

An Interview with
ERWIN TOMASH
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Conducted by Arthur L. Norberg

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Abstract

Tomash discusses his career, including employment at Engineering Research Associates (ERA) and the founding of Dataproducts Corporation. He begins with his electrical engineering education at the University of Minnesota in the early 1940s and his subsequent entry into the Army Signal Corps as a radar specialist. He recounts his initial task at ERA, conducting research for *High-Speed Computing Devices*. He surveys ERA's work with the predecessors of the National Security Agency and other government offices, and the company's expansion and move to the forefront of computer technology in the early 1950s. He describes changes in the company and his own move into management when the company was sold to Remington Rand in 1953. Tomash recalls his departure in 1956 from Remington Rand to Telemeter Magnetics, where he soon became president. This company manufactured core memory systems and one of the first successful transistor memory systems. Tomash explains how he used the organization he and others had assembled from Telemeter Magnetics to found Dataproducts Corporation in 1962.

ERWIN TOMASH INTERVIEW

DATE: May 15, 1983

INTERVIEWER: Arthur Norberg

LOCATION: Los Angeles, CA

NORBERG: Today is May 15, 1983, we're in the home of Mr. Erwin Tomash, retired chairman of the board and founder of Dataproducts Corporation. Mr. Tomash is presently Chairman of the Board of the Charles Babbage Foundation, the supporting arm of the Charles Babbage Institute. Mr. Tomash, in the interview that you did with Robina Mapstone some years ago for the Smithsonian/AFIPS project, there was no discussion in the beginning of the interview of your early childhood, your parents, and your education in St. Paul. Could you tell me a little something about your parents, your father's occupation, what your mother was involved in, and where you went to school?

TOMASH: Certainly, Arthur. My parents were immigrants and I was born about a year after they arrived in this country. They came from Moldavia, which is the border area between Romania and the Soviet Union and currently, in this present period, is the Moldavian Socialist Peoples Republic. It's part of the Soviet Union. It's an area whose ownership has alternated, like Alsace-Lorraine; it's sometimes Romania and sometimes it's Russia. My father had been a dry goods merchant in a town called Mogil'ov-Podol'skij. In the revolution he, of course, lost his business and so they fled in, started I guess, in 1919. It took them a better part of a year to leave. He was 45 years old when I was born, so he was a relatively mature settled individual. My mother was his second wife. He came with 4 children, 3 of them by his first wife and my sister with my mother. I was the only one born in this country. In this country he tried selling dry goods, door to door, but was unsuccessful. Ultimately, they started a small grocery store and all through the Depression he more or less... [Interruption]

NORBERG: You started to mention about what your father was trying to do after he arrived in this country.

TOMASH: He tried to sell dry goods, the same thing he had done in the old country. But in the old country he had a shop, he'd been a substantial citizen. In this country, of course, he had no capital and he tried selling dry goods door

to door and was unsuccessful at that. So he ultimately, about 1926, I guess I was about 5 years old, started our first grocery store, the first of many. On and off all through my childhood years, usually very marginally, no always very marginally, he made a little living. We lived off a corner grocery store. He never did adapt well to American society and he never was a successful merchant in America. When I was a teenager I was critical of my parents--I guess like most teenagers are--I used to say that he could take any store and ruin it in three or four years. But it was the Depression and it was a hard time.

So I was a Depression child. My memories of my youth are that times were bad, people were out of work and money was hard to come by. My father opened the store at 7 in the morning and kept it open until 9 o'clock at night, seven days a week and shut it only 3 days a year for the Jewish high holidays. My mother worked in the store as well, helped with that. Generally speaking, with one exception, we always had a store which had living quarters behind it or above it. So we lived above the store or behind it. I was a poor boy and...

NORBERG: Was this store in the Cleveland Avenue section of St. Paul?

TOMASH: We moved around a lot. We had one on the West side; we had one near Central High School on Milton; we had a few near downtown, the last store he had was off downtown St. Paul on Broadway. When I went to the University, I commuted from downtown St. Paul, from 7th and Broadway. This is now a freeway, but was then an older area of the city, even then it needed redevelopment. And so we moved around. We had five or six stores and generally managed somehow to eke out a living. We never had a store farther west than Lexington Avenue as I recall.

NORBERG: Therefore you shifted around from school to school as well.

TOMASH: Right, I shifted around from one school to another. I was very busy in those days. I'm Jewish and my parents were Jewish and so religion played a moderately strong role. My father was not truly orthodox; he was what we would call today conservative. He kept the store open on Saturdays, for instance, but he insisted that I have a

Hebrew school education. So my days were pretty filled with planned activities, mostly centered around education. I went to public school and at the end of that school day I went to Hebrew school. At one point I was also taking clarinet lessons, because my parents thought it might be useful for me to be able to play an instrument to help me earn a living. I recall that I had no interest in music at the time. Childhood activities like play or having free time for myself or hobbies or having pocket money, what we regard now as the ability to express oneself as a child were just things that were alien to them; it just never occurred to them and therefore to me that anything like that was important in any way. So I didn't do any of those things.

I'm making it sound like my childhood was a pretty rough go. Of course, we had a very strong family relationship and a very warm loving environment. So I had lots of good things going on as well. As my older brothers and sisters grew up, they would go out to work and they brought some money in the house. Very early when I was only five or six my eldest brother left home; he moved to New York subsequently. In turn, as each child grew up they left home. They either got married and left home or they moved out of St. Paul to work. So from the time I was eight years old, my sister and I were the only ones home, and so from my teenagehood I was the only child left at home.

NORBERG: How much older was your sister?

TOMASH: Four years.

NORBERG: How much time was left to work in the store for you, say as a teenager, did you need to work?

TOMASH: As a boy, I worked in the store, usually on the weekends. About the time I was about 14 or 15, I went to work in another larger store for money on Saturdays. I worked in a big downtown store. Since I had experience in grocery stores, I was able to find work. In our store, I used to help out an hour or so during the day, that is at the end of my other activities. I had to spend a lot of time commuting because the Hebrew school was in the central district of St. Paul up on the hill. It was on Milton and Grotto, or something like that when we lived way over on Broadway or when we lived on the East side I had to take the streetcar to go to Hebrew school five days a week and on Sunday

mornings as well.

NORBERG: Did you develop any hobbies in this period?

TOMASH: I remember collecting stamps. I never had any money, so I'd collect them off the envelopes that came in the store and so on. I had a little stamp album, but I didn't have any other hobbies. It always seemed to me such luxury to be able to buy things. When I'd meet boys who bought things like an airplane kit to put together and so on, I was envious. I never had the pleasure of doing that. It wasn't regarded as important in our family. What was important was schooling, education; it was clear that they wanted me to go to the University right from the beginning. What was important was cleanliness and having clothes and food on the table. Those things were important--good clean clothes, food, shelter, but that's all. Not much time spent on pleasure.

I did have some better off relatives, not wealthy in retrospect. Some were small merchants. They had some luxuries. One was a professional; he was a veterinarian. They had some luxuries. He had a summer cottage at White Bear, which was then a commute. It wasn't part of the greater metropolitan area. People would go out there for the summer, although I never seemed to have been invited to go out there and spend any time. I remember going out for the day. I remember spending time with my cousins on a Sunday at wiener roasts and things like that in the fall--a nice time of year in Minnesota.

In school I wasn't a particularly good student. I didn't concentrate much. It didn't seem to me important, but I evidently was bright enough. I kept moving along in school and didn't have any trouble passing and so on. One thing I remember very, very well was that in the ninth grade I took a course in algebra. I was attending the Mechanic Arts High School and the teacher's name was Miss Christopher. I remember her very well. Everyone told me how hard it was and what a terrible teacher she was and so on. Much to my surprise, I found I liked it very much and I was very good at it. I think my first introduction to the idea that I might study engineering or be associated with technical things somehow was that course in algebra. I also liked history. I liked the social sciences. I liked politics. I was very interested in politics, as were a lot of the young people at the time. Used to talk a lot about politics. We

thought Franklin Roosevelt was a god and we were very actively concerned with world affairs.

NORBERG: Can you be more specific about the date?

TOMASH: Let's see, I graduated high school in 1939 so I would guess the ninth grade would be 1936 or 1935, 1936. I remember being very interested as far as world politics, the Spanish Civil War which was going on just about then. The most dramatic thing in the world, it seemed to me would be to be a war correspondent. Not a war, a foreign correspondent. Lots of books being published by them. There were the John Gunther "inside" books; I used to read those. And Pierre von Passen and a number of others. They were foreign correspondents who were syndicated in the papers and they would also write books. It seemed to me to be such an exciting way of life to be in on all these world events. I never followed that interest up in any way, but I did like to read that stuff.

I like history. I liked social studies in high school, but I knew that my father felt very strongly that I should have a trade or a skill. Although he didn't communicate a lot with me, he was a quiet man, he wanted me to be very sensible: to have a trade, to have a vocation. He really didn't think I should just get an education. He observed lots of very well-educated young men were without jobs. He always had a story about someone who had a degree in social studies or economics or something and couldn't get a job. He urged me to learn the electrician's trade when I expressed an interest in electricity. At the time, I attended Mechanic Arts High School near the state capital and it was located right next to the vocational high school, within a block or so. It was possible to take courses at the vocational high school for credit on your high school curriculum. So I did that for a while and I actually took a couple of courses in electrical work. From that I learned I have very little mechanical aptitude; I was not good at it. While I understood the theory very well--I was one of the best students in the theory section--I was one of the worst students when it came to putting bearings in a motor or to wiring things up. Translating all this theory into reality was hard for me. But then I liked math; I liked physics--I had a good physics teacher, no, a fair physics teacher, a very good chemistry teacher. They encouraged me. So, when I graduated there was no question but that I would go on to the University. The University was very inexpensive, even by the standards in those days. It was 15 dollars a quarter, or something like that for the registration fee. The government had started a program called the National

Youth Administration where you could get employment at 50[^] an hour while you were going to school. So I signed up for that and registered as a freshman with an option for electrical engineering. I never again questioned that choice and just continued on in that.

NORBERG: Who was around then teaching courses at the University in electrical engineering and such subjects?

TOMASH: My first encounter with them was as a sophomore. I don't know if it's still true, but then the first year of engineering was the same for everyone. We all had chemistry, freshman chemistry, and we had algebra, and so on. Then the first branching occurred in the sophomore year in engineering. My first instructor was a young man named Muckinhern. He remained as a professor for many years. I think he's retired now. Also, a fellow named Becklund, Orville Becklund, was a young instructor there then. The head of the department was Henry Hartig. No, the head of the department was a man named Bryant, whose specialty was electric power. The Electrical Engineering course was divided into two options, power and communications, not electronics but communications. It was the equivalent of power and radio engineering. At first, Bryant was the head of the department, and when Bryant retired, Hartig became head of the department. A man named Caverly, who was a power specialist, was also one of my professors. Everybody had to take some of the power transmission courses anyway. I remember Caverly. Also Professor Larson, I saw him recently. He is one of the few that I saw at the dinner in my honor one evening a couple of years ago. He taught electronics courses. Roleman was still there; he's emeritus and still around. He was a motor and generator specialist. So that was the faculty.

NORBERG: Which communications courses did you take?

TOMASH: Well, they were mostly in radio communications and the professor there was a man named Webb. He was completely incompetent. Cliff Helms and I, who were classmates, talked this over and he and I went to see the dean of the Institute of Technology. It was Lind, who was a chemical engineer at the time. We just said the man was incompetent. We were juniors or seniors by then. Before that you really didn't study much communications. In the junior year, we had a course by Becklund about telephone transmission lines and so on. But the real communications

subjects, even simple things like how a radio receiver worked and how you design it and how antennas worked and so on, Webb taught those. So we told Lind that Webb was completely incompetent and that we had a petition which had all the signatures of all the students. There were only some 20 of us. These classes were tiny by today's standards. I think there were perhaps 30 electrical engineering seniors in a class and they might be split half communications and half power. Anyway, we had signatures from all the students in our class. The students were frightened; everybody was very nervous about this. People signed the petition, but they didn't want to go to the Dean. And I remember we went through an elaborate arrangement, Helms and I, where all the signatures could be torn up and anonymity maintained if the protest backfired. When we went to see Lind, he didn't argue much. He was evidently aware of the problem. He took immediate action. Right in the middle of the quarter, he pulled Professor Webb off the course and a young assistant professor named Russ Nielson, who later died, took over. He was really not a professor; he was a research assistant or something hanging around there. He was better and he helped us.

NORBERG: Do you remember the textbook?

TOMASH: No I don't.

NORBERG: By any chance was it Terman's?

TOMASH: Yes, it probably was. *Radio Engineering* by Terman. Right, it was Terman, I think.

NORBERG: Might be. I can't confirm that. I'm just curious, because that certainly was a standard of the time.

TOMASH: Yes, I think it was. So that was my University training. I was an average student. We had some straight A students, a few. By the time you got to be a senior all the filtering had been done; I think everyone passed.

NORBERG: What sort of work did you do under the NYA program?

TOMASH: All the audiovisual services at the University were centralized in the basement of General College, an old building that may not even be there any more. If any instructor, any lecturer, wanted slides shown at a lecture or wanted a PA system they would call this service. And I was employed by them to do that. And we also ran the sound system in the Student Union and at Northrup. So I did this all through my University career. It was a pretty good job. You could go down to the control room in the student union, if you got assigned there, and for 6 hours you could study while you'd play records for the dancing or run the PA system for an affair or whatever it was. So that's what I did.

NORBERG: What did you do during the summers?

TOMASH: I generally worked in a local grocery store, generally worked the whole summer. Sometimes I'd take a week or two off. All during the school year I also worked on Saturdays at a grocery store. One summer--I guess between my sophomore and junior year--I worked at a camp about 75 miles away from the Twin Cities as a maintenance man. I was in charge of keeping it clean and I got paid a little bit plus I lived at the camp. One of the counselors up there was a young man I'd known; he was a friend of mine from high school days. His uncle owned a butchershop and I got a job that fall working at the butchershop on the weekends, on Friday afternoons and Saturday instead of the grocery store. The butchershops were unionized and I was paid much more money for essentially doing the same thing. I didn't cut meat, I waited on trade. I was a counter man; I weighed it and wrapped it up and so on. I never did learn to cut meat, but anyway, I had what was considered a very good job. While you might make five dollars a day in a grocery store on a Saturday and those were long twelve-hour days, at least 7 to 7, in the butchershop it would be 8 to 6 and it would be \$7.50 or \$8.00 and...

NORBERG: Per day?

TOMASH: Per day, per day. But, from that I could accumulate enough money to pay my fees at the University and generally buy my own clothes, go to a movie. A first run movie was 25 cents or 35 cents.

NORBERG: Did you live at home all this time?

TOMASH: I lived at home all the time. I lived at home and commuted. Often times in the nice weather I commuted by thumbing. I'd hitchhike from St. Paul to the campus. The last year was kind of deluxe. I remember carpooling and paying for a ride. They'd come by for me in the morning. That was pretty fancy, much better than the bus. It used to cost two tokens to go from St. Paul to the University, because you had to cross the city limits to go from Minneapolis to St. Paul. Every year there would be a big campaign to let students use one token for that ride. A token was 7 1/2 cents, so the ride cost 15 cents. It's surprising now what you'd do for 7 1/2 cents. I'd take the streetcar from home all the way to the city limits and then walk from the city limits up in Midway to the University. I'd walk past the stadium, it was a couple of miles in the cold for 7 1/2 cents. Other people were doing it too. The thing that surprises me about all this is, as I look back, all this time in my youth I never felt poor and I didn't think any of this was unreasonable. It didn't seem remarkable at all that I should be doing these things; thumbing rides, carrying my lunch and not belonging to a fraternity and so on. Sometimes I'd hear about people having dates and buying flowers for their girlfriend and buying them presents but that was just an alien world to me. I couldn't understand it. I couldn't imagine why anybody would want to do that, but I didn't feel that I was missing something or cheated or second class or anything else.

NORBERG: Erwin, you got your degree in '43 as I remember, is that correct?

TOMASH: Right.

NORBERG: Were you anticipating doing any sort of government work in the defense effort at the time?

TOMASH: Yes. Right after the war started in December '41, the Dean announced that classes would be given by the Institute of Technology through the summer and that we would all be given deferments from the military if we continued our education. So the summer of '42 the whole class enrolled for a summer quarter. In the fall, we began with the second quarter and we graduated in March rather than in June. A few people took jobs in the defense

sector. Some had been in the reserve, and went directly from school to the Navy and the Army. I hadn't been in the reserve and I hadn't made any special connections. So I applied to the officers recruitment program for both the Navy and the Army. First, I applied for the Navy and was turned down. My eyes weren't good enough or something like that. Then I applied for the Army and was accepted. So I was sent to the Signal Corps as a second lieutenant. I never was a non-com or private.

I had met Adelle when I was a junior at the University. We met and saw each other on campus. We became engaged when I graduated and were married at Fort Manmouth in New Jersey when I started my training there in July 1943.

I was commissioned as a second lieutenant, and after a military instruction course at Fort Manmouth, sent off to radar school. It was a 6-month program, three months at Harvard, right at Harvard Yard. We used the law school buildings for the lectures. Three months was at MIT but that was not on the campus at MIT. The course was given in a building that MIT leased downtown, the Harbor building. A few of the people from my class that had gone in the Navy also ended up at MIT. The Army used Harvard then MIT, and the Navy had another starting school and then sent people to MIT, so we met up. Bob McDonald was an assistant instructor there. He had graduated a year or so ahead of me and I saw him at Harvard. He was a monitor, helped with the class sections and so on. One of the most important things about my experience at Harvard and MIT was I did very, very well at both these schools. I was third or fourth in the class at Harvard and this was out of 400 young officers from all over the country who came from different schools.

NORBERG: This was studying what specifically, Erwin?

TOMASH: We studied electronics. It was the first time I really studied electronics. Circuits, design of circuits, analysis of circuits, and pulse techniques, which were then brand new. Then, towards the end of the course at MIT, we actually studied a couple of pieces of equipment, how the parts and circuits worked as a system. It struck me that my education had been quite good. It was quite confidence inspiring, for me. These young lieutenants and Navy ensigns were electrical engineering graduates from well-known schools all around the country. Here I was from little

Minnesota and I was able to rank third or fourth in the whole class. They tested us a lot each week. They were really giving us a lot of advanced electronics information in a hurry. It made me realize that my training, despite my misgivings, was very good. It also emphasized the things I was good at, which was the systems and analytical side.

NORBERG: Was there anyone else there besides McDonald that you came up against, that you knew?

TOMASH: I don't think there are any others. A couple of people from my class were at Fort Manmouth when I got there during training.

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TOMASH: But none were in my class at Harvard or MIT.

NORBERG: What did you do after you finished at MIT?

TOMASH: Then we were sent to a field radar school, a radar camp, Camp Patrick in Florida, near Palm Beach, West Palm Beach. It was actually a training course on anti-aircraft radar. I spent like three or four months there. The system was SCR 584, which was a 50 millimeter anti-aircraft gunlaying radar. We actually learned to run it and maintain it and so on. And then we were prepared to go overseas. The Army was having trouble maintaining equipment of this complexity. So they had formed a new type of organization just six months before, a Signal Company Maintenance Unit, which was a specialized radar maintenance unit. SCMU's were little teams consisting of one officer and five or six mechanics. I was assigned to form one of these new units. So after the Florida training I was sent to a few camps until things got sorted out. I guess I finished training in March and then by June I was on my way overseas so...

NORBERG: June of '44?

TOMASH: June of '44.

NORBERG: And you were overseas for approximately a year?

TOMASH: Two years.

NORBERG: Two years. So you didn't come back until '46?

TOMASH: Right, came back in the summer of '46. It was a year after the war was over before I got back.

NORBERG: Okay, and is that when you became part of ERA?

TOMASH: No. I came back and I decided to go back to school. I went to see Henry Hartig and he said that's wonderful. We have all these G.I.'s coming here and we need help and we'd love to have you. And so I signed on to a master's degree program and also got a small fee as an instructor and taught some of the labs. I worked for Muckinhern and I worked for Becklund. And I didn't like it at all... and it was...

NORBERG: Do you remember why you didn't like it?

TOMASH: I didn't like two aspects of it. First, I didn't sense that any of the faculty were at the leading edge. They didn't know much more than I did about electronics. What they were doing was teaching the 1939 curriculum, the pre-war courses. This was fine if you're getting a basic grounding; it had served me well. But as a graduate school, compared to what I'd seen at Harvard it didn't match up. We had the regular-Cruft Laboratories faculty there. Cruft, I think is the name of the Lab. We had the regular faculty and the head of it was very famous, he was old then, was an antenna expert. I thought of his name the other day when I was walking around there, a white-haired man....

NORBERG: Pierce?

TOMASH: Chaffey.

NORBERG: Chaffey.

TOMASH: Chaffey. And Minno and LeCorblienor, who was very good in analysis. Anyway, I had had a taste of mathematical techniques and modern electronics and I wasn't finding it there at Minnesota. I'm sure that's all been changed now, but it wasn't there then. Admittedly, they were straining just to handle the flood of undergraduates. All we had for a master's degree program was one advanced math course and a seminar led by Hartig. So I didn't think much of the training.

As for my reaction to the academic side, I didn't get any sense of dynamics. It seemed that the faculty were all, even the younger ones, middle-aged in their attitude and their outlook. The pace was very slow; they spent a lot of time in discussions and in staff meetings. So those are the reasons I disliked what I was doing.

So I told Hartig just that and he didn't argue with me. First of all, I was not a star student. Electrical engineering research didn't stick out all over me. I was clearly not going to be an outstanding researcher or anything like that. So he didn't discourage me in any way.

He did say that Bill Rumba, who had been a professor of physics, at Minnesota, was head of the Naval Ordnance Laboratory in Washington D.C. and that they were looking for people. If I was thinking of a job, why didn't I consider them. I agreed and I think he dropped a note to Rumba. He soon told me when Rumba was going to be in town. I remember talking to Rumba, who said, "Sure, we can certainly use you." And I took that job.

So in the winter of '47, early in the winter, Adelle and I drove to Washington to work at the Naval Ordnance Laboratory. The Naval Ordnance Laboratory was just moving out from the Naval Gun Factory, which was in Anacostia, to its new home at White Oak in Maryland, and I worked at the Gun Factory for a couple of weeks and

then transferred out to White Oak. Strangely enough, at White Oak, I worked indirectly for Atanasoff. Atanasoff was the head of the acoustics division. I worked for a seasoned engineer named Myers, who had been at the Carnegie Institution, and was the head of one section of Atanasoff's division. I was two layers down; I was a junior engineer. We were building a big wind tunnel and acoustics test chamber. They also had a bunch of the German scientists from Penemunde there. The Germans were really doing the design as far as I could see. I had no contact with Atanasoff.

Here, too, I found I really wasn't happy. I wasn't challenged, didn't seem to have too much to do, and I really didn't feel like I was learning. I worked there about 3 or 4 months before I decided that. I used to carpool with a man that I worked for, named Fitzpatrick. He was a very fine individual, a young man, Catholic University graduate, but he was also quite inexperienced. There was no mentor relationship. He was just a nice guy. One day he told me about a small company that a friend of his was working for in Washington that was looking for engineers. The friend was a fellow graduate from Catholic University.

NORBERG: Was this just a casual conversation?

TOMASH: Yes. I was telling him I was not happy with the government work. I was carpooling with him, and while he was my boss, we had become friends. There were a lot of petty irritations. The government was going through one of its periodic reviews. Evidently, during the war, the Civil Service ranking of a number of people had gotten upgraded beyond the demands of their jobs and their capabilities. The government was going through a process where they were trying to get grades and skills and salaries matched more evenly. And so I was told that in order to justify my rating which was a P-2 at the time, I would have to fill out this lengthy form. Fortunately, my military experience could count towards experience. Otherwise, I was only qualified to be a P-1. So I finally filled out the form and sent it in. About two weeks later they asked that I do it over, because they wanted some more information or something. So I took an evening and did that. About a month or two later I got a note from the Personnel Office saying that my file was lost, could I please submit a P-2 justification or something, when I came home that evening I said, "That's enough. They can't even find the thing. They don't think I'm worth it. They're trying to make me a P-1

instead of a P-2 and this isn't any fun," and so on. I was upset. I think that was the last straw; but it certainly wasn't the causation of it. My project was in the midst of moving out to White Oak when I joined, and I wasn't fortunate enough to be assigned to someone who could act as a mentor and be a role model and challenge me.

When Fitzpatrick mentioned this other company, I was eager. I was interviewed by John Price, his classmate from Catholic University. The company turned out to be ERA. It was ERA in Arlington, Virginia, their liaison office. It was only total coincidence that headquarters were in St. Paul, Minnesota. I was enjoying Washington. We liked it there and we weren't eager to move back to St. Paul or anywhere else. So I took the job.

NORBERG: What sort of job did they offer you?

TOMASH: Junior electronic engineer; they just said that the work was highly classified, that it dealt with systems and engineering not unlike radar pulse techniques. The first assignment they were doing was a survey. C.B. Tompkins, who was the director of research, needed some people to do some legwork and I would be helping him with this survey. That was the job description. And indeed that's what it was. The survey turned into a book. I worked on the book. [*High Speed Computing Devices*]

NORBERG: Why would a job of that kind have excited you when you had been through two other situations that, seemingly at least, were not much better?

TOMASH: Right. I think it was in the interviewing process at ERA that I started to meet some people who seemed to know what they were doing and had a sense of purpose. There seemed to be an intensity and orderliness to it. Of course, I wasn't sure. At the time, I was wondering whether a career in engineering was for me. If this is what engineering is like, maybe I ought not to be doing it. I was always and have always been a risk taker. A foolish risk taker, in many ways, in that I seldom worried much about the steps down the road. I always thought, "it's not irreversible," especially at that time in my life.

NORBERG: Were you conscious of this seeming to take high risks? Or is that just something that when you look back on it now...

TOMASH: No, it did not seem high risk at the time, even now when I look back on it. At the time, it seemed to me reasonable that I should try it and that is as far as my head went. It might be better; I didn't have that much to lose, that sort of thing. It's only later on in life that I started to realize that other people in the same situation might have been a lot more concerned with the "what ifs".

NORBERG: What sort of salary differences were there between the position at White Oak and the position with ERA?

TOMASH: It was about \$800 per year. My position at White Oak was about \$3,600 a year and this was about \$4,400 to start. However, within the next couple of years, the ERA moved me up pretty fast. I had entered at a low level and I had a couple of big jumps of \$1,000 a year, which, you know, was a big percentage, to where I was making \$6000 or \$7000 a year in a couple years.

NORBERG: You worked on the survey and then did you leave there and come back to St. Paul?

TOMASH: Yes, right. I worked on the survey and as the newest boy I got the least attractive subjects. Tompkins asked me to look into mechanical calculating machines. This was good for me, because it introduced me to MTAC and I read stuff by Comrie and so on. It also was good for me because in the engineering curriculum you don't really do much library research. You're busy solving problems, learning tools, mostly learning to solve the problems your professors have solved, perhaps not the problems that need solving, but that's what you do most of. You don't spend a lot of time doing library research as you might in other disciplines. This assignment forced me to go to the library and find and read these articles. I had to understand for myself and summarize it, and write it up. It was good experience for me for that first few months. Then as I got clearance, at least partial clearance, and they put me on some other projects. ERA in Washington was always a small liaison office, which did work before machines were

designed, and would help NSA with its tasks. Within about 6 months, I was going out to meetings at NSA. There were pieces of work that they would want done in connection with problems, to make them computable and so on. And I did that the better part of a year.

NORBERG: NSA was new then wasn't it?

TOMASH: Yes, it evolved in a couple of steps and it was new. [Pause] NSA was new. It was first defense...well I don't remember the exact...

NORBERG: No, but I remember in 1947 the act was passed that established this National Security Agency.

TOMASH: Yes, right. At the start there was the usual political infighting. They had three of everything for awhile. All of that did not affect me. All that did for me was to introduce me to some very fine people and some interesting problems. I met the director of research at NSA and the director of operations and some of the other key people. I'd been doing this work, as I said, out of the ERA office in Virginia. The ERA office had been in downtown Washington when they hired me, right on 15th street and K or L, an old red brick building. They soon ran out of space and we moved over the bridge to Arlington, Virginia, and I worked there about a year.

I also enrolled in a Master's Degree program at the University of Maryland. Most of the courses were taught in Washington but I had to spend 2 semesters taking course work at College Park in Maryland. I received my MSEE from Maryland in June, 1950.

By this time, I knew the company well. I met Arnold Cohen and started to meet the people in St. Paul, among whom was John Coombs. He was then the chief engineer in St. Paul. I also got to know Bill Norris well; he was spending part of his time in Washington and part of his time in St. Paul. I also worked on proposals, because we were always working on short-term things. We didn't have long-term solid commitments like the fellows in St. Paul did, we were liaison and we could provide hands. Both Arnold Cohen and Coombs urged me to move to St. Paul. They said, look,

if you want to really know what's going on, what we're doing and you want to get into the design of these systems and get into more than just these paper reports, you ought to come out to St. Paul. I agreed and moved to St. Paul and was assigned to work on the 1103 project, which was then Task 29, when it was just getting started.

NORBERG: That would be 1950.

TOMASH: Yes, 1950. Task 29 was really a room with Arnold Cohen and a few co-workers. Arnold had his own office across the hall. This was in a little temporary building there--temporary! It's still there I suppose, probably been temporary for 30 years. It was a little barracks building. The staff included Warren Burrill, an engineer still at Univac, just retiring, and George Hardenburgh, who is still around St. Paul, and me. George was a wealthy, very, very bright engineer. He was a CalTec graduate, who comes from a wealthy family in St. Paul, and only on and off has worked as an engineer, but is a very bright man. We had our desks in one room and we were the whole Task 29 project. I remember in the first week Arnold setting me down and teaching me what a selective sequence calculator was and how it really worked and how it fetched things out of store and how it manipulated data. Of course, I had been introduced to all this through the ERA book and through some of my discussions at NSA, but I hadn't really gotten into the nuts and bolts before.

Jack Hill, who was really the best engineer that ERA had, was just finishing up Task 13, which became the 1101, and we were starting to plan Task 29 as the logical outgrowth of that machine. He started talking to me about circuits and design philosophy and so on. Those first months were a real eye opener.

So that was my first real exposure to how computers worked and I enjoyed that very much. I enjoyed the systems planning, and the systems design very much. As the project wore on, I became an engineer on the project. After it went through the paper design stage and the customer approved it, the project assumed a different character. Now the real engineering had to be done. Without going into all the details, Frank Mullaney had worked for Jack Hill on the 1101, on the Task 13 project, and when that was delivered and finished, he came over to head up the engineering phase under Jack Hill on the Task 29. I was in charge of the central control system under Frank. I did very well in

terms of, as I say, the whole concept of the machine. To work on the project, we hired a whole group of people out of Minnesota. We took virtually the whole class of 1950 and '51 out of the electrical engineering school...

NORBERG: At Minnesota.

TOMASH: ...at Minnesota. One of whom was Seymour Cray. I think he had gotten his Master's degree. Another was Bob Kisch. There was the guy from Network Systems in St. Paul...

NORBERG: Herman, Thornton?

TOMASH: Thornton.

NORBERG: Jim Thornton.

TOMASH: Jim Thornton. They were all in that same class. Pete Zimmer--you may not have heard of his name. They were all classmates. We hired all of those fellows. They were all put on this project. We had lectures in the morning so they understood what a computer was, and then we divided up the work. Kisch was a good engineer, Jim Thornton was an outstanding circuit designer from the beginning; Mullaney really ran those guys very, very well and brought them along nicely. Pete Zimmer was also a good designer. These guys all were in Control Data later, all of them vice presidents of Control Data at some point in their careers. Cray showed his talent very early and he was the best, of course.

What I learned from all this was that I really wasn't up to speed with them in terms of hardware engineering. I really wasn't a good hardware engineer and I had little aptitude for it. I had little interest in all the tiny details which must be handled. For instance, one must consider not only the connectors and the choice of the connectors but which wire sizes to use. Pete Zimmer loved to sort out the connection scheme and the different color system for the wires going to the connector and which would take more current and all that. I'd drawn those lines for the whole control system

when I designed the machine and I couldn't think of anything more boring than assigning all the connector numbers and so on. But there really is a lot to all that detail design. That's what makes a machine work right and I don't denigrate it in any way, but I was never good at it.

Having done the design of the central control system, I was in demand to write proposals all the time for new projects. Norris was always calling on me, because what you need is someone who can conceive of this stuff and can describe it. One of the characteristics I discovered I did have and do have is that I would have been a good teacher if I had stayed as a teacher. I like to explain things and I do have a mind that tends to organize and connect and sort.

Indeed, as Norris saw this, he started to use me for projects that required that skill. ERA had gotten into real trouble with the Navy over the fact that while the equipment was working well, none of the manuals were available. The manuals were very late. Norris asked me to look into the problem. It turned out that there just was no talent in the manual writing department and the manuals were late because the writers didn't know what to write. They really didn't understand the machines. The project engineers who had built the equipment were long gone. They were doing other things and couldn't take the time and the people assigned to manuals weren't able to read the drawings and so on. Norris then asked me to go into that department and straighten it out. I was quite willing to try things like that. So I ran the Technical Publications Department for about a year. We had to change a lot of people; we hired a lot of new people. I hired a man from the University to come out and teach the new groups something about technical writing. I lectured, myself, on how computers work, in the mornings. That got it going. I found I liked those kind of challenges, which was a mixture of administration, management, organization and technology. I did seem to have this ability to explain things to people. I could do it in an effective way and I wasn't afraid to make a presentation in front of others.

Well, the months went by and there was lots of interesting challenging work. It was a very friendly, homey place. It was an exciting place to be. We young engineers did a lot of complaining but we learned. We enjoyed the politicking and we watched from afar the interplay of forces between John Parker and Bill Norris. It was very good

training for us. We had some mentors, there were a few older heads. Arnold was a older head; Jack Hill, and Johns Coombs.

NORBERG: So how long did this involvement with systems development and general troubleshooter for Norris continue?

TOMASH: About a couple of years--the whole time I was in St. Paul, really, that's what I did. The company was bought by Remington Rand in 1952, perhaps late '51, Immediately, there ensued a couple of events. The week after ERA was bought, General Groves, who was the head of research and development for Remington Rand at the time, came to St. Paul. He had a little entourage with him. He succeeded in one visit in alienating everyone at ERA. He was kind of a blunder buss anyway, as you've undoubtedly heard from your atomic energy work and studies. So Norris and Parker complained to Jim Rand. The agreement had been that ERA would be left alone, the usual sort of thing that is said to placate new acquisitions. Rarely is it followed for it rarely makes sense. Anyway, they complained, and Rand took Groves out of the loop and divorced him from ERA. ERA was placed under another vice president who was in charge of the manufacturing. Rand, instead of facing that issue head on, by this action, created two computer camps within Remington Rand because Philadelphia was under Groves; that is, Eckert-Mauchly was under Groves.

The second thing that happened was that they kept asking us if we could do this project or we could do that. It was kind of a "no, you're warmer, no you're colder" game. The ERA response was usually to ignore the question and to remain silent. This was as part of Remington Rand now, but you see they're not cleared. They don't know what's going on. Rand had bought some engineers and some projects, but they aren't cleared by NSA, so we can't take them through and show them what we're doing. They know it's so many million dollars a year in classified work, that's what they know. For example, IBM announced an electronic calculator, the 602A as I recall, it wasn't much of a machine. But immediately the phone calls from Remington Rand; what have we got and what can we do to answer this new IBM threat.

Mr. Rand, himself, as I learned later, was an opportunist. He was not a fundamental thinker. He was always looking for a quick answer, and we at ERA didn't have an answer ready to counter the 602A.

The machine we were just finishing was the Task 29, in the summer of 1952. We were getting ready to ship the 1103, which was then Task 29. It was really the best machine that we knew of anywhere. It was the world's most powerful computer and was well engineered and was really working. So Arnie Cohen and I went to see Bill Norris, following a conversation he and I had had at lunch. And we said, look, we are playing this game where they keep asking us what we can do and we report that we can't help or we don't have anything to do with that and we don't know what the 602A is. In that case, by the way, we actually had to go find a 602A and look at one because we didn't know anything about IBM punchcard products. Why don't we go tell them what we can do? We're sitting here with Task 29, it's a great machine. Bill Norris thought this was a great idea.

TAPE 2/SIDE 1

TOMASH: We had to ask the Navy for permission and they granted that after a bit. It had to go through NSA. We took a couple of special commands out of Task 29 that were especially designed to do some things for NSA, and we were allowed to describe the machine which we had named the 1103. After these elaborate arrangements, about Thanksgiving time, pretty close to around that time, we had a meeting at Rockledge, which was the headquarters of Remington Rand. Rockledge was an old mansion in Connecticut, around Norwalk. That's where Mr. Rand had his office. It really wasn't a very practical place to try to run a large business, but it was very convenient to where their senior people all lived. It had a nice dining room and so on. We had a big meeting at Rockledge where we described the 1103. Bill Drake worked at ERA and he was in charge of what little bit of advertising and PR we did. We built a model of the machine which we carried there. Also, we put together a very nice folder in which we contrasted the 1103 and the IBM 701, which they were just starting to ship. We compared features purely from a hardware system point of view. We knew nothing about software, nothing about applications.

NORBERG: Who participated in the meeting from the St. Paul side?

TOMASH: Oh, Arnold Cohen, of course, I worked for Arnold. I made the presentation, because I was most familiar with the whole 1103 system. John Parker and Bill Norris, Hank Forrest, who worked for ERA in Washington. Also Sid Rubens. I remember Sid was there. We showed our model and I described the machine. General Groves was there as were several people from Eckert-Mauchly. Also many people from the sales department of Remington Rand. Our emphasis was that this was the most powerful machine ever built and so on. I remember that Mr. Rand came late. He sat in for the last part of it. So, Mr. Rand never discussed the 1103 with me, but he discussed it that afternoon with Parker and Norris. They said he was impressed that it had been developed with government money and hence they would get this product without having to do much development. Also, that it was superior to IBM. It was agreed that we ought to try to market the 1103. That is, go ahead and try to sell one. It was also agreed that we could buy parts to build a couple of machines. That was the extent of it.

The Eckert-Mauchly people opposed the 1103. They felt, first of all, it was a threat to Univac. They were very worried about funds getting diverted from their project. They used the fact that it was a binary machine, not decimal, and didn't handle alphabetic information to fight it. At that time, we were using machine language to program, and so machines were built either decimal and alphabetic or they were built binary. Eckert and Mauchly said that the market was much bigger for Univac than the 1103. They, of course, were right. Their criticisms were aimed at showing Rand and Groves that we at ERA really didn't have anything and the 1103 was missing the market completely and so on.

Nevertheless, Parker and Norris got Rand to OK the 1103 announcement. After the program was authorized, then Norris asked me if I would try to sell some, if I would become the marketer. That's how I got into marketing. Soon, I was severed from the project itself. By this time, the first 1103 was already delivered and the next, with some changes, had been started, also for NSA. We drew up a little brochure and a letter--Drake helped again--a little two page brochure. And, I found that there was interest in the machine as the word got around. We sold a machine, the first actual 1103 was sold to the Air Force. Ed Berkeley was involved. He was acting as a consultant to the Air Force. They were setting up a big test facility in Florida, not Cape Canaveral, but Eglin Air Force Base; it's on the other side of Florida. Eglin bought one of the first machines.

In February, I came out here [Los Angeles] to attend the Spring Joint Computer Conference of 1953. Remington Rand had a display booth and so on. The local Remington Rand office invited the whole West Coast computing community--Northrup, Convair, North American, Lockheed, Rand, Douglas, and so on--to come to an 1103 presentation which I gave...It seems to me it was the closing day of this Spring Joint Computer Conference. Remington Rand had a very nice new headquarters on Wilshire Boulevard and they had an auditorium that seated maybe a maximum of 150 or 200. Much to my surprise, when I showed up to give my talk it was full. It was just jammed full. It was an example that people were very hungry for information. I talked for about 2 1/2 hours, from about 9:30 until noon. I knew the machine like I knew the back of my hand. I had no slides or props, I just used a blackboard. I started out with what we were trying to do and how we had done it and then went right on down through the system and how it all worked and what the features were and so on. I have made a lot of friends out here in the computing community over the years and almost invariably they remember that day. Many regarded it as a tour de force. Because they were used to the presentations, not from designers and engineers, but from marketing people. Sales people made presentations of what they had learned from the engineers. I, of course, didn't have to learn from anybody. I had just finished a couple of years of working on the 1103. I had been thinking about it day and night. And so I got very good response to the presentation and later an open door at many companies after that. Convair, Boeing, Lockheed, all wanted to know about the machine, wanted more computing capacity. Very fortunately for us, IBM had committed to only building eighteen 701s. And, at that point, they were all placed, virtually. I think they were on number 14 or something. So, for a while, we had a new product and competition didn't have anything. Of course, we didn't have anything to deliver either and Rand had only authorized two machines. Soon, we authorized two more, because we had sold those two. I came back to Minnesota and I told Bill Norris that I could sell 1103s and that I wanted to move to California because the market was here and it was exciting. Also, I had personal reasons. We had had a terrible winter and also a very severe winter the previous winter...

NORBERG: '52 or '53?

TOMASH: Both. The winter of '52 was a bad one, just terrible. And the winter of '53 was no better. Both Adelle

and I wanted to get out of St. Paul. We had two small children and they had the flu all the time. Adelle was in the hospital twice with difficulties. It could of been all coincidence, but nevertheless, it was just a miserable experience. Kids were sick. I was working real hard. I remember shoveling the walk for the 2nd time one day when the wind had blown it closed, so that the doctor could get into the house. I found myself saying this is ridiculous. This is ridiculous! So when I got to Los Angeles in February, it was a typical winter out here, I decided we would move here. When I returned to St. Paul, I told Norris that I really wanted to move to Los Angeles and that the market was out here and Remington Rand needed a presence here and he accepted that. I don't recall telling Norris, but I did have another job offer. Bill Gunning at the Rand Corporation, who had attended that presentation, had called me. They were looking for somebody to join their computer group. Paul Armer was already there. They were finishing the JOHNNIAC and they were talking about building other machines. When Norris and Remington Rand agreed to send me out, I turned Gunning down. Willis Ware ultimately took the job. Anyway, the point is I was determined to move and I did have another job. We moved out here in August of 1953. It took us 'til then to get it all together. I moved right in on the salesmen's floor at 2601 Wilshire for Remington Rand and opened an office for the Electronic Computer Department.

When Remington Rand bought ERA, they had kept it as a subsidiary with John Parker as the president and Norris as the head of operations in St. Paul. For about a year, they operated ERA just as it had been. However, in December 1952, they merged ERA into Remington Rand and turned it into a Division with Norris in charge. As Parker tells it, Rand did it and then told him. There no doubt were reasons, probably something to do with tax. Anyway, Parker agreed to move to New York as a Vice President of Remington Rand and set up a sales division called the Electronic Computer Department. This really changed his relationship with the ERA Division, which was now headed by Norris. In the summer of 1953, when I was getting ready to move out to Los Angeles, I had to do a lot of politicking. The new sales office would report to Parker in New York. It would be his Electronic Computer Department that would be setting up the West Coast sales office, and I was to be transferred to Parker. At the same time, I needed a close ERA link and Norris wanted to keep my allegiance. I knew I needed those ERA connections, the 1103 wasn't a "product" and there was no production line. Each machine was custom built to order. Parker wasn't going to get me machines, wasn't going to get me engineering, or anything else out of St. Paul. ERA was a little fiefdom of its own; as was

Eckert-Mauchly as was Parker's department. When I moved out, it was as part of the Electronic Computer Department headed by John Parker in New York and he became my boss. I was very successful. I was very fortunate in that IBM didn't have a competitive answer available. We had good machines and there was plenty of demand. So in short order, I sold 1103 to Convair, Boeing, Lockheed, and White Sands. The ERA factory didn't do too well. They were geared to engineering projects, not production. They had trouble building and testing the machines. In the field, we had a lot of trouble getting them maintained. ERA had to learn all of the things that IBM knew how to do. Anyway, that's how I got into marketing. And I stayed in marketing. I ran this office nearly three years.

NORBERG: How did a marketing office run at that time in the Remington Rand Corporation?

TOMASH: Remington Rand was a kind of a department store for the office. They had adding machines, typewriters, Kardex, Library Bureau, furniture files and punchcard equipment. So they could sell you file folders; they could sell you stationery; they could sell you desks and furniture; and they could sell you office machines. Remington Rand had been put together through a series of mergers and consolidations. Each product line represented some prior acquisition, which had then been folded in. Each office, like Los Angeles, was headed by a branch manager, who was essentially in business for himself. He purchased, in effect, products from the factories and paid a transfer price. He was permitted to set prices above that transfer price. There was, of course, a list price. But to get the business he was permitted to cut price, as long as he didn't go beneath the transfer price. He also had to cover his overhead, he was charged for his expenses and charged for hiring and training new salesmen and so on. Salesmen were all on commission. So each of these branch managers was actually a very potent guy and he really ran his territory. There was a national sales manager and then a series of national product line managers, one for each line like punched cards and typewriters and so on. Within a major office like Los Angeles, there would be a sales manager for each of these major lines as well. All salesmen were strictly on commission. It was strictly a selling organization. The highest technology product was the punched card equipment. They did have a maintenance organization in punch cards, but not a really good one. They were definitely second class. They were about the same size in total volume as IBM, but probably a ratio of 10 to 1 in the punched card field. They might have had about 10% of the market. And so that's how the thing was organized.

Now along came this new thing they didn't understand: computers. They didn't have an organized use of their resources. The punched-card business was separate; Parker's electronic computer department in New York was separate. ERA was separate, Eckert-Mauchly was separate. The branch manager in Los Angeles was not certain what to do with me. I didn't work for him but I was in his territory. It wasn't even defined what he would get if a computer were sold in his territory. Indeed, there were lots of arguments over that later on. So we really weren't very well organized and I was not very well accepted. The punched card people that had the big accounts--Douglas was one, they were strong in Douglas, they were strong in the entertainment industry, films--those people were very interested in Univac, because it gave them something to talk about. They loved having me around. They invited me to come to their clients and to visit their accounts. They had a club of users I was invited to talk to, because they wanted to hold the computer out as the symbol of the future. They didn't want to sell computers, but they just wanted to talk computers. So they were interested.

The manager in Los Angeles was a very good man, Ted Norton, who was the vice president of the company, and he had a broad view. He tried to help in whatever way he could, but you know his livelihood, his organization, depended upon sales of adding machines and typewriters and things like that and Kardex, especially, which they had pioneered. His territory was large and it was quite a network, so he couldn't spend time with me. He had everything north up to Bakersfield, south to San Diego, and east to Arizona. He had branches and on down to dealers that reported into each branch. In the littler towns, they didn't have their own office, they would have a dealer, so that's how it was structured, for the traditional lines.

It was only when I started to hire a couple of people and afterward when I left the Remington Rand operation to some other people, that I realized that not everybody could do what I had done. I didn't need a lot of definition. It didn't bother me that all this wasn't clear. Didn't bother me at all that the local organization didn't know what would happen if a Univac was sold. I just tried to stay out of all of that. I just kept calling on the people I thought might want to buy a computer. Then, when I'd get the order, I'd let Parker know. Sometimes Parker would be very helpful. Parker was very, very good at high level contacts. He'd spent his life in the brokerage business and in the Washington

scene and he genuinely knew a great many people. He could get an appointment with Donald Douglas. He really could. When you needed that, he could do that. He was very effective. So I would use him. I would call up, tell him I was working on Lockheed and needed some help higher up. He'd say, "Well, let's see, have you talked to so and so? I'll give him a call. Why don't you go see what he says." He was very helpful.

NORBERG: Were you then a direct salaried employee under Parker?

TOMASH: Yes. I was a direct salaried employee. There was no commission. When I came out to Los Angeles, I was earning about \$10,000 a year. After about a year, I'd done well, and they raised me to \$15,000. The second year it went to \$20,000. By then, I was one of their higher paid people. For me, at the time, 1955, I was 34, it was a lot of money. I was feeling pretty good. It wasn't truly a great amount, in retrospect, but it was fine with me. We had money in the bank, we had a new car and an old car and a nice house. It was fine.

In 1955, Sperry and Remington Rand merged to form Sperry Rand. Shortly after the merger they decided to form the Univac Division and put Norris in charge. Norris phoned me and asked my advice on marketing issues. He asked me to come to New York, as they were going to announce this new division. He proposed that I become the national sales manager for Univac. He knew only a few of the Remington Rand people in the field. I was one of the few people that he could talk to directly and trust, someone who lived in the sales environment and knew what was going on in a branch office and so on. They had been pretty insular in St. Paul. I advised Norris that I thought it essential to put Univac, ERA, and the punched card business together, including all sales and service. There was no way to divide it as far as I could see. He agreed, recommended that they do that and that is what became the Univac Division. In this process, I made some mistakes. I got caught up in a lot of politics. The notion of one division was in its formative stages. It was a tricky time when roles were not real clear and people hadn't consolidated their power base--I didn't understand those things. At the time, Norris couldn't do what he wanted. He hadn't gotten his own people in all the positions of authority. Norris was in a delicate position. Parker was still running the Univac sales program and Norris really didn't want that. He would have liked to combine all sales but not under Parker. He certainly didn't want the reversal of roles. He had worked for Parker and now Parker was to work for him. There was

no real respect and trust between the two of them, though they were certainly civil and friendly.

With the changed organization, Parker became suspicious of me. I'd been working for him but was I really a Norris man? All of a sudden I seemed to be in a powerful position because of my connection with Norris. That bond had remained strong. I relied on Norris and ERA as a factory that's been shipping me machines with special features that I need and so on. All along, I've been working through Norris and his engineers. And so I had good strong bonds there. Norris was the new Division manager and he had asked me to come to New York. In retrospect, however, I would say 3/4 of the problems that I had in New York, and I had problems in New York, were of my own making, my own ineptitude, my eagerness, my naivete in some ways. I got caught up in a political mess, a corporate power struggle; a struggle that drove Parker out of the company and Norris, too. It led to the formation of Control Data. By the end of 1955, it was clear that it wasn't going to work in New York. Parker was still there in charge of sales and he distrusted me. Norris was out looking for a senior marketing executive. He was going to replace Parker with somebody of stature, who was a seasoned marketing man. So I told Norris and Parker I ought to leave.

NORBERG: Before you go on to that, though, let's drop back a minute. Couple of things I want to clarify.

TOMASH: Sure.

NORBERG: One of them, you mentioned that Norris recommended to management that the Philadelphia, St. Paul, and the punched card activities all be merged into a single division. Now, when Sperry and Remington Rand merged, was this recommendation by Norris to the new Sperry management?

TOMASH: What happened specifically was that after the merger, the president of Sperry, Harry Vickers, assigned a retired Sperry executive, a fellow named Greene, who they trusted, who'd run Sperry Gyroscope, to look into this whole computer mess which was losing a lot of money. ERA was breaking apart on its defense work, doing okay, but losing money commercially. The punched card business was losing money, and Univac was losing lots of money. And so Greene took 3 or 4 months and studied the situation. He visited plants and talked to people. He was the one

who wrote a report to the Sperry management that said to put all this together. Oh, they also had a laboratory in Norwalk, Connecticut. Greene recommended that the tabulating division and its service; Parker's operations in sales; the tabulating laboratory in Norwalk, the Philadelphia and St. Paul engineering activities, all be put together in one division. Of the executives there, he got along the best with Norris and he recommended Norris be put in charge. Norris recommended all this to Greene and vice versa.

NORBERG: You know this directly, that Norris was recommending this to Greene.

TOMASH: Yes.

NORBERG: Secondly, did you ultimately take over the national sales program for the Univac Division?

TOMASH: No.

NORBERG: You did not.

TOMASH: No.

NORBERG: So what happened after you had this conversation with Norris and he was suggesting you as one of the people who might be qualified for this?

TOMASH: Right. He felt that the day the Division was announced that Parker might quit and he wanted somebody there in New York that he could trust to put in charge. That was to be me. To his surprise Parker didn't quit. Indeed, Parker made sounds about being willing to work for Norris.

NORBERG: Work for Norris?

TOMASH: Work for Norris. Norris told me that John Parker indicated he would be willing to continue as the marketing head working for Norris. That posed a problem for Norris, because he really didn't want that. He wanted a new seasoned marketing head with me as national sales manager. But how to get out of it? In the meantime, he got a lot of noise on the circuit as he started to implement this reorganization. Eckert and the whole Philadelphia group were now apprised of it. They didn't fight Norris, but they fought the whole reorganization. The tabulating people really fought. They were frightened. They came from the ranks of old time Remington Rand and they dragged their heels and created all kinds of problems. What are you going to do about offices? About commissions? These people all brought up a million things that had to be settled and that had not been thought through. So there ensued a period of about 6 to 9 months where Norris really was running St. Paul, was nominally in charge of everything, but couldn't act. All of this reorganization into a Univac Division was being directed by Sperry people but the pieces were part of the Remington Rand group of Sperry Rand. The group was run by the old Remington Rand management. Right about the time that I told Norris I thought I ought to leave, his wings were severely...

TAPE 2/SIDE 2

NORBERG: Norris' wings were severely clipped?

TOMASH: Yes. The old line Remington Rand management, the sales people and so on, had been making their case against Norris, Parker wasn't helping Norris either; the complaints: This guy is going to move it all to St. Paul. He doesn't understand punched cards. He isn't going to use our tremendous resources and so on. The major argument they made, I subsequently learned, was that Norris was not going to take advantage of the tremendous resource that Remington Rand represented in all its sales offices. He wanted to build his own, run by his engineers. They said we've got these two thousand salesmen in 450 cities nationwide ready to go sell computers and so on and so forth. That was the pitch. The man they sold it to was Marcel Rand, James Rand's son. James had by now retired. Marcel was not a very strong character; he was in charge of the Remington Rand Group. So he reorganized the Univac Division. He wouldn't fight the Sperry plan, he emasculated it. He turned Norris' job into an engineering and manufacturing job and decided that marketing would be handled out of New York. I think Parker was in favor of this

plan but he had already said he was going to resign. They put somebody else in charge of marketing in New York. By the way, the reorganization was really the genesis of Control Data. Norris really had a very bad winter that winter. He was very sick; he was out of the office a great deal, and not feeling well.

NORBERG: This would be the turnover of '56, '57?

TOMASH: Yes, that period. It was that fall when they started Control Data. And he was ripe and ready, because Remington Rand had really boxed him in. He was back running the engineering and what manufacturing there was. Philadelphia and Norwalk and St. Paul reported to him all right, but the marketing didn't. He no longer had control of the product program or the research base. The future depended, of course, on the research budget. What had happened there was that Marcel Rand brought in a well-known individual from Bell Labs named Thornton Frye--Groves had retired--and Thornton Frye came in. The idea was that Frye would coordinate all the R & D programs. From Marcel Rand's viewpoint, the Philadelphia, St. Paul, Norwalk integration wasn't going right. Frye was the staff man to make sure the product direction was right. It clearly became a question of whether Norris was the top man or whether Frye was the top man. So this situation was pretty confused and that helped perhaps prompted Norris to support the establishment of Control Data.

NORBERG: Now where does this leave you? When you feel you're having difficulties with the New York crowd, did your position change as a result of that, did you return to Los Angeles and continue...

TOMASH: Yes, my position did indeed change. I hadn't moved the family, originally we had talked about moving to New York. Now that was out of the question. There were several different compromises proposed. That perhaps I should return to Los Angeles and just sell Univacs. Or, perhaps, I should be a national sales manager for the scientific computers operating from Los Angeles. I was pretty sick about the whole thing. As I say, I realized I had handled it pretty poorly. I had been direct and honest, but I had talked too freely. You know, sometimes discretion is the better part of valor. I was cocky and aggressive and I made some enemies in New York. I told Norris that I didn't think I could stay in New York. He said, "Well, then, you ought to move up to St. Paul." That was the haven, you

could move to St. Paul and Norris could hide you. "Or you could move back out to California." I decided to return to California and I was in despair. I was very despondent, really felt bad, felt I had failed. After a few weeks, I told Norris that I wanted to leave the company.

Just through serendipity, I met George Brown, on one of my flights to Los Angeles--I tried to come home once a month or so from New York. I was in New York the whole period from late spring through the summer, until early winter of 1955. So on one of these flights... in those days, it was a DC7 that took like 8 hours, but it was non stop. The man behind me waiting in line to check in was George Brown, from International Telemeter Corporation in Los Angeles. I'd known him from the Rand Corporation. I spent the three years that I'd been out here getting to know people in the community. George and I sat together. During our conversation, he told me about an opportunity with some people who were building core memories in their company. During the Christmas vacation period, when things were quiet in New York anyway, I went and looked at this company. It was just getting organized. I decided to join it and that was the formation of Telemeter Magnetics.

NORBERG: Tell me a little bit about Telemeter Magnetics please, Erwin.

TOMASH: Okay, be happy to. It's really a very, very interesting story. By the late 1940s, the future impact of television on the entertainment industry was already emerging. Especially concerned was the film industry. It certainly was not clear as to the details and timing. A man named Carl Lesserman, who was typical of the old line movie entrepreneurs--he'd been a vice president of marketing at Warner Brothers and a couple of other places like that--started a company called International Telemeter Corporation to go into pay T.V. He interested Paramount Pictures in helping back it. These people were showmen; they were old business people from the motion picture business. They said that we have to have a box so people can put coins in it. We have to collect the money. People don't pay for entertainment later; they pay for it when they want it. You collect the money ahead of time. They outlined the system of what they felt they needed.

I don't know how the connection was established, but they recruited Louis Ridenour from the University of Illinois to

head up International Telemeter from a technical point view. Carl Lesserman was the president of it. Louie was a very broad, articulate man, a very brilliant man. He soon recruited a blue ribbon technical group. By industry and university standards, the International Telemeter motion picture people were willing to pay high salaries. This was all in keeping with their idea of how to run a business. Ridenour was a star. He was very bright, a big man with good presence. He could address the Board of Directors of Paramount and explain technical matters to them. He did a great job. So they got themselves a star. Louis in turn recruited a fine staff including Gilbert King, George Brown; those were the best known, very good people. As they were building their staff, the Joe McCarthy witch hunt occurred. International Telemeter got Bill Gunning from Rand as a result. It was something innocuous, Bill's wife had once signed a socialist sponsored petition on something--Bill's long since been cleared. And Irv Wieselman--our Dataproducts Irv Wieselman--somehow had his clearance at Northrup pulled. He never did find out why. It was just quietly reinstated after about three years or so. One of these crazy things. Anyway, International Telemeter built a good staff.

Ridenour and associates were imaginative, technically broad thinkers and the pay T.V. project challenged them. So they did some pioneering things. As a test bed, they wired the city of Palm Springs. They selected a city that had poor television reception nestled in the hills and they built the first cable television system in the United States. And they developed all the necessary components: the antennas, the couplers, the amplifiers, all the elements to do all that.

NORBERG: This is International...

TOMASH: Yes, this was International Telemeter. It is important to understand that Louis was always very interested in computers and he had a high-powered technical group. First, he convinced Paramount that they would need computer technology inside the coin boxes and also to control the whole TV system. They needed memory to record what people looked at. And they needed a lot of control and computing because this is a very complicated business. This was all viewed as the traditional business of entertainment. The group was very interested in computers and started to do some contract work as a way to build their engineering capability. For instance, they

undertook, for the Bank of America, development of a competitive system to the ERMA system which is today standard MICR encoding of checks. George Brown ran that project. It was another way to mark checks for machine handling. Ridenour felt, and rightly so, that storage, memory, was the key to development of computers. That memory was the central problem. Semiconductors in the form of transistors were already on the horizon so that logic and control was not the problem. It was memory. Jan Rajchman at RCA had a little group that was working on magnetic core memories and so Louis recruited some of the key people from that group and brought them out to Los Angeles and started a memory project.

NORBERG: Do you have any idea of when that occurred Erwin?

TOMASH: Yes, I would guess that must have occurred in the '53 period, '53 to '54. They undertook some core memory contracts. They also bid on some major computer developments. They bid against Univac on the LARC program at Livermore and they bid on a machine for the National Bureau of Standards. They also developed an optical disc memory. They were going to do computer development and they understood Paramount was going to back them. Well, by 1955, some pay T.V. realities had set in. The cable system was working in Palm Springs and now the Paramount management faced the fact that if they started showing first run pictures on T.V., the exhibitors weren't going to like it and the distributors weren't going to like it. Paramount's business came from the distributors and exhibitors. The matter was bigger than Paramount, however, because others were starting to think pay T.V. The distributors and exhibitors mounted a big anti-pay T.V. campaign, a political campaign, with ads in the papers with the theme: You'll have to pay for what you're getting free now! It seems so ridiculous today, but there was a State Initiative passed against pay T.V. That was a little later in 1958 or '59; California had an Initiative against pay T.V. which passed overwhelmingly. Okay, that was that part of it. In the meantime, Ridenour and International Telemeter were spending money at a high rate for those days, \$100,000 a month, \$150,000 a month. It started to add up to big money. So Paramount sent a watchdog out from New York, a fellow named Lou Novins, and Carl Lesserman was fired as president. Novins was not a competent man for this assignment. He's a lawyer and he is an articulate man. Here he was faced with some real sharp technical people and all these advanced programs. The net of all this is that Paramount greatly reduced the budget, and hence greatly reduced the activities. This is 1955. Louis Ridenour quit in

a huff. I don't remember now whether he then became chief scientist of the Air Force or whether he became the vice president of Lockheed and helped them set up their new missile division and then became chief scientist in the Air Force, but Louis Ridenour did not want for opportunity. George Brown quit and went to the faculty at UCLA. He was a well-known man. Gilbert King went to IBM.

Well, Paramount had a little embarrassment. They had taken four government contracts by now to build core memories. One was to put a memory on the JOHNNIAC at Rand. Another was to add memory to a computer at Aberdeen. One was to go to Cape Canaveral on a machine called the FLAC--Florida Automatic Computer or something. All but the FLAC were for IAS type machines. Paramount had these contracts, the government contracts, and had lost a lot of money. They really would have liked to just knock it all off, but didn't know how to do that. Paramount didn't want to go to the government and default.

In the meantime, Novins needed some new people to finish up the pay T.V. project. Novins felt that Ridenour's group was too high faluting, too theoretical, too many university professors, too many Ph.D.s, too big a program. He felt that the need was for some engineers. First, he hired as consultants a couple of people, Carl Wendt, a well-known T.V. engineer, and his associate Bill Squires. They had a little consulting company in Buffalo, New York. He tried to hire them for ITC to get them to finish the jobs and so on. They refused to join ITC because they had their own little company. In typical movieland fashion, Novins bought their company and moved it out here and put them in charge. Paramount did not want Wendt and Squires to have equity in ITC. So what they did is take the memory contracts and the other government work, which wasn't much, and they spun it out of ITC and formed a new company, Telemeter Magnetics. They merged the consulting company into TMI and assigned Squires, as President, to finish those contracts. That was how they gave them some equity. That was the plan.

George Brown had left International Telemeter, which was a shell of its former self. But he's a director of this new Telemeter Magnetics. On the plane ride, he told me that the Buffalo people are reasonable engineers and they're finishing up the pay T.V. system. But, George said, the ITC memory group is exciting and he believed that TMI has something here with this memory thing. However, they don't know anything about the market. They're looking for

somebody to do the selling, would I be interested? And so that airplane ride with George Brown was how the opportunity of TMI was presented. Telemeter Magnetics was in existence about two months when I showed up one day in January 1956 for a visit. Well, I was very impressed with the technical people. There was Milton Rosenberg, there was Ray Stuart-Williams, both of them worked for Rajchman at RCA. Raymond was an Englishman, a very, very bright man. Milton was a very good magnetics engineer. There were some good designers and circuit designers. Irv Wieselmann was a good systems designer. He had worked at Northrup and had trained in mathematics. There were, altogether, eight or ten technical people TMI had been assigned the memory contracts and had been funded with a couple hundred thousand dollars. After a second visit, they offered to pay me what I had been making at Remington Rand, which by now was \$22,000 a year or something like that. But I could buy some stock in the company, and that turned me on. So I bought some stock in the company, just a small stake, and signed on to be the vice president of marketing.

Within a few months, we had designed our first product. I specified--Ray Stuart-Williams designed it--what we call a buffer, the first little box of memory. A 1,000 word transistorized memory and it was the first commercial memory product in the world. Model #1092BQ8, was an 8 bit buffer. Paramount had agreed to finish up the contracts and had put \$200,000 into the company. Within about three or four months, Novins and Squires, who was TMI president, were fighting. First, it was costing a lot more than planned to finish up the contracts and Novins wasn't looking good back in New York. A lot of the \$200,000 was gone. But second, Squires--he was about my age, he was 32 or 33 at the time, maybe 34--had let all this go to his head. He had bought a big house and he was flying an airplane and he thought he had it made. So they broke apart and Novins fired Squires. He came to see me and asked me if I would run TMI. I said I was interested but I would have to ask the people. I had learned from my New York experience.

NORBERG: Now wait a minute, who came to see you?

TOMASH: Novins.

NORBERG: Novins.

TOMASH: I said I'd have to ask the people, because I had only been here for a few months. I did and they all said, hurray, one of ours, a computer man; for the first time somebody in charge will know something about the business. So that's how I became president of Telemeter Magnetics, almost by default. When Squires was fired, he sold his stock back to the company and I bought some of that and most of the technical staff bought some. So the management group, all the engineers and myself, ended up owning about 20% of the company and Paramount owned 80%. International Telemeter was now completely separate, very small, still working on pay T.V., and we at Telemeter Magnetics had our 15 or 20 man group and we're finishing up these four contracts and we had the start of the new product.

NORBERG: Who was the competition to Telemeter Magnetics, Erwin?

TOMASH: In the memory systems business, in supplying a box of memory, there was no competition. We also made and sold the cores themselves. The leading supplier of cores was a company called General Ceramics, which is part of Electronic Memories and Magnetics today. They--General Ceramics is a very interesting story--they first brought ferrite technology, square-loop technology into this country from Europe. That's an interesting story in itself. There was no other competition. Cores were very, very new. Cores were being made at MIT and they probably knew the most about it. Cores were also being made by General Ceramics. Phillips, in Europe, who had invented ferrites were just starting to make some cores. General Ceramics had a patent on the formula. So that was the competition and there was no real system supplier that offered a product like a memory system.

NORBERG: I asked you the question about who would buy the product then?

TOMASH: We really didn't know. It was such a new market, I felt, based on my systems experience and my knowledge, that an inexpensive box of memory, intended for buffering purposes would sell... This was not really a random access memory. It had 8 wires in and a storage capacity of 1000 words. You got words out in the same order as they went in. They would be used, we thought, in matching tape to computer, computer to communications lines,

and so on. A lot of paper tape was still being used to feed machines, a lot of slow magnetic tape and so on. And we sold them, just a handful. It was never, you know, a very big business. We used to sell a few a month. But we sold them to Collins Radio; we sold them to Univac; we sold them to a lot of smaller electronics companies, who started to use them as a systems building block.

It was the first commercial transistorized memory system. The specifications, as I remember, were not less than 1000 words, not more than \$10,000, and as fast as you can make it. Well, we ended up with the 1000 words, but we had to sell it for \$14,000. We never did make the cost goals on that first product. But it was a breakthrough, at a time when memories cost \$100,000, the idea of having something that was \$10,000! There had been no fully transistorized memories, except on experimental units at MIT in the TX computer. So the 1092BQ8 gave TMI something to talk about. We mailed the specification around. We showed it at shows. It established our credibility as a memory house.

Our first big job for memories was on the ERMA project, the first bank check MICR computer system. ERMA was developed at SRI with Bank of America money and then GE took the contract from the Bank of America to develop and produce the systems, because GE wanted to get into the computer business. GE gave us a sub-contract for the memories and that was what started Telemeter Magnetics on its road as a memory builder. Plowing that money back in, we developed a product line of small memories and large ones and ultimately became a major supplier of systems, cores, of core stacks. Stacks were sold to OEMs who built their own memories but wanted to buy a whole module with the cores already strung. Other OEMs wanted to buy cores and do their own stringing. We developed a whole range of products and built the business up in five years. By the way, Paramount Pictures, just as a footnote, got all its money back, got a lot more. Let's see, they got about 15 million dollars for their 80% of Telemeter Magnetics and they sold at the wrong time. Two years later they would have gotten a lot more money for it. They had no understanding of the potential value of all of this. They got about 15 million and they had put about 7 or 8 million into pay T.V. at that point. So they did very, very well. They got all their money out of just Telemeter Magnetics.

NORBERG: Were there spinoffs from Telemeter Magnetics that turned out to be important later on?

TOMASH: Yes, quite a few. Not at the beginning of course. We were a small tight knit group. But, when we were sold to Ampex--and that was done over our objections, Paramount had 80% of the stock--they sold us in 1960. Then, within 6 months, Trude Taylor, who was head of one of our divisions, took some of our key people, chiefly in the core manufacturing, Milt Rosenberg, Bob Johnson, and a fellow that used to make the cores, Bob Weisz, and started Electronic Memories, which became a major factor in the core memory business. So that was a major spinoff. Electronic Memories, in turn, merged with a company that acquired General Ceramics. So those two, became Electronic Memories and Magnetics.

NORBERG: So the combined company is Electronic Memories and Magnetics.

TOMASH: Yes. Actually, there was another company involved, one which made magnets for many years. They made them for television, made both ferrite and iron magnets and so on, called Indiana General Corporation in Valpariso, Indiana, an old line magnet company. They first merged with General Ceramics and then that company merged into Electronic Memories, and when it did, it became Electronic Memories and Magnetics. And Trude Taylor is still Chairman.

NORBERG: I see, so the company is still...

TOMASH: Still in business, around 100 million. It was once a rising star. It's been at about the 100 million dollar level for the last...

TAPE 3/SIDE 1

NORBERG: You mentioned they were a company of about 100 million dollars?

TOMASH: One hundred million dollars of activity and volume and it hasn't grown in the last four or five years.

They've had several attempts, but they've not been successful in getting out of the core memory business and into other things. As that business has declined, their fortunes have declined. The two independent makers that are still in business are still AMPEX, which is the old Telemeter Magnetics, and this one.

NORBERG: Two things about the company before we proceed on to others. First of all, were there other spinoffs besides that one?

TOMASH: No, that was the major one.

NORBERG: Secondly, you mentioned that this was the first successful use of transistors in producing a memory system. When would that have occurred and how did you people become familiar enough with transistorized systems to be able to incorporate them in a device?

TOMASH: It occurred in the summer of '56. Ray Stuart-Williams was a brilliant engineer, indeed, a very brilliant man. He understood the design of the magnetics very, very well. The part of the memory that was hardest to do with transistors was the switching, the selection of the selected cores. We did that magnetically because the transistors could not handle the power required. We had hired an engineer named Ben Goda, who had some experience with transistors-- and I'm trying to remember where--and he did the design. Because the other TMI technical people for the memories were all vacuum tube designers. When we did the General Electric memories, they were hybrid. We used tubes to switch the power, and we used transistors to do the sensing. It wasn't until the second model, the second iteration around, that we went completely to transistors.

NORBERG: Did Paramount play any role in the management of the company during that period after you became head of the company?

TOMASH: Yes, they did. Novins spent another six months here and then went back to New York. He was never influential. But I used to work with Barney Balaban, the president of Paramount. He was my mentor in financial

matters. It was a great training ground. He had nothing to do with the technology and didn't understand the selling and was very uncertain about the whole market. It was all very alien to Paramount. So they were not involved in any management decisions. But, they provided the money and helped us get credit to grow the company. Barney used to talk to me a lot about financial considerations. He taught me a lot about accounting. I really had no previous exposure. I remember the very first time that monthly statements were prepared, Stanley Wainer, who's presently the chairman of Wyly Laboratories, was our young treasurer. He sat me down and took me through the balance sheet and income statement and started to explain how these things work. But as for Paramount, I used to go back to New York about quarterly. I wrote a monthly report and I'd go back quarterly to New York. When it came to financial matters, they were very astute and very experienced and I learned a lot.

NORBERG: Can you give some more details about that, Erwin? About your interaction with the head of Paramount?

TOMASH: Well, I remember in response to our own planning sessions going back to Paramount and making a pitch to Balaban that they put a million dollars into TMI so that we could really expand and take advantage of the market opportunity. Barney did not respond directly, said he wanted to think about it. As was his custom with me, at the end of the day we'd go off and have dinner and maybe take in a show--as head of Paramount Pictures, he could always get seats on the aisle. We'd go to Sardi's and all these famous people would come up and say hello and talk a little show business, the actors in the shows and so on. I always enjoyed that very much. Anyway, we went to dinner that night at Sardi's and then we went to a show. On the way home, he said, "Now, about this million dollars." He said, "You know, any fool can make money on a million dollars. After all, you could just put it in the bank and you do all right. Or if you make some prudent investments, it won't be too bad." He said, "Now, making some money on a small stake, that's hard to do. We'll give you \$200,000." Well, the amount was really not important. He had no basis for whether it should be 2, 4 or 6, but he was simply reflecting the conservative, experienced financial viewpoint. Something that stood me a good stead later. I came to expect that kind of response from that sort of person. Another example: He was the first one to teach me the difference between cash flow and profit and loss. It's a big important difference. You can't pay salaries with profit and loss statements. You need the cash. It's really very, very hard to

understand and sense that difference and how cash peaks and ebbs. He would phone me every couple of weeks and his first question always was how's the cash. So he taught me to watch cash and understand the importance of cash flow. You know, we were making lots of mistakes. I didn't know how to do things. It really was a wonderful learning experience for all of us, as we were making this transition into a commercial marketplace and fortunately not too highly a populated one.

NORBERG: Who did you meet in the computer field at this time that you had not previously met, who might be useful--to you certainly in retrospect--was useful to you in the future?

TOMASH: As a supplier to the industry, which we were rapidly becoming, we met all the new entrants. So for instance, here in town, ElectroData, which later was purchased by Burroughs, was relatively new compared to ERA and Eckert-Mauchly and IBM. They became a customer at Telemeter Magnetics for memories. I got to know the Burroughs people and the Burroughs organization through that connection. The chief engineer, Robinson, went on to join Friden when it started to build the first electronic calculators. Those machines used Dataproducts hammers and memories. The memory capability put us in a nice position from the point of view of getting to see the whole system range. The people we had the most trouble meeting were the ones who had their own memory capability. There were just a few of those. There was IBM. Univac to a limited extent. But, we had a nice entre that way. Our sales people who were always in attendance at the computer conferences would get to know all the new, young companies as well. Generally the new companies wanted to buy a memory rather than spend their time building their own.

NORBERG: That's what I was hoping you would lead toward, these other new companies in California, because if Paramount sold Telemeter Magnetics in 1960, there's an important breakpoint there, around '60, '62 in the structure of the industry, in some respects, which we can talk about at another time. But what was the southern California situation like in that period say from '55 to 1960, in terms of the number of companies coming on line, and in terms of changes in the market here?

TOMASH: In terms of the number of companies, it was still a big company game. There were a few startups, of course, that had started right in that period. Magnavox had started a big program out here. They had taken people from UCLA who had done the SWAC and started Magnavox Research Laboratories and there are remnants of that around still. The Northrup people, who were really quite a fount of technology and ideas--going back before my appearance on the scene here, Northrup had been the leader in computing technology. They invented the CPC for instance; they adapted punched card machines to make the IBM CPC. They ordered the BINAC from Eckert-Mauchly very early on. They were right at the edge, ahead of the Lockheed's and the Douglas' and North American's and so on. A Northrup group quit and formed Computer Research Corporation (CRC), which was bought by National Cash. Out of that group later came several companies: Scientific Data Systems, Max Palevsky's company. Max had a step along the way. He first started Packard Bell Computer Corporation. Packard Bell was a T.V. receiver company out here and they backed Max in a little company. Packard Bell Computer Company was ultimately sold to Raytheon; it's Raytheon Data Systems today. But Max left it after a year or two and started SDS. So you had ElectroData, Magnavox, CRC and Packard Bell. SDS, at a little different time, SDS was started about 1960, I guess. Southern California gave birth to the early software companies too. Computer Sciences was the first of the software companies and I think it grew out of the Share program. And Informatics, of course.

NORBERG: But those are in the beginning of the 1960s now.

TOMASH: Yes, the CSC is, I think, '56; yes I think so.

NORBERG: But you're not remembering very many. Does that suggest that there were not very many?

TOMASH: No, no, I don't think there were too many. There were a few. I knew them all. There was a company called ALWAC. The name of the company was not ALWAC. The name of the company was Logistics Research Corporation and its computer was ALWAC. It was named after Axel Wennigren, who was a Swedish industrialist--that's the ALW Automatic Computer. That was a first attempt. It was a tube machine, but it was the first attempt at a low cost machine. They sold some to the government. That guy that started that came out of the

Northrup group. That was in the '50s. No, there aren't that many.

NORBERG: Turning then to AMPEX and your joining that firm, you became a vice president but didn't stay very long. Who were your associates at AMPEX?

TOMASH: AMPEX had been one of the premier success stories of the 1950s. Beautiful business record. They pioneered the use of magnetic tape and its use in audio work and so on. They also had developed the use of magnetic tape recording for instrumentation. There were 14 channel recorders for telemetry. So AMPEX equipment was used on all the missile ranges. They also did a lot of business with the National Security Agency. A fine firm with a good reputation. They had also developed digital tape transports to sell OEM, just as we were selling core memories, but they didn't do a good job with those. Their digital units were not really good. In 1960, Paramount was really going through a difficult period. Within a couple of years, they were subject to a takeover bid and finally became part of Gulf and Western. The management had grown old. It hadn't moved along with the times. Paramount didn't have a big library of T.V. things going. They had done another War and Peace and another Ten Commandments. Anyway, they decided, with the advice of the Lehman Brothers, who were their investment bankers, that the time had come to sell Telemeter Magnetics. We had gone public in 1959 and our stock was selling at a much higher multiple than Paramount's. So they decided to sell. Lehman Brothers proposed several partners: Beckman Instruments, Raytheon, and AMPEX. Of those AMPEX seemed the most desirable. I felt that if we were going to get married and it's going to be a shotgun marriage, might as well pick the prettiest girl. AMPEX seemed the most sensible.

They wanted very much to buy Telemeter Magnetics. Management had a fine record. They were very personable people. The president was George Long, who was an ex banker. The senior vice president was a fellow named Bob Sackman, who was an engineer, had been a Washingtonian and worked for NSA. Tom Taggart, was an ex Douglas Aircraft man, a financial man was also a Senior Vice President. He remained a good friend of mine all these years. They seemed like nice people, honorable, growth oriented, and they were divisionalized. As we talked, they proposed that we put together their tape units and the TMI core memories into something called AMPEX Computer

Products Division and I would run that. That seemed interesting. TMI wasn't losing money and Ampex was doing well. My stake by now represented a few hundred thousand dollars. It was a start of something for me. At the time, it seemed like a lot of money to me. All the other employees had stock and would do well. And so we did it. We agreed with Paramount to merge with AMPEX.

Within about six months, AMPEX was in real trouble. It turned out that Ampex had difficulty manufacturing quality tape. They had bought a tape plant down in Alabama, Opalika, wherever that is. They had invested a great deal of money in expanding the plant. And it turned out that the tape they had been making for several months was no good. So they had a big write off, announced a giant loss. The companies had just merged, we had just gotten to know Ampex people. Cressap, McCormick and Paget, a consulting firm had been called in by the Ampex Board. Within a few weeks, they were really running the company, and George Long had resigned, a big write off had taken place and not just from the tape. They started to clean house and made all kinds of inventory adjustments. And before you know it, it's a truly big write off and the stock is way down. There is a reorganization and all kinds of changes and the Cressap, McCormick people are running things while they're searching for a new president. Our TMI business was good during all this time.

The president they brought in was named Bill Roberts, who had been executive vice president of Bell and Howell and had been passed over when Charles Percy was made president. Percy was later the senator from Illinois. He was a contemporary of Bill Roberts and I guess they had chosen Percy as the president over Roberts, and so Roberts came out to run Ampex. Cressap, McCormick and Paget and Roberts decided that the efficient way was to centralize Ampex, rather than have divisions that were market oriented. That didn't appeal to me, though Roberts really tried to adjust things so that I would be pleased and comfortable. He offered me a job up north as head of all the marketing and so on.

NORBERG: By north you mean up in...

TOMASH: Redwood City.

NORBERG: Redwood City.

TOMASH: I didn't want to move. I guess I really didn't want to work for some- one else. At the time, I had no idea about starting Dataproducts. So I announced my resignation. I waited until year-end; I had some options, things like that. All the arrangements that had been made outside of the financial deal, all of the terms and conditions--how we were going to operate and what we were going to do, the dream--were all changed. There were a lot of new players. Art Hausman had been brought in from NSA as head of R & D. He was a good guy, a bright guy. He wasn't making any troubles for me. But he was running a whole new centralized R & D program. It was all a lot different than what I had thought it was going to be. So I left. I was going to take a cruise or a trip or something and look around. The moment I left, the phone started to ring. It ranged from investors who had deals, to people who wanted me to take a job.

NORBERG: These were people you knew?

TOMASH: Yes, people I knew. Those were some of the benefits of the early times you asked about. When you asked about that, I missed a very important aspect. Barney Balaban at Paramount had not wanted to fully finance Telemeter Magnetics directly. He wanted us to stand on our own feet. So once we had finished up those loss government contracts, he introduced us to the Bank of America so we could get a line of credit. Of course, at first Paramount guaranteed it. Then, within a year, as TMI did better, they were able to withdraw the guarantee. He was weaning us so that we would be in business for ourselves. So that we would raise our own money and wouldn't be an obligation for Paramount. He was very prudent, very conservative. Well, the young lending officer who was assigned to our account by the Bank of America was Tom Clausen, who ultimately became president of the bank. At the time, he was just a young lending officer. Within a year after they loaned us a little money, the bank decided to set up an Electronics loan division and put him in charge. So, after I resigned, Clausen had several companies around here that maybe I'd like to run. They had loaned them some money and they were in trouble. Also, he made clear he'd be glad to loan us some money if I decided to start a company. So that was kind of a byproduct. I had that kind

of connection, people who knew me. Relatively speaking, you know, in what was a small community, I was well known.

At the same time, Ray Stuart-Williams and Graham Tyson, suggested that we ought to start a company.

NORBERG: Williams you had talked about before. This is the first mention of Graham Tyson.

TOMASH: Tyson had worked at Northrup as an engineer. In 1956, late '56, after I had become president of Telemeter Magnetics, I needed a replacement to do the selling. I recruited Trude Taylor. He in turn hired Tyson as a salesman. So Graham was a sales engineer at Telemeter Magnetics and had risen to be a sales manager and then a division manager. He was in charge of our memory systems. He was a key man. Trude had already left to form Electronic Memories. That was started in that one year period while I was still a vice president of AMPEX. It was really Raymond who said, "Everybody's waiting for you to start your company. We all want to come."

NORBERG: Had your people talked about this sort of thing before?

TOMASH: No.

NORBERG: Then how would they raise this issue?

TOMASH: They said, "You know you're not going to retire. You must be going to start a company." It was that kind of thing. It was really Raymond who brought it up most often. I really had no idea of my future. I was going to take my time and then see what I wanted to do. But I talked to some of the others and I found that what Raymond said was true. The moment I said, "Let's start a company," they'd said, "Yes, great idea, we'll own more of it this time." The key people were Raymond and Graham. Another one was Helms, Cliff Helms; Cliff Helms was a classmate of mine at Minnesota and he had worked at ERA. About the time I moved to St. Paul, he and a few others quit and went to Remington Rand. General Groves came and recruited them. They had worked at the Norwalk Laboratories.

Then, of course, we all got put back together. He was still at the Norwalk Laboratories when I recruited him to join us at Telemeter Magnetics. He's a very good engineer. He started as a project engineer and he rapidly rose to chief engineer. Raymond was more the systems conceiver. Raymond was an engineer like Pres Eckert is; very broad, very, very fast, very good at solutions in the development sense and very poor, really, at making products. Helms is a basic thinker; he really spends his time trying to understand the basics, the components. Once he gets that right, he feels that you can build all sorts of machines, big ones and little ones. Cliff and Raymond made a good team. They didn't always agree. Indeed, it was very seldom that they agreed, but they had genuine respect for each other.

So, in the first months of '62, we started to plan Dataproducts. In the meantime, the senior TMI financial man had also quit Ampex right after me. His name was Bill Mozena. I had recruited him in 1956 to be the financial man in Telemeter Magnetics. He started as our controller, but he's a very good man and he grew with us. He quit Ampex because he didn't like the new management and the new centralized approach. So he and I started to plan Data Products. Raymond, Graham and Cliff were all employed at Ampex, so we couldn't include them. But Mozena had already quit. So he and I could noodle and draw up the plans and think about what we were going to do. Our choices were to start from scratch, or to try to save time by buying a company. We decided to do the latter and we looked at a number of things. Tom Clausen served up a few for us; different companies that were in trouble, or in need of management. Some people had divisions they wanted to merge together. We looked at a number of things. One that popped up that was most interesting was the Telex situation in St. Paul. The moment he heard that I quit, Bill Drake had called. Telex was being run by Arnold Ryden. I had been an investor. I knew about Telex. They were a hearing aid company and they also had bought a portable phonograph company. They made those old fashioned portable phonographs that had two speakers, built into a suitcase. They also made earphones for telephone headsets and things like that. They also had a group that had broken off from Univac to develop a disk file in St. Paul. It was called the Telex Data Systems Division. Another group that they had backed was headed by Sam Erwin in Detroit. He had an idea for a printer. That was part of this same Data Systems division. They had a little ten or twelve man group in Detroit.

NORBERG: I'm sorry Erwin they backed, who's they?

TOMASH: Telex.

NORBERG: Telex.

TOMASH: Right, Telex. So Telex had a little group in Detroit, which was working on a printer and they had a fair-sized group in St. Paul, working on disk files. That was about a twenty-five man group. They had a contract from General Electric for disc files but couldn't deliver. The system didn't work. It was still in development. They had tried two or three managers and all had failed. Telex was losing a lot of money on this contract, about \$100,000, \$150,000 a month was going into it. So the moment he heard I quit, Bill called and said, "You really ought to come up and run Telex. The big future is this disk thing. All this other stuff is not important..."

TAPE 3/SIDE 2

TOMASH: I just said, "Look, I'm not moving to St. Paul and I don't want to run all of Telex and I don't want to work for Bud Ryden." I didn't tell Bud that, but I told Bill that. I said, "Let us buy the disk file. That's the kind of business I do know something about. I think we can bring it to market. We'll raise some new money and that will stop the bleeding at Telex." They didn't want to sell and the time dragged on. Ryden is the one who came up with the idea of a spinoff. That is, to set up a holding company, which owned the Data System division, then sell us an interest in it, and then send the shares out to the Telex shareholders as a dividend. So that there would then be Telex and the new company. If you were a shareholder of Telex, you'd then have two pieces of paper. That was Ryden's idea. He was a financial man and very creative that way. That solved the problem I had, which was, if Telex were to remain a major shareholder, they would dominate, even though it wasn't part of Telex. So the spinoff satisfied that.

NORBERG: Did you get any information back to Ryden about that through say Bill Drake?

TOMASH: About...

NORBERG: About a spinoff.

TOMASH: Not about the spinoff. Ryden thought of the spinoff. I sure got the information back to Ryden that I was uncomfortable unless we were independent. So the next thing we had to do was raise our money. I made a lot of visits to sources. One was an investment banker that I had met through Paramount. He was at Lehman Brothers, who were the Paramount banker, his name was Bill Osbourne. He's still a partner at Lehman Brothers. He came out and heard our story. By now we had a plan and a pitch about what we wanted to do. He said, "We'll raise your money for you." Lehman Brothers agreed to raise 3 million dollars for us. This was going to be enough money to take over the Telex division, finish the development, and deliver to GE. Encouraged by that, Tom Clausen at the Bank of America agreed to loan us short-term funds until all this could happen. By now it was the middle of March and we went ahead and negotiated our deal with Telex. Our people only got 25 percent of the company and the Telex shareholders got 75 percent. We agreed to finance it after April 1. So that was how the thing was set up. That's how Dataproducts was formed. Dataproducts ended up a public company the day it was born, because as a spinoff it had all the Telex shareholders.

NORBERG: Who, then, was the group involved in Dataproducts at that point?

TOMASH: At that point, say by the end of the first month, it was 12 or 15 people. It was me and Mozena; it was Ray Stuart-Williams, Cliff Helms, Russ Dubois, to head up our marketing. Russ had been our vice president of marketing at AMPEX. A couple of other engineers that we selected were Ray Lorenz and Ron Kicklas.

NORBERG: Where did Tyson and Williams fit into this?

TOMASH: Ray Stuart-Williams, I mentioned him, and Graham Tyson, of course--if I didn't mention him I should have--Stuart-Williams, Tyson, Helms, Irv Wieselmann, Russ Dubois, Howard Rose was the manufacturing man, a couple of secretaries, because they wanted to come along, two accounting people that worked for Mozena- -one on

the cost side, Jack Birnbaum, one on the accounting side, Marv Stein-- all within the first month or six weeks. We also had 80 people in St. Paul transferred with the factory developing the disk file. And we had the group in Detroit. We started in temporary space on Wilshire Boulevard. George Brown had owned part of a little company that he and a friend of his had sold to C-E-I-R. Walt Bauer reminded me that the fellow that founded C-E-I-R is named Robinson. I think he must have been the father of the computer services industry. He's still around, and I don't think anybody's ever interviewed him.

NORBERG: This is the fellow who started C-E-I-R?

TOMASH: C-E-I-R, right. C-E-I-R ended up in Control Data ultimately, but they really were in the computer services business before Timeshare, before Computer Sciences. I think they were really the first people that wanted to rent out computer time and give services. Anyway, they had a building on Wilshire Boulevard and George Brown was a director, so he got us some free space there until we could find some space. Graham Tyson set about looking and in Culver City he found a building where a company had gone bankrupt. It had furniture in it; it had offices. It was a little shabby and so on, but we could move in fairly quickly and cheaply. At this point, after April 1, we're getting money for the payroll from Tom Clausen. We'd put in our own money, which was about one quarter of a million dollars, and we had all the assets in St. Paul--a building, we owned the building, and we had the group up there. But of course, they're spending money like crazy. So you know, it's a lot of money going out the door. We had a payroll in Los Angeles, a payroll in St. Paul of 80 people and a 10 man group in Detroit. So that was April 1st. We kind of sprang full blown, including a contract from GE. It was kind of fun, but not much, because April 2nd we had a strike in St. Paul. You know, I was naive enough not to worry about details. I didn't know there was a union problem. They struck. The GE people wanted a few days and telegraphed us the 5th or 6th of April canceling their contract for non-performance. It was exciting. So that's how we got the company started.

NORBERG: Well, don't leave the strike! How did the strike get settled then? Were they after more money?

TOMASH: Yes, they wanted more money. It was a unionized shop going back to hearing aid days and they had

been negotiating with Telex for months. They didn't know what had happened. All of a sudden, there was this new name and these new people and there had been no final negotiation. One of our people up there--it was Byron Smith, who was an associate of Drake's and Ryden's and had worked at ERA, he was really the first software manager at ERA--was the vice president of Telex under whom this disk file program came. He found us on April 1st and he was the general manager in St. Paul. He settled the strike by essentially renewing the contract plus all the changes they asked for, including a small across the board raise, after about 2 or 3 weeks. The union was very concerned that all this reorganization was some kind of complex management ploy to break the union or something. He settled in about 3 weeks. In the meantime, I went to Phoenix to find out--that's the headquarters of the GE Computer Division--to find out the depth of our problem there. That's where the prior contacts and the long association worked, because coming from Telemeter Magnetics, we had a good reputation with GE. We knew the marketing people. We knew the purchasing people. We knew the manufacturing people. The general manager was a new one--GE kept changing. We bought some time. They agreed to reinstate the contract, if we showed some performance.

So Mozena and I and Ray Stuart-Williams went to St. Paul and I sent Helms and Tyson to Detroit. That first evening Helms and Tyson called and said, "There's very little here." They were just getting ready to ship their first printer. Tyson asked them how long they'd run it and they replied that it hasn't run at all, but that it's overdue. So Tyson made them run it. It lasted about 15 minutes. By the third day, I was still up in St. Paul; Helms and Tyson phoned, "Look, there's nothing here. There's one young engineer that's really pretty good. If we could get him, he knows something. The rest of the people aren't competent. The printer design is terrible. There's no hope for it. But there is a pretty good idea here. They got an idea for a moving coil actuator, which really looks pretty good." Helms said, "I don't really see how to make the actuator so it won't fly apart, but still it has a controlled arrival time and that lets it print a straight line-if we could ever figure out how to make it." So we concluded that first weekend that we would shut down in Detroit. We hoped to move the one engineer and Helms and Tyson would take over on the printer project in Los Angeles. Raymond and I and Mozena would stay in St. Paul where there were also all kinds of problems. To help save the GE contract, everyone else in Los Angeles would come up there and we'd try to help straighten out the disk file program.

The man that was running Detroit was a fellow named Sam Erwin. He was later involved with a company called Sycor that was quite successful. He is now doing something else...Erwin Magnetics, I think. He's a very bright, energetic individual but not too solid as an engineer. But, he's very quick and seems to have a very good feel for market trends. Sam didn't like the fact that we shut down in Detroit. He didn't talk to me for a few years, because we had shut it down so peremptorily. But, we just had too many troubles at once, not to move fast. All this time we were borrowing money at the bank. Lehman Brothers' was saying they were going to raise our \$3 million.

So, in St. Paul, we were working away and getting a handle on who and what was useful and what wasn't. We found no manufacturing organization and we realized we had to build that up. The engineering development leader, a fellow named Don Sampson, was pretty good, but he didn't have any electronics strengths, so we gave him Wieselman. We had to try to find out what the costs were, because in addition to this contract, there was a big option in the GE contract for a lot more machines. I needed to know whether we didn't want GE to reinstate their order. Perhaps it would be better to let them cancel the whole thing. I sure didn't want them exercising this option until I had figured out what things were costing us. So that's what went on in the month of April. In May, there was a big stock market break. It was around the 21st, anyway, the market dropped sharply. Maybe it was the 17th; the market dropped 20 points in one day. Then, in subsequent days continued to retreat. Those were very, very sharp drops--20 points on a Dow Jones of about 500, not 20 points on 1200. After a couple of days of hemming and hawing, the Lehman Brothers' people simply backed out on our financing. They were polite and they didn't want to say they were backing out, but after explaining all about the market conditions and so on, they said they would continue to try, but they could no longer guarantee us any money. They never did raise any money for us. By now the Bank of America had agreed to loan us \$400,000 and our \$250,000 was in. We really had to scurry. We ultimately raised one million and a half dollars and gave up as much equity for that as we would have for the \$3 million. We got a third of it from the Bank of America SBIC, a third of it from Continental Capital, which was a new SBIC in San Francisco, and one third of it from Greater Washington Industrial Investments in Washington D.C. All these participants came from very old connections. Tom Clausen helped. He wanted the deal to go, because he'd loaned \$400,000 to a company with no equity and the Bank SBIC participated. Greater Washington investments was headed by Arch Scurlock, who had worked at ERA, and I knew him. He had become a venture capitalist in the Washington D.C. area. Frank Chambers

had started Continental Capital in Northern California. I didn't know him, but his senior consultant was Tom Taggart, who I had known at AMPEX. So it all connected. So by the time we got it all together, it was July. These things take time. We owed the bank \$800,000 by July.

But by July, we had made progress on the printer and we had the disk file product straightened out and we were starting to ship to GE. We'd brought in a manager to St. Paul, a manufacturing man, and we started running it as a business. In that same period, Helms had really designed the moving coil hammer and outlined the process for its manufacture. That hammer built the company. He just went at that step by step to isolate and identify the problems and figure out how best to solve them. In a very innovative way, he concentrated on getting a hammer mechanism that was both accurate in its flight time and extremely reliable. That gadget, which we patented, and with a larger number of variations--lighter ones and heavier ones and thicker ones and thinner ones and so on--has built Dataproducts. But for the first couple of years, we lived off the disk file business with GE and others. That's how I met Arthur Humphreys. We sold them to ICL. We sold them to Ferranti and then to ICL. We sold a few to Japan. We sold some to RCA. The disk file business maintained the company until the printer could come on stream. In the same period from January to March, after my resignation from AMPEX was announced, one of the people who called was Walter Bauer. Walt was at Bunker-Ramo, which had been formed out of Ramo-Wooldridge to do commercial computing work. He was ready to start a software company and wanted to talk about raising money. I knew Walt because I had sold him an 1103. He'd been a young Ph.D. out of Michigan. He'd come to work at Ramo-Wooldridge and he'd ordered an 1103. And we'd gotten to be friends. And so I said, "Let's get together to talk about it, because I'm doing the same thing. I'm starting to raise money." After that meeting I said, "Why don't you throw in with us? You know, software and hardware are going to be linked inexorably, and it all fits together. We have to raise money anyway. So why don't you think of your software activities as part of Dataproducts?" At first, he wasn't completely sold on that. He'd like to have his own company, wanted his own company. But it also had some advantages in his mind. In the end, Werner Frank and Dick Hill--the two other key people from Bunker-Ramo that were joining him--thought it over and they finally agreed. So on April 1st, when Dataproducts was organized, it also had a 100% owned subsidiary called Informatics. It was already in the software business.

NORBERG: Now I don't understand that because of my lack of background in economics and setting up corporations, etc. What was the advantage to Walt, first of all, being capitalized in this way?

TOMASH: He didn't have to raise any money and he spread his risk. He wasn't sure he could raise the money. I was going to do it. He put in his savings, \$20,000 or so as I recall, he and his key people, bought Dataproducts shares. He didn't have to raise the half million dollars or so needed to run Informatics. We also would give him administrative service: finance personnel, space, insurance, etc.

NORBERG: Therefore you were promising to raise the capital needed. What was the advantage to you?

TOMASH: I thought of Dataproducts as a company which would serve the computer industry with both peripherals and services. I saw the software market--and so did he at that time--as selling software to computer systems builders. That was also who we expected to sell peripherals to. The idea of a software product sold to the user didn't come along for really another at least five years. People who rented or bought computers expected to develop their own software, or did it in a cooperative manner, or expected it to come free. It was bundled, you know. What was available, came free with the price of the equipment.

NORBERG: Then was Informatics providing the software to Dataproducts?

TOMASH: We didn't have need for any at the time. We were strictly hardware. We were just building printing devices and memory devices and we really didn't have any software. No, Informatics started right off doing contract software work.

By the way, Walt, as he reflects on this, points out that he was hedging his bet too. That is, when you're starting one of these things, you're not really certain that you're going to get these orders and that you're going to succeed and build a company. Even if he was less successful than he hoped, Dataproducts hardware might be more successful and therefore the hardware side would still give value to his investment. And we, I suppose, had the same thing

going for us.

NORBERG: But some of the hardware products didn't do so well like the disk files, is that correct?

TOMASH: Disk files didn't in the long run. They did very well in the beginning. They carried the company, including Informatics. Paid for the printer development. At the outset, they did. But we weren't able to keep up with the pace of development later on.

NORBERG: I see, why not?

TOMASH: Because we didn't have enough money, didn't have the resources. IBM really started to step up the pace with replaceable disks and other models, and big files and little files. Our little group couldn't keep up technologically.

NORBERG: So what happened in Dataproducts at that point, when you realized that you couldn't keep up?

TOMASH: Well, we had to get out of the disk business. What occurred was something like this. Informatics really succeeded quite quickly. The first year they had some problems, and Walt felt some insecurity because it wasn't going well. But, by the second year, it was nicely profitable. Then by the third year, it was growing. In that same three-year period, we had skimmed the cream of the previous investment by Telex. We'd cleaned up the disk file design and had them working. Our shipments were profitable. But, IBM was introducing new models and we were already starting to fall behind. Our printer program was not going along very well yet. So the hardware side wasn't doing great just as Informatics was doing very well. So when that happens, there's a natural tendency for the subsidiary to say, "Who needs you? You're holding us back." It happens over and over again. To satisfy them, we deliberately took the step that we knew would separate us in the long run. We sold them some shares in Informatics and gave them some options in Informatics. Once you do that, the door is open. The next step, now that they have shares in Informatics, is to set a value on their holdings. What value do the shares have if there's no market? So

soon there is pressure to take Informatics public. Once you've done that you now have two sets of shareholders whose interests might or might not be congruent, and inevitably the two companies diverge. It's a particularly difficult people problem. We had it to a degree with Data Card. But it's particularly difficult in software where the business is so people dependent. With hardware, when you differ with the management on this point, you can say it's not going to be separate. The choices are for management to agree or leave and go do something else. You own the product and its customer base. In the software business when you've lost the people, you know, it's like a university without a faculty. You may have buildings, but you don't have a university. Walt knew that we needed him. Well anyway, that was the what happened with the Informatics/Dataproducts relationship.

It took us about a year to develop a printer that was reliable mechanically. And it was 18 months before we had the electronics in good shape and the styling set. Our competition was a company called Analex in Boston; they had what printer business there was. The market in the early '60s is not the market today. The market was the big systems companies. It was GE and RCA and Honeywell. Then there were some smaller OEMs. Collins Radio took a few and so on. There were no mini-computer makers yet. The whole terminal business wasn't there. You either sold to those few key accounts or you didn't sell to anybody. So our printer business was very slow in coming. We did pretty well with the new accounts as they emerged. We sold to SDS (Scientific Data Systems), then later on we sold to DEC, which became our biggest customer (Digital Equipment). After that, we sold to Hewlett Packard.

Step-by-step. But in the meantime, after we finished developing the product, we really tried to sell the majors: Honeywell, Burroughs, Univac, RCA and GE. Analex, to keep the business, cut the price, because they didn't have the product.

NORBERG: Typical.

TOMASH: And they cut the price to where they finally went bankrupt. And they were sold in bankruptcy to Mohawk. Later on, it was a great business but, if we hadn't had the disk file and Informatics, we wouldn't have been around to enjoy that. So the printer was slow in acceptance and slow in reaching volume. We finally introduced a small tabletop 80 column printer for under \$10,000 dollars, really under \$7,000, and that product finally got us going

with the DEC's and the HP's. Those are big prices now, but then those were breakthroughs. When we started, Analex was getting \$35,000 for 600-line-a minute printers and they worked pretty well but required daily maintenance. Ours was \$15,000 and needed monthly maintenance. When they cut their price, they had to cut it down to \$8000. They were keeping us out, but they ruined their company. Let's see, that's the printer thing.

NORBERG: That's a good stopping point, Erwin.

END OF INTERVIEW