Oral History of Ralph Baer

Interviewed by:
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Recorded: October 12, 2006; November 27, 2006
Manchester, New Hampshire

CHM Reference number: X3775.2007

Session 1: October 12, 2006

Gardner Hendrie: [October 12, 2006] Today it is our pleasure to have Ralph Baer doing an oral history for the Computer History Museum. Thank you very much, Ralph, for agreeing to do this.

Ralph Baer: You're entirely welcome.

Hendrie: I think we would like to start with, if you could share with us a little bit of your family background, where you were born, what your parents did, any siblings you had, a little bit of background of your very early life.

Baer: Oh, sure. I had the misfortune of being born into a horrendous situation. It's 1922. It's Germany, Western Germany, near the Alsace-Lorraine borders in southwestern Germany. I was born in Pirmasens. Pirmasens is the shoe town of Germany. When I was born, it was still occupied by Moroccan troops, French Moroccan troops, with the officers taking all the better apartments, and the troops stationed at people's houses. Food was short. Everything was in short supply. The town was half destroyed. And that's the mess I was born into. I lived there for a year and a half. My sister was born there, too. Then my father, actually at my mothers' urging, moved us out of the small town of Pirmasens to Cologne, where I grew up. Didn't leave Cologne until I was 16 in 1938, when the Nazis made life miserable for anyone of Jewish extraction. We were fortunate enough to get out in August. In November, Kristallnacht took place. We didn't even know how bad things were going to be. Fortunately, we had a large number of American relatives in New York who provided the affidavits. Going to Stuttgart in 1938 and meeting the American consul, and talking to him in English -- we all spoke pretty good English -- I think helped get us on the quota, which was miniscule. If it hadn't happened, I'd be dead by now. Most of the family on my father's side did not make it. They all wound up in the concentration camps. In any event, I grew up in a perfectly normal way, but at age 14 I was thrown out of school. The Nazis threw all Jewish students out of school. I had to go to work. For the next years I worked in an office doing typing, shorthand -- at age 14! -- typing, shorthand, in two languages, collecting money from bars because they were importing wine and bottling the wine, and distributing the wine to places like bars. They sent a 14, 15-year-old kid into the bars to collect money from the bartenders. Some of the patrons in there were somewhat less than nice.

Hendrie: What year was this?

Baer: 1938 minus two and a half -- 1935 roughly.

Hendrie: 1935. Ok. What did your parents do?

Baer: My father had a leather tannery in Pirmasens, supplying all his friends who now ran the shoe factories after the war, having taken over from their parents, with leather. But by 1923,

1924, inflation started to rage and everybody went bankrupt, including my father, who was said to be the only guy in this town of Pirmasens to have two cars, which I assume meant one was a truck for delivery of leather to his friends. Incidentally, all these friends, including my father, had been in World War I for four years. My father was wounded twice, once on the Western Front, once on the Eastern Front. All those medals, and the (Pour-le-Merit) Kreuz, all that did not mean anything when Hitler came into power. In any event, I was out of school at age 14. Had to work. I wanted to be a plumber, and I interviewed with a plumber. He asked me whether I was willing to put my hand into you-know-what. I said "yes", but I didn't get the job. I was not Aryan enough. Stay with that subject for a second. How is it possible to take a country like Germany that was well in advance of everybody else in terms of technology, science, culture -- how is possible to screw up the heads of virtually everyone in a country of that type and of that size inside of three or four years, with propaganda? How do you convince people that they belong to some Aryan race which had descended from the Vikings or some fantastic thing like that, and are superior to everybody else, and therefore deserve to run the world? All it takes is loudspeakers in every storefront, and Goebbels on the speaker every day of the week, and inside of three years you turn everybody's head around, especially those who are less sophisticated and the underdogs in the country who need their egos bolstered a priori. So we had to get out of there, and we did in 1938.

Came to New York. I'm 16 now, and I go to work in a factory of one of my cousins. And the factory - still not in any way associated with electronics, which didn't exist in those terms anyhow. That term was created about that time, late 1930s. We don't know by whom, but there was a magazine called "Electronics" published by McGraw-Hill. That is how they spread the name around. But before that, it was radio or it was television, and electronics was not a common term. In any event, I am riding the subway one day to work and someone across the aisle from me is reading a magazine. On the back of the magazine is an ad by National Radio Institute in Washington, D.C., "Make big money in radio and television servicing." I guess some bell went off inside of me -- that was me. I subscribed immediately, and I paid about a buck and a quarter out of my $12 a week wages to take this course. When I finished the course, I took the advanced course, and the moment that was done and I graduated, I quit the company. Got myself a job as a serviceman in a radio store on Lexington Avenue between 78th and 79th Street. The two guys who ran it did nothing. I did all the pickup, all the delivery, all the servicing. I learned the hard way how to fix sets.

Hendrie: Ok. I don't mean to interrupt you but I need to go back and understand a little bit more about your education, when you were still in school in Germany. How did you learn more than one language? Was that taught in school, or was it your parents?

Baer: No. It was part of the standard curriculum to start a second language in the 5th grade. Actually we called 5th through 12th grade "high school". The first language I chose because I went to a *Oberrealschule*. There were two types of schools, an *Oberrealschule*, and a *Gymnasium*. If you wanted to become a lawyer or a doctor you went to the gymnasium because they taught Latin as a basic language. Every doctor had to learn Latin in those days. I went to the *Oberrealschule* and started in French. Took four years of French before they threw me out of school. In the last year, we started English. After that I got some English instruction, as well as my sister, from a little British lady who taught us English after hours in the evening. But most of my English I learned by reading books. I read "Tarzan." I would write the

transliteration of words which I didn't know in pencil between the lines. Learning English was just a sort of natural thing. It didn't take more than a few months and I mastered that language. Also, apparently I have the kind of the ear that can listen and hear what things sound like, which makes it possible to reproduce it. You take a guy like Kissinger. I'll bet you dollars to donuts he's tone deaf. He can't hear how things are pronounced, and – presto digito - he can't reproduce it. So he never loses his accent. I didn't have that trouble.

Hendrie: Ok. Was there any math or science taught in the school you went to?

Baer: Well, in the 8th grade, I think we went as far as early geometry, and that was it. But part of the radio servicing course had some elementary math to it. And once I was in the service business, I started teaching myself from correspondence courses, which went on all through my servicing time. That lasted until 1943 when I got drafted and spent the next three years in the Army.

Hendrie: Ok. I just wanted to go back a little bit about the education. Tell me a little bit more about the servicing job. What was there to service in this time? This is before World War II.

Baer: Well, it may be hard to remember, but of course we're back in the vacuum tube days when radios and early television sets, like early RCA 9-inch and 12-inch TRK9s, TRK12s, were full of vacuum tubes and full of just discrete components. They were always breaking down. Condensers -- capacitors were called condensers then -- condensers would always short out. Resistors would change values. Tubes would burn out. Especially in my location on Lexington Avenue and 78th Street, [which] had a peculiar situation in that that whole area around me had 110 volt DC left over from an ancient Edison power plant. So when people moved into the neighborhood and plugged in their AC sets, which had a power transformer in it and its power supply, they would burn up the power transformer. Here was that huge stench of burning tar, so that when they came through the door of my shop, opened the door and walked in with the set in hand, I already knew what I was going to do. Namely, convert the sets from AC to AC/DC operation, which required changing all the tubes from 6-volt tubes to 24- and 25-volt tubes and 12-volt tubes, stringing all the filaments in series instead of in parallel, changing output transformers to the speaker because there was always a very poor match through the new output tube, and a whole bunch of other little changes. But after awhile, I could do that in an hour, an hour and a half. In fact, the first thing I did when I got into the Army is write a story -- I still have the original -- on how to convert sets from AC to AC/DC, something that probably no more than three people in the world today know anything about, or have the slightest idea about. I will tell you another story similar to that a little later when we get to my college days. If I don't, remind me of it.

In any event, there was a problem, though. People simple didn't want to pay for labor. It was like labor was not worth anything. So we were constrained to doing hokey things like taking tubes out, shining them up, and selling them tubes, when what we really did was replace a capacitor someplace, which required skill and knowledge of how to find the darn thing, how to take it out, how to solder a new one in there, make it all work. They wouldn't pay for that, right? But they would pay for the vacuum tube. That was fine. Every once in a while I would go to

customers homes and service sets right there on the floor, especially if they were large and a big pain to carry. No car in those days. You walked with a tool box in one hand, a chassis in the other hand, a loud speaker hanging from two fingers . Every once in a while I would get on a bus when it was too far with all this stuff hanging from my hands. How I paid for the fare I do not know. Must have put it all down on the ground, but that's what you do when you're young. I was 18, 19, 20. In any event, one day I'm in someone's house and I'm on the floor, and the man of the house looks over my shoulders, which I hated. He had just read an article in a magazine that had published a series of articles to the effect of "Watch out, or the XYZ will gyp you". Well, XYZ that week was a radio serviceman. The week before it was a car repairman. So he is looking over my shoulder, and he says something to the effect of "why is a nice Jewish boy like you in a racket like this?" Well, I was very offended, because I considered myself a professional technician, which I was. In those days servicing also involved installing antennas, because an ordinary radio wouldn't work unless it had an antenna. In most cases, in a place like New York City downtown, you could dangle a piece of wire from the radio. That was enough to pick most of the broadcast stations. But when it came to FM -- FM started in about 1940 or 1941 when Major Armstrong, who invented FM modulation technology, built a transmitter, W2XMN, in the Palisades on the other side of the George Washington Bridge on the New Jersey side, and broadcast mostly high fidelity music on that station. FM sets required an antenna on the roof, because otherwise you couldn't pick up the signal, just as television sets a few years later. So I would be up there on the roof, on virtually every roof between about 85th Street and 65th Street. Every once in a while people would chase me off the roof because some roofs had penthouses. People would be looking out the window and see this guy crawling on the roof, and they didn't like that. Didn't want their privacy invaded. You asked me, what did you do? You actually took parts out of radios, television sets, and replaced them. Nowadays when you look into a television set, there is a small board in there with four or five integrated circuits that have 64 leads coming out, with hundreds of thousands of transistors on each of those chips. You don't service anything. You just throw the damn thing away.

