no business being on the books. We sent auditors in. The meetings of joint marketing effort didn't end anywhere. The profit results were disastrous. There were lots of ways of tweaking to pretty up the profit results. There's lots of accounting shenanigans where you can do things, but underlying that, McCardell was a very astute financial analyst. The place was a financial loser. There was no way of turning it around without an enormous additional increment of energy. The other thing, of course, is that the people who held SDS stock were worth untold millions of dollars. And they said, "Why should I work for those guys? They're not my kind of people anyway." The whole thing started unraveling in the summer of 1972 where you suddenly started having an exit of top SDS people. XOS, the Xerox Operating System, a joint venture of CII, was late. The auditors found problems with plans and so we suddenly started sending people from Webster, New York, to help to run the plant. The more you helped to run the plant the worse it got because of the culture and totally different approach. In other words, the Sigma machine was not a serially mass-produced machine in quantity. It was a hand-assembled one of a kind, OEM kind of a thing, mostly done to defense specifications with little consideration of price. The new manufacturing managers had a notion, "Well, we have to get volume up and unit costs down, materials control. Don't negotiate with suppliers. Let's go for bid." All of those things that are good practice in a totally different sort of an environment. As you started importing more and more people from the East Coast, the thing got more confrontational. The first thing, of course, that Xerox did then is they said, "Well, we have to back up our people that we shipped out, so let's bring manufacturing under central control, and let's appoint now a vice president of manufacturing so we get synergy. Let's start moving, because we were out of capacity in Rochester and El Segundo was down, so let's start moving some production out of Rochester so we keep those people busy." Well, this only made things worse, because a plant that is optimized around production of a hand-made, custom-made, and so, wired together computer is not a plant that can turn out printing machines at the rate of 300 a month. So it's like a Greek tragedy. If you tried to fix it, it got just worse and worse. Then marketing became involved where we wanted to achieve synergy by joint selling. "Let's go and sell existing accounts that buy copying machines." Well, the copying people were calling on the office manager in the purchasing department, and computer people were calling on people like Strassmann. The XDS marketing people never called the people like Strassmann; they always called

on the scientists, the university data centers, and so forth. There were lots of Sigmas out there in universities doing time-sharing. The thing ran good FORTRAN. It was a better machine than the DEC-10 by far. The losses mounted. There were all sorts of bold task forces. I was a member of about more than half of them. There was always, "Okay, now let's have a task force, and let's redirect the thing." The tragedy was that the investment decision to go into the computer business, which was made in 1969 rather impulsively, by the way, and as years went on more and more people detached themselves from that decision. The decision was made strategically and it was basically a long-term 10 to 20 year decision. The administration of that decision increasingly became a quarter by quarter kind of operating exigency decision. There was a mismatch between the execution frequency, planning frequency, and the rhetoric. Meanwhile, however, the U.S. government came in and in the usual helpful way decided that Xerox was monopolizing trade and had too much of a market share, and that Xerox really had to let other domestic competitors in. Smith-Corona launched an anti-trust suit against Xerox for monopolization of trade asking for penalties like half a billion dollars worth of penalties. Smith-Corona made a crummy, sticky machine, but they asked for half a billion dollars worth of penalties. So Xerox got involved in early 1972 in a long-term litigation and a potential anti-trust suit. The top management was subpoenaed and in court most of the time. Stock prices started going below 100. Xerox had entered, I believe in 1973, a concept agreement of licensing its patents to all comers. And so, late in 1973 Xerox's focus became redirected against the potential entry of both IBM and Kodak into the copying business, because the intelligence indicated, "This is what they are going to do." So suddenly Xerox said, "We need cash to invest in anticipation of the Kodak and IBM entry." So suddenly XDS became a second, a third, a fourth, and a fifth order priority. The management of business started focusing on the potential entry of Kodak and IBM. In fact, Kodak and IBM ultimately did enter much later with much poorer equipment, or much poorer marketing. Meanwhile, Xerox started building bigger and bigger machines because we were going to counter what is called the "high end." We were going to protect ourselves against the high end entry business. Intelligence indicated that there was going to be high end entry. To fuel all of this thing, Xerox decided to get out of the leasing business, and so Xerox started selling its installed base. It turns out IBM made the same mistake later on. There is something very fundamentally problematic that you do when you start selling your installed base. When your equipment is on a cancelable lease, the sales person spends lots of time hand-holding, worrying about you, because it almost doesn't matter what

equipment you have, because he is going to get his revenue based on how many copies you make and how well you like the copies. You need the cash and you're building a defense fund against a half a billion dollar penalty.

TAPE 2/SIDE 1

STRASSMANN: The load on management, the airplane trips, the committee meetings, and so forth were just ferocious. We are talking about people sitting in committee meetings, and the style was to involve people. It was a well-intentioned style, so you had meetings attended by 40 to 50 people to talk about corporate strategy. You had one corporate strategy task force after another. "What's the future?" "Zero." "What is our role in the electronic business?" By the way, in those days I wrote some very, very important papers on where the electronic business may go in the 1980s and the 1990s. At any rate, as Xerox was preparing and selling its installed base, the sales force was being converted from leased support -- a sort of franchised relationship which goes back to the Rectograph days where you had a very close, intimate relationship to the sales force where the customer really became your enemy, because you had to unload your quota of items onto the customer. You had to sell him the least profitable machines and keep the most profitable machines. Do you understand this?

NORBERG: No. Selling the least profitable and keeping the most profitable?

STRASSMANN: In other words, various machines of different profitability. It turns out that when you look at the cost of the machine and the way the accounting system was run is after a machine of a given size, say, made 30,000 copies which paid for the maintenance, because maintenance was bundled. Everything above that was profit. It went straight to the bottom line. If somebody had an expensive machine but made only 12,000 copies, in fact, it was costing. You had the wrong machine in the wrong place. Yet the price of the very profitable machine and the unprofitable machine was the same because a Xerox 3600 was a Xerox 3600. It had a list price of \$40,000. So the purchase price, the used price, and the used profit was different. If you go into sell mode, you want to keep on lease the 3600 that is making 40,000 copies and you want to sell to somebody the 3600 that makes only 10,000 copies. The

guy is going to get stuck with a more expensive machine.

NORBERG: Which looks to me as if it's bad for the company in the end.

STRASSMANN: It's bad for the customer, and it's in the end bad for the company. But meanwhile, the salesman is being compensated based on the list price of what he sells. So then you see suddenly the commission system driving the company one way, and the pricing system driving the company a different way. This is where the tragedy occurs. By the way, this happens very often when you look at history of societies, how the taxation system that the government or the king imposes just tears the country apart. And it's, by the way, the interesting part of the story about the French Revolution, how in fact, the taxation system just tore up the place. But at any rate, Xerox is looking out of the window while IBM and Kodak are coming. Meanwhile, that's not what happened. It abandoned what is called low-end because it is more profitable to sell the big machines. Suddenly these cheap little things are coming in on the West Coast. I was in the meetings, and, well, these are little, dinky machines. They can never borrow too much revenue anyway, and they are not particularly good. They got the coated paper and so forth. Now, what the company did not do is to spend the intelligence and the strategic analysis to show how, in fact, you enter these markets, how you can go after market share, and how you can then lose quality. By that time, because of the largess of the U.S. government, the xerography patents were available to the Japanese. In other words, the U.S. Government removed the protective barrier from Xerox as a way of increasing American competition which never happened. As you know, IBM has exited the copier business. And Kodak has done okay, but nothing very good. And the U.S. government basically said, "Okay, Japanese, come and get it." There were tariff issues and there were other things which made it very attractive for the Japanese to enter the business. By the way, there was a good rationale for the Japanese to enter the business, because they had already moved very heavy into photography and it was just an extension to move into that. The other thing, of course, the Japanese did is, the key to the technology was a photo-receptor technology and that was maintained as a supplied item. In other words, Canon, Konika, Konisura, all of those were buying the same photo-receptor from one supplier, which means that supplier suddenly started getting economies of scale. So although they started with a low market share, the Japanese started building volume very

rapidly on the experience curve and the quality curve. Now the Xerox position was, "Look, we are spending 135 million dollars on R&D. Our best information says these Japanese don't spend more than a million dollars on R&D all put together. They can never amount to anything, and whenever they come up with something we can out-R&D them anyway. They can't touch us." So there you have this management view that is still continually being whipsawed between the failure of XDS, the falling stock price, the tremendous internal commotion in the marketing organization. Misfortune sort of accumulated. What happens at this particular point? The Japanese have these copiers and the other thing that we said, "Well, the Japanese don't have a distribution system. We have the most powerful sales force of anybody." We had a very highly compensated sales force still going back to the days when there was lots of money around. So now that we go to sale, we started cutting commissions. Suddenly some of the Xerox salesmen, who had been extremely well trained and have these time-sharing terminals to do price analysis and profitability off these things, begin to say, "Now wait a moment. What I can do is in this district in San Diego I have machines that are turning very high marginal returns, because they are what is called 'pumpers,' but I can go into leasing. I can become a leasing company. I'll go and buy those machines and lease them." You know the economics of that thing. So the guy quits Xerox. On the last day he goes to his APL terminal, does a complete profitability by name, because we had this fantastic data base because of open APL. Everybody had access to everything. He has all the pricing. He has all the customer volume, all the discounts. He tears off the sheet, walks out, and quits usually with a fine settlement in accrued commissions and what have you. He goes out the next day, visits all of his friends and says, "Look, you have a 3600 and you're paying \$3000 a month, right? I'll give it to you for \$1800." The guy goes out, borrows money -- Xerox, under consent decree, has to sell machines to all comers -- and sets up a leasing company. With four machines the guy can make more money than he made for Xerox. So now here he is a distributor. So now he has four 3600s, pays for his mortgage, pays for his life, buys a new car, buys a fur coat. And the guy gets done in the first two days of the month with billing and everything, and now he has 28 more days left. Well, here comes these two gentlemen in coats with slant eyes and say, "We understand you really know the copier business. Would you like to be a distributor? And we will give you 50% of the margin." So the guy said, "Well, terrific." So all these Xerox people who left Xerox with customer lists overnight become distributors. Now, it doesn't cost the Japanese a penny to have a ready-made distribution system, to know exactly where to market. And these

guys find the Japanese very reasonable. The Japanese don't mix into their business. They don't want to collect money right away. It's a wonderful deal. And so some of the best Xerox salesmen leave within four years. They become an absolutely elite distributorship sales force for the Japanese. Later on, the Japanese lower the margins, but the ride is terrific. Of course, that eats immediately into the profit, and that's where Xerox profit starts dropping. In 1973, all of the task forces start congealing and what have you. And the word is out, "Look fellows, we cannot afford x deals of stock." A task force is convened by one of the three people in the task force. We looked at the facts. We looked at the company. The thing is deteriorating by the day. After McGurk leaves it, Jack Lewis, who subsequently became president of Amdahl, becomes the head of XDS. Jack Lewis basically said, "Look, I will never be a business data processing company. I just can't do it." Jack is a superb pragmatic guy. Jack Lewis goes back to time-sharing, takes a Sigma 9, fixes up the operating system, and runs circles around the DEC-10. So now, Jack Lewis, early in 1974, has a first quarter that's profitable. Its real profitable. Jack is just ready to turn the business around by saying, "Look, I don't care what you guys tell me," because by this time in 1973, people are telling Jack, "We don't care what you do, just make it profitable." So Jack Lewis is ready to make the company profitable by going back to the roots of the company which is time-sharing, virtual memory, and going back to university contacts. Jack and I get along extremely well. Some time-sharing businesses are set up. In other words, the company sets up the time-sharing subsidiary providing on-line time-sharing support for small businesses -- Xerox Computer Services. Suddenly lots of people inside Xerox wanted on-line services for supply ordering. So I give that business to Xerox Computer Services. Xerox Computer Services grows in two years from 2 million to 80 million dollars of which 50% is internal business at list price. We finally get to 1974, and we look at the future of the time-sharing business, the DECs and all the other things coming in, and give the marching orders. The marching orders are not xerography. We want another 10 billion dollar hit. That's the marching order to the committee. We are just like a jury. This is like a judge going to the jury and saying, "Here are the rules." If this rule applies it's guilty, and if this rule applies it's not guilty. And we came to the unanimous verdict, "This is never going to be a 10 billion dollar company. Down the chute. Let's find a way of selling it." And that's the end of XDS.

NORBERG: In spite of the fact that it's becoming profitable?

STRASSMANN: That's right.

NORBERG: So that's the end of XDS, and you have all these Sigma 7s sitting there.

STRASSMANN: Yes, we make a deal with Honeywell -- Web Caster, who is the account manager at Honeywell -- they are in the salvage business. There's money in the scrap iron business. There's money to be made in having 144 Sigmas at Xerox and getting rental revenue out of it, because once you put a computer in, my friend, you can't get it out. It gets imbedded. It's very hard to dislocate a machine because of the user costs.

NORBERG: Well, if the 10 billion dollars is not going to come from XDS, where is it going to come from? What sort of interaction had you had with Xerox PARC up to that time?

STRASSMANN: When I came back in May of 1969 with a clunker of a Sigma, and I told people, "Look, I can make a business and data business system out of it." Since Xerox is a gambler and says, "Well, maybe this one doesn't pay enough, but remember the arithmetic. We can waste lots of money on lots of high stakes. If one comes through, we are going to just be rich beyond belief." So early in 1970, the idea comes around that Xerox ought to do another risk investment. There is plenty of money around. Remember, there are other portfolios in the risk investments. Xerox keeps investing in education and so forth. All that goes sour -- it's gotten rid of -- but right throughout the 1970s Xerox buys venture money. The top men at Xerox love to buy companies without much staff work. The reason is that rational analysis would have convinced you never to have anything to do with Chester Carlson. That's the premise. The premise is that rational people rejected Chester Carlson. Part of the lore is the fact that IBM went to A.D. Little, because IBM didn't trust itself and asked A. D. Little to write a report about Chester Carlson. And A. D. Little wrote this long report saying, "It will never work. If it works, it is going to be too expensive. And even if the costs come down, it's too complicated. And even if they simplify it, nobody would want to use that much copying." So here is a respected consulting firm. And so the paradigm at the very top is "Balls out, faith, inspiration." In other

words, inspiration or vision is being used. It's a strain which is very deep in the American ethos. "Full steam ahead. Damn the torpedoes." It's a very emotional, anti-rational strain, very prevalent. Of course, nobody discusses the odds, but everybody talks about Wozniak and Steve Jobs. So Xerox gambles. In 1970, Jack Goldman, who was the new vice president of R&D, comes to Peter McCullough saying, "Look, there is this fantastic electronic stuff out there, and we are doing this computing." By the way, Jack Goldman never bought into XDS. Neither did some of the other top guys inside Xerox. In fact, one of the most savvy people we had by the name of Abe Zaren, an entrepreneur who sold electro-optical systems to Xerox. Remember, we are buying lots of companies and so we have lots of entrepreneurial people who become rich, but they are savvy. They are the West Coast culture who are inside Xerox. Abe Zaren, by the way, resigns. He was the development director at the time. He was the acquisition man at the time of the XDS acquisition. He resigns when McCullough buys XDS. So we have lots of people around. If there is anything about Xerox, there is talent. Everybody will tell you, regardless of which side. Whether you talk to Bob Taylor or anybody. Xerox had more talented, verbal, aggressive, charismatic people per square foot than anywhere else. It was a very lively crowd. It sort of reminds me of the French Assembly at the time of the French Revolution. There were some very charismatic, outspoken kind of people there. When you read what these people are thinking of, they were ahead of the 21st century with all of these ideas. So, you're never short of ideas. Abe Zaren and Jack Goldman go to see McCullough and said, "What we really need to do is we really ought to go for the next great thing which is office of the future." And Peter McCullough likes the thing. At this particular point the other thing about Xerox was that you always needed legitimacy. You need a sort of theology. You need a unifying theme. In the 1970s it was a great thing. Just making money and doing things, taking care of your customers, was not lofty enough. So Peter McCullough gets up (he has a speech maker by the name of George Marshall) and says, "George, I have to give a speech at the next annual meeting. What is Xerox trying to do? We just spent a billion dollars for XDS. We really have to have a vision of the future." And Marshall, who is a very slick writer -- I've talked to Marshall since then, and everybody knows that Marshall wrote the speech -- writes this speech. It's a beautiful speech. It says, "We are going to be the architects of information in the 21st century. Xerox is dedicated to the architecture of information to make it possible for human beings to communicate with one another electronically." It's a wonderful speech -- content free. So here we go after architecture information. Then people say, "Peter, what did

you mean by architecture information?" Peter said, "Well, that's for you guys to figure out. That's what I am paying you for." So Jack Goldman says, "Well, there's a simple solution. If you don't know what you don't know, you're going to do research on it. So I want a research center on the architecture of information." Peter McCullough says, "What a great idea, Jack. Where do you want it?" Jack says, "Well, look, what seems to work is to put it somewhere in a university environment. In my opinion, we have to put it away from the rest of the company." And of course, this is in tune with the ethos of the company. You have to go away. You have to go to the desert to see the burning bush before you really know the true religion. Am I being helpful to you [laugh]? Jack likes Palo Alto. Jack is a terrific poker player. He's got all the right instincts. Jack tells everybody, "We are going to put an institute to study the architecture of the future out at Palo Alto. By the way, the only way I want this thing done, I want a fence around the place. Any marketing man, or anybody from Rochester who shows up out there is going to be shot at the fence." Peter says, "Well, sounds good to me." So Jack gets funding, and Jack says, "Oh, by the way, I don't want anybody to mess around with the budget for at least five to six years." Jack, who is very well connected -- he is on the Science Board and what have you -- knows this guy who is the Provost of Washington University, George Pake. George Pake is just one of these wonderful, quiet guys from Missouri -- very quiet, very unassuming, very wizened guy -- doesn't talk much. George knows everybody. George is inside the establishment. George is not happy in the university, and there are other personal reasons. Jack calls on George. He has known George for a long time, and asks if George would like to head this lab. And George says, "Well, I know nothing about architecture information. All I know is I know how to pick people." He, by the way, is better than Licklider, and I know both, because Pake has this totally unoffensive, subdued, low ego. He has no ego at all. Them's hard to find. George says, "All I know is how to manage. I know how to manage R&D people." Jack said, "Well, that's all I need." So George takes the job, and George makes a few phone calls, and they say, "ARPA is going to hell, and ARPA funding is evaporating. There is this guy, Robert Taylor, at ARPA. He knows everybody." So George calls up Taylor and says, "Look, we want to study the architecture of information for office of the future. Would you like to come in on this thing?" And Taylor says, "What's the deal?" Taylor just makes a few phone calls. In six months, there are more brilliant, innovative computer scientists in PARC -- I have been told this from many sources, and I'm sure you have heard it -- than you can find any place. The cream of the crop. And they know each other there. They have been hacking together. It's

a peer group. To be invited to PARC means that everybody has to interview. Management doesn't interview. You come in and you go into this beanbag room and everybody interviews you. It's a peer group, academic kind of a West Coast version of a very interesting, congenial group. By the way, those people got along very well, too. It's just delightful to see. It's a culture. So they get started, and in like a month they all agree, "We are going to go to totally distributed computing, and we are going to give everybody computing power. We are going to go to personal workstations." In other words, much of the thinking that has gestated in SRI and ARPA right through the 1960s, "Well, fellows, we can do it now, because money is no object." Alohanet was lingering in ARPA. It becomes Ethernet. And the workstation comes from Salt Lake City, from ARPA, where it in fact, becomes the ALTO, which is a Data General Nova -- \$80,000 micro running a high-resolution screen. They go to the high-resolution graphic interface right away. Remember, there is less than 100 people there. What they are going to do is they are going to bootstrap the environment by giving everybody inside PARC the tools. So PARC becomes the first building in the world, so far as I know, where everybody is electronically connected. There are these real funny interludes that I have to adjudicate like they want no part of the Sigma 7 or Sigma 9.

TAPE 2/SIDE 2

STRASSMANN: . . . because they have a totally different architecture in mind. The notion of the architecture's information is a representation of a cultural concept that you don't want central authority. You want totally distributive authority. You want cooperative computing. People compute together when they want to compute. Time-sharing is a total central view of rationing things out. It is philosophically repugnant to these bunch of guys. These guys have the notion of "computer lib." It is very much in the pattern of the spirit of the times of the 1970s -- the EST movement. Most of those people are on a macrobiotic diet. They all drive bicycles. They don't like cars. The girls are slim and drawn-out, and there are some real nice girls there. It's Berkeley campus, but one up. People jog. There is tofu in the cafeteria. Can you imagine somebody from Rochester county in the cafeteria having tofu for lunch [laugh]. Arthur, you don't understand any of that thing. Because they are protected, the money is there, the congeniality is there, and George Pake is a cooperative manager. All he does is he makes sure everybody cooperates.

You create an environment which is just unbelievable, really. People just blossom forth. Anything they want they get. And they stimulate one another. The place really vibrates. They put the three megabyte, the early version, of Ethernet in. By 1974 those Novas are in. I go there very often. As a matter of fact, I am considered somewhat of a curiosity. The reason is that I am usually called in to explain how the outside world works. "Tell us about that, about invoicing." These people have no idea about getting invoices out, but they're curious. They're intellectually curious. How do you get a manufacturing stream together? They want to do architecture of information devoid of any real knowledge about anything in the world. They really don't. They are totally inverted on themselves. They want to build things which will suit them as workers, as intellectual workers, because they consider themselves the elite. Their needs are for text creation and graphics, and creativity is the tool that they are creating. In other words, it's the tools created in their image. They say, "There are more and more professional workers out there. Professional workers have to be anti-bureaucratic. They have to be creative. They need the kind of tools that suit us." There are many precedents in history for that kind of creative idea. The flaw, of course, on that thing is that if you push that simile too far, the thing just falls apart. This happened to the monastic orders. The people from the East Coast would come to visit out there, and certain corporate staffers are allowed there. It's partially to placate us, partially to keep the funding, partially because we are a curious bunch of people, and I am just totally fascinated by it. I am asked to lecture there once a year. I am continually being surprised by the naivete of those people about the real world, and yet some startling insights. Top management goes and visits there once a year, and sees these guys sitting behind pictures, and poking around a square, and pushing a square, and picking the big or little what have you, and playing with tops. Alan Kay has an organ in his room, and he runs the organ. In other words, he does visual composition on the screen and the organ plays one of his vision proposals. The guys just go out and say, "How many earnings per share will this give us?" [laugh]. I cannot portray to you the richness of the experience, but the thing is an exciting place. So in 1974, when we folded XDS, we were all, "What do we do next? Well, we have to do something. Well, we have this office of the future." Although we can't see it, everybody who goes out to PARC has these raving notices. The press tells us, "Xerox, PARC is marvelous." People are actually beating down the door. People call McCullough. Ministers of science from all over the world want to go and visit PARC as a pilgrimage place. So those guys must have something. Now, meanwhile, of course, the PARC people totally rejected the El Segundo people.

There is no way of salvaging any of that thing and moving it up. One of the intriguing things that the PARC people do, however, is when they have a Bitnet screen, they clearly conclude that matrix or raster printers just won't do. They go and retrofit a copying machine called a Xerox 2400, which is obsolete, and put a laser head on it. Xerox has been intrigued with non-impact printing for many years. We are very pleasantly surprised at the reception of the market of non-impact printing. So they do a low-cost laser printer, which of course, those guys love, because PARC, per capita, has more published papers. PARC output by 1974-1975 is greater than Yorktown in terms of published ACM papers. As you know, in that world how many papers you get published in ACM and what ACM committees you get on is the measure of how good you are as a researcher. By 1975, since the optimal output of PARC is published papers, they can publish papers in camera-ready quantity and quality faster than anybody else in the world. Because there is a group and they send the papers around, they can get them reviewed in two days. They just crank out papers -- good-looking papers, printed papers -- and they are much in demand. The legal control over those papers is fairly lenient. So there's lots of disclosure, because those guys love to show off. You go to ACM conferences, everybody sits there and says, "Okay, tell us what's new." And these guys say, "Can't you see what I have here?" So lots of the things get published. The iconic things get published. The font work gets published. Everything that's behind Adobe, which is behind Macintosh, the context addressability. The ARPA people bring in anthropologists to really look at the behavioral aspects of the man-machine interface. So a small part of PARC is devoted to really experimenting and testing things for school children. So much of the acceptability of Macintosh and some of the conceptual ways of spatial orientation really come out of experimentation from school children. So it's just a very lively period. The question is, what's the product and who's going to market it now that we got rid of XDS? The XDS sales force, whatever is left over, gets folded into the Rochester establishment to sell non-impact printers which is a box sell. It's an OEM box sell. It's not a systems sell. There's no architecture information. So at this particular juncture, there's also an internal struggle inside Xerox about the future of the company. You've got all kinds of committees going back and forth. At this juncture, McCardell, the conservative, says, "Well, how about going to the market to test it? We'll never find out. Let's go test it. If it's that good, let's see if we can sell some." And so we go and we take one guy from PARC, Dr. Jerome Elkind, who is from the MIT Computer Science Department, and we give him the charter to take the Alto's which are now doing desktop publishing inside PARC,

and we said, "Jerry, go out and see what you can sell and to see what you can install." This is called probes. With probe, he is given a budget. You don't have to recover the full cost of equipment given to the customers. Well, suddenly there is this wild rush. Everybody wants to be a Xerox beta test site. Every university wants to have a Xerox Alto. This is where the Xerox system sort of grinds to a halt. The company is unable to produce. You see, now you have to start producing those Altos. You have to supply them. You have to have field support. Now, Elkind is a guy from Palo Alto who knows nothing about documentation, sales support, maintenance, spare parts. ARPA, for instance, takes a whole bunch of these things. They take them mostly for the laser printer. Well, the laser printers are down, because when they are down, there is nobody to repair. There is a jurisdictional fight. Now remember, these are Nova Data General computers. They are overpriced, inappropriate configuration, they have some special boards, but they do decent desktop publishing. These probes, which are supposed to gather evidence as to the economic utility of this configuration, so you can go in with the next generation of custom-made chips to go into production, the probe takes too long. It's poorly supported. The few places where the probe has an in-house capability, like Boeing Computer Services up in Seattle, make fantastic use of those machines, because for a certain type of aerospace documentation, and particularly for Air Force proposals, money is no object. They're doing a very good job. The economic return is very high even at the target price of \$28,000 per workstation. It's so labor-saving, it's opportunity costs, it's the collapse in the time. In other words, the problem is not keystrokes, the problem is elapsed time of getting things done. Because of the network configuration and the cooperative ability to have 12 to 20 people work simultaneously on the same document, which previously was unfeasible, you suddenly get compression time on high value documents like Air Force proposals. However, PARC is not interested in cost effectiveness. Elkind is struggling just to keep the thing alive and support with spare parts. Xerox is involved in a succession struggle between Kerns and McCardell. McCardell ultimately leaves. There is this theme of external disturbances while the internal problem is not handled. In other words, the execution isn't there -- very elementary things don't get done. And underlying all of this thing is suddenly the realization of the remaining sales force who now has lost lots of people and the market share in copying is coming down at the rate of like 1% marketing share per month. The place is hemorrhaging -- the marketshare. The question that suddenly started bubbling up, starting in 1976 and becoming endemic in 1977, 1978 and 1979 whether the copier sales force, who is now being repeatedly told

by top management they are obsolete, will be superseded. Everything that management has done in terms of selling off the base and support has sort of confirmed to these people that they are obsolete, and they will never make it. No effort is made to reeducate, for instance, the existing sales force. There is a continual wave of new people coming in top-side from IBM, because by this time people are defecting from IBM. So here you have, a time of turbulence. Out of this turbulence emerges a huge power struggle as to the future of the Xerox sales force. Who is going to sell the new technology? Nobody knows what the new technology is, how good it is, although the copier salesmen at Boeing quickly spread the news from Boeing that "This thing is fantastic!" So now the sales force also loses some very good propaganda. Some events dramatize how wonderful this new technology is, and the office of the future becomes a slogan. And articles are written in *Fortune* magazine and *Business Week* -- the hype. Also, there is the beginning of the slowdown of the computer sales. So office automation suddenly starts creeping up. After 1975-76 office automation suddenly becomes established as a new wave. Everybody is jumping on the bandwagon. Xerox management finds it very convenient to say, "Well, computers are really sort of phasing out, and it's topping out, and the next place is office automation. We didn't make it on the computer turn, but boy, we are going to make it on the next step!"

NORBERG: What was the planning structure like in 1976 when all of these difficulties were happening that was making it difficult to service these probes that are out there in the community?

STRASSMANN: The planning structure was three-fold. In the spring you submitted what is called a long-range plan. A long-range plan was a document which was fairly specific as to your cash requirements, profit forecast, product launches, market share targets. These were documents which sometimes had thousands of pages of schedules. All the products were mentioned, all the enhancements, all the release days, the manufacturing date. A very, very formal system. And there was a large cadre of planners who maintained those documents. The plans were submitted to corporate for corporate review in a very formal schedule and man weeks of management time were spent, starting in April until June, in the review of those plans. These meetings lasted two or three days. These were 12 to 14 hour meetings per day, attended usually by a minimum of 20 and sometimes as many as 60. That's the long-range

plan cycle. Then in the fall you had an operating plan cycle, which basically started in the middle of September and by December you had an approved headcount and expense budget for the following year, by quarter, and sometimes by month, and then one more year out, so that you could actually smoothly slide into the second year. In addition to that, there was a third review process. These were product proposals, product reviews. So although there was a portfolio of approved products which flowed from the long-range plan into the operating plan, when you suddenly came out with a brand-new product, or going after a new market, or going for an acquisition, you had to come with that proposition to the corporation and explain why you wanted to do that. And then you also had to show how that particular proposition folded into the long-range plan into the next year's operating plan.

NORBERG: It seems to me this is counterproductive when you're looking for a ten billion dollar new product. Trying to fold it into the current plan, and making sure it fits the business operations doesn't seem to go hand in hand with the big strike. Let me ask you a question rather than asking you to comment on that. What were the strengths and weaknesses of this planning process for the kind of thing that Xerox was trying to do with the Nova Alto system?

STRASSMANN: Well, I wrote a critique of the planning process in 1976 which was either going to get me fired or promoted. It happened it got me promoted, but you could never tell. My critique of the planning process was that there were many small, venture-oriented planning groups all over the place competing for money. There were too many things going on. In fact, I believe I identified that Xerox was pursuing over 50 initiatives, all under-resourced with inadequate prospects of getting a major market share. I complained about goal proliferation. The company was pursuing so many avenues, because there were so many imaginative people who had their own singular vision of what's the right answer that nothing ever stood still, and nothing ever got done. When things did not progress as expected, because there was a tendency always to over promise because that's the only way you could get attention, things were cut. So there was continual exuberance. It was a manic-depressive system. I used that term. It was a manic-depressive system, and it would not be viable. In 1978 I articulated the notion that Xerox really was not a computer or an information company. It was basically a company that had its origin in printing and should remain in printing and move gracefully from xerography, which I viewed as the end of the Gutenberg era, into electronic

printing where text gets originated, and the connection between the writer and the text was electronically mediated, rather than mediated by pieces of lead.

NORBERG: Can we go back to the earlier critique though? Did you propose any substitution for the older system or just simply make some decisions and cut down the number of initiatives?

STRASSMANN: Cut down. My view that was held consistently, and even when I was leaving, because I announced that I would retire in 1984. The company decided to keep me for one more year -- didn't want to let me go right away. Even after retiring, I was on a two-year on-going contract. So I am now out for five years and the company still comes to me. So, although people disagreed with me, or had different opinions about my political savvy, when it came to this issue of really looking at goals, the company always acknowledged that my view, at least, was a consistently legitimate point of view, which many people found unpalatable, by the way.

NORBERG: Why did you feel you could write such a document in 1976? What was your authority inside the company?

STRASSMANN: My authority in the company was that although I was Chief MIS Executive, I was the highest paid non-operational person. The highest paid staff person with credentials is somebody who understands the user end. Right from the very beginning, I pointed out that the use cost of information technology vastly exceeds the purchase cost, which you understand, and everybody else nods on, but then they go and do something else. Any my view, because I worked with this thing, was that the user cost is the way how you do technology insertion. Therefore, you cannot necessarily plan all of it, but if you plan and execute well, and you keep a close connection with the user and their benefits, then you will come out all right. I was looking for a much more adaptive, customer-oriented, short-tactical correction way of dealing with the entry into that business, rather than what I used to call galactic plans.

NORBERG: With the hope of achieving what? Getting a change in operations in the company?

STRASSMANN: The hope was that Xerox would be able to make the transition from the copier business which is today growing at the rate of three to four percent. In other words, it's growing at the GNP rate on a global basis. So my feeling was that if the company wants to maintain a high stock market multiple, it has to be in a business that grows more than twice the GNP. By all indications, the copier business, because of its high labor content, was not going to go more than twice of GNP. First you had to have dominant market share, even at dominant constant market share, you were not going to make your revenue objective. Electronics intrinsically lowers the users' costs. The Boeing example, which I used zillions of times to illustrate, is for every dollar they paid us at \$20,000 a workstation, they were making six. It was their utility that made the purchase decision, whereas the Xerox people were always talking about unit manufacturing costs. One of the major problems with people moving out of the copier business into the electronic business is that the unit manufacturing cost is now less than 8% of the sales price. Marketing costs and software costs become dominant. So people who are steeped in the automobile culture and in the financial analysis culture do penny analysis on less and less and less.

NORBERG: Don't they see the increasing costs of marketing and software?

STRASSMANN: They saw it, but that was overhead. See, you must understand that one of the fundamental problems of the American civilization today is that the accounting structure and the measurement paradigms are deeply rooted in a labor variable cost, materials cost culture, not recognizing that it is the overhead, the meetings, the committees, the lawyers, the P.R. campaigns, and all of that thing.

TAPE 3/SIDE 1

STRASSMANN: The price has to be reasonably within range of what you're offering, although then, later on when it becomes a commodity, like PCS became 15 years later a commodity, they you're playing a different game. During the technology insertion time, the customer utility is the dominant value that drives the technology insertion. Now, to

gauge and connect with customer utility, you need a direct connection between marketing and product development.

That was severed by design.

NORBERG: Severed by design in Xerox? And how about the historical situation in U.S. business?

STRASSMANN: Clearly it was severed by design in General Motors case, and in many of the other cases that we know of.

NORBERG: Yes, but all in the 1970s or earlier?

STRASSMANN: Well, starting in the 1960s. In other words, it goes deeply to the technocratic, functional way of looking at business. There are some very deep and disturbing cultural views of how the economy functions which dictated much of the destruction of American competitiveness. It is being restored now by the emphasis on customer value and customer responsiveness and talking to the customer. Now, Xerox, because of the internal conflict -- who are going to be the chosen children and all of those other things which I described to you before -- had a genetic inability to deal with that. And the probes, which I described to you, which was Jerry Elkind's attempt to insert maybe 200 machines out there to test things, did not deliver the feedback, because it was illegitimately conceived, poorly financed, and the execution was not properly designed to provide a valid feedback. It was not a sensor, to use a servomechanism analogy, that was chartered to sense feedback.

NORBERG: Why do you think it was illegitimately conceived?

STRASSMANN: Because legitimacy required that there was a connection between the motor function and the sensing function. Well, the motor function then is manufacturing support, spare parts, and all of that. It was not wired right.

NORBERG: Yes, you said that before, and I just wanted to make sure that was what we were talking about there.
There was one no way to overcome that within the company?

STRASSMANN: There was no way of overcoming that.

NORBERG: Now, is it because the probing was to be done by someone out of Xerox PARC, as opposed to someone in Stamford? It was Stamford then, wasn't it?

STRASSMANN: Well, Stamford is corporate headquarters. The power centers were Rochester and Dallas.

NORBERG: Supposing it had been done out of Rochester at that time? Could they have legitimately conceived it and make it work?

STRASSMANN: Absolutely.

NORBERG: Then why was it placed in Xerox PARC? Do you know who made that decision?

STRASSMANN: Well, that decision goes back to the paradigm, namely, that you need an outsider to really innovate, and that you will fold it in later, you see. The model was, "Don't disturb the organization."

NORBERG: We're not talking about conception now. We're talking about a product development. And product development was not within the charter of Xerox PARC, was it?

STRASSMANN: No, it was not.

NORBERG: Then I don't understand why it wouldn't have just been removed at that point.

STRASSMANN: There was no center for legitimate product development. You must understand when you draw the company in those days it was bi-modal. It was very heavily on the leading edge. It was very heavily in hum-drum delivery, marketing, service, billing and all of that that finally got straightened out. There was nothing in the middle. When you do a model of insertion of technology, you need a company that has a continuum from R&D, advanced probe, product development, market initiation, market maintenance and market phase-out.

NORBERG: In your view, what is a good example of that in that period?

STRASSMANN: Among other companies?

NORBERG: Yes.

STRASSMANN: IBM had that. Of course, they got heavy at the other end. They got so dominated by the imbedded central processing unit although in advanced development they had microcomputers. The inertia of car-end operating profits and car-end profits did not allow for the smoothing in of a new inflow. Xerox was just the other way. In other words, I can do graphics for you saying that Xerox was two-humped. It had fantastic brain, and strong legs, but not much of a neck and not much of anything in between. IBM had a tremendous torso, but a pinhead above the neck [laugh]. It's an overstatement.

[INTERRUPTION]

NORBERG: Can we talk a little about your new duties as director of Strategic Planning for the company? Did this bring you into a new level of interaction with corporate management?

STRASSMANN: Let me just be very precise. At this juncture, the company divides itself into two domains: one called information products, which is really all the non-copier business, and the other one is the duplicating business.

The non-copier part is about 1.8 billion dollars a year -- we are talking about 1977 -- and the copier part is about 6 billion. Each is headed by an executive vice president, and each executive vice president has divisions working for him. I become the vice president of strategic planning for the executive vice president in charge of all of the non-copier businesses which included Xerox's diversification into word processing, typewriters, disk drives, floppy disks, electronic printers, non-impact printing, and all of those kinds of businesses. Reporting to the executive vice president are division general managers who do their own plans. Those plans come in to me. I consolidate the planning, guide those plans as we bring them to corporate. At the corporate level you have the vice president of strategic planning for the whole corporation.

NORBERG: I see. So what sort of tasks did you engage in then in the late 1970s?

STRASSMANN: The tasks really dealt with trying to sort out the proliferation of missions. There were too many missions even in the non-copier part. We had a computer services business; we had a floppy disk business; we had a hard-disk business; we had a custom software business; we had impact printing; we had a local-area networking business; we had facsimile. Just on and on, a long litany of products. There are hundreds and hundreds of products and hundreds and hundreds of markets worldwide.

NORBERG: And what's the process for shaping these down?

STRASSMANN: Well, the process for shaping those out was again the long range planning cycle in the spring, and the operating plan cycle in the fall, and then reviews as they occurred for major acquisitions or new major product launches. For instance, Xerox's launching into the typewriter business would be such a venture, Xerox's entry into the personal computer business in 1981 would be such a venture, etc., etc.

NORBERG: Now, as director of strategic planning, did you buy into the notion of finding that really dramatic new technology to invest in?

STRASSMANN: I did not buy into the idea. As was typical at Xerox in many of these kind of situations, you staff a group of people at the top with people who have different ideas and let them sort of hammer it out. So I was able to survive in that position from late 1977 until 1984 having a deviant view.

NORBERG: Were there new products that came along that were particularly exciting?

STRASSMANN: Well, sure, the Xerox Star came out in my time. The Ethernet offering, the 10 megabyte Ethernet, came out of that.

NORBERG: Did both of those come out of Xerox PARC? I know the Ethernet did, but did the Star?

STRASSMANN: Yes, the Star came out of Xerox PARC. The high-velocity laser impact printer. The Xerox 97, still the leading product, also came out while I was vice president of strategic planning. There was the world's first plug compatible optical drive came out, along with the high-speed daisy wheel -- Diablo -- in those days. We had very exciting products.

NORBERG: Now, there is this view that we talked about earlier when the tape was not on about Xerox not capitalizing on the fact that they at least had the capability to enter the personal computer market. Was there any discussion of that sort of objective while you were in strategic planning?

STRASSMANN: Of course. In fact, that consumed most of the time starting in 1979. Our first entry was not the personal computer, but the first entry was the Star which was the product version of the Alto that goes back to PARC. Remember, we did Alto in 1974 and we did the probe starting in 1975. Then there was all of this delay due to the probe. So we did not have a product to enter the market until the National Computer Conference in May of 1979, which was the Xerox Star, and it got rave reviews. The problem with that machine was that it was geared, advertised

and promoted, to be all things to all people, to be an executive workstation. It didn't have any of the software to support it. In other words, it had just a very poor desktop editing software program, and that's all it had. The manufacturing capability behind it, and the support capability in the field, and the trainability of the field sales force left much to be desired, because that is the time when, as I told you, due to the internal conflict, it was a question of "Are we going to have one sales force, or two sales forces?" And the pendulum has swung to two sales forces, but run by the same branch manager who was always a copier guy. So the first product launched was the Xerox 8010 called the Star. It clearly was a Macintosh precursor in every respect. It had many compromise electronics in it. And the problem with that machine was the company still wanted to position the machine as the 10 billion dollar shot. Therefore, in a typical Xerox fashion, it came out too broadly and too narrow. In other words, it was one mile wide and one inch deep. The insertion of that machine as a desktop publishing machine for specialized, high-value added applications like the Boeing application would have made that product an instant financial success. But that's not the way it was introduced, because the company was still hoping for a big shot. To some extent, the reviewers sort of clouded the picture, because the reviewers were euphoric about the machine.

NORBERG: Did these companies like Boeing purchase the Star, however?

STRASSMANN: No, they leased it.

NORBERG: So there was some financial success associated with the introduction of the product.

STRASSMANN: Yes, but it did not compensate at all. The product was a loser financially.

NORBERG: Leaving aside the question of the sales force, what was the competition for the Star in the marketplace?

Was there anything?

STRASSMANN: None.

NORBERG: There was nothing?

STRASSMANN: Not even close.

NORBERG: So the question of application is not a serious one, is it, at that time? The fact that there wasn't a lot of support?

STRASSMANN: Yes, but the question of application is critical, because for people to buy the machine, they had to justify to their management and find where to put it. The customers, starting in the late 1970s, early 1980s -- this is when the budget started coming down -- just couldn't buy these things for technology's sake. They had to explain to their management why they were doing it. Many people who were buying it were buying it because they just loved the idea of this kind of a machine, but that is not the basis for a solid, profitable business.

NORBERG: Certainly. I understand that. What I was trying to do was to compare it with the Apple and the later PC, and trying to remember whether or not there were sufficient applications when those machines came out. My recollection is that Apple did not have very much. The PC had a better move on the market because things had been developing in the meantime.

STRASSMANN: Well, sure, because spreadsheets were there. In other words, when the PC came out you had already a generation of people who had done Visi-Calc. You suddenly had Lotus 1-2-3, and Microsoft Word, and Wordstar. So people could move in, and, between the spreadsheet and the word processor, you had a market. It was an applications-driven market.

NORBERG: Okay, but that was not available in 1979, and no one had the foresight to see that it was necessary until the machine got out there.

STRASSMANN: No, that's not correct. The Visi-Calc package and Wordstar were available on an Apple II as early as 1978, and these were CPM machines. The PCs that came in 1981 were DOS machines, but there was a generation of machines preceding that. I had a machine here in 1978 -- an Apple -- which ran spreadsheets, and word processing, and God knows what.

NORBERG: I see. If that's available in 1978, then there is very little excuse for not making it available on Star.

STRASSMANN: Yes, but you see, Star was much more expensive. You see the Apple IIs, and the Kaypros, and the Osbornes, those were the first-generation CPM machines. Those machines did not have a high-resolution screen, did not have the optical thing, did not have a mouse. They were difficult machines to learn. You see, the thing that was so beautiful about the Star is you could sit down and learn how to use that machine in a text mode in 15 to 20 minutes, and really do a decent job. The Star had also a laser printer. It was the first machine that came with a laser printer. So you had all the graphics. You could do camera-ready copy. The stuff that came off the CPM machine was pretty awful-looking. Those machines cost \$2000 to \$3000 apiece. The Star was \$11,000. It was a premium price application which only would have worked for premium kinds of situations.

NORBERG: Where does that leave us then in this discussion? We started out talking about the introduction of Xerox into the information business. In 1974, they get out of mainframe activities by selling Xerox Data Systems. However, they still have the question of some sort of new product that they wish to manufacture if it comes down the line. They find one in what turns out to be the Star. Did they have to retool to do this? Were new manufacturing facilities necessary?

STRASSMANN: You see, the manufacturing facilities for putting together workstations and personal computers -- unless you're talking serial production of, say, 10,000 units a day -- all of those machines were really batch production. These machines were not very complex. They did not require too much labor. It was largely assembly,

because the circuit boards were made somewhere else. We subcontracted the circuit boards. The disk drive came in from an OEM supplier. The printer came from an OEM supplier. The power supply came from an OEM supplier. You see, one of the attractive aspects of those days was that when you looked strictly on a unit manufacturing cost basis and all of the technology, the margins were horrendously profitable. There was like 70% gross margins. So anybody who was able to get volume made an awful lot of money -- volume at a favorable price, at a reasonable price. So everybody who looked at that business said, "Well, that's the business I want to be in."

NORBERG: Why not lower the price of the Star to make it a financial success?

STRASSMANN: Remember, it cost the user eight times as much to just operate a machine in terms of learning, support, and hand-holding, than what the price is. The price of the machine within a given range, unless there is a commodity competition, doesn't matter. What matters is the benefits. Can you get the benefits? That is where Xerox totally missed the boat. Top management didn't understand that.

NORBERG: In spite of what you and others were trying to say to them?

STRASSMANN: That's right. They just didn't understand. It was a mentality that was based not on customer value, but it was made introspectively. That is very much true even when you go to the case of the automobile business. Why did General Motors make unreliable cars? They didn't give a hoot what was the customers' costs. It turns out the customer life-time cycle cost for an automobile vastly exceeds the purchase price of the automobile. Therefore, if you want to compete in the automobile business the first thing you would do is try to lower the customers' costs by increasing gasoline efficiency, and reducing maintenance costs, and making the car reliable. It's obvious. That's in a mature automobile business which is an 80 year old business. They still made that mistake. Can you imagine if you are in a new electronic business, and you have very little experience, and it's very easy to fall into that kind of a trap.

NORBERG: Well, what about the situation in the copier business side of Xerox? Did they make the same mistake

there, too?

STRASSMANN: Yes, they did.

NORBERG: They were in that business for 50 years by the time we're talking about.

STRASSMANN: But Xerox made the same mistake, because, for instance, the major cost of copying is not making the copy, but the person standing in front of the copier feeding the original in. Xerox did not put an automatic document feeder worth a damn on to the copier until the Japanese started doing it. Yet, the use cost of the copier, of the person standing there and opening the lid and putting the thing down. It's just terribly time consuming. So as soon as a competitor comes in that offers an automatic document feeder, that competitor is going to get the business. Then, of course, you have the maintenance costs. The maintenance costs on a copier today are greater than the purchase price. The Japanese solved the problem very easily. Xerox was committed to a very highly engineering selenium drive, which was, really, the selenium is clad on top of a very high precision aluminum drum. The Japanese said, "Well, that requires too much maintenance cost. We are shipping them by shipload, and giving it to these distributors. The distributors don't have money to have a maintenance force. So we are going to design, in order to compete in this business, a machine that has no maintenance costs." How do you do that? Well, you take the photo receptor and you make it a cartridge that's disposable, which means the customer pays for the cartridge. And if the thing spoils, the customer has to throw the cartridge away, but the customer has no maintenance costs. Not only do you get market share, you change your distribution channels, because now you can sell the copiers through warehouses and by mail order. You get revenue on the cartridges. And if the thing fails, so the guy bought a cartridge that's worth a thousand copies and he throws it out at 800, he already paid us. And that's obvious. Yet, Xerox just said, "Well, we have to make a good photo receptor," because we had this huge photo receptor department that was optimizing photo receptors.

NORBERG: Well, isn't it possible only to take that position that the Japanese took when you're trying to enter the

business and achieve market share?

STRASSMANN: Yes, but that's an option that was available to everybody.

NORBERG: How is Xerox going to get rid of its photo receptor branch? Can you make that rapid a decision and just decide to cut it out and that's the end of it?

STRASSMANN: No, but you see, that is the sort of cataclysmic centrist view of management.

NORBERG: My view?

STRASSMANN: No. Associated with the American style of management. When you finally get down through all of the words, American management, and Xerox, and IBM remain high centralized. So you have a hundred thousand people. How do you maintain central control over all the decisions? You have to make those decisions very binary, because everything has to come from the top. You see, that's imbedded in the way I want to run things. Therefore, your decisions have to be very dramatic. You see, if you decentralize power, and you say, "Well, let's do some with photo receptors, some without photo receptors," you, in fact, don't need all of that management structure. You don't need all of those planners, because, let's just see which one is better, which is the Japanese way. So you have been forced to make these big, cataclysmic decisions, "Do we go photo receptor, or don't we go?" You have committees studying this thing for years. You never go out and say, "I cannot engineer it. I don't know what the customer will want, but let's try it." It's a different view, and after you have accumulated layers and layers of vice presidents of strategic planning and you have corporate planning, and divisional planning, and group planning, and product planning, you have these enormous staffs. In 120,000 people Xerox company, there must have been only about 14,000 service people, and about 8,000 factory workers.

TAPE 3/SIDE 2

NORBERG: 22,000 out of 120,000, directly involved with customers?

STRASSMANN: And the ratio for AT&T was even worse. So you see, to understand information technology and the insertion of information technology into American culture and American business, you have to understand that much of the information technology that was ingested in the 1960s and 1970s was basically ingested to support the increasing span and control requirements of a growing bureaucracy. Now, that created the information business, and that created the demand, but the providers of that, in fact, became infected, and represented even in a more extreme way the behavior of their customers. So the models were basically control-oriented bureaucratic models. And now, if you are involved in that sort of thing, that's where you have the decision-making where the purchase of CPUs is always for a big, central mainframe, usually done by a central procurement, usually done by the financial man in order to increase control. The technology decision on the supply end mirrors that thing, because the structure doesn't allow me to just say, "Well, I don't know what you guys are doing." The notion of venture probes, which is now fashionable in big corporations, was an unthinkable alternative in the 1970s.

NORBERG: A venture probe in the sense of Xerox taking the throw-away cartridge and using that?

STRASSMANN: That's right, and seeing whether it works. The mode of bringing in the innovation goes back to what I pointed out today. In these monolithic structures, the way you innovate is you go buy somebody who is certified as an innovator, pay him lots of money, and, usually destroy the guy. Then you go to the next one.

NORBERG: Is that only happening in the U.S. and Europe or is it all over the industrialized world?

STRASSMANN: It's heavily in the industrialized world, although it has different management stations in countries like Brazil where the government regulation puts another layer of complexity on that. It clearly is the way you have to study the British electronics industry and what happened to it. And of course, it is in spades, if you want to

understand the Soviet model. The Soviet model is an extreme form of what I am describing to you here. The saving grace of the American model is that, regardless of what happens, Xerox doesn't remain a monopoly. So, there are constraining forces that even if Xerox goes to an extreme in its model, the clock runs a decade and then your stock goes from 172 down to 26, and the game is up. If you totally decouple the system, like you do in the Soviet kind of economy, or the Brazilian economy, well, then you have an extreme case, and then the thing just goes cancerous, and there is nothing you can do about it. It's very important from a standpoint of history and understanding information technology to look at the demand side and what are the underlying social and economic forces that drive the thing. To understand why people buy IBM mainframes, you really have to understand the organizational context of that environment.

NORBERG: What does that say about the various kinds of innovative development that did occur in the 1960s and 1970s? Things like time-sharing which did not come into industrial circles without a fight. There was a lot of resistance to building machines that had time-sharing capability. That's one example. The second example is networking which took a long time after the initial concept to get any sort of acceptance. It was with things like Ethernet when the acceptance finally came because of the demonstration of usefulness on a local level. If what you are saying is true, that most of the user purchases in the 1960s and 1970s were for getting greater control over the organization in which the purchasers were located, what does that say about innovative activity in the computing field?

STRASSMANN: Well, what changes at the end of the 1970s is that the guys who went to Berkeley and who were the radicals of the 1960s -- those who didn't go farming in Oregon or Maine -- became department heads, because you needed intellectual power. They, in fact, start voting Republican [laugh] -- my favorite joke. They become the distribution manager of Kroger, or the head of marketing for Sunkist, etc. The MIS guys are so wedded to the mainframe, and they get so overloaded with work backlog, that they start doing what I did, because I told you when I got in in 1969, I said, "Okay, let's give them APL. Get out of my way; I've got more important things to do, like getting invoices out." So what happens is that the DEC's and time-sharing become part of a legitimized counterculture that

comes in not through the MIS procurement process, nor were the MIS guys smart enough then, the MIS guy legitimizes it as relieving the pressure. That's where DEC comes in. DEC runs in on the scientific engineering counterculture that the bureaucrats cannot touch easily because the R&D guys take their money. Nobody knows how to justify, but they get their 4% and then they go away. Then they say, "Okay, let's buy some PDP-8s and call it lab equipment. The MIS guy doesn't even have to see it. Then when PCS come in, I'll buy it out of petty cash. So that counterculture, the turn against decentralization, then you have sudden start-- Peter's book, *In Search of Excellence*, and *Inc.* magazine comes out -- and things start turning, because things are pretty bad towards the end of the 1970s. Of course, by 1983, IBM growth rate goes to zero.

NORBERG: What do you think is taking place now that's going to produce changes in the information field, say, ten years from now?

STRASSMANN: This is not history.

NORBERG: That's right. This is speculation. I understand.

STRASSMANN: Speculation. First, I don't know, because nobody can predict the future. So I don't know what's going to happen.

NORBERG: We knew in 1965 that time-sharing was going to have an impact. We just didn't know what the impact would be.

STRASSMANN: So let me tell you my algorithm, why I have been able to hold my position for as many years as I have, with honor, although not necessarily great popularity. I basically look at the malfunctions of society, economic organizations, and I go and I isolate the major causes of malfunction. Then I postulate, saying, "Given reasonably free play of forces . . ." -- if that's not true, then I don't know how to play the game -- "but given free play of forces

which means there's always somebody who will innovate as a way of getting a competitive edge." To predict the future all you have to do is look at the current diseconomy and say, "They cannot exist." In other words, it's like water levels. If you see water level high and nothing containing it, that the water is going to fall down. It's going to seek a given level. So my view of the future, and I have just written an article for *Technology Review* about it, is that the major diseconomies today in the industrial world are excessive overhead costs, with accumulated excessive costs in coordinating what needs to be done. The reason why these costs are excessive is because the communication mode today depends entirely on verbal, around the table, face-to-face negotiation that uses a technology that is approximately four million years old, which is the tribal pow-wow. There has been no innovation in there. And it turns out as we solve the transactional piece of our economy, and the production piece, and as we are solving the logistic piece, what sticks out as a sore thumb is the executive meeting, and the training costs of the ineffective lecture. In fact, when you do a frequency distribution of events in the so-called information society -- which, by the way, isn't -- you'll find that we are now accumulating maybe as much as a third of the GNP in people who are just trying to communicate with another, using a very poor, synchronous, slow speed -- 300 words per minute max. Usually 100 words per minute in transmissions of information that have different cultural meanings in different contexts. In other words, the tuning and the redundancy that takes place in typical executive meetings, which is trying to make a decision, is just unbelievable. I sit in Washington meetings, and committees, and what have you. And you could say, "Well, this meeting runs \$150 a minute." It's just somebody taking \$150 and throwing it out of the window. Nothing is happening. In fact, the disorder actually increases. The more brighter people are around the table, the greater the disorder. It just turns out that when you look theoretically at some of the work that has been done in communication, you discover that we suddenly have tools in place which come from the disciplines of linguistics and cognitive science, which are able to make possible for us to look at a totally new way of decision making which can take huge hunks of costs. When I say huge hunks of costs, I am talking something between half and a trillion dollars a year of inefficiency out of the economy. As we are becoming global, multicultural, and multilingual, the problem of global communication almost mandates that you go to this electronically mediated way of doing decision-making, commercial transactions. And unless things go to the contrary politically or otherwise, I am convinced that that is how the course of information technology will evolve over the next 50 years, and it's a pretty

safe bet.

NORBERG: So this ought to put Xerox in a reasonably good position for the future.

STRASSMANN: Well, Xerox was always in a good position [laugh]. There was never a time when Xerox wasn't.

NORBERG: Here's a case where they ought to be able to take their own technology and improve decision-making within the company so as to avoid past mistakes. Are they learning any of that these days? Did they learn it in 1984, would you say, before you left?

STRASSMANN: No. I came back a couple of times. I was asked to review things. And in fact, the mistakes of the 1970s were being repeated.

NORBERG: One last question. What things have we not touched on as a result of my questions that you think ought to be included in this discussion?

STRASSMANN: There's so much to be said.

NORBERG: On what topics?

STRASSMANN: On the whole subject of the culture of the user. The thing that concerns me in the work that's being done by the Babbage Institute is a preoccupation with the supply aspects of the evolution. To understand what happened, and I'm talking now from the historical standpoint -- it's a one-sided story. I tried to mix in the utility view, and the user economics, and the user compulsions, and the power structure of the MIS. The whole evolution and the role of the MIS professional on the user sides is a very, very important story, and because without that story, you will not understand what happened. You will be just clapping with one hand.

NORBERG: What are the best ways into that discussion? Is it through conversations like we have had? Is it through looking at the MIS literature which developed from what , 1966 or so, as a full-bodied professional approach to the problem?

STRASSMANN: You need both. The literature is particularly poor on what I consider the historical view. And the reason is the people who occupy the MIS field posts in the 1970s and early 1980s are the creatures who became heads of MIS in the late 1960s under the aegis of the centrist control orientation of the finance establishment. They reflect a world view, which is that, "We know what's right, and we are going to tell you what's right." It's a deeply totalitarian view, a deterministic view. Organizations are machines that can be engineered and programmed. Many of the leaders that you would be interviewing today of my age group would be basically people who have the paradigm of organization as a machine where, in fact, the central computer is viewed as a way of programming people.

NORBERG: Do you think they hold that view consciously, and did they hold it back in 1970?

STRASSMANN: Yes, gosh, yes.

NORBERG: I'm inclined to think not, Paul. I'm inclined to think that's a very subconscious element in most people's operation. They have a view that they're helping you. They're not controlling you. I'm not saying that's not the result. I'm talking about now what their view is.

STRASSMANN: Yes, but you see, this is the difference between psychology. We had this discussion about Licklider. He wants to be a psychologist. You see, I am not making that statement as a psychologist. I am observing. I'm describing behavior -- what they do. There is a difference.

NORBERG: Yes, I understand that. But what I am trying to get you to say is that it is not a conscious perception on

their part that that is what they are doing. Otherwise, we would have heard more about it, don't you think?

Otherwise, they would be higher up in the organization, perhaps, as well. These might be the people who would move to the top, and they're not.

STRASSMANN: Well, there are other reasons for that. There are other reasons. You also must understand that computers were viewed as Pavlovian machines. If you are very good in this totalitarian wiring of these Pavlovian experiments, and you do that for 10-15 years, that's what you want to do at the top. That's where they break you, because they can't do it, because they wouldn't survive.

NORBERG: Would you think that microcomputers and local area networks undermined this centrist view?

STRASSMANN: Not really, although some people claim that, but that's utopia. When you look at the microcomputers, they are solipsist. When people are using nets, they are taking a central message and sending more copies around faster. These are not cooperative, consensual kinds of networks. They are just a way of getting around the copying machine faster. I have some specific examples to prove that. Electronic mail, today, in many places, is totally discredited, because there is just so much there that people can't cope with it.

NORBERG: That's interesting. I may have a very narrow view of this, but electronic mail has helped us cut our support costs, because when I get on and send a message to someone, say, like you, I have no secretary involved. Nothing. It's a one-to-one interaction. You send me the information back I need. Maybe I can act on it and maybe I can't.

STRASSMANN: We have a relationship, but when you are in an organization and you want to send 25 copies of a memo, you must understand in a big organization, who gets copies becomes very important. You don't send 25 copies if some secretary is standing in front of the copier and stuffing the envelopes, but if all it takes is, somebody says, "Add me to the distribution list." You have 42 people in the distribution. The marginal cost for sending

another 42 copies is zero, as perceived by the sender. You see, the big problem in information processing, and this is something that is not properly understood, is that a use cost, particularly as technology advances, vastly exceeds production costs. Therefore, you have to start reorienting your view of information technology. It's not your labor costs that I am concerned about; it's my labor cost.

NORBERG: I was having a discussion with another faculty member Wednesday night about the question of facsimile. She was insisting that she ought to have a fax available to her and I was talking about the costs of installing it just for her convenience in terms of, how many copies is she going to send, and can she send them to the people that she wants to, can they receive, and so on. We began talking about the user costs in this. It's cheap to buy the equipment and install it, but what does that mean in terms of the user costs later on.

STRASSMANN: The use costs today are horrendous.

NORBERG: All right. Thank you very much. It's been very helpful.

END OF INTERVIEW