Oral History of Joseph S. (Joe) Vranka

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INTRODUCTION

This is one in a series of oral histories taken by the Computer History Museum's Storage SIG on the history of magnetic tape recording. Oral histories and memorabilia collected during this series can be identified by searching the museum's catalog database for "Storage history, tape"

Today's session will focus on tape media development at IBM.

Joseph S. (Joe) Vranka completed the work towards a PhD in Chemistry at Duke University and after a brief interval joined IBM in 1961 as materials technologist specializing in film coatings. During his 26 year career at IBM he contributed to the development and production of all the magnetic coatings for tapes used by IBM from the Hypertape to the 3480. In addition at IBM and after retirement he worked other coating challenges such as occur in specialized papers.

Memorabilia contributed by Vranka is cataloged in the museum's database under lot number X8473.2018.

Gardner: This is Tom Gardner representing the Computer History Museum. We're here at the offices of Aweida Venture Capital in Superior, Colorado, to interview Joe Vranka, who was Senior IBM Technologist, I guess is the best way to describe Joe's background.

Vranka: Right.

Gardner: For 26 years.

Vranka: Right.

Gardner: Retiring from IBM in 1987. Today's focus will be on tape development at IBM and with IBM and its partners, such as 3M. Joe, tell us about yourself.

Vranka: Okay. I was born in Johnstown, Pennsylvania, to immigrant parents from Czechoslovakia. I was conceived in Czechoslovakia but born in the United States, so I am a citizen, not an immigrant. In any event, my parents were raised in the Carpathian Mountain Region, the Tatras, in Slovakia, what is now the Republic of Slovakia, and they were peasants, and my father came to the United Stated when he was about 17 and migrated to Johnstown where he had a sister who lived there, and became a coal miner, and then in the early '30s went back to Czechoslovakia and married my mother and they immigrated and they came over on the Carpathia, which was the ship that saved people at, from, the Titanic. Was the first ship to arrive, and any event, they went through, my mother went through, Ellis Island, and it was at the height of the Depression, and as they were going cross-country from New York to Pennsylvania she kept saying, "I'm going to live here, live there," because there were some nice towns we went through. "No. We're going to live in this," and they ended up in this coal-mining town, coal and steel. Johnstown was essentially run by Bethlehem Steel and eventually my dad ended up working in Bethlehem Steel coal mines where they were situated above the Conemaugh River, the coal mines, and then right below was beginning of the whole steel process. The coal was converted to coke and then it went into the blast furnaces to make pig iron, and then the pig iron was transferred to open hearth furnaces to make steel and then there were a whole series of plants along the river for eight miles, making sheet metal, wheels, wire, et cetera. A whole series of products. All of that is gone now. That was all shut down and it's Rust Belt area now. So I went to grade school and both public schools and parochial schools, and then graduated in high school from the local Catholic high school, Johnstown Catholic High School in 1952, and I did well in school and my teachers and the principal of the high school thought I should go to college. My father was totally foreign to that. He said, "Why doesn't he go out and make some money and bring some money into the house?" you know, and… But the principal convinced him that I should go to college and I took competitive exams and I got academic scholarships at St. Francis College, St. Vincent's, and Waynesboro State, and I chose St. Francis because the principal of my high school had come from there and he kind of influenced me to go to St. Francis, in a little town called Loretto, Pennsylvania, so I went there and majored in Chemistry, minor in Math, and the reason I chose Chemistry is I thought I wanted to do some form of science, either physics or chemistry or math, and my best friend from high school also went to the same college and I looked over as he was filling in his application and he put down Chemistry, so I put down Chemistry, -- and here I am. I graduated in ’56 with a Bachelor of Science in Chemistry and then went on to graduate school at Purdue University, and got into physical chemistry, kinetics, and was working initially on a Ph.D. and then I flipped back to a master’s and then the professor I had chosen was a bad choice and he ended up being fired from the university and went to Duke and everything got scrambled up there in the late ‘50s and I got married and on and on, and so I ended up never completely finishing. All the coursework and research and thesis were done, but never, never tied a bow around it, and then we started having family, so I got a job at Duncan Electric Corporation doing various materials. It was a watt-hour meter manufacturer, and I worked on electroplating problems, adhesives problems, all sorts of materials problems for a year or two. My wife who was a graduate student also at Purdue in Biochemistry was originally from Pennsylvania, Eastern Pennsylvania. We never cared that much for Indiana. So I interviewed for a number of jobs and selected an offer from IBM in Poughkeepsie, New York, to work in a polymer technology laboratory. So that’s how I started.

Gardner: Children?

Vranka: I have five children, yeah.

Gardner: Grandchildren?

Vranka: Eight grandchildren.

Gardner: As I said, their children will probably enjoy this.

Vranka: Right.

Gardner: At least the first part of this interview.

Vranka: Right.

Gardner: Do you remember the town in Slovakia that your parents--

Vranka: Yes. It’s called Nishna Sunava [ph?, most likely Nižná Šuňava].

<laughter>

Gardner: Yeah. Both parents from the same village?

Vranka: Yes. From the same village, yes. It was an arranged marriage, you know, as things were in much of the world, and families knew each other and the commitment was from a long, early age.

Gardner: And your wife's family is from?

Vranka: Well, originally her father was from Maryland and her mother was from Philadelphia, and her father moved from Maryland, from the Havre De Grace area to Philadelphia, and became an apprentice upholsterer and worked at the same company that my wife's mother worked at. She was a drapery worker there, and they got married and decided to get out of the city and raise a family in the Pocono Mountains, so my wife grew up in the Pocono Mountains, first in Delaware Water Gap and then they moved to Canadensis and most of her grade school and high school years were in the Canadensis, Pennsylvania area, and she went to college at East Stroudsburg State Teachers College at that time. Now it's called East Stroudsburg State University, and then she went after graduating with a teacher's degree, went to Purdue to graduate school also.

Gardner: And that's where you guys met.

Vranka: That's where we met, right.

Gardner: And were her parents first-generation Americans?

Vranka: No. They had many generations now. On her mother's side, she was mostly Irish. Hulett [ph?] was her mother's maiden name, and I don't know anything beyond that, but I think there were several generations in the states. On her father's side there are number of generations that went back. Her maiden name was Rider, and I think they trace their ancestry to ancestors in the Civil War and maybe even into the Revolutionary War. So they had a longer history, and I don't know, she doesn't know. She's thinking about getting her DNA tested because she doesn't know if she's more English or German in addition to the Irish side.

Gardner: I believe I said offline my brother had his DNA tested and it, in fact, confirmed the family rumors. So it's worth doing if you're interested in that.

Vranka: Right. Well, my ancestry is pretty well set. I'm Slovak, as far as I know. Of course, there were hordes of invaders, like the Tatars, et cetera, that came through, and there was a strong Hungarian influence, because during the World War I, the country was controlled by the Austro-Hungarian Empire, and actually the native language, Slovak, was forbidden in schools. Everybody had to take Hungarian, understand Hungarian. So my father spoke Hungarian in addition to Slovak. My mother was a few years younger and she avoided that.

Gardner: Did you speak either of them at home as a child?

Vranka: The only thing I did speak when I went to first grade was Slovak, and so my mother used to use my same homework and books to try to learn English. So she's learned English along with me.

Gardner: Still speak some?

Vranka: Very little. My next brother, -- there were four kids, one girl and three boys. I was the oldest and my next youngest brother is much better at it than I am. He's kept up better, Slovak.

Gardner: So we are now at 1957, and you're moving to Poughkeepsie?

Vranka: Well, no. I didn't. I worked at Duncan Electric from 1959 to 1961 and in September 1961, we moved to the Poughkeepsie area. We didn't live in Poughkeepsie. We lived across the river on the west side of the Hudson in a little town called Clintondale, which was surrounded by apple orchards. So we lived in an apple orchard over there. For the whole period in Poughkeepsie, which was five years. Then in '65, the lab director proposed for Boulder, came and spoke to us and said, "You'll all be getting offers to move to Boulder, Colorado, and that sounded interesting, so we moved to Boulder in 1966.

Gardner: Do you remember the lab director's name?

Vranka: Yes, Max Femmer.

Gardner: And he was the Boulder designated lab director.

Vranka: Exactly, yes.

Gardner: It's back to '61 now.

Vranka: Yes.

Gardner: You're going into the polymer lab at Poughkeepsie.

Vranka: Yeah. We had laboratories in the main manufacturing building, which the site employed about 20,000 people, so it was a big change to go to this big site, and we were tucked into the third floor on Building 2, I think it was. Large building there along the Hudson River, and the group had been responsible, this polymer technology group, did work, like, in paint finishes, polymer work of all types, plastic's moldings and a lot of things, and when I joined it they had just done an extensive effort on a major problem in large core memory manufacturing and that was magnetostrictive ringing. Magnetic core memories were composed of tiny toroids of ferrite material, of soft magnetic, low coercive force magnetic material, and they were strung in X, Y and Z direction with wires.

Women setting up these core memories, and one of the properties of ferrite is that it's magnetostrictive.
<0:15:00>
That is that when the magnetization state is changed, there's a physical change that occurs. It's very microscopic, but it's real and it would induce onto these wires a spurious signal called magnetostrictive ringing, and there was a big effort in Poughkeepsie prior to my joining the group there to try to find polymer systems that would damp the physical dimensional changes, and there were lot of thing, usually latex rubber things, that were investigated, but the guy I ended up working for, Bob Haynes, was the manager of the group, my first manager at IBM, and he was quite inventive, but he was a crazy man. Absolute nut. I would not be sitting here today if I had ever met him before I joined the company. When I interviewed he was out of town and so I talked to rational people that worked at his group. A Dr. Milton Fuller and a Dr. Lea, a physical chemist and a organic chemist, and they seemed like decent people, and when I ended up showing up for the job and met Bob Haynes I thought what in the world had I done? Because I had kind of a weird oddball as a major professor at Purdue, which contributed some of my problems there, and I really thought about revisiting some of the other offers.

But the day after I started at IBM we had our second child and I wasn't ready to start moving around, and after a while I settled down and I learned how to work with this guy. But any event, the first thing was -- I had no office. I said, "Where should I sit or work?" He says, "Right in my office," and he was a terrible smoker. He smoked cigarettes, cigars and pipes, mostly pipe, and ashes, ashtrays everywhere, so you had to dodge them, and when I asked him what to do, he handed me a couple of books, theoretical books on polymer physics, and says, "We need to understand the coatings that we came up with," because they did come up with an invention, he and his technician, of a system that worked to dampen and was used for years on core memories and was really an oddball system. It was uncured epoxide. It was Epon 1004, which is a solid at room temperature, and it was plasticized with PCB, polychlorinated biphenyls, which we now know is highly carcinogenic but was widely used. It was invented by GE and GE contaminated the Hudson River with tons of it. It sits at the bottom of the river to this day and it was used in transformers, but that plasticized system was used then for years at IBM to get rid of this problem of magnetoresistive ringing.

So I looked into some, did some characterization work on that polymer system -- I talked to other people that worked in that group, people that worked in plastics molding and then we had a paint guy and then an adhesive guy and they all had their own project and tended to ignore Haynes and Haynes didn't manage. He was in the lab constantly and he took on a lot of the projects himself. So we had a lot of programs where we were involved with different problems in the manufacture of the large computer systems that were in Poughkeepsie at that time. All the 7000 Series of computers, prior to the 360 days, and then we got into the 360 also, and during that time, we were also doing work for this large effort called plated tape and that was to make a tape for a proposed one-inch-wide recording system called the Hypertape drive, and if you go through and do the calculations for magnetic recording, the ideal thickness for the highest packing density of data is zero thickness. So thin films are the way theory tells you to go.

Gardner: Of course you get zero signal.

Vranka: Right. <laughs> So any event, sometime in the late '50s, and I have all this only by talking to the people who were there, and I wasn't involved prior to that time. In the tape business, there were a number of things that had happened, and one of which was to set up this large plating system where onto polyester film they finally set up a 24-inch-wide plating system where large rolls of this film were put through a complicated process. The original process was to take the polyester film and etch it in a very strong chromic acid bath, which essentially etched away some of the surface followed by a rinse in water and then into a very strong sodium hydroxide bath, which also did more etchings and made the surface hydrophilic, water wetting, and then went, followed that into a bath of nickel hypophosphite -- that's an electroless system. Excuse me, it was preceded by a bath of tin salts and then a bath of palladium salts and then into the electroless nickel bath where about a thousand angstroms or about four or five micro-inches of nickel was deposited and that was a conductive surface and that was followed by deposition electrolytically of nickel cobalt, thin film, and the resulting product was a thin tape or thin film of magnetic material onto polyester coating on both sides and was slit and placed onto reels and evaluated.

Now, I was told that the original work that had been done had been on a small plating system on 35 millimeter film that, and the results of that, was tape that met all the requirements for defects levels and wear, so forth. But that didn't translate to the manufacturing system. They had great difficulties meeting wear requirements and then there were huge task forces and we got involved in the '60s, in '62 and in '63, and then in '63 actually, they transferred the whole department, all the people, into the plated tape efforts, so we were involved into it wholly at that time, looking at overcoat technology to try to solve some of the wear problems. I personally got involved in coming up with some systems that were less invasive for the etching, because that was pretty rough on the properties of the tape. I did find that glow discharge in air or oxygen, actually, could make the film hydrophilic and would not disrupt the surface very much. But that was pretty late in the process. We were getting in too late, and also I actually found a system to protect the surface. Serendipity happened. I was working on some materials and I wanted to make sure I could get a measurement, so I thought I would cover some of the surface with the material I could dissolve off and create a step, a microscopic step, and then interferometrically get a measure of the thickness. Well what I thought was a material I could easily remove ended up reacting with the surface, so I then coated the surface with silicate coatings. At that time, there was a program that took the tape that Jesse Aweida was running that made loops of the plated film and then recording was done by accessing these loops pneumatically to a read/write recording fixture, and he wasn't finding anything that would work and this finally did work. But the program was killed.

Gardner: Jesse said yesterday that the big challenge was wear and cleanliness, just keeping the loop as it moved from the matrix hole to get to the capstan that was spinning it would get contaminated, would get wear, and they were working that problem and trying to solve it when the program was canceled.

Vranka: Right. And also I have to back up because there was a major change in plated tape and in the '62, '63 time.

Gardner: This tape was actually used in Tractor and Hypertape or was this tape still a research project?

Vranka: It was still a research project. It never came to as a product, and halfway through this plated tape process was changed and simplified, there was work done in San Jose research showing that we could make just one thin layer, we didn't have to go through electroless nickel, and directly deposit cobalt phosphorus from a cobalt hypophosphite bath, and so all the later work there in '63, '64, was on the cobalt material directly, and the film that I have here is the cobalt phosphorus film.

Gardner: Mm. That's a one-inch?

Vranka: One-inch, yeah. You can see some corrosion occurs with time.
[points to discoloration on surface of reel of tape]

Gardner: That's got to be, what, 50 years old?

Vranka: Yes.

Gardner: More than that probably.

Vranka: Yeah.

Gardner: So it's mid to early '60s, right?

Vranka: Right. Yeah. That's yours if you want it.[1]

Gardner: So this is an example of the tape from the mid-'60s.

Vranka: Late '50s, early '60s. It was going to revolutionize magnetic tape. Now, magnetic tape at that time was made traditionally for half-inch tape drives, reel-to-reel. Was on a thicker base, actually, 1.42 mils. Polyester, polyethylene terephthalate chemically, which is plane oriented. Interesting film with properties, but it was widely used for many things. Photographic basis. Has a photographic base, but also for magnetic tape, and it supplanted the original acetate film. It had much better properties mechanically, surface-wise, et cetera.

In the '50s, IBM worked with 3M and 3M manufactured all the tape that IBM sold at that time, and it was a gamma iron oxide, which is a acicular ferrite, and it should be paramagnetic, but it's actually ferromagnetic, because it has some oxygen dislocations or vacancies in its structure and allows it to be ferromagnetic. So these materials are single domain. They're needle-shaped with aspect ratios with length to width of approximately seven or eight and they're dispersed in a polymer matrix, along with additional ingredients, such as carbon black surface active agents to help in the dispersion process, and milling systems are used to make the dispersions all the way from the classical ball mills to more modern techniques called sand mills and et cetera. Any event, 3M manufactured and sold the tape to IBM. I don't remember the exact price IBM paid for it, but I think it was in the order of $5.00 a reel for a 10 1/2-inch reel, 2400 feet long, and then IBM a hundred percent tested it and sold it for close to $20 a reel. No. The actual manufacturing costs of making the original tape in the order of several dollars, so--

Gardner: So these are 1950 dollars.

Vranka: Yeah, 3M certainly was making a lot of money and IBM was making even more money, and in that period, the Justice Department made overtures to IBM because they had already sued IBM for antitrust violations in the punch card business in 1956. Forced IBM to divest of the punch card business to many and set up many other companies. So there were overtures about, to, both 3M and IBM about the half-inch tape business. So initially IBM hired people like Bob Haynes, the guy I worked for, to come up with our own tape, and he did. It was, I think he called it, Duracell, and I don't know whether IBM never copyrighted that, you know, and now it, course, is a battery, but I think it was called Duracell and they actually set up a coater in Poughkeepsie in a separate building in the middle of the town and it was manufactured there and it was shipped actually to some accounts and tested it, and one of the accounts was-- now, all this is hearsay, I was not involved in any way, and it was an iron oxide tape in a Pliobond

[1] Accepted by museum as part of lot donated by Vranka

binder. Pliobond is an old adhesive system for shoes. It's a phenolic type of polymeric system. Anyway, the tape had really great wear performance. It out-performed the 3M tape, but they discovered a serious problem. Once it was shipped to a customer, the U.S. government, Social Security, under high humidity conditions, it stuck to everything. So IBM quickly withdrew it and went back to 3M again to buy the tape.

In any event, in parallel effort to the plated tape effort, it was decided that because of the pressure from the Justice Department, that we better look at getting back into making our own tape in-house. So there was an effort put in place to duplicate the 3M formulation. First there was a lot of work, I was involved in it a little, to analyze the 3M tape as to what it was. The particle, the iron oxide that was used, was pretty well characterized. The polymer system was found to be a mixture of acrylonitrile styrene, which is a glassy polymer, with acrylonitrile butadiene, a rubbery polymer, and there was a dispersing agent, soya lecithin. We didn't know, of course, the process that was used to mix and coat it, but there was a difference. If you took the acrylonitrile styrene and acrylonitrile butadiene that we thought it was, purchased those and mixed those together, they were an incompatible system. They did not dissolve in the solvent to form a single phase. But the 3M material we extracted, was a single phase and so I can recall Bob Haynes staring at a sample of the extract and trying to figure out how in the world they did that.

I didn't work on actually doing that. Actually went to the literature. There were a lot of indications of how to improve polymer compatibility and they were probably utilized by 3M, including a milling process that included some heat that might cause some change in the polymer system to make them compatible. Any event, time was going on and then we weren't succeeding. There was this huge effort and producing tape like crazy and constantly testing and evaluating. So it was pressure to, "We got to make some change," so there was a big effort to evaluate tapes from all over the world. They looked at Ampex. I don't think Memorex was in operation yet. This was about 1964, '65 period.

Gardner: Actually, Memorex was probably shipping at that time. They were founded in '61. Ampex was certainly in the business.

Vranka: Yeah. Yeah. I know Ampex was looked at and then probably Memorex and then there were some Japanese tapes looked at, and that was Sony -- Sony looked pretty good. What happened also to drive this effort to looking for a outside source was that 3M presented us with a new formulation and that tape looked far superior to the stuff that we were trying to duplicate. So, you know, it all came crashing down to an effort, or program, to work with Sony. Now, that presented some problems. IBM ended up buying the formulation and process and installed it in Boulder.

It was in that interim in 1965, the decision came out to build a plant and move all the tape drive activity, including the tape itself, to Boulder, and the first building on site that went up was the tape building, and Sony installed a 24-inch coater, their own coater there, and then IBM people also installed a 48-inch-wide coater of our own design in that plant and started making the Sony tape, and there were many problems along the way. It was a very complicated formulation and a very complicated process. The iron oxide, carbon black and polymers, which were, it was VAGH, a vinyl chloride acetate alcohol polymer, along with a polyol an isocyanate, plus the dispersing agent, and the carbon black, and that was all put into a mill that heated, the mixture with a small amount of the solvents. Solvents were MEK and toluene, and temperature was applied and energy to this mix and the process caused dehydrodehalogenation, the splitting out of HCL, out of the vinyl polymer, and it was critical as to how much you split out and when and it wasn't measured quantitatively. The Japanese just would open the mill and take a sample and sniff it and test it for its tensile properties and they would say, "Run it another 20 minutes or so," you know. Anyway, they knew how to do it, and as long as this Japanese guy named Koay [ph?] was there, we made satisfactory tape. As soon as he went back to Japan, we started having problems.

Gardner: On both lines? Both the 48-inch and the 24-inch?

Vranka: Yeah. Well, they were fed by this one milling line, so after that, I forget the name of the device that that was called. It's like a Brabender, was another one that was a similar system. A sigma blade in a heated chamber milled this device, because then that mix, a paste, was taken to a three-year-old mill and milled additionally, and then that material was transferred to 600-gallon ball mills and ball milled for 48 hours. So it was a long process before it was shipped to the coater to coat onto the polyester film, and so the-- it was almost a week before, you know, you have finished tape once you started the process, so it was a long time before you got to testing to see if you had done it correctly. So it was complicated, so that activity went on and we finally solved some of the problems and--

Gardner: It sounds like you figured out how to measure the HCL so you would know when the mixture was ready to go to next step?

Vranka: I think it was done more empirically… we had various time levels and whatever and found out what gave the best results, rather we've never instituted, not to my memory, any good way to measure the HCL or the tensile properties.

Gardner: But somehow you now know that was a key parameter which was not measured. A lot of our industry in that era was art and not science.

Vranka: Exactly right.

Gardner: I remember at Memorex for a long time, with the ball mills, the first three batches of pigments were thrown out; they would not use the actual material until the third or the fourth batch of pigment was put in.

Vranka: Yeah. It's called the heel. You had to generate a heel. That is a remaining amount of material that was left in the mill, and then new stuff was added to it.

Gardner: When they found out why, they changed their process and then they went to sand mills and that didn't happen at all, but, you know, there was a period when-- was three the right number? Would two have worked, would four have worked? Who knew?

Vranka: Right.

Gardner: Somebody, manager, decided, "We're going to throw out three, and the fourth one will go to the line."

Vranka: Right. There were some interesting dynamics managerially behind this Series 500. I was told by, many years later, by a guy, I can't remember his name, who ended up being lab director in San Jose, who was involved in some of the managerial work. I think he followed Jack Kuehler as the lab director out there. I should know his name, because I knew him fairly well, but I can't remember it right now. But he said that John Opel, who later became CEO of IBM, was involved in the management, was one of the higher-level managers, that was involved in the decision to go to and to accept Sony's offer. You know, whatever we had to pay them, because they also got, I think, 10 cents a reel royalty too. But in any event, he found that a very difficult decision because John had been a POW in World War II and had suffered torture under the Japanese, so he didn't like the idea at all of doing business with them.

Gardner: Could it have been Jack Harker who replaced Kuehler at San Jose?

Vranka: It's not Jack.

Gardner: As part of the review, I'll figure out, I'll give you a list of directors and if you could identify the one. [Kuehler->Harker->Harries]

Vranka: Okay. Yeah. The guy I'm thinking of got very heavily involved with Boulder on printer work. San Jose was involved in the 3800 printer development, this huge printer which was leading-edge printer in the industry for many years, and OPD made the photoconductor, initially in Lexington, Kentucky, but that was moved to Boulder when the printer effort was moved in the early '70s from Lexington Printer and Copier to Boulder, and this person I'm thinking of often appeared to run reviews on, because there were problems with, especially with the new photoconductor called blue coral. IBM was the first to introduce a purely organic photoconductor, which appeared in the printers and copiers that IBM produced, as opposed to the original Xerox material, which was, again, metal coatings. Any event, he's the guy that told me about this and the problems of doing business with Sony, at least on our side.

Gardner: You said [the Sony process bought by IBM] was called the Series 500?

Vranka: Called Series 500, yes, and it was released in, I think started shipping, in ’67. I moved to Boulder in ’66 and got heavily involved. Got immediately assigned to tackle some problems on the Series 500 tape. For example, it was failing a cupping test, and this was a test to measure the transverse shape of the film. The test actually included cutting off an eighth-inch strip across the half-inch and then putting it under microscope and measuring how far from flat it deviated, and spec was 10 mils, and we were going well out of spec. But so I started looking at tensions and temperatures and the drying ovens, so forth, and the process, and the problem was that I kept getting whispers that you couldn’t believe the data. That some of the data was not good on really recording what these conditions were. So I retreated to the lab and did a lot of work on taking the ink, as it was called, and coating it under varying conditions of tension onto small samples of film. Tensions and the configuration and essentially showed you could do it, could get anything you wanted, even to reverse cupping, you know. But that they were important, so fed some of that information back, but it was, the other part of it, was the technician that was doing these measurements, I saw him quickly, as fast as he could, cut the sample, put it under the microscope, and I said, “Why are you moving so fast?” He says, “If I don’t take the reading it’ll go out of spec.” I said, “Let me look in there,” and I looked into the microscope and I could see it. It was alive and changing. So I changed the spec that they had to do the measurement after, allowing the sample to sit for an hour and reach some equilibrium configuration, you know. But any event, that and other problems.

Gardner: Did you resolve the cupping problem?

Vranka: Yep. But I can’t tell you really how at this time, Tom, for sure which, what one item, was changed.

Gardner: Oh. Ric, in his discussion of the 3480 tape, said they didn’t solve the problem of cupping on that tape until late in the ‘80s. I mean, it was ultimately solved, I think, by, I mean, by matching characteristics of the binder to the substrate as the binder cured.

Vranka: Yes, yes.

Gardner: It would create forces on the substrate and cause it to bend one way or the other -- the trick was to find a way that netted zero force.

Vranka: Right, right.

Gardner: I take it that’s the type of experimentation was going on in the 500. Was that, did that become an approved tape or was it still just the 500?

Vranka: It was just the 500. It was their Sony video formulation.

Gardner: Mm-hm. The particles were from 3M?

Vranka: No. The particles we purchased from Hercules. It was Hercules 280, I think it was. They had a whole series. There were several vendors of Gamma Fe_2O_3, Pfizer Pigments[2], Hercules. But the one that approximated what 3M, now, I don't know whether 3M made their own. They may have, because a lot of the work at 3M, including the development of tape formulation, came from their coated abrasives work, which they had been in forever. You know, it was a product line that they had been in it forever, and so a lot of the polymer systems and pigments, et cetera, were developed there, so they may have made their own magnetic polymers.

Gardner: My understanding is they did make their own. That comes from, my understanding, of the disk coating line at IBM in the '50s and '60s, which 3M was the purveyor of particles.

Vranka: Oh, really? Okay.

Gardner: But that's second or third or fourth-hand, so I may have it wrong.

Vranka: Yeah, I don't know. I had, you know, I worked somewhat with people at IBM occasionally on disk formulations, but by that time it was, I think, by the 3330 or something like that, I can't remember the internal name that it was referred to, but that used a particle from Pfizer called 2 cubed 8**.** It was really a superior magnetic particle which ended up in half-inch magnetic tape in the Graham Tape product. Graham Tape in Texas, in, later on, in the '70s.

Gardner: So we're now, in the mid-'60s; IBM's in production.

Vranka: IBM's in production.

Gardner: Is it a hundred percent production of IBM's demand [for tape]?

Vranka: It was a hundred percent.

Gardner: Cut off 3M at this point.

[2] Headquartered in Easton PA Pfizer Pigments went thru a number of ownership changes with its plant closing in 2017. Source: "Local pigment plant with 140-year history to close," WFMZ-TV website, Sep 20, 2017.

Vranka: Cut off 3M, yeah. Switched over, and the other parts of the process too that contributed or affected cupping is the calendaring process, and that was an important process. After the tape was coated and wound up on these big jumbo reels, it was transferred to a stack of rolls, one of which was highly polished, chrome-plated steel that was heated and hit the surface under, and so it was, pressure and temperature was applied to the surface of the coating to make it smooth and therefore reduced the distance from the read/write head, and to improve the performance of the tape electronically.

That was critical too. I have to back up from a personal standpoint, what happened in 1964. My manager, Bob Haynes was-- I don't know how he ended up working with a group in Vestal [NY], IBM Vestal's laboratory, which was a Federal Systems Group, and there was a program there to replace the core memory devices called the Bit Strip memory and it involved taking, Mylar film, polyester film, and depositing, nickel-iron films, low coercive force films, as a potential replacement, as a new memory system -- one approach would be to vacuum deposit and that, there was a large effort in IBM, which eventually ended up in Burlington, Vermont, facility, of replacing core memories with a thin film, nickel-iron, and that was deposited in a vacuum system -- it was proposed that an approach could be attempted to make a replacement for these cores using nickel-iron films deposited onto curved polyester surface and then when you straighten the material the tensile access became the easy access of magnetization, and that did work. That was demonstrated. But anyhow, we got involved in making these films by thermally decomposing nickel carbonyl and iron pentacarbonyl. Now, both these materials are highly toxic carcinogens, pyrophoric. So in Poughkeepsie, we set up a laboratory. It was just myself and my technician, where we put together a gas train and included a mandrel that we could hit and mounted polyester film and then introduced mixtures of nickel tetracarbonyl and iron pentacarbonyl in the right proportions and we were able to make very good films.

Now, we had, in order to protect ourselves, these gas trains were in a high-velocity hood. Plus, we wore Scott air packs to protect ourselves while we were making material. So we worked for a year on that separate project, and we were quite successful in the properties of these films, but the program, the other end of the program, of making the device, and I think it was under a Navy or an Air Force contract and ended after a year's work in that area. So I was not involved in the other stuff in Poughkeepsie for that year of '64. Anyway, after Series 500 tape, I was working in the GPD lab. It'd originally been called the Systems Development Division, and that was changed to General Products Division, which included tape and disk drives. So Boulder was tape, and disk drives were in San Jose, and I ended up in advanced tape development group that we started looking at the various components of tape and looking of how they could be improved. We did some work, in looking at alternate base films like polyimide films called H film, that DuPont made in addition to polyester film.

There was even some activity in another group in our area, that was looking at maybe we ought to get into the possibility of actually making our own polyester film, but I think that was rightly decided that that was too big a bite to chew. It's a pretty complicated process and it's the plane-oriented polyethylene terephthalate.

I ended up doing a lot of work on new particle systems. At that time, chromium dioxide was coming around. DuPont had done a lot of work on and had a lot of patents on how to make this rather strange material. Chromium dioxide is a semiconductor. There are very few chemical compounds of chromium in the plus-four valence state and it ends up being ferromagnetic and these were very good-looking particles. They had aspect ratios of like 10 to 1 -- each individual particle's 10 times longer than it was wide. They were, it had, a very narrow distribution of particle sizes. Material looked very good and very interesting and 3M then developed a videotape using chromium dioxide called chrolen [ph?] tape and so future tape programs in Boulder also were looking at this because it was a well-performing tape. It was higher coercivity than the iron oxide. You could get all the way up to maybe even 700 Oersteds, you know, and I think the product we were looking at was around 500 Oersteds.

But I looked at Bob Haynes, who was no longer in management, back fully to the bench. He was working on trying to synthesize chromium dioxide, but he used the DuPont approach, which is high temperature, high pressure autoclaves, bombs, essentially. He had a little building built in the back of the site where he actually could run these autoclaves, because they were really extremely high-pressure systems. Where you took chromium trioxide plus other modifying chemicals and placed it in the bottom and heated them up and applied the pressure and then what happened was you got chromium dioxide. But I was looking at the literature and found some other possible roots and was pursuing those. But in addition, I was looking at metal particles and as it turns out, the cobalt phosphorus that was used in plated tape, if you took that bath and applied the palladium chloride directly instead of depositing it on the surface of the tape, and then plating out cobalt, you could just add the palladium solution to the cobalt solution and you formed cobalt phosphorus particles, and so we pursued that path and made, you know, laboratory samples of the tape and looked to implement that into future tape products. But we never got the recording results that were as good as chromium dioxide.

So for things like the, what eventually became the 3480, we pursued the chromium dioxide path. I have to diverge again, in that same period we also were supporting the mass storage system, which started out as being I think about a 2 1/2-inch-wide tape with parallel track systems and it was called the Comanche program, and that eventually was sold to Control Data, who used that system in their product, and the tape that we developed for that was on 1 1/2-inch or 1 1/2-mil Mylar and it, hundred micro-inch thick coating of gamma iron oxide. But with a new polymer system using Estane 5702, so pre-form polyurethane cured with trifunctional isocyanate that cross-linked the system, and we also, using the same binary system, put a carbon black coating on the back side of the tape for static dissipation and so that that's the Comanche system. Went to Control Data.

Gardner: IBM sold or gave, depending up on your perspective.

Vranka: Exactly. Internally, IBM decided to go in a different direction for a mass storage system using helical scan technology from the video industry, and it was called the Oak program, and that similar tape was, that we developed, was used, that same formulation of iron oxide and urethane binder system, Estane, and the carbon black coat, and that was [used on Oak]. So we worked on that in the early ‘70s and I ended up running a test group that did a lot of evaluation on that. I got into management in about 1968 and had an advanced development group on the various materials that go into tape, but then I got moved over to running a test area.

Gardner: Okay. Let me back up for a second before I’d like to explore the MSS also. Did the Series 500 become, was it known by, was its code name MST?

Vranka: No.

Gardner: At some point there was a multi-system tape, MSS?

Vranka: There was a follow on. We, in the middle ‘70s, we started working on a replacement of the Sony material so we wouldn’t have to pay [royalties].

Gardner: So that’s after the MSS.

Vranka: It was parallel, somewhat parallel.

Gardner: Okay. Which one would you like to talk about first?

Vranka: Well, the MSS involved a lot of our resources and lot of our attention, you know, but that went reasonably well, and the product was released in ’75, introduced to the world.

Gardner: The original work started in the Comanche program.

Vranka: Yes,

Gardner: I think the Oak tape is narrower than 2 1/2 inches.

Vranka: I’ve forgotten the exact--

Gardner: I think it’s 1.9 or 2. I could be wrong. We could look that up.

Vranka: I thought it was over two inches.

Gardner: [It's 2.7 inches wide] I frequently make mistakes in these interviews.

Vranka: <laughs> No, no problem -- I tried to look up, you know, some records that I might've had, but I have a big problem in 2013. Where we live, we had a lot of flooding in my finished basement. I had my office down there, and we got flooded out, and so a lot of stuff got thrown out, and I was amazed I could even find this plated tape reel. It was in a box in the garage under a bunch of stuff, you know. Few things we were able to salvage.

Gardner: Was it submerged in water?

Vranka: No, it was not submerged in water.

Gardner: I wouldn't think it would look like that if it'd been submerged.

Vranka: Right. But in any event, I've had difficulty trying to find any of these records, because a lot of stuff that was sopping wet we just heaved out. But as far as the half-inch tape development, that was done by an engineer called, named, Tom Kitsey did most of the work on that development, and the-- it was still gamma iron oxide, but the polymer system was totally changed. It was VAGH mixture, plus Estane 5701, and then cured with a trifunctional isocyanate. Had much better wear performance and overall performance -- I looked at that information that Ric had and I think some of that is in there, that, on the old tape, you know. That was called multi-system tape. So multi-system tape replaced Series 500 and became our standard tape formula for half-inch tape from there on, and that was released in 1978.

Gardner: And that's different than the MSS.

Vranka: Yeah.

Gardner: Still gamma iron oxide.

Vranka: Still gamma iron oxide but a different polymer formulation and--

Gardner: Still Mylar substrate.

Vranka: Still Mylar substrate, right.

Gardner: Okay.

Vranka: But it had different-- one of the other ingredients, which I failed to mention, which we always included in tape formulations, is a lubricant, and that's varied all over the place from, oh, straight hydrocarbon type lubricants too, in later years, and particularly in the MS or the multi-system tape isocetyl stearate was the lubricant that was used in that.

Gardner: Soap?

Vranka: Soap, right. Similar, yeah. Well, soap is sodium stearate. So this didn't have sodium. It actually used still a hundred percent organic, no inorganic component. But any event, yeah. So that tape became the basis for all the half-inch tape from there on out.

Gardner: Any interesting challenges in switching over to MST from the 500?

Vranka: No. It worked surprisingly well, and it was, there were strange dynamics involved with people. IBM had hired several people from 3M. They hadn't worked in tape directly but in, like, coated abrasives and in polyester film manufacturing. But any event, those people were involved in the formulation for the MSS and went to these pre-formed 5702 Estane systems and there was another group that was in IRD [Information Records Division], which is the division [that sells tape], it was very complicated. GPD did the development work on tape, but the manufacturing was done by IRD, which had been back East in an IBM New Jersey location, and that was moved to Boulder, so there was always a problem with this release. It was not a smooth release--

Gardner: So you have one physical plant.

Vranka: Right.

Gardner: But two different management teams.

Vranka: Exactly.

Gardner: Probably not coming together until the chairmen.

Vranka: Exactly. You're exactly right, yeah. And so that was always contentious, and this Ph.D. chemist, Tom Kitze, was in the manufacturing/engineering side, did a lot of development work and he actually wrote a letter to IBM management that the people that we had hired from 3M had stolen the technology from 3M and, you know, it became very, very messy, and as it turns out,

Tom was also our liaison to Sony, so he had confidential information, of all the work Sony was doing on their successive products beyond Series 500 that they had sold us. We were having difficulties with some of the work that was being done on MST, and so he went to upper-level management and says, “Give me one shot and I will give you a tape that works.” I forget what areas we were failing in, but in any event, he did that and he, with this formulation of this vinyl chloride alcohol, VAGH, and Estane 5701, and it worked beautifully with the isocetyl stearate and all that.

Gardner: So why do you think he was so successful? By this time are you better understanding the physical chemistry of the tape system?

Vranka: Well, I was running a test area at that time and I said, “Hey, Tom, can you show me all the variations you did and some of the test results?” and he gave me the data and I looked it over and he selected this one series of conditions and the formulation and, you know, over a lot of different things he looked at and I looked at the test data and I said, “I don’t see a difference. Why did you choose that?” His exact words were, “I felt like it.”

Gardner: <laughs>

Vranka: And what I suspect happened is he took the information that he had from Sony and took their best data and implemented that. But it worked and he got an Outstanding Contribution award and it was successful personally for him.

Gardner: Did he get a patent, do you know?

Vranka: I don’t know if he got a patent.

Gardner: That was probably treated as a trade secret.

Vranka: Right. Well, anyway, that ended up our work on the standard gamma iron oxide tape in that time period. Then we changed focus to the chromium dioxide and Pegasus work.

Gardner: So just looking back at that whole period, IBM went from essentially buying 3M tape.

Vranka: Yep.

Gardner: Bought Sony's formulation and process which became the 500?

Vranka: Right. We then developed our own for MSS and MST.

Gardner: Any interesting interactions with the head folks? IBM was designing and making heads.

Vranka: Right.

Gardner: So there's always an interesting dialogue going on between head developers and tape developers.

Vranka: Right. There were conflicts and, you know, but they were essentially resolved.

Gardner: Any thing interesting?

Vranka: Head wear. I'm trying to remember.

Gardner: --different than a dialogue that you can recall between-- was it easier? Must've been different for the head guys, and you're not the head guy, but you were on the receiving end as a media person.

Vranka: Right.

Gardner: Particularly when you were then providing the media.

Vranka: Right. I think, I'm trying to think. There was some critical periods where there was a lot of conflict. I can't remember how the exact nature of it, but you know, we also looked at ways to do testing of the tape to make sure that we were not inducing a lot of head wear.

Gardner: Oh. When you were in the test area -- you have a problem. Is it the head or the tape?

Vranka: Right. But we were looking from the tape side, of course.

Gardner: Of course.

Vranka: We looked at of how to evaluate the tape for head wear without actually using real heads and we did a lot of work in that arena. But I'm trying to think. I can't remember exactly what. I remember sitting down and having some difficult conversations with the head people.

Gardner: None come to mind when you were running that test area.

Vranka: Right. I can't remember one particular one that was.

Gardner: So we've pretty much exhausted MST and MSS.

Vranka: Right.

Gardner: I guess one question I might ask is the MSS had a recording placed on it, the servo information.

Vranka: Right.

Gardner: Video. Any involvement with the issues of pre-recording the tape or testing a pre-recorded tape while you were there?

Vranka: No. Didn't get involved with that.

Gardner: Okay. So we're now ready to talk about both the transition and also the movement of tape from Boulder to Tucson.

Vranka: Right. So in '78, most of the tape people transferred to Tucson, but there was a group of 28 left in Boulder, and we had established this 24-inch coater where we were making essentially production-level Pegasus tape for 3480 and doing all the development work. In addition to the chromium dioxide, what was introduced was a sand mill process, different than the Gamma Fe_2O_3 tapes and this high-speed coater, which we could coat at up to 600 feet a minute. It was a state-of-the-art coating system in a Class 100 clean room conditions, you know, so we could make tape where we handed it to the machine people. We didn't have to apologize for, you know, that this was made in the laboratory et cetera, et cetera. It was actually high-quality tape, and I was a second-level manager in charge of two groups in Boulder. One responsible for the formulation and one responsible for the production on this 24-inch coater, and a group in Tucson. So from 1979 to 1982, I was still reporting to Bill Phillips in Tucson and spending, like, half my work time in Tucson and half in Boulder. So was constantly traveling back and forth and understood a lot of things about the dynamics of interaction or that distance provides. In those days, we didn't have any video links. All we had was conference call phone, and I would sit in Tucson and get the impression of the Tucson people saying, "Oh, they're running a country club up there, just having a good time," you know, and sit in the conference room in Boulder and get the input. "These guys don't understand at all what we're doing," and, you know, all that. So it was interesting to bridge that communication gap, but we did it and I think Bill was satisfied with my management capability to handle the thing, you know.

Gardner: So you chose not to go to Tucson.

Vranka: Right.

Gardner: Because?

Vranka: Family concerns, primarily. The kids were all involved in ski racing and skiing was not that available in Tucson.

Gardner: You were a skier at that time?

Vranka: Yeah. And I wasn't violently opposed like some people. Matter of fact, the manager of the group that I managed in Tucson was Dr. Satish Sharda, a chemical engineer, a guy that I really liked, and in September of 1979, after he had moved down there, I get this call from him and say, "Joe, you got to get me out of here. This is the worst place on God's green earth." You know, "It's hot. I can't stand it. My wife hates it." I said, "Satish, the way you're describing it goes beyond the definition of anyplace I know on earth." I said, "Give it a chance for a month or two," so he settled down after a while and did okay. But I got other calls from, like, a technician that used to work for me. Same way, you know. "I hate it down here. You got to get me a transfer back." I said, "Well, there's no path back." The people that stayed in Boulder eventually in 1982 then moved over to the printer/copier supplies area. We all got absorbed in that.

Gardner: How many folks didn't go?

Vranka: Twenty-eight.

Gardner: Out of how many, about?

Vranka: In tape development, maybe about 40 or 50, on that order.

Gardner: They move the manufacturing people too or was it just the development?

Vranka: Well, there was no manufacturing by that, at that time, of tape. I mean, we were the manufacturing with our 24-inch coater.

Gardner: Okay. And now the 24-inch line you're talking about was here in Boulder.

Vranka: Here. Yeah. And then Satish had the responsibility to replicate all that that we had in Boulder in Tucson, which he did, which that group did.

Gardner: Oh. My recollection of Bradshaw's oral history was they didn't really have a development line. He tells funny stories about having to do his development work on manufacturing lines.

Vranka: Well, parallel to that, there was a manufacturing line being put into Tucson. Yeah. But we did replicate the coating facility for development.

Gardner: So there was a development coater in Tucson.

Vranka: Right.

Gardner: And a development coater here in Boulder.

Vranka: Yeah. That way there would be no interruption of the development side, so we're able to, you know, supply Tucson with all the needs over that period, transition period, and as far as I know, that got, they coated and all that system got replicated in Tucson very satisfactorily, you know. All the billing operations and coating and…

Gardner: And so who was the lab director here at Boulder at that time? Was he transferred? Do you remember?

Vranka: The lab director in the tapes?

Gardner: I mean, the lab director for tape in Boulder, yes.

Vranka: Oh, let's see. It ended up being Carmen Rosato was the lab director in Tucson that managed it, you know, and I had a number of meetings with Carmen. I liked Carmen quite a bit. He had a reputation of being a tough nut, but I got along with him pretty well and he tried to get me to transfer to Tucson. I told Carmen, "I'd enjoy the job you have for me more than what's in store in Boulder, but, you know, I'm not going to make the move."

Gardner: Actually, I think Phil Dauber was the first lab director for Tucson.

Vranka: Well, he was in Boulder. Then he transferred to Tucson? I didn't know that. I didn't remember that. I don't remember who.

Gardner: Yeah. Many years later I worked for Phil Dauber at Memorex. He came into Memorex at a difficult time as one of the folks trying to turn it around. He's also a tough guy.

Vranka: Well, he was a weird guy. Phil would bounce off the wall. You could find him in Boulder sometimes lost. He didn't know, remember, where his office was or how to get there.

Gardner: <laughs>

Vranka: He was out of IBM Yorktown Research. I didn't remember that he was the original lab director in Tucson

Gardner: He was, just during the transition, and shortly thereafter Rosato took over. I worked very hard in Tucson to get a list of the lab directors, and I think I succeeded. I'm now trying to, when I ask you questions about Boulder, I'm trying to get the same sort of history nailed down. IBM San Jose did a very nice job of recording its history [thru the first 25 years]. I didn't find any sort of history recorded in Tucson. For example, "Who were the lab directors?" No one seemed to know and we worked together to develop a list

Vranka: Good.

Gardner: --. Same question for folks in Boulder. I mean, who really were the lab directors? Which, in, as I understand, in IBM culture, they're the person responsible for the development of products.

Vranka: Right.

Gardner: And also the business management function usually within the development lab.

Vranka: Exactly, right.

Gardner: So before the history goes away, I'm trying to build, I'll try to build a list.

Vranka: Yeah. But you're right. Phil Dauber, you know, is the only, last, guy I remember in Boulder associated with tape drives.

Gardner: Yeah.

Vranka: And I didn't remember that he transferred -- he kind of went off my radar. He kind of disappeared. Think it must've been shortly after he transferred to Tucson that he left IBM, huh?

Gardner: That's probably right -- I ran into him in '82 at Memorex -- he was part of the team from Unisys - when Burroughs acquired Univac and became Unisys, Burroughs had already acquired Memorex.

<laughter>

Vranka: Right.

Gardner: And so Phil, I believe, came in in that wave of management. And then I left shortly thereafter, so I didn't work with Phil.

Vranka: I didn't realize that he had left IBM even.

Gardner: Yeah. So he must've left shortly after Tucson [Duaber joined Burroughs in May 1981][3]

Vranka: Right. Well, most of my memory of interaction with a Tucson lab director is with Carmen Rosato. Had many meetings with him and, you know…

[3] Source: "Dauber joins Spangle in newly formed Memorex Executive Office," Memorex Press, Volume II Number 6 June 1984

Gardner: Yeah. So I've asked you lab directors' names for Boulder, and, you know, as you go through the transcript or even afterwards, if you can think of who are the lab directors? Unless there's some sort of history society around here that's keeping old IBM Boulder history?

Vranka: I'm not aware of any.

Gardner: So I'd like to document it as best I can. So you think it's a pity your files got submerged in water, but I'm sure there was a Boulder newsletter for IBM employees.

Vranka: Right. I'll spend more time in the garage digging through some of the boxes that we saved.

…

Vranka: Yeah. Now, the IPD lab director was Jim McDonald. Now, I didn't report to him or into his organization until I transferred in '82. In '82, then I left GPD and took a job in the supplies area in IPD.

Gardner: Hm. So let's back up now to Pegasus, and the decision to go with chromium dioxide, and I guess there was a competing metal particle alternative.

Vranka: Yes, the cobalt phosphorus, yes.

Gardner: And I was, I've been told there's a rumor that it was a flip of a coin between the two particles for the Pegasus. Tell us about that.

Vranka: Well, actually, I was in the competition. I was making the cobalt phosphorus particles and pushing that from the standpoint of higher output and more entrée into the future and Bob Haynes was the chromium dioxide advocate, and we both made presentations to our upper-level management and it was an easy win on my part because Haynes could hardly communicate, so, you know, the decision was made internally to go with cobalt phosphorus. But the fact of the matter is samples of tape we made and produced with the metal particles just didn't perform as well as the chromium dioxide for density and output.

Gardner: So it was essentially a recording channel decision?

Vranka: Exactly.

Gardner: That you did not have the amplitude at a frequencies the chromium dioxide exhibited.

Vranka: Exactly. And we did a fair amount of work there to try and understand that, and a physicist that worked for me named Tom Bolliog [ph?], came up with a figure of merit for the particles called switching field distribution. That is the change of coercivity as a function of applied field you could measure in a magnetometer, and for chromium dioxide you had a very sharp transition which meant that, you know, you could get really good signal output, whereas we had much broader with cobalt phosphorus, and over time we were able to compete. But by that time, the decision had been made to go with chromium dioxide, which I don't think was a bad decision. The only problem with chromium dioxide was that it's inherently a metastable material. You know, it wants to revert to the stable form of chromium oxide, which is CR_2O_3, the green pigment, and also the chrome six from which it comes is highly carcinogenic. So, you know, you can get some formation of that material, so inherently I thought it would be better to go with metal particles. We didn't have those concerns.

Gardner: Think it's also conductive, which created problems?

Vranka: It's a semiconductor. You don't even have to add carbon black to the pigment.

Gardner: Yeah, that created some problems and it's a platelet, as opposed to a ellipsoid?

Vranka: Right.

Gardner: And that's created some problems?

Vranka: Well, a platelet, you mean, for the cobalt phosphorus?

Gardner: I thought the it was a platelet.

Vranka: No. The chromium dioxide is needles, just like gamma iron oxide.

Gardner: Oh, it is needles.

Vranka: Yeah. They're needles that have higher aspect ratio. They're longer and skinnier.

Gardner: That's why they produced initially the better switching field?

Vranka: Well, we eventually learned how to make metal particles with fantastically narrow switching field distribution.

Gardner: And that starts with a shape issue?

Vranka: Well, we were able to modify the particles and make them very small and very uniform. They were spherical, actually, by the introduction of water soluble polymers during the synthesis process, and you get this chain of a hundred or three hundred angstrom spheres that had very, very narrow switching distribution and very high coercivities. Around 900 to 1200, depending upon conditions. But that was much later into the program. By that time, you know, the decision, the ball, was rolling down the road with chromium dioxide.

Gardner: And--

Vranka: And what made chromium dioxide work was the binder system, the Morthane which Ric worked on, and that didn't react with, like, the Estane did with the chromium dioxide and formed the stable systems and eventually produced the product, which was produced in 3480 cartridges in Tucson.

Gardner: Yeah. Ric went through a series.

Vranka: Stallion was MST nickname.

Gardner: Oh. So it started with Stallion actually and then became Pegasus.

Vranka: Half-inch tape was iron oxide[it was never chromium dioxide.

Gardner: So Stallion was the code name for what became MST?

Vranka: Exactly. Which was shipped in '78.

Gardner: Got you.

Vranka: And then--

Gardner: And then Pegasus was the first chromium dioxide, and that was started here in Boulder.

Vranka: Yes. And all the decisions to go in that direction were started here. Before everybody bailed out. So any event, in 1982, the summer of ’82, the GPD group, the 28 people we had in Boulder ended, and we all got moved over to I think maybe one or two person’s changed minds and transferred to Tucson, but essentially the whole group stayed in Boulder, and then I was, became, third-level manager in charge of two big projects. One was the new coating system for photoconductor for printers. There was a big push at that time to convert from the original organic photoconductor that had been used in the 3800 to an improved one.

An improved one based on a new chemical called chlorodiane blue. What had happened is that IBM had problems at some facilities primarily in Europe with the 3800 where the people went out on strike because they heard this material was carcinogenic, the old photoconductor that we had in there. There had been a lot of testing and that was never shown to be the case, but the rumor was out, so there was a big push to make a transition to this new photoconductor which didn’t have any of that indication, and a new coating line and about a 20 million dollar project was put into Boulder to produce this material.

The new coating line was called HPC1, because it adapted it, which stood for hydro pneumatic coater, and where that came from was the principle engineer in our magnetic tape facility in Boulder developed a process called hydro pneumatic coating where instead of using gravure rolls or reverse rolls, which were the classical ways to apply a film of the iron oxide material to the polyester, is to use a balloon essentially, or a pressurized film, to produce the, or to lay down, the layer, and that was adapted by the photoconductor material and was so successful over their previous way of coating it improved their coating speeds from a few feet a minute to hundreds of feet a minute. It could produce much more material much more rapidly and with better control on thickness and other properties. So the new coating system was called HPC1, hydro pneumatic coater Number 1.

In parallel to that, on the magnetic tape side, I was responsible for a whole new coating system that was highly automated in both the milling and the coating operation to produce half-inch tape and other derivatives like we also made diskettes. All the diskettes in IBM, the original diskettes, were made in Boulder. All that material was a adaptation of the, initially, the Series 500 formula and then the MST formula, and, you know, and all the development of the surface finishing and all that, that was all done in Boulder for diskettes and the diskette history was strange one. Started in San Jose. Then transferred to Rochester, Minnesota, and then back to Boulder. This was the drives themselves, and the large coating system, which was 48 inches wide that we had, a new one that we were installing in Boulder in a highly automated sand mill system for production of the inks, as they’re referred to, was probably overly ambitious. What we decided is we would have one central formula, easily modifiable for a variety of product. No. I’m wrong on that. We never converted the MSS tape to any of the new polymer systems. They still, what we did was, before shutting down the old 24-inch coater which was installed by Sony on which we made the Comanche or the MSS tape, we built ahead thousands of cartridges and put them in storage for, hopefully for end of life.

In any event, this magnetic tape coater for half-inch tape and diskettes, we had a lot of difficulty implementing that strategy of a once single formulation to meet all requirements, and a lot of automation, a lot of problems, and the other problem was managerially. We were all now located in IPD, Information Products Division, and yet all this tape work didn't provide them any revenue or they, you know, didn't help their products at all. So here were all these resources dedicated to this fancy system so there was very little management support for it. Was about a 25 million dollar project to get this new tape line, and we were having a lot of difficulties and at the end we produced satisfactory tape. But it was, the program was killed. Now, the HPC one, worth about 20 million, had a lot of problems too in parallel, but at the end of that program it did well. We gave awards to all the people involved and it sailed through, but I think in my opinion a lot of that was due to the organizational structure and the way the things were laid out.

So in 1985, there was a big come to Jesus meeting in Boulder where Jack Kuehler, who was a corporate mucky-muck by that time[4], came in and the corporate director of finance, Frank-- I can't remember his last name. There were a whole bunch of high-level corporate people came in and I got dragged in to the meeting to make a presentation but the result of that was at that meeting, although really it probably had been made offline earlier, was to completely get out of diskette media, diskette drives, half-inch tape, all magnetic media, half-inch-- the whole shebang, and to take 500 people that were involved in the development and manufacturing of all these things and transfer them into printer/copier activity, and along with all the tape work that was killed, the diskette drives, we had spent, IPD had spent by that time, about another 25 million, setting up an automated drive manufacturing line in Boulder and that all got shot, all shot down, and torn out and so totally about a hundred million dollars of write-off was taken on everything, and the fact of the matter, the conclusion of this group, was that, "You guys have made a technical success." What we had developed was a four-inch diskette drive comparable to Sony's that was quite advanced and beat Sony's by a mile. The tape and that was based on Pegasus technology. It was a 40 micro-inch thick coating of chromium dioxide and it worked very well, and the way this treasurer summarized it, he says, you know, "If we stay with these programs, in a year or two I'm absolutely certain we'd be celebrating, but instead of drinking Dom Pérignon, it'll be Strauss beer," and what he was trying to, the analogy he was making, is that the margins were small. That it was profit margins that were, IBM was not used to dealing with. Small profit margins. But a lot of that was totally falsely based. At that time, the yen to dollar ratio was something like 150 to 1, you know. In very, very short order, that changed, and so a lot of basis for the financial analysis was false or at least way off the mark, and I always regretted that. Sitting there at that meeting, I made up my mind that I was going to retire soon as it was possible.

That was in 1985, so then in 1987, IBM came out with a program called the Five Plus Five, but it only, they did it, companywide and it only happened once where they added five years to your age and five years to your service and so at the age of 52 it made me eligible both on service and age. So I retired in July 1st, 1987. Now, after all these, after the tape line was shut down and the diskette drives were shut down, I was taken out of management and went back to the bench and worked on photoconductor

[4] In February 1985, Kuehler an IBM Senior Vice President assumed corporate executive responsibility for worldwide development and U.S. manufacturing. Source: IBM

materials like amorphous silicon and other things for future developments in the printer business, and also in 1986, I was asked to take a group of people to Germany to work on a printer supply for an electro-erosion printer that IBM sold at that time, where the supplies were developed in Boulder on our coating system and then farmed out to an outside source, Rancor Corporation[ph?], in Durham, Germany. So I took a team of people. They were having problems making material that was in specification. The material that was being made was a paper coated with aluminum, which the printer was designed for, electro-erosion, a high, 600-dots-per-inch printer, with capability up to 1200, which was a system of tungsten styluses, which applied about 5,000 volts, produced images by blasting off the aluminum coating on paper, which had a undercoat of I think a carbon coating. But it was being produced to work with offset printers. In the offset printing process, the plates are made, printing plates are made, by camera, having camera-ready copy of the images that you want that essentially then uses a photographic process to produce plates that are used in the printing process. In that process, you produce negatives and then the negatives produce the positives, and materials were developed, which essentially short-circuited that process. Instead of printing onto paper you printed onto this Mylar film with, that had an undercoat and then an aluminum layer and then overcoat, and that material was manufactured by Rancor. So the first run that was made in, by Rancor once we got over there and looked at their milling process and handling of the materials and made, and spotted problems, it was the first run that they ever made that was in spec. But to be careful, IBM careful, I got assigned, along with one of the people on the team, to be over there every time they made a run, from then until I retired. So I spent a lot of time then in Germany, and after I retired, Rancor offered me a consulting job, so I worked for Rancor for several years after that. Among other things.

Gardner: Got a few miles on your airline program.

Vranka: Right. So that essentially ended any formal work.

Gardner: So I'd like to back up a little bit and talk about the floppy disk media and the floppy disk drive activity here at Boulder. First of all, I was a little confused about the two different tape lines. Would you go back over?

Vranka: Well, when the Series 500 effort was made, the original tape was made on a 24-inch-wide coater, I think running at about 200 feet per minute, which was installed by Sony. It was truly a Sony coater.

Gardner: Sony line.

Vranka: They shipped over all the parts and it was set up over here. But in parallel, there was, in another room, there was a 48-inch coater that was installed that had higher capacity, of course, to produce more tape for half-inch tape. Now, the MSS tape that we developed was manufactured on the 24-inch line, and that was used until the end of the program.

Gardner: Now, the floppy disks--

Vranka: Floppy disk was done on the, I think, on the 48-inch line. The original material was to take the formula for standard half-inch tape, coat it on to 3 mil film for floppy disks, and then punch out disks. Now, in the process, the orienting magnets were turned off so that you minimize the longitudinal orientation of the iron oxide particles.

Gardner: So the 48-inch coating line would be adjusted for floppy disks to produce a different thickness of coating and not oriented and you would then produce a number of jumbos for that.

Vranka: Exactly. Right.

Gardner: In that mode.

Vranka: Right.

Gardner: And those jumbos then would be punched into disks.

Vranka: Floppy disks, right.

Gardner: And the same coating line would be reconfigured and same 48-inch would be used for half-inch MST tape

Vranka: Right, exactly.

Gardner: So we have this, and the 24-inch line is producing MSS tape.

Vranka: Right. There were other minor products, like for OPD, which was the original division, office products division in Lexington for their typewriter program. There were some typewriter products that use strips of magnetic tape to record images and so I think that was on even thicker substrate and that was manufactured here. Again, you adjust the line for those requirements and it was manufactured in Boulder.

Gardner: But then there's another, a newer, higher volume line?

Vranka: Yes. That I had ended up having responsibility for. It was a program called Inca, that line. So I had Inca for tape and then for photoconductor HPC1. One was a sterling success. The other not so

Gardner: And you never actually produced on Inca.

Vranka: Yes, we did, and we actually produced good half-inch tape, which performed well. But the decision was made at that time to get out of that business.

Gardner: And so no product was ever shipped.

Vranka: No product was ever shipped.

Gardner: And the same Inca line was used to produce diskettes for floppies but those also were never shipped

Vranka: They were never shipped either.

Gardner: Never shipped, but in IBM's terms, you got through product test … through C test?

Vranka: Some level of test. I can't recall.
<1:50:00>

Gardner: Some level of testing was done and you were prepared to go into production.

Vranka: Exactly. Yeah.

Gardner: And essentially a similar line, same high-speed technology, was then used, was also used, to produce--

Vranka: Pegasus.

Gardner: Pegasus?

Vranka: Well, not in Boulder but similar coating lines were installed in Tucson.

Gardner: I was going to say. You used to produce the printer to coat for printers?

Vranka: Oh, yeah. Oh, you mean for the photoconductor.

Gardner: For the photoconductors, right.

Vranka: Yeah. Yes.

Gardner: So we have three lines now?

Vranka: Yes.

Gardner: Okay. Two in Boulder.

Vranka: Yes.

Gardner: And then the Pegasus in--

Vranka: In Tucson. Yeah.

Gardner: So you got that whole series of developments that went through Boulder.

Vranka: Right.

Gardner: Ultimately. Resulting I think in probably the technology that's used today.

Vranka: It is. Yeah. It's the same technology as, which was then taken over by 3M down in Tucson. Yeah.

Gardner: But it's still spinning out tape as we speak.

Vranka: Is that true? That's still, the tape plant's still going now?

Gardner: I think it's still going on.

Vranka: Okay.

Gardner: But okay. So the photoconductor. Let me get my term right -- That was a successful line?

Vranka: Yes. Yes. That was a successful line and is still running now but it's owned by Lexmark. IBM spun off in the early '90s, the printer effort, and a new company was established, which eventually was named Lexmark, which now has been sold to the Chinese.

Gardner: Yes. So you talked a bit about a floppy disk drive.

Vranka: Yes, the four-inch.

Gardner: That would've been the 3.9-inch drive to be precise.

Vranka: Right.

Gardner: Was there production of other size floppy disk drives? IBM, of course, invented the eight-inch.

Vranka: And then the five and a quarter.

Gardner: Did IBM produce five and a quarter?

Vranka: Oh, yes.

Gardner: Floppy disk drives?

Vranka: Yeah, drives and tape, yeah.

Gardner: Here in Boulder?

Vranka: Here in Boulder.

Gardner: Okay. That's not generally known.

Vranka: Right. Now the drives at that time might've been in Rochester yet. I can't remember the exact transition for Rochester to Boulder for the drive side. But on future drives, which ended up being the 3.9-inch, you know, all the future stuff that we worked on, in which we adapted the Pegasus technology for the media for that, which was working quite well. At least on, during, the development phase. You know, it was all done here. Everything came together into Boulder in the early and mid-'80s for that.

Gardner: Mm-hm. You said they had an automated assembly line for that drive?

Vranka: Yes, they did.

Gardner: Built here in Boulder.

Vranka: Yes. Spent about 20, 25 million dollars it setting up.

Gardner: Is that the drive line or tape line?

Vranka: The drive line.

Gardner: And the tape line was another investment.

Vranka: Right, another investment.

Gardner: Okay. Very good. Is there anything more you like to share with us about the printing side of your career from-- and you talked a little bit about going to Germany to work on the supplies.

Vranka: Supplies for the electro-erosion printer.

Gardner: And your consulting business afterwards?

Vranka: So right after I retired, not only was I traveling to Germany to work for Rancor Corporation but I got a call from IBM Federal Systems Division to work at least part-time for them for several years on a Air Force project that was being developed here, -- I can't remember the code name, but it was a 14-wheeler, a semi-trailer tractor that was, whose sides of the trailer part were high gain antennas and inside it was jammed full of telecommunications and computer systems and I think we built about half a dozen of them, which in the case of nuclear war, could rove around the country and provide the Air Force communications and computing power, and it was a strange system in there.

The memory system and computer were, because you didn't want any volatility of your information, were still the old core memories. I couldn't believe it -- they were made in Taiwan, I think -- but any event, the data storage system used a tape cartridge specifically designed for a new tape drive which was developed by a military contractor in the West Coast. There were some problems with the tape and I got involved in that for a while with IBM for several years. So I had that job going, plus Rancor's job. Now, Rancor is a old-time company founded in about 1900 in Rur Valley. Not the R-U-H-R but the R-U-R, which is another river which was, along which there were many paper mills, and as a result, Rancor was founded to do, like, blueprint paper and all kinds of materials to make coatings on paper and other substrates. They were a small company, had an interesting philosophy. They stocked about 10,000 different items of recording, types of recording paper. You name it -- all sorts of paper and they had a number of coating lines there and had a lot of development activity -- all the way from coating all these printer type materials to making Christmas wrapping paper.

For example, the electro-erosion printer material which we made. We coated a base coat in Durham, Germany, and then shipped the rolls to Freiberg, Germany, where Rancor had these huge evaporators to apply the aluminized layer. Well, those also were used to make Christmas wrapping on various types of substrate. So, you know, they had a big variety of products and then, like, on the electro-erosion material after aluminization, then the rolls were shipped back to several hundred miles north to Durham to apply a graphite-filled coating for wear resistance on the electro-erosion materials for IBM. So I had that going and then about 1989, I was contacted by old friends from Tucson to work for a company called Sunshine International, a Chinese company that was trying to get a contract with the Chinese government to make magnetic particles and magnetic tape in Guangzhou, China. So were several trips there, and I was made the magnetic recording physicist specialist. <laughs> The guy that worked on formulation was a former Graham Tape guy, and so essentially we developed a process to make iron oxide here in Boulder with a laboratory in Mead, Colorado, called Boulder Scientific Corporation, because originally they had been located in Boulder and moved across the county line where they could get away with working with a lot of the materials that they worked with to produce iron oxide and then on taking the iron oxide and making tape, this guy from Graham provided the formulation which was based on the favorite magnetic particle for disk and which also Graham used in magnetic tape. This Pfizer 2 cubed 8 material, which was a very elegant iron oxide product and had properties comparable to CrO_2 in many ways.

Gardner: Really?

Vranka: Yeah. It was a narrower distribution of sizes and it was also much more sicular [ph?]. Had aspects ratio approaching those of CrO_2. Any event, we released all this information and designed all these processes, turned it over to the Chinese, and they walked away. <laughs> But I had no involvement with those negotiations. The principle on our side for Sunshine International was a former IBM employee, Jiaqiang Xu[5] [ph?], who had been prosecuted by IBM for supposedly, when he worked for IBM, transferred confidential information to the Chinese. Now, I don't know whether he did or not, you know, but… Yeah.

Gardner: Yeah. But by this time, IBM is sort of not in the tape business.

Vranka: Right. They could care less. Yeah.

Gardner: You would think they would encourage the development of a superior product rather than the opposite -- but you never know.

Vranka: I mean, I got paid as a consultant, but Jan Kai Quo never got the big bucks that he was hoping to get from the Chinese.

Gardner: So at this point I'd like to ask, you know, in the 26 years at IBM, 30 or 40 years' experience in the particles and coating and the physical chemistry of things on substrates what do you think were the most impressive inventions in tape recording?

Vranka: As far as my personal involvement or…

Gardner: No. your have a broad view of the industry.

Vranka: Right. Well, I think the MSS was an accomplishment, the tape, and things we did there, and…

Gardner: And the key there, of course, was the formulation, right?

Vranka: Right. Formulations.

Gardner: And the particle was iron oxide, there was no particle invention, so really the accomplishments were in the binder?

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[5] Spelling based upon:"Ex-IBM Employee Sentenced for Stealing Secrets for China" https://americansecuritytoday.com/ex-ibm-employee-sentenced-stealing-secrets-china/

Vranka: The binder, right, in that work, and now, I personally didn't develop that. I had the Ph.D. chemist Don Jeanie [ph?], who had worked for 3M and who we hired in late '60s, was the principle architect of that system. But I was involved in the management of it and test it and so forth.

Gardner: Any others?

Vranka: And the Pegasus program. You know, the early Pegasus program.

Gardner: It went through four generations. I think the third generation, they shipped several million cartridges and recalled them all.

Vranka: I didn't know that.

Gardner: Yeah. The third generation had some serious life programs and basically they had to literally recall all of the cartridges or let them be recalled and replace it with a fourth generation formulation, I think has carried through well into this century, and so that was, as I heard from Tucson folks…

Vranka: Primarily Ric, right?

Gardner: Andy.

Vranka: Andy Gaudet?

Gardner: Yes. and John Toole. There was a consensus, I think, amongst the eight people that I interviewed, that what ultimately evolved into the 3480 cartridge then was carried into the, was really a technical accomplishment that was also a business accomplishment.

Vranka: Right.

Gardner: And that would be, started, with Stallion. Went four generations. The third was the one that shipped and the was recalled. It's all there in the transcripts.[6]

Vranka: Okay. Okay. Well, Sonoita was a follow on.

[6] The four generations as defined by Tucson were Stallion, Mustang, Pegasus and Sonoita.
Source: "IBM Tape History – Session 1: Tape Media," Computer History Museum, 2015

Gardner: Sonoita, that's the last one.

Vranka: Yeah. Follow-up. Was that recalled?

Gardner: No. Sonoita, the final one is still there today.

Vranka: Okay.

…

Gardner: How about looking forward? Where do you think tape is going or…

Vranka: I haven't kept up, actually, Tom. Yeah. Just to finish the story, I then, in the early '90s,
<2:05:00>
I worked for Lexmark Corporation as a paper engineer, of all things, but that was to support Inkjet printing, because we purchased our paper initially from Canon Corporation.

In order to improve the images, they coated an aluminum type coating onto paper, so I became heavily involved in that and then eventually we changed sources to Rexam [Graphics] and I was involved in the--Rexam had a big paper coating line out in Portland, Oregon, so I spent a lot of time in Portland watching them produce our paper coated with Inject coating material on that. So I worked for several years on that, plus got involved in some substrate problems that were involved in photoconductor coatings and also worked on new charge control agents. These are chemicals that are applied to toner to improve their electrophotographic properties. They're complex organic materials.

So after that then a guy I'd worked with at IBM in tape started a startup company to produce a large-scale, multi-colored printer based on liquid toner systems using silicon oil as the base material. All copiers and printers used solid toner, and there was a, there is a commercial system which was developed in Israel using liquid toners where the toner particles are milled and then put into petrochemical materials, oils, essentially, to make a liquid toner. Now, the reason for this is you get very vivid colors and very high density printing, and that big printer system was bought by HP and it's marketed and sold by HP. So the system we were working on would be competitive to that, and we did get funding and did develop the inks and patented some of the formulations but we were able to produce images. We modified an offset printer and met some of the requirements, but we never quite got over the hill. Still had problems with some of the ink systems and so the program was essentially ended and went out of business in the early 2000s, and then I ended up with colon cancer and that kind of ended that, and so I haven't worked since my bout with colon cancer in 2005.

Gardner: Looks like you're a survivor, right?

Vranka: Twelve years now.

Gardner: So that raises a recollection which has nothing to do with what we started with, but I'd be curious. I remember when paper had a good side and a bad side, and now paper doesn't have a good side and a bad side. Is that a result of the coating type of work that you're talking about?

Vranka: I don't think so. I mean, paper is made, you know, it's a huge industry -- to watch a paper machine is unbelievable. I mean, they move paper at a thousand feet per minute or so.

Gardner: But somehow, it's the paper for copiers or paper for printers, used to have a good side with even arrows on the labels.

Vranka: Yeah. Well, for specific applications, like with Inkjet, in order to accept that ink and get the best resolution and color reproduction, you do need to put a special coating on, and so the paper--

Gardner: They must coat both sides.

Vranka: No. We generally at least were, on the Inkjet printers that IBM and then Lexmark made, we coated only one side.

Gardner: Paper used to have an arrow pointing to the good side.

Vranka: Right. Right.

Gardner: But it doesn't have it anymore, so…

Vranka: Right. Well, a standard paper doesn't have a good or bad side anymore.

Gardner: No, so…

Vranka: But, I mean, the uncoated paper.

Gardner: So I should buy, to the extent I have Inkjet printer, I should look for coated paper with arrows so I get the best product.

Gardner: But you worked on coating the paper and it was single-side coating.

Vranka: It was single-side coating, yeah.

Gardner: All right. So anything else you'd like to discuss, talk about or share with us?

Vranka: I can't recall at this time.

Gardner: Okay. And I'd like to thank you very much from Computer History Museum and my, personally, for taking the time to help us understand how some of these things evolved. Thank you very much.

Vranka: Oh, you're welcome, Tom. It's been good talking to you and meeting you.

END OF THE INTERVIEW