Hendrie: Yep. So what happens next in your career?

Baer: Well, what happened next is what happened to everybody who could still walk and breathe in 1943. I got drafted. I'm first off to Fort Dix. I thought I would get shipped to Fort Monmouth, which was the Signal Corps headquarters, because here I am, I am a radio man and I want to work on radios. But that is not how the Army works, you know. The Army wants to make sure that radiomen become cooks, cooks become truck drivers, and truck drivers become medics, so they can teach them to do things their way, right? Next thing I know I was in the combat engineers, with all the other 6'2" and 6'4" Georgians, and Louisiana types, whose accents I couldn't manage. And who also had a fair amount -- there was also a fair amount of anti-Semitism in the ranks. Yes, it was a different world. And I was busy laying mines and booby traps, or making areas safe from mines and booby traps, building Bailey bridges, pulling tanks out of ditches that they couldn't get out of.

Hendrie: Now you learned how to do this.

Baer: I learned how to do this in the combat engineers.

Hendrie: Yes. Now were you assigned overseas, or what did you do?

Baer: No.

Hendrie: This is just the training where you are learning how to do all this.

Baer: In about the second month of basic training, I am up to my neck in water, building a Bailey bridge. They called me out. I had to get in the back of a truck, go to the company sergeant. Get new orders. I'm off to Camp Ritchie, Maryland. Where the hell is Maryland? I didn't know that. Camp Ritchie, I knew less. Turns out Camp Ritchie is full of non-native, non-Americans, all of whom have language qualifications. I spoke German, of course. A lot of the guys were Italian, and remember the North African-Italian affair -- war -- was very much in progress then. So we all were trained as interrogators of prisoners of war. We all had to learn the order of battle of every damn army in the world. Which means that you have to know the organization from a squad on up -- through the company level, the battalion level, through the corps level, through the army level -- of every cotton-picking army in the world whom you might encounter on the battlefield. So that when you interrogate a prisoner, you can make some intelligent guesses as to what his rank is, where he might have been, and so on and so forth. Well, to make a long story short, when you graduated in Ritchie… Drew Pearson, who was a muckraking journalist of I forgot which major newspaper in New York, wrote an article showing that the officers in Camp Ritchie, Maryland, were building themselves an officers club using GI labor, which was a no-no, of course. And therefore the natural thing happened. All the GIs got shipped overseas, and the officers stayed behind.

So next thing I know is I am on a British freighter, the *Mataroa*, going overseas, zigzagging in a convoy, two and a half weeks to Liverpool. I had latrine duty, which meant, on this little ship with its rocking cement floor, picking up little brown papers marked HMS, His Majesty's Ship, from a cement floor with my fingernails, which I didn't have many of, while the ship is rocking back and forth and while the guns are going off up there, probably for practice, but we never knew. Other than that, it was a pretty uneventful trip. By that time, I think, we had the submarine danger pretty much under control. The destroyers knew how to take care of them. We get to Liverpool, which looked pretty good.

From there I went to a camp, actually went down to the Salisbury Plain, which is a large area in southwestern England, that has been traditionally an army training ground even before World War II, since World War I. We had lots of American troops there. They were staging troops there in advance of the invasion of Normandy in June. This is the previous year, September, October, November. When we got there -- we being the small group of MIs, about 25 of us -- we stuck together in this freighter, the *Mataroa*, and we fell out together, and we exercised as a group. We did the usual close order drill for a couple of days. When they asked us, "Who the hell are you", we said "We're the MIs". Ok, we're the MIs. Nobody questioned what we're doing.

All this comes under the heading of chutzpah. You know what chutzpah is? Lots of nerve. Our great leader was a PFC, who had been an officer in the Hungarian – no, where did he come

from? -- the Viennese Army, the Austrian Army. He knew the ropes. He went to the camp commandant, along with a couple of us, and we sold the camp commandant on making us cadre, and teaching the troops intelligence subjects like recognizing uniforms, interrogating enemy soldiers, handling their weapons, recognizing their weapons, handling them, firing the weapons, recognizing aircraft, running messages -- all manner of subjects. I had forgotten, but I found recently all the documents that were the basis of the syllabus that we taught. I wrote this stuff. It's on onionskin paper, and it's on mimeograph paper. It's about ready to fall apart. I am going to send this to the Smithsonian. They already have a large collection of my wartime papers. Little by little we collected weapons so we can teach them how to handle the weapons. Where did the weapons come from? They came with the British troops out of North Africa. As the troops got repatriated, they came home and they brought with them all kinds of stuff. Besides, there were weapons all over the place in the Salisbury Plain.

Before you knew it, I had a museum full of stuff. The museum was a large arch-type building in which the British horse artillery used to train indoors, pulling 105 (cm) canons in the winter, when the mud in England is so deep you can't possibly pull a canon anywhere. And I had this whole place to myself. In it we had an 88 left over from the Spanish Civil War, and a 105 howitzer, and a half-track truck, and a tracked motorcycle with a 30mm MG-30 antiaircraft machinegun on it. I had a whole bunch of hand weapons, pistols, rifles, German, some machineguns. The next thing I knew I am studying manuals in German, English, Spanish, French -- whatever I could find, on these weapons. So I become a self-taught minor expert in weapons. British individuals, collectors of weapons, hear about us, and they come into camp. It wasn't like today. They weren't fenced. They just walked in. That is wartime. I show them my stuff, and the next thing I know is I'm trading guns with these guys. I get more and more involved in this gun business.

I start writing a book on the history of machineguns, because I have these British individuals who have been in the trade for decades, some of them. They were twice my age, and I used to sit at their feet like sitting at the feet of some Greek oracle, and listen to all their tales of who did what, who did what to whom, which is reflected in the book I wrote which is in the Smithsonian now. It never got published. One spread-out sheet looks like a radio engineer drew it. It is a schematic that shows the relationship between a machine gun developed in, say, Austria in 1904, to one that was developed in Germany in 1902. I knew that the bolt action of this gun was copied by this guy. It's all there in connecting lines. If anybody's going to look at it, I have no idea. One of the problems with the material I gave the Smithsonian on my weapons, is that they lost their expert in small arms five or six years ago. He died, and they haven't been able to replace him with anybody. I was kind of disappointed because I was hoping to be able to talk to somebody about all this stuff I donated, which was part of me for three years. I was really into this stuff. Not only do I collect weapons from all over the place, but I send my Austrian great leader -- whom they had made a first lieutenant by this time, because it got embarrassing to have us teach the general staff of two armored divisions that were coming through, and we were all privates, PFCs. They made him a first lieutenant. I asked him to go to Germany and Europe and Austria and other places, along with another guy, and collect weapons that were missing in my collection.

Meanwhile I had moved to Le Vesinet, which is a suburb of Paris. I had a whole building to myself that was once a sanitarium, which had become Eisenhower's French headquarters,

because the war was over by that time. We're now into 1946. I skipped a lot of the stuff. Here is this huge place with balustraded staircases made of marble and its ceilings 15 feet high, with coffered ceilings and fancy artwork on the ceilings. And we got machineguns in one room, and we have sub-machineguns in another room. We have anti-tank weapons in another room. We have handguns still in another room. It's just another guy and I. We are taking every one of the guns apart, cleaning them, and running them through a motorized wire brush, which is the only mechanical tool we have. Mostly elbow grease. And putting three exhibits together which eventually got crated in an ordinance depot full of German prisoners, who were happy as hell to see me coming because I had all this interesting stuff. They had spent the last two years shipping two and a half ton truck rear axle crates, rear axles, from one end of the camp to the other end of the camp. They had built wooden boxes made out of wood lumber shipped in from Germany, crated the two and a half ton rear axles, shipped them back to the front end of the camp, where they tore the boxes apart, took the axles out, and shipped them back to the back end of the camp. So the German prisoners were happy as hell to see somebody come in with a load of stuff that needed to be packed where every piece was different.

Hendrie: Yes, ok.

Baer: I had no problem communicating with those guys, anyhow.

Hendrie: So you basically worked on the small arms weapons and training and things like that the whole war.

Baer: The whole war. The only time I was in any kind of danger was, first, in England. When we were training troops, I put on a German uniform. Another guy did the same thing. I was carrying the base plate of a 50mm German mortar, and the other guy was carrying the barrel. We were running through the British woods and some troops are chasing us, right? It was all an exercise, of course, but someone saw us from a passing train, and they chased the home guard after us. [Laughs] That was kind of wild. Another time in Normandy, where we had set up another camp to teach troops, I am sitting… I acquired this arboratorium, big glass house. We were in a place that had been a Vanderbilt estate before the war, and I am living in this chateau. I have this glass house for my museum. I'm outside sitting on the grass, fixing a typewriter, when the ammo dump the Germans had left on the hill behind us went up in flames. It was Hitler's birthday. Somebody sabotaged it. For the next few days stuff started coming through the air. Things like the tailpipes of German rockets that were fired from wooden crates would come through the air, and one buried itself right next to me. That is when I retired indoors, which was not much help because it was all glass.

One day a captain or colonel came in, and I showed him around the museum. I heard something coming in, and so I hit the ground behind one of the tables. And he, this idiot, he just stood there, right? When I got up I felt like saying, "You know, that was pretty stupid, colonel", but kept my mouth shut. Which reminds me, when the war was over in Germany, I get an assignment. What's my assignment? Teach artillery officers, for redeployment to Japan, in recognition and characteristics of Japanese artillery. What on earth did I know about Japanese artillery? So I studied handbooks on Japanese artillery. But my problem was: I knew French

artillery, I knew Italian artillery pieces, I knew Czech artillery pieces. I didn't know a damn thing about US artillery pieces. So in class I am always comparing the Japanese stuff with French or Czech. One officer walks up to me after class and he says, "Are you in the habit of comparing unknowns with unknowns?" I said, "Yeah. I can't help it. Sorry. I don't know a damn thing about US weapons." A funny scene.

In any event, we packed up all our weapons. It was something like 110 crates, about 18 tons of this stuff. Took it to Le Havre, which was still in horrible shape. That port was all torn up. Only about one or two piers were in working order. Loaded it all on the Liberty Ship. Once it was all loaded, I went in to inspect it. I couldn't find it. Those ships are so cavernous, even this huge collection of boxes just sort of disappeared in one corner. You could hardly see it. Then we spent ten days -- maybe it was nine days, eight to nine days -- going through the North Atlantic in a January storm. With the ship doing the usual thing, you know, climbing up on the bow wave and then -- wooooomp! -- coming down like a rock. Down below we were stacked about four high. You can imagine that the barrels that were at the end of each row of bunks were full of you-know-what. I couldn't stand that, so I spent the entire trip laying on a tarp outdoors, all wrapped up in GI blankets. When we got to New York it was kind of strange, because the war was over. It was January of 1946. Everybody had been home for months. I was very late coming home. Most of the guys go off the ship. I am still there attending to getting all those weapons transferred to the Brooklyn Army Yard. I walk off the boat, and after three years in the Army and three years of war, there is nobody there. There ain't no trumpets. There's no fanfare. There's nothing. I just walk off and I walk into the street just like -- back in New York where my folks lived as before. It was kind of a deflating experience.

It took awhile before they told us where to go. We got on trains and took all these weapons to a place in Massachusetts, actually in Worcester, I think. That was the third, the lowest grade exhibit. The second exhibit went to Aberdeen Proving Grounds, where it supplemented an existing exhibit of small arms, which kind of disgusted me. Because walking around in the storerooms there were all these bins full of parts, like a bolt action from a rifle, and a stock of something else, but half the stuff was mislabeled. I knew all that stuff like I knew the back of my hand. I could disassemble every one of those weapons in the dark behind my back. Anyway, the major exhibit went to Fort Riley, Kansas, which was military intelligence headquarters in those days. That exhibit remained the official military small arms exhibit for about 20 years. Then some officers robbed it blind. It doesn't exist anymore, which is kind of a shame.

Hendrie: Wow.

Baer: Yeah. That's life. In any event, they asked me to stay in the Army, stay with the weapons. But I had had enough. I worked briefly in a factory at Emerson Radio in Brooklyn.

Hendrie: When did you leave the Army?

Baer: In March of 1946, long after everybody was home. The war in Japan was over in the fall of 1945. Much earlier than that the war was over in Europe.

Hendrie: So you decided you had to get a job.

Baer: I had to get a job, so the first job I got was...

Hendrie: Now, you weren't married or anything at this time?

Baer: No. I am now 24. 21 when I get drafted, 24 when I leave. Never been in a school in the United States anywhere. I was self-taught.

Hendrie: And that correspondence course that you take.

Baer: Yeah. In fact, Algebra Two sort of saved my life. I'm in England. It's before D-Day. I'm sitting in the mud, and the mud was a foot deep. We had duck boards laid out all over camp, because if you didn't walk on those you would sink in a foot of mud. I'm sitting out there, studying Algebra Two, from a USAFI -- United States Armed Forces Institute -- correspondence course. And I wake up in the morning, blood all over the place. Pneumonia, right? So I go off to some British hospital north of there, and the other poor bastards go you know where: Normandy.

Hendrie: Oh, wow.

Baer: So Algebra Two saved my derriere, there's no question about that.

Hendrie: I see.

Baer: I've been very lucky all my life. I always said, those scrapes, somebody somewhere had me on a different program. <Laughs>

Hendrie: That's good.

Baer: I didn't have to check out. So I'm now 24. I'm in New York. I need a job. There's Emerson Radio across the 59th Street Bridge in Astoria, on the Queen's side. People forget, in those days we made radios and television sets in the United States. Japan was still making cheap sheet metal toys, which we bought. We had Emerson. We had RCA making television sets and radios. We had General Electric, Motorola, Sylvania. They were all in the radio and television, and phonograph records, record changer business in those days. My job at the factory was to fix the sets that came off the production line that didn't work, which was just about all of them. But that was pretty boring because once you knew what to do, it was a routine job. I quit after about three months. I figured I had to get some training. I went to every school in New York, but I had no credentials. I couldn't even get my high school records because they got lost. We bombed the crap out of Cologne, where I went to school, although

the school was still there. I went back to Germany just this past June, and there's my old school still very much there, and it is still very much the same kind of school. I walked in and out again. It looked exactly like it looked back in the late '20s and early '30s. In any event, how was I going to get into school? I interviewed with a guy like Professor Giordano, who later became a great light in the microwave heavens at Brooklyn Polytech. They were all very sympathetic, but there was nothing they could do. The schools were brim full with GIs.

Hendrie: Right, all on the GI Bill.

Baer: All on the GI Bill. Then I saw an ad for this small school in Chicago, American Television Lab of Technology. So I decided to get on a train. Who flew in those days? Nobody flew, because it was too expensive. Got on a train. Went to Chicago. Interviewed. Liked what I saw. Besides, what choice did I have? Signed up. They gave me an entrance exam. I skipped the first year. I mean, I knew all that stuff. I had all the basic math that was required for the first year. Taught myself. I'd been working on radios and televisions, because I had been building stuff, designing stuff. Every technician eventually winds up being a minor engineer, and if he gets the chance he can become a full fledged engineer without ever seeing the inside of a college. So I skipped the first year, and inside of two and a quarter years, I'm done. In the meantime, they get accredited, so I wind up with a legitimate BS in Television Engineering, the first time that kind of degree was given.

While I was there, one of the directors of the school was Lee DeForest. Dr. DeForest, of course, is the guy who put the grid, the control electrode, in the vacuum tube in 1904. One day I get called into his office. Here is this great man, right? I'm, what, a 25, 26-year-old student. He wants me to work for him. What does he want to do? He wants to go back into the diathermy business. Nobody knows what diathermy is. In the '50s and '60s, and before World War II, many doctors had what amounts to a 100-watt type, one megahertz, two megahertz type transmitter which could feed its power into either an induction coil, or a couple of pads that you put on a patient's chest or arms or shoulder to produce internal body heating, which increases the blood flow and therefore helps stimulate healing. Of course, no doctor today can afford to do that. In the first place, they are scared of the stuff. And in the second place, you get 15 minutes with a doctor, especially if you are a Medicare patient, he ain't got time to take care of patients who have to sit in a machine for half an hour or 45 minutes. That's out of the question. Anyhow, he wanted to go back into that business, but nothing came of that. But while I was there, he took me into his lab and showed me a mechanical color television system he was working on. It consisted of a plate in front of this 10-inch black and white television.

Hendrie: Could I interrupt you for just a second, and we will pick up with that description of what it is.

<tape change>

Baer: Back to the DeForest thing. DeForest takes me to this private lab and shows me a mechanical color television system he is working on. There is no color television in the United States yet, shortly after the war, in 1947 or 1948. What his system consisted of was a

stationary plate about 10 inches in diameter mounted in front of a 10-inch black and white monitor, and another plate the same size which would rotate through very small dimension. The rotating plate had three triad holes with RGB, red, green, blue filters in them, and clear across the plate. The stationary plate had a stationary hole, of course. So what you were looking at was a picture that was broken down -- if you want to call it a hole a pixel -- into pixels along horizontal lines, which were serially converted to color pixels by virtually that little plate moving through a very small motion, with that plate counterweighted so that it was very easy to drive with a very small motor. Very creative idea, but I knew instantly it wasn't going to fly because I could see that the light transmission was so bad. The percentage of light coming through from the CRT to the front through these little holes was not enough to make a nice, bright picture.

But that is beside the point. See, I was really part of history, you know, looking at this stuff. Sequel. This is 1948. It is almost 60 years later. I am surfing the web. I go into the website of my school, and especially the guy who ran it, Ulysses A. Sanabria, who was a very well known character. He was the major producer of cathode ray tubes for the Army all through the war in the very place where my school was. I had no idea when I went to school that that was a CRT manufacturing place, which grew into a school for teaching radar technicians during the war, and then became this institute I attended. Nobody told us this. I didn't know. I find it out 60 years later by going to the web. And there is a picture on this website of DeForest sitting there next to a tech, another guy I did not recognize, with the color scanner.

Hendrie: With his scheme for the color television.

Baer: In front of the black and white television set. And another guy standing behind a long piece of equipment which clearly was a camera with probably a rotating disc in front of it, to feed this thing pictures. Here's this historical picture. I'll bet you dollars to donuts there aren't three people on earth who know what that picture is all about. So I wrote a little story and put it on the website, an archival television type website. It shows all kinds of ancient television sets, some of which I serviced in 1939, 1940.

Hendrie: So you're at this school. Now what happens next?

Baer: I graduate. So what do I do now? I had promised a guy who was an alumni, at the Alumni Association of National Radio Institute, before the war where I was, … the chief honcho. I was about half of the age of the other guys. I was always up there on the board showing them how FM works and other stuff. Anyhow, this guy had a small company downtown New York, and when I came out of the war he insisted I come to work for him. He made electro-medical equipment, things like muscle toning equipment, depilation equipment (hair removal) r.f. generators, DC galvanic equipment to treat muscles, especially paralytic muscles. In those days this individual, his name was Wappler. His father had run Wappler X-Ray before World War II, which became GE X-Ray. Bert Wapler actually went around and treated individuals, mostly kids, with paralytic legs, with paralyzed legs, with these machines. Can you imagine doing that nowadays? You'd be in jail so fast you couldn't say Jack Robinson. So I spent a year and a half building this equipment. Got some of it published in the Electronics magazine,

but it was much too primitive for my taste. I knew I had to go into an environment with other engineers working on more complex stuff.

I got myself a job at Loral. Loral is a giant company now. Loral was maybe 75 people. It was a little place on Bruckner Boulevard. Bruckner Boulevard in the Bronx, about the 4th story up. The third floor was a machine shop and sheet metal shop run by a guy whose last name was Lorentz, L-O-R-E-N-T-Z. What became Loral was called Eastern Amplifier, run by a lawyer with the name Alpert. Loral was the contraction of Lorentz and Alpert. Nobody in the world knows that except Ralph Baer, I bet you. Maybe a couple of other guys of my age, you know, in their mid-80s who remember, or were there. I got a job doing what? Building a television set there. What in the hell was I doing building a television set at Loral? They had already turned from Eastern Amplifier into Loral, totally in the military development and production business. Well, the chief engineer, Sam Lackoff, wanted to build a classy television set. So he hired me, and then he hired Leo Beiser, who later became a great light in the laser heavens. The two of us sat in the screen room for a year designing a set from scratch. The only thing we bought was the tuner, the front end of the television set. I was in charge of doing - I assigned myself -- the front end, the IF strip, the intermediate frequency strip, the video amplifier, the detector/video amplifier, and the high voltage power supply, and the deflection circuitry. Oh, Leo did deflection circuitry, power supply and a few other things. We were a licensee of Hazeltine in those days. Hazeltine was basically an invention factory before World War II, after World War II. And I guess Loral subscribed to their service.

The chief engineer insisted that I take some of this great stuff and use it in a television set. I spent two weeks futzing around with a DC coupled video amplifier. Somewhere in the television set you go from radio frequency to video signals. Mostly circuits then were capacitively coupled, which removes the DC component that's in there, and you have to restore that. So if you build a whole thing DC coupled all the way through, you don't have to do the restoration, and presumably when average scenes go from very bright to very dark you get a better black and white contrast. There was a schematic of a DC coupled video detector, video amplifier, via this firm. I spent two weeks screwing around with that, and it never worked right. So the hell with that, and I went back to doing it the standard way. When we got done, we had a set that worked just about as good as some other sets on the market. I mean, what could we improve? We used a one-inch projection tube made by Phillips. They also supplied the optics, which was a box about I would say nine by nine by nine, with Schmidt optics inside, to face backwards at a mirror. There were correcting lenses in there. It projected on a screen that was probably the equivalent of a 19 inch cathode ray tube. But you got to remember that in those days 19 inch tubes were extremely expensive. That's what the chief engineer wanted, that's what we built.

Hendrie: He wanted a large screen TV.

Baer: We built a large screen TV. Went on test in Alpert's home, next to- I forgot what it was, a commercial television set. I will come up with the name in a second. It was just about as good. I mean, what could we improve? The whole thing died right then and there. That was the end of my career as a television engineer at that point. Although while I was in school in Chicago I worked after hours in a television studio where Sanabrias' younger brother had built television studio equipment. Oh, I got to go back to that. We are in the vacuum tube age. In the studio

equipment, you need to generate horizontal-vertical sync signals, horizontal sync signals. Those were the days when we had 440 line television. Now we have 525 line television for the last 100 years, right? 440 line required a horizontal oscillator to run at something like 14 kilohertz. And you had to generate a 60-hertz vertical signal, and they had to be locked together, that is a 14 kilohertz signal had to be a multiple, exact multiple of 60 hertz. So what do we do today? We tell a microprocessor, divide by umpty ump, right? And it does it, right? What did we do then? We take the 14 kilohertz thing, we divide it in stages with things called blocking oscillators that could divide by three, by four, by six, by two. And little by little we get all the way down there, and every one of these things has screwdriver adjustments to make them lock in. By the time you get done generating horizontal-vertical sync, you have got an 18-inch rack panel with all the tubes working at 6.3 volts and 3/10th of an amp, which is a watt, and 1.8 watts right there, times 10 of them, by 25 watts, plus the 250 volts of plate voltage, running at maybe a 100 mils. There is another 25 watts. There is this powerhouse burning up all kinds of energy. Doing nothing but going from 14 kilohertz to 60 hertz. That is how it was done. Things were so simple in those days that to this day I can draw the schematics of virtually everything I built way back then from memory.

Hendrie: Wow, wow.

Baer: Yeah. Think of it. When I was in the medical business, I built a cutting machine for cutting human flesh in an operating theater. It was nothing but a 100-watt RF generator, a single vacuum tube, big transmitting tube. I did not even rectify the 60 hertz. The tube, itself, is a rectifier. It only worked on the positive half cycle with a 1000-volt transformer. 150 volts going in, and a 1000 volts out, RMS. This thing ran at about a megahertz. In those days it was megacycles. Megacycles. Put out about 100 watts. We tested that by putting a light bulb on the output cord, a 100-watt bulb. I just cranked it up until the light bulb would light up. Testing that unit was a real joy. I would go out and buy meat at a butcher store, and surround the operating theater with chairs, from which I hung Airwicks because when you started cutting, the stench was unbelievable. I put fans behind the Airwicks, and blew air over the Airwicks which changed the air so you could breathe. It was pretty putrid. Doctors wear these masks and all this stuff, but when they operate and they cut things with that, it stinks.

Hendrie: Let's see. You are at Loral, and you just built a television set.

Baer: I built a television set, which went nowhere. I am done with it, and what do I do now? Either leave Loral and go to work for some television outfit, or I go into military electronics. Well, I interviewed at CBS Television in Brooklyn, and Izzy Melman [ph?], who was one of the factotums there who ran the place, wanted to hire me on the spot, and offered me a job. But when I came home I had already given my notice at Loral, mostly because when I asked for a raise they said, "No, no, no. You're making about as much as you're worth." Exact words. And I had just taken a system of which I had built a part, which an airborne system, that allowed a Westinghouse radar to scan a surface of water from an overhead airplane in such a way that we always looked at a stationary map, which meant deflecting the radar antenna to offset the movement of the airplane. I had the job of taking airspeed from a Kolesman airspeed generator, which was a synchro output, and make that turn a pot, which had DC across it, so that it got an output voltage that was proportional to airspeed, generated by that airspeed

generator. I had to add to that or subtract to that wind speed, which was put in manually, based upon information the pilots got through their radios from some place where they figured out what the winds were. What else was there? Oh. I got compass information from a GE auto-compass that was sitting on the wing someplace, which was another rotary synchro thing. And I built all this into a 18-inch rack panel, and I used in it my favorite circuit, a cathode follower, which is now an emitter follower. It's a high input impedance or high output impedance circuit on which I did my final paper in college, showing how the circuit reacts to waveforms of given rise time versus capacitive loads, which requires a solution of a differential equation of some sort. It was pretty messy. Anyway, I'm in there. I've taken all this gear, plus the whole system, through a type test with the Navy inspectors. Spent three days going in and out of the temperature chamber and humidity chamber, all this nonsense. And it passed, which was a bloody miracle, because it never really worked before. But, I mean, it never really worked well afterwards. And they tell me you're making as much as you're worth. So I knew I had to quit. I had this job offer from Sylvania, from CBS, to build television sets, which was very attractive. But I got a telephone call that night from the chief engineer at Loral who had left Loral and started a small company downtown on Spring Street near Canal Street in New York. He says, "I want you to be my chief engineer." My reaction was, "How much, Sam?" He offered me five bucks more than CBS did. I had to call Izzy Melman and say, "Sorry, Izzy. I got another job." So I steppd out of tele-

Hendrie: How much more was this than what Loral thought you were worth?

Baer: Oh, maybe five, ten bucks more. In those days making $10,000 a year was the pot of gold at the end of the rainbow. I mean, that was something that we were really striving for. But you got to multiply that by almost ten or five...

Hendrie: By inflation.

Baer: Inflation -- to get where we are today. In any event, I leave. I start in Canal Street. We had no orders yet.

Hendrie: Now what was the name of this company?

Baer: Transitron, a name pulled out of the air. There was later on a Transitron in the Boston area, who made early diodes and transistors.

Hendrie: Yes. But it wasn't the same. Never related.

Baer: They were never related in any way. Eventually, after about three or four months, we got lots of military work, mostly building radar test equipment, L-band, C-band, X-band radar testers which basically emulated the transmitter signal. You could change the pulse width, the pulse rate, and pulse duration, all this stuff. They worked anywhere from 100 megahertz up through 10 gigahertz. We called it megacycles in those days. Next thing, as I say, I am chief engineer

at this place. I had to learn a hell of a lot. What the hell did I know about radar equipment? Nothing, right? What did I know about test equipment? Nothing. What did I know about putting stuff into production? Nothing. What did I know about military specs? Zippo. Right?

Hendrie: Now, when you are testing a radar, test equipment for radar, what's its purpose?

Baer: It puts out the radar frequency, which might be say 1.2 kilo megahertz. Right? It is pulse-modulated. It has a certain PRF, like maybe 1200 pulses per second. The pulses come out maybe 50 microseconds wide. All these things were adjustable. The pulse width, the pulse rate.

Hendrie: But this thing goes into a radar set?

Baer: Yeah. It plugs into a radar set, either radiated through an antenna, or more likely from an attenuator right into the radar receiver input.

Hendrie: To the receiver. So it is generating signals to see whether the receiver is working properly.

Baer: Exactly.

Hendrie: Got it. That is what I want to know.

Baer: Not the antenna.

Hendrie: You are testing the receiver.

Baer: We are testing the receiver, not the antenna. That was another story.

Hendrie: And you are not testing the transmitter. You are testing the receiver.

Baer: Yeah. We are testing the receiver.

Hendrie: Okay.

Baer: Yeah. The transmitter we tested with huge boxes that were basically tuned cavities, of which we built a couple of hundred. They were called echo boxes. They had dials on them, and you could read the frequency off, and check transmitter with them. And some of them were huge. Some of the transmitters worked on at 100 megahertz, right? Very low. The Army had

very low frequency transmitters, and the echo boxes for them were humungous. This is another long story.

Hendrie: Okay. Anyway.

Baer: Anyway, we went into the military business, I had to learn that when you are thrown a stack of drawings to reproduce a piece of equipment, and the drawings are barely readable because they are blueprints that have been through God knows how many reproductions, and you have to create a brand new set of drawings with them that you can put in production, and actually get hardware that works, you learn a lot. Within a year, I was a walking encyclopedia of military paint finishes, metal finishes, hardware. I knew all that stuff because it was all in the drawings. I had to learn what the hell it was all about. We had a purchase to buy it. So I am into this business in a big way. I had a special technique for generating the bill of material. The Air Force had come up with a form of indenting items in the bill of material when you went from one level to the next. Here's a major assembly. It's a subassembly, two subassemblies indented, and subassemblies of this subassembly, is indented again. Once you do this, and you get acquainted with the drawings, you get a very good picture of how the whole unit is organized. I was really good at that stuff. I wasn't at first. I was scared shitless, to put it bluntly. In fact, I told Sam Lackoff in the beginning, "I don't think I can handle this." Sam said, "Yeah, yeah. You can handle it." I got a little depressed. I went to his house one day. He lived in New Jersey, across the George Washington Bridge, and I said, "Sam, go get yourself somebody else to do this. I don't think I can do this." So he goes and he gets the chief engineer of Emerson Radio. This guy is about ten years my senior, probably made twice as much money as I did. And within the week I found out I was doing all his work anyhow, right? So, you know, I took over. And that was the end of that little negative…

Hendrie: Lack of confidence.

Baer: Little lack of self-confidence. Everybody goes through these things. In any event, about a year and a half into producing this hardware -- less than that -- we have so much work that we are really short of money to procure all the parts, the components, and to pay the model shop, which made all the cavities. All this stuff had cavities, the size of them, with gears running the finger stock inside to tune the cavities. That was all quite expensive to do everything, silver plated inside and out, all the microwave components, the attenuators all silver plated inside and out. We needed money. So we sold ourselves to a holding company in New Bedford, Massachusetts, who also owned a large machine and tool company that was very respectable, and also had bought Insuline Sheet Metal. Insuline was the premier sheet metal outfit for radio before World War II. After World War II, the Specter family who ran this outfit sold themselves to this holding company, because they owned an empty factory building on the Merrimack River in Manchester, New Hampshire, and factory buildings were there by the dozen because the textile mills--

Hendrie: Because the woolen mills had moved to the south.

Baer: That's right. They had all moved to the south. Were totally empty. So the next thing I know is I come in one morning and I am working at my desk. Another guy -- it's a Saturday morning. There are only two guys there, me and the other guy. We're working on drawings, and Sam Lackoff brings in this little guy. He opens up all the big cabinets where my original drawings are, and he shows them to this guy. What the hell is Sam doing showing my drawings to this guy? They're *my* drawings. Why is he screwing around with my drawings? It turns out this guy is chairman of the board of the holding company, and within weeks we are moving to Manchester, New Hampshire. Where the hell is Manchester, New Hampshire? Well, it's some place we went through on the way to the White Mountains in the wintertime. Who on earth thought of ever moving to Manchester, New Hampshire? Well, I had a brand new, little son then. For the last few months in December, January.

Hendrie: What year is this now?

Baer: This is- what year is this? This is 1952, or 1951, 1952, 1953 [actually '55]. Every weekend the small crowd that went up there from New York stayed together, about 12 of us, gets into their cars and drives back to New York. No I-93. None of that.....taking little roads like 101, 13, and 11, through 20, through Worcester, and eventually the Wilbur Cross and the Merritt Parkway into New York. Took forever, especially in December, when you drove through Worcester being guided by the overhead street lights because you couldn't see the street the snow was coming down so hard. In those days we had real winters. In any event, we moved up to Manchester. We were quite successful for a year and a half, two years. And then the Insuline company below us on the first floor of this big building on the Merrimack River, lost more money than we could make upstairs, and we could see the handwriting on the wall.

Hendrie: Now what was the name of this company that you are working for?

Baer: Well, the overall company was Van Norman Industries. Van Norman was the name of a machine tool company that made extremely good, high quality vertical millers ever since the 1910s, very respectable. But Insuline hadn't changed their sheet metal equipment since before World War II, never mind after World War II. And they couldn't produce anything that met specs. They produced more scrap than good stuff. They stuck me down there as chief engineer for a couple of weeks. It was totally hopeless. They also had a line of automobile antennas. Virtually 90% of the stuff they made didn't work. It was horrible. The tools were so worn out, and they never replaced them. So I saw the handwriting on the wall, and I left. There was only place to go, and that was Sanders Associates. Sanders was in Nashua. I lived in Manchester. It's about 18 miles from one place to another. When the neighbors first heard that I was going to commute to Sanders in Nashua, 18 miles every morning, they thought I was crazy.

<crew talk>

Hendrie: Tell me the story about how you got to Sanders Associates.

Baer: When things weren't doing well at Transitron, Van Norman Industries, I knew I had to go somewhere. I had met someone from Sanders, one of the original associates, at a private party. I contacted him and he invited me to Nashua. I interviewed. Got a job right away. They put me into the equipment design division, which was run by a guy who left about a year later, and I got his job a year later. So within a year I was major manager there. First they did not know what to do with me. I started about June or July that summer.

Hendrie: Of what year?

Baer: Of 1965 or 1966 (actually 1958). I forget. For the first few months I helped someone put a system for the Air Force together, which consisted of putting antennas, spiral antennas, printed circuit spiral antennas, on the side of an aircraft, both sides of the aircraft, from little antennas running at six gigahertz to antennas the size of a house, down to the few megahertz. Obviously for the precursor of AWACS, for the Air Force. Which meant building a whole bunch of cavity oscillators to convert incoming signals that we were listening to, to a common i.f. frequency. I spent the next few months bending solid aluminum coax in chasses with cavity oscillators and detectors. That was kind of fun. But comes January 2nd of the next year, I come in and Lloyd St. Jean, the division manager, calls me over, introduces me to two spooks who came up from the second floor where all the highly classified stuff was going on. He said, "Got a job for you, Baer." Turns out they wanted to build a system to look up the Russian's kilts in Berlin. Berlin was under siege at the time, right? Monitor all the Russian radio transmissions, whether they were FM, AM, single sideband, whatever. So in the next six weeks I built two six-foot racks full of the stuff, including all these demodulators, including a time-of-day clock, which read out in binary, and which consisted of a whole 19-inch rack panel with cards in it that had nothing but two flip flops and three AND gates and a few OR gates on it, which was the state of the art at the time. All this to do far less than what is in <points to his digital watch>.

Hendrie: And this was all tube equipment, of course.

Baer: No. That was transistorized.

Hendrie: Oh, it was transistors.

Baer: But the rest of it, I had Collins receivers, which were all tubes, of course. The demodulators I built was all tubes, because that's all I knew. I had done business with a company in Brooklyn called Freed Transformers, for magnetic components, for years. They did all our production requirements. So I could get on the phone and have them send me toroids I needed in a hell of a hurry to build band-pass filters for some of the detectors. Yeah. It helps to be an old hand at stuff, and have connections. That made my reputation in the company. I worked 18 hours a day. I practically slept there seven days a week, and finished the damn thing ahead of schedule. Then they told me, "Well, how about building a directional antenna?" I took some half inch, solid aluminum coax. Made a huge loop out of it. In the box below I had a switch-controlled inductor, so I could tune the loop to bands all the way from 2 megahertz to up to 30 or 40 megahertz. We stuck that on a television antenna rotator which maybe nobody knows what that is now. We used to have rotators on their roofs to turn the antennas to pick up

television stations. That went off to Berlin. Shortly thereafter Lloyd St. Jean, who ran the division, was transferred to a new plant in New York, and I got the division job. So I was a division manager in 1966.

Hendrie: How old are you?

Baer: I am 84 now. In 1966, that is 22 from 66, I was 44. I'm in New York on some business, waiting for another guy to come in so we can visit somebody on business. Long since forgot who that was. I'm sitting on a curb or some steps outside of a bus terminal, waiting for this guy to come in, and the idea of playing games with a television set resurfaced. It had been there once before. When I was with Loral I suggested that we do something with a TV set. But the chief engineer said, "Forget it. You're already behind schedule anyway, so stop screwing around with this stuff. Build the set." The idea came back. The next morning in my office I sat down and wrote a four-page paper. If you go to the Smithsonian website where all my documents are located, you can find that paper there. It lays out the whole idea of attaching something to a television set and playing interactive games with it, though I don't think the term interactive was there yet. That wasn't used yet. A few days later I had somebody sign. One of my engineers signed the papers, date them, sign them. A few days later I put a technician on a bench and had him build television Game #1. We didn't call it that then, but that's what it was. It was basically a demonstration of how to put a spot on a screen, how to move it laterally, horizontally, and vertically, and how to color it, how to color the background. Once that was done, really nothing happened for several months. It was not until early next year that I conferred with a director of R&D, suggested that maybe he ought to put a few bucks into it to make it a legitimate project.

Hendrie: So now have we jumped ahead? How many years? How far have we jumped ahead at this point?

Baer: Well, we really haven't jumped. We are still in 1966.

Hendrie: We are still in 1966.

Baer: …and 1967. About March or thereabouts, one of the technicians, whom I'd met over that intelligence job of the equipment that went to Germany, came on board. He started building the very first, actually TV Game #2, this time all transistorized. It started like a big breadboard with circuitry designed and put on copper-clad printed circuit boards, onto insulated standoffs, the way we built stuff in those days. He learned how to build -- I showed him how to build -- RF oscillators, so you could get into the antenna terminals of a TV set on Channel 3 or Channel 4. He built a transistorized horizontal and vertical sync generator. Little by little we got stuff on the screen. Then we started thinking about what games to play. So, we put two spots on the screen, so they could chase each other and wipe one spot out upon contact. The very first thing I had him do was go out into a store and buy a plastic gun, and made a light gun out of a plastic gun, and shot at spots on the screen. When the director of R&D came up to look at that stuff, he fired at the screen, and he could shoot at the screen from the hip and hit the spot. We got some money. Not much, yeah, two grand for both. I think two grand for direct labor, and my

overhead was horrendous, you know. After all, this stuff had to take place in my division, and my overhead -- this is a military electronics company -- my overhead was at least 150%. So the two grand was like 800 bucks of useful money, you know. And I think he gave us 200 bucks for material, which also got loaded with, I don't know. I forgot how much that was worth, about 150 bucks. Well, if you multiply it by maybe two or three to get to today's dollars, you've got the idea. It wasn't much money. I ran a division that had maybe 300, 400 people that grew to 500 engineers and technicians. So what I did there, it didn't even ripple my overhead, you know. I could do that with impunity and never even tell anybody about it. Within a couple of months, we had Game #2 going, which played seven different games: chase games, gun games, and a color wheel spinning game.

Herb Campman, the director of R&D, suggested that we better show this to the management. I reported to Harold Pope, the executive VP, and he in turn reported to Royden Sanders, who was the president of the company and the chairman of the board. So I had to do a demo. When the demo date was set, I found out that during that time the board of directors would be there. So I knew I had to demonstrate not only to my boss, executive VP, to Royden Sanders, the president, but the whole damn board. I wanted to be extra careful and not blow the demonstration. I went and bought a little audio tape recorder, recorded a cassette with my voice explaining each of the games before they were played. Then we rigged up a little 4.5 megahertz FM oscillator, stuck that into our chassis, and summed the signal of that oscillator with the video signal which developed the right sideband on the TV signal, because the audio carrier is 4.5 megahertz from the video carrier, which is standard television transmission. So my voice came out of a loudspeaker in the television set on which we were going to play the games. So here was the first video game in the history of humanity that had somebody explaining what it was going to be all about, the voice-over coming through the speaker in the television set. The demo went pretty well. But after it was over, Royden Sanders said a natural thing. "What are we going to do with it?" Right? "How do we make money out of this? This is a military electronics company, you know. How the hell are we going to handle this?" So I just said, "Let me worry about it."

Hendrie: This is cost plus typically, right?

Baer: Yeah, right.

Hendrie: Doing R&D.

Baer: Oh, yeah. Most of our R&D was CPFF.

Hendrie: You did not manufacture military pieces of equipment, other than very small quantities of things.

Baer: Yeah. Well, we could spend an hour just talking about CPFF contracts. What a farce that was, because we always bid something you knew you couldn't build for the price you bid, and then you had to come in with engineering changes and get more money so that you could

wind up on the plus side of the ledger, you know. This is a big lying game that goes on to this day. Anyway, back to Sanders. We went through the demonstration. Royden says, "What are we going to do with it?" And I said, "Oh, we got to build a saleable product. This big thing we built is just a demonstration system. We can't sell that." We built another box that was very small, two knobs on each side that allowed us to chase two spots around on the screen, and wipe one out upon contact, a little handgun to shoot at the screen. Then we did a bill of materials and priced it. It was close to 25 bucks. We said, "Forget it. It'll be a $50 product. $50 then was like 150 bucks now. Didn't do anywhere near enough fun stuff for 150 bucks. Forget it. We're dead, right?"

Baer: "We", at the time, was Bill Harrison, our technician, who later became an engineer, very good circuit designer, and me. That was it. We built this little box, and it was too expensive. We're dead in the water again. I asked Herb Campman to send somebody else up to help us come up with new ideas. We knew we had to have something better. He sends up Bill Rusch. Bill Rusch was an MIT graduate, very, very smart, very creative, impossible to work with. Comes in at 10:00 in the morning. Spend the next hour on the telephone with his broker. Would absolutely take no instructions or orders from anybody. Defied being controlled. But he was creative. So he's sitting there for the next three weeks ruminating in his notebook coming up with hundreds of ideas. The major idea he came up with [is] a third spot controlled by the machine. Not two spots that are controlled by the manual operation of humans, but a machine-controlled spot. The minute that came along, we knew what the answer was: ball games. He describes a ping-pong game, a handball game. It's all there in his notebook, which you can see on the Smithsonian website. Once we had the ping-pong game going, we knew we had something. There was no question. This was terrific. It was great stuff.

Of course, being engineers, we went on from there. Couple more transistors, then we made it into a handball game, a volleyball game, into this, into that, you know. And instead of having a nice, small box, which we had at first, it becomes a big box, the Brown Box, which eventually became the Odyssey game by Magnavox. Got much more complicated, a little more frightening to people who looked at it from the point of view: I got to produce that? And we were really done. Now the question is… We're not at the Brown Box yet; we built a first ping-pong game. And now the question is, now that we got it, what do we do with it? Do I know anything about marketing? Pppppph. No. Do I have any connections? Do I have any idea how the commercial consumer product business worked? Heck, no. So the first concept was, well, maybe we could help cable people improve their ability to penetrate the markets out there.

I picked up a phone, cold turkey, and called Teleprompter in New York. At the time Teleprompter was one of the two major cable providers in the country. They had maybe a 100,000 subscribers, both on the west coast and the east coast. And I get Hub Schlafly, Hubert Schlafly, on the phone. He is one of the two guys who designed the Teleprompter unit way back when. He answered the phone, and what he was really interested in was not what I was interested in. His concept was that he wanted to use the cable as a security system provider. He figured maybe Sanders can help him get into that business ....do the engineering. So when I said, "You ought to come up here and see what we got", he said, "Yeah, I'll come up." He really wanted to talk about security systems. He came up in a blinding snowstorm in January of 1968. We demonstrated the ping-pong game and some other games, and he got quite enthusiastic about it. We discussed it, and other problems. He went home and told Irving Kahn, who was

"Mr. Cable" -- president and chairman of the board of Teleprompter -- that he's got to come up here and see that. So Irving comes up in February. By this time we have already revised the circuitry to improve it, but it still plays this ping-pong game and a handball game. The handball game has a wall on the left hand side of the screen, so the ball bounces off a wall. You take alternate turns batting the ball back, and use an "english" control to make the ball bounce in different angles after it comes off your paddle. It gets pretty challenging, especially if you move close to the wall, it gets very fast and it gets awfully hard to catch the ball. It's a damn good game. I like it better than ping-pong. We show all this to Kahn. He says, "Well, we got to work on this."

The next thing I know is I'm going down to New York repeatedly. Another division manager who had real imagination decided to join me. Went down there together to help negotiate the contract. Lou Etlinger, who was the corporate patent attorney -- who just died this past Monday, unfortunately, went to the funeral on Monday -- he started negotiating the contract. I wrote the technical description of what we were going to do together. Bottom line was: Teleprompter ran out of money. Their cash flow was negative, and the whole thing came to nothing. While I was there, just to give you a little perspective of where the industry was at, he took me around to one of his studio areas and he showed me the very first character generator that was built by RCA for them. It was a half-height rack, a four foot rack, 18-inch rack, with a whole bunch of 18-inch rack panel units in it. And all it did was produce the alphanumerics or the time of day. It did a hell of lot less than this watch did. It was this big chassis full of stuff designed probably in Camden, where you came from. That was the state of the art, and I believe it was all transistorized. Now we're back to square one. What do we do with it? Actually nothing happened for almost a year. I was basically running the division, and scratching my head what to do.

Hendrie: Stop for a second. What did you want to say?

Baer: Chronologically there was another interlude – no, that comes later. Ok here's what happened. I communed with Lou Etlinger, the corporate patent attorney, trying to figure out what to do. It finally dawned on us, heck, all the parts we have in here are the same parts that are in a television set. The assembly procedures for a box like that would be exactly the same. So what's the most natural assembly line on which a television game -- which is what we called it, the term video game had not been invented, had not been coined -- what's the most natural place for something like that to be produced? In a television factory. Once that light dawned on us, Lou got busy. He called up his alter egos at RCA, GE, Sylvania, Motorola, at Warwick, which was Sears' producer of television sets. He called the lawyers, patent lawyers. And they all sent groups. They came one after another, starting with RCA, then GE, Sylvania. They all had a good time playing the game. They all thought it was creative. They all thought it was terrific, but the only ones who moved off a dime was RCA. So Lou starts negotiating a contract. And Lou -- we are in New Hampshire -- Lou always acted like an innocent New Hampshire cowshit kicker. These other guys are New York type lawyers, but there was no grass growing under his feet. When we got done, we had a contract relationship. It was too onerous altogether, and we cut if off.

RCA tried to pull a fast one on us. Fortunately for us, a member of the RCA team had left RCA and joined Magnavox, and became their VP for marketing in a New York office. He had been so impressed with what he saw, he called up Fort Wayne, where the headquarters were, and where television sets were designed, and said, "Hey, you guys need to look at this." The next thing we know is we get an invitation to come to Fort Wayne, and Lou Edlinger and I travel there with our Brown Box, with our rifle, and with a putter, and a golf ball on the end of a joystick for putting-games. We are in this big room with a big table in the middle, sort of a boardroom, and a bunch of glum looking guys sitting around the table, from both engineering and marketing and who knows where. The head of marketing, the VP for marketing, who also controlled manufacturing in their Tennessee plants, was in charge. When we got done demonstrating, he said "It's a go." All the faces changed expression, and they had to get with it. Unfortunately, it took another year to negotiate the license agreement. So here we are, and the engineers had not even started doing anything yet. So the next thing they told us to have something in production in six months.

Hendrie: Could I roll back a little bit about the license agreement? What ended up as being the royalty or the financial situation with the license agreement?

Baer: The license agreement was an exclusive one for Magnavox, with rights to sublicense under the patents that hadn't issued yet, and the patents that had already been issued. The video game patents had already been issued. The royalty rate was typically 5% of manufacturer's sale.

Hendrie: So the manufacturer's price, as opposed to list price in the store.

Baer: Yeah. The deal was income from royalties was to be split 50-50 between Sanders and Magnavox. The same thing with income from legal action, if there was to be any. [It was a] if we went arrangement. It took them forever to cross all the t's and dot all the i's. Meanwhile, the engineers had barely six months to build a production unit. So they had no choice but to copy what we had, which worked. So, in fact, if you take a big schematic of Odyssey ITL 200 units and hang it next to a schematic for the Brown Box, it's almost identical. They had to make improvements in the RF section, because there were FCC specs that had to be met. It had to be well shielded, and there was a lot of bypassing to be done, and harmonic suppression to be done. But the circuitry? One for one. What they did change radically was to go from a bunch of switches we had out front to go from game to game, to plug-in cards, which were basically printed circuit cards that interconnected the internal logic, a lot of diode logic, in different ways to create the different games. That was very creative. And, of course, it started the whole concept of plug-in games.

Hendrie: Yes, in which there was more than just a printed circuit board in there with nothing on it.

Baer: Well, a story hangs by that tale, too. That will come a little later. It was that winter. So the engineers worked like hell. We go to Fort Wayne, we being Bill Harrison, my technician, and I, with the hardware. We had prepared very detailed and clean-looking schematics and

wave forms and all that stuff. Harrison is with the engineers, and I am with the marketing manager. Fritchie was his last name. I got involved in things like doing overlays, creating overlays, because the screen looked so barren -- had a couple of spots up there, maybe with a bar down the middle for the net. That was all there was. It was much more interesting when you overlaid it with a colored overlay, which got backlit by the CRT, the picture tube. I also was part of, and wasn't very happy by, all that other jazz that they put into it. They really didn't trust the video game by itself to take off on its own merits. So they stuck into the original package a bunch of playing chips, and playing cards that went with some primitive on-screen roulette wheel type things, all because they did not really have confidence in what would take off. Part of that was because they had to make decisions before they even went out and did market testing. They built half a dozen units, engineering models, and went all over the country. I have all the reports, and in fact some of them are in my book, "Video Games: In the Beginning." They had uniformly terrific response all over the country from what they were doing. But the engineers didn't know that, and the marketing manager were at a stage where they didn't have those inputs yet. So they created all this other jazz that went with it. And I wasn't happy about that, but I had no say, really.

That was another problem. I am there to help. But I am from another company, and there's always that "us is us" and "you are you", and never the twain shall meet. In fact, I had Lou Edlinger negotiate a relationship for me, personally, to go back and forth between Sanders and Magnavox and support them in the generation of new ideas and creation of new things for video games. I always did it. It was always unilateral because I met nothing but resistance at the other end. It's me and you and them and us, and it never really worked. So here we are in late 1971, and the industry is buzzing about Magnavox's mystery product. Nobody knew what it was. Comes May of 1972, I get invited to a dealership demonstration of the 1972 line of Magnavox's product. The demo I went to was at Tavern on the Green, the restaurant in Central Park West in New York, and there were other demonstrations in places like L.A. and San Francisco at roughly the same time, in May of that year. On the stage was their newest television sets, a color camera they had built, and a few other things. But the hit of the show was definitely the Odyssey game. I could hardly restrain myself from jumping up and down. I am in a crowd of guys sitting on folding chairs. They are all dealers. Also, most of them were Magnavox dealers. They had their own company stores, before the Federal Trade Commission, FTC, got in there and stopped all this because it was a restraint of trade type thing. Anyway, I was sitting there and I could hardly contain myself from jumping up and down yelling "that's my baby." That is when it was introduced in New York. At the same time, the game was introduced in Burlingame, California, on May the 27th, I think, of 1972. Nolan Bushnell, who worked at Nutting Associates at the time, with Ted Dabney and a few others, went to see that demonstration, played the ping-pong game, hands on, signed the book. We have the book. Signed the guest book, the Magnavox guest book. And then, of course, it's history. Bush now hired Alan Alcorn, who worked at Ampex, where he had worked before. Alan Alcorn is told to do a simple game, a ping-pong game. Right? Nolan incentivizes him by telling him that he has got a GE contract; he needs to deliver the thing in six weeks, or some such fantastic thing. Alan Alcorn busts his butt and gets it done. He builds the first Pong game, which, when it finally hit the street, became a huge success. But Pong is simply a knock off of the Odyssey ping-pong game. So here we are. The Odyssey comes out in May. By the fall, it's out in production. It's out in the stores. By December about 95,000 pieces have been sold. The next year Magnavox didn't do a thing, sold only about 50 or 60,000 pieces. Then they finally got off their tail and ran another production run, so by the time early 1975 came along, they sold 350,000 Odysseys. Remember it's a home game, so at least four people on average saw it or played with it. So

there is a million people, a million two, a million five, maybe more, who now knew what television games were. And there were at least another million people who had played the arcade games. By 1972, Atari was in business and made 7,000 Pong games, in 1972. By the middle of 1972, Bally Midway was already building knock-offs, so was Seaberg, and several other companies, so there was something like 20,000 arcade games out there that year, all playing basically rudimentary Pong games. Put Pong on the map. Now, if you wanted to play a Pong game at home, you had one choice, right? You went to the Magnavox store and bought an Odyssey game and took that home. We launched the industry. Think about what we sold the public. This is a box that lasted into 1975. It is designed in 1965 at the post-vacuum tube days, and in the very early days of integrated circuits. If you go through our drawings and our sketches, you come across one where we tried to build the spot generators with T-squared-L, TTL, transistor-transistor logic. It worked, but it was totally cost ineffective. They were too expensive, and they were power hogs. And since we wanted to run off batteries, because there was no concept of plugging in- really everything plugs in the wall, right?

Hendrie: Right. Not then.

Baer: It did not exist then. It wasn't a concept you deal with. A consumer product like that had to be battery operated, and it had to last on the batteries. Could not do T-squared [TTL], out of the question. Back to discrete transistors. Here is a 1966, 1967, 1968 transistor design, that's because we didn't know how to sell it, lasted until 1969, until it was finally demonstrated. It was 1970, 1971, when licenses were negotiated. Now we're six years old, right, or thereabouts. It goes into production now in 1972. Now it is six years, five years, six years old, 1973, 1974, 1975. By this time integrated circuits were all over the place, and people had already learned how to combine basically many more transistors on a chip, and make state machines, like basically combine a bunch of T-squared L, or CMOS devices, all on one chip. So it didn't take the Atari guys more than a year and a half, after they got into the coin-op business, to take a leaf from other peoples' experience with making single chip state machines. They put out a ping-pong game, a Pong game that was built around a single chip. Bushnell went to Sears Roebuck and sold the concept, and walked away with an order for, I forgot what, I think 250,000 pieces. And then he couldn't supply enough of them, and then another big order, and a huge success at-Christmas of 1975, I think it was. Maybe it was 1976. Anyhow, that was the start, big start, between Magnavox's Odyssey and that ping-pong machine. That was the start of the video games.

Hendrie: Wow. But Magnavox did not choose to reinvest and to modernize?

Baer: Yes, they did. Finally they woke up in 1975 and out came Odyssey 200, the 300 model, 2000 model. They took advantage of the fact that a bunch of people, including General Instrument, who had an IC outfit in Hicksville, Long Island, came up with a single chip device that actually came from their Scottish plant, Glenrothes, in Scotland. Two guys did it on the side, another com-sho (unofficial) job.

Hendrie: But a single chip device that had…

Baer: Played a Pong game, and put scores up, and the whole thing.

Hendrie: Oh, they integrated all the logic and everything.

Baer: They integrated all these transistorized circuitry in a single chip. At the same time that the Atari people were doing it with one or two different companies in Sunnyvale and some other place. So almost simultaneously these devices become available. Atari is first with the product. But now it's possible for almost anybody to build a video game based on a single chip. All it needs on the outside is a single transistor oscillator running at about a megahertz, an RF oscillator outputs the game on Channel 3 or 4, and a few R's and C's, resistors and capacitors, and a printed circuit board, and a cabinet and a couple of controls with pots in them, and that was it. Right? I came to Hicksville early in the game. The two guys who had done the work in Glenrothes, happened to be there. They brought the breadboard with them, and the general manager, who trusted me, showed me what was going on. I said, "That's fantastic. I got to tell Coleco." Why? Because I'm already doing toys and games, electronic toys and games, after hours -- nothing to do with Sanders -- in cooperation with a firm called Marvin Glass and Associates in Chicago.

Hendrie: Now, you're still working for Sanders?

Baer: Yeah, I'm still working for Sanders, but by this time money is coming in. They made me the first Engineering Fellow at Sanders, and I can do what I want because there is a lot of money coming in from licenses. I met the president of Coleco at the Marvin Glass showroom and lunchroom, a number of times when I was there in Chicago. So when I saw this, I called up Coleco and talked to the president. I said, "You got to come to Hicksville and see this." So he goes down there and he places an order for, I forgot, I think 100,000 of those things.

Hendrie: Of the part, just the part. Yes.

Baer: The AY-3-8500 chip. He gets on top of the order list, which was important because in those days when we made integrated circuits, the yield was pretty low. Didn't really know how to build that stuff effectively yet. So he was on top, and he got delivery. He built a game which was called "Telstar", a standard type game just like the Atari game. The only problem was that he sent his guys down to Maryland to the FCC labs to pass RFI, radio frequency interference testing, and they flunked. Right?

Hendrie: Oh, no.

Baer: I come in one Monday morning. The telephone rings in my lab, in my office. The chief engineer of Coleco is on the phone. He says, "We went down to Baltimore or Washington or some place. We flunked. Can you help us?" And the president of the company was on the phone with one of our VPs looking for help. Well, I had built the largest RFI capability in the northeast up here at Sanders, because we never had one when I came here, and I saw that we

needed one. So I hired two guys out of Sylvania RFI. This is four or five years earlier. By the time this situation developed, we were already well entrenched in the business. We knew what the hell we were doing, and we had a partial floor in a big building on Canal Street in Nashua, New Hampshire, that had radar absorbent material on the ground. It was a perfect range for doing RFI testing.

Hendrie: Yeah, and you had a screen room and the whole…

Baer: The whole nine yards.

Hendrie: The whole nine yards. Ok.

Baer: Yeah. Screen rooms.

Hendrie: And all the measuring equipment.

Baer: And all the test equipment that you needed. So we go out on the roof. I tell them come up and we will see what we can do for you. They're there the next morning. It is Tuesday morning. We go on the roof and we tried bypass capacitors, and we tried this, and we tried that. The problem was excess radiation on the second harmonic of Channel 3 or Channel 4. That was the main problem. And nothing works. I go home that night…

Hendrie: Couldn't you figure out where...

Baer: No. We couldn't. We couldn't. Try all the usual things, improving strapping things to the ground, and bypassing things. Didn't work. I go home that night and I'm awake half the night scratching my head, and I couldn't come up with an answer in bed. I get up early the next morning. I walk upstairs to the floor where this partial floor was, where we had our equipment. I'm too early. Nobody is there yet, except a couple of microwave engineers. I'm walking around the lab, and I see two pieces of military equipment connected by a piece of coax. At each end of the coax, the coax was strung through a couple of ferrite toroids, with a couple of turns, right? I asked one of the engineers who was walking around, "What's that?" He said, "Oh, we had a little problem with radio transmission from somewhere being picked up by the coax sheath, the outside, and getting into our equipment. We suppressed it with these two chokes. " These RF chokes, which is what these things were. A couple turns of the wire.

Hendrie: Yeah. They're baluns. Yeah.

Baer: Yeah, a balun. "Bay-len", "Bah-len".

Hendrie: I don't know how to pronounce it.

Baer: I said, "Well, shit." I ran around, opened up drawers until I found some ferrite cores. The RFI guys came in. We went out to the deck and I took the output coax cable from the game, wrapped it through a toroid two or three times, on the inside of the cabinet, like a strain relief, just where it came out of the box. Bingo, we're in spec, just like that. It suppressed the harmonic.

Hendrie: Oh, my goodness.

Baer: We sent them away. They passed. If they hadn't gone down, they would have had to go to the end of the line, and there were N number of people on the line. It would have been weeks. They had 30 million dollars worth of product, which is like a 100 million now, sitting in a warehouse, all finished goods. It was really nail biting time.

Hendrie: That's right. Now what was this Coleco product? What did it do?

Baer: The Telstar machine that played a ping-pong game. Period.

Hendrie: Okay. What was it called?

Baer: It was called Telstar. It was just a name they came up with. From there they developed a whole line. In fact, I got a little side contract from Coleco after this to help them with the next generation of machine, the next year's machine. I wound up designing some part of next year's, and the year after's, hardware for them. Here is a military company designing video game hardware. I'm pretty sure that the contract we had between us was the only contract that the president of Coleco ever signed where he didn't really know what he was going to be charged. He was a real good haggler. You couldn't get away with anything with this guy. But they were so desperate for our support, they just signed. I mean, when I sent him a bill, in came the check. Now, of course, I have five or six guys in my department. I'm no longer the department manager in my old department (division) running this stuff. I'm on the inside looking out, being totally frustrated because Magnavox wouldn't let me help them. As an example…

Hendrie: They wouldn't let you help them?

Baer: Well, we bring them in. We show them the next generation of things. We have a fantastic looking hockey game. They don't want to do it. In the winter from 1972 to 1973, when the first Odyssey games were already out there being sold to the public, I come up with the concept of putting active components, like transistors and stuff, resistors, capacitors, on those plug-in cards.

Hendrie: Oh, alright. Yes.

Baer: I figured, hell, we're at the limit of what we can do with these plain printed circuit board plug-in cards. What if I put some parts on there? So I sit at my bench in the lab next door and make two cards, one of which is a ping-pong game that actually makes a ping-pong sound, which we didn't have, and also allows speed adjustment. I make another card up that plays a handball game, either the normal way or, by the flip of a switch, has the wall to come in slowly, making the game faster and faster.

Hendrie: Faster and faster until you die.

Baer: Yeah. Until you need to push the button, reset it. They weren't interested. They weren't going to do that. So I had…

Hendrie: Was this lack of imagination? Why do you think they…

Baer: I'm outside. They're inside. It wasn't their idea. You know, "not invented here". Forget it.

Hendrie: They would have had to pay royalties on this. Was it about money?

Baer: Yeah, but that was secondary. They would have made money on the product. That wasn't it. It was just the same old thing, "not invented here". Same old NIH problem. Had I been as sensitive to the whole patent business as I became later in the course of 10 years of litigating, which we'll get to later, I would have chosen to write a patent disclosure that covered the use of active components to program a video game by plugging in a card with active components. Had I done that, I would have had the whole damn cartridge business by the tail. But I didn't do that because I wasn't sensitive to it. That's a lesson that engineers have to learn. You can't tell what tomorrow brings, right? And you don't have any idea where some of your stuff might wind up someday. For goodness sakes, don't throw away the documentation. Don't throw away your schematics no matter how ratty they look. Date them. Sign them, ever day. Keep them. Don't throw them away, because you never know when the damn thing is going to be worth a fortune. Had I kept that documentation, which I didn't --for once I was careless -- we might have been able to assert it later on.

Hendrie: Well, if you had gone to work for RCA, and been trained there, you would have had a lab notebook…

Baer: They would have sued the hell out of everybody.

Hendrie: …and you would have written everything in the lab notebook.

Baer: You bet.

Hendrie: And when it was finished, it would go into the archives, and you'd get issued a new lab notebook, so there would have been documentation of everything you did.

Baer: There was no shortage of documents and notebooks at Sanders. My technician, my engineers kept them. I kept very detailed notes, always. But that was a job I did at home here, on a bench here.

Hendrie: Yeah. You did that at home. Home job.

Baer: And when I couldn't interest them, it just sort of disappeared into the woodwork. A crying shame, because it would have been worth a ton of money, ton of money downstream somewhere. Where are we now? Well, we were already up to three years later, the 1975-76 period. By this time, the first microprocessors start showing up. A couple of years later, the guys in Grass Valley, which were the engineering operation for Atari, came up with building a unit based on the 6205, was it, [6502], which also became the heart and soul, later, of the Apple -- Apple I, Apple II machines.

Hendrie: Right.

Baer: They weren't the first. The first microprocessor-driven game was done by Fairchild, with their F8 processor, which was a single chip processor. It was programmed by plug-in cartridges. The cartridges they chose were inside of 8-track shells. So everybody who looked at them at an electronics show when they first showed this system thought there was a tape recorder inside.

Hendrie: Oh, my goodness.

Baer: Yeah. Because, you know, we were used to tape players delivering data to rudimentary, early homebrew computers.

Hendrie: I see. So they thought this was the tape, and it would read the tape.

Baer: Thought there was a tape inside. It took awhile for it to sink in, to hear that, no, inside was a ROM, a Read Only Memory, all of 1K Read Only Memory. And then RCA came out, they had the Spectra four-bit computer, and they built a unit that had no plug-in cartridges. You could switch it to play three or four different games, a ping-pong game and some others. And then along came Atari. There was at least a year's gap in between. And I am forgetting a whole, huge scenario, which everybody seems to forget. When the AY-3-8500 chip from General Instrument became available to anybody -- once they were in production, they could spit them out like candy bars -- a whole Asian business developed of making what they called Pong games, or ping-pong games, based on that chip, in Taiwan and Hong Kong and other places. They sold millions of those damn things for a period of about two years. And every one

of those people out there, they were all our licensees. By this time Magnavox got off their tail and they got themselves a major company in Hong Kong who would supervise this business of surveying the Asian producers, and make sure they all came under license, because they themselves were a licensee and they wanted an even playing field. There was so much money coming in every month that when I went to…

Hendrie: To Sanders?

Baer: At Sanders. When I went to quarterly meetings, review meetings, where I got invited along with Lou Etlinger, our corporate patent [lawyer], looking at the big screen at the end of this auditorium, looking at their results from the counter-measures division, and the radiation division, and the IR division. We always made more money than any of them on licensing.

Hendrie: And of course it goes right down to the bottom line, because you don't have any expense. There's no cost to consult. There's no engineering expense.

Baer: Nothing. Well, they had to pay me, right? But meanwhile, we're still working on putting them into new businesses. We'll get to that later. Like the video-based training and education business for the military, among other people, which got them into a whole new business. I'm looking at the screen, and our income is always greater than everybody else's. On top of that, it's capital gains money, because it is based on royalty license. So it has a favored tax treatment. Naturally our name is up on the corporate tower in neon lights. We could do what the hell we wanted. It didn't make any difference. And we did, out of which came a lot of business, as I just said, for Sanders because they left me alone. No more supervisory responsibilities. None of that stuff.

Hendrie: I know we're going to go on. I think we're probably going to go on the next tape. But I just wanted to roll back and ask you a couple of questions about the other things you were doing while you were working on this, in sort of the skunkworks, sort of the backroom, or on these corporate, on what became Odyssey. What were some of the other projects that your division was doing?

Baer: Well, not before, after. Oh.

Hendrie: Back in the 1960s.

Baer: At Sanders.

Hendrie: Yeah, in Sanders.

Baer: At Sanders, one of the things I was frustrated by was that I was a supervisor of a major group. I had up to 500 engineers and technicians working.

Hendrie: What were they all doing?

Baer: I am far from the bench. And I am an engineer. I want to be on the bench. So I figured out how to beat the system. I conned the IR&D director out of some money to do research. First I put them (Sanders) into a whole new business of making multi-layer boards a totally different way from the plated-through hole technology that was in its infancy -- and very bad in the beginning, full of problems -- by creating solid pillars between the different layers and a board. Then I put them into the high speed display business, because I had had a guy working for me in my previous company, and then at Sanders, who knew all about ferrites. I put him together with my magnetics people who knew how to build transformers and all kinds of magnetic parts and we built the highest speed deflection yokes for cathode ray tubes of anybody. They were low impedance, very wide bandwidth deflection yokes, which means we could build display systems that could zip the beam around so much faster than the competition it wasn't even funny. Out of it came a contract with NASA for the displays that were monitoring the Saturn vehicle while it was still on the launch pad, both at the launch pad at Canaveral, and back in Houston. The only reason why we got the job is because we needed to not only display 525-line television for cameras that were on the gantry, and 945-line television cameras that were also on the gantry, looking at the vehicle before launch, we also had to take the telemetry that was coming in that was data, like measuring temperature in places, and looking at places where the pyrometetry devices [were], and display the telemetry results, alphanumerics, on the screen. How the heck were we going to do that? Well, we need an extremely fast display to do that. How we did it was to shrink the horizontal display time to leave over a couple of microseconds on each line when we played video. Right? And during those two microseconds, we wrote a character or two or three or four. And the characters were…

Hendrie: Because you could…

Baer: We could zip back and forth so fast.

Hendrie: You could zip back, do the character.

Baer: Do the character.

Hendrie: And then come back and do the next line.

Baer: Yeah. Do the next line.

Hendrie: Wow. Alright.

Baer: And that was wow alright.

Hendrie: Oh, wow.

Baer: It turned into a 30 million dollar contract, which is like a 100 million dollar contract today. And also put the company into other display businesses. So, it isn't like I wasn't doing any engineering during all those years. Typical jobs came along, like some guy in the electro-optics division was going to go over to Vietnam and sit in a bunker and monitor, with gear they had built, incoming sounds by setting up directional microphones to attempt to develop a direction for the incoming artillery, so that they could plot it on a map, know where it was coming in, and do counter firing.

Hendrie: Do counter firing.

Baer: So they needed a huge map table on which a standard Army map would be displayed, and they wanted light points come through from below, punch through the map so you could see the light point, and track the incoming.

Hendrie: Incoming shells.

Baer: What the computer decided was the incoming track, which never worked because there were so many mountains in Vietnam that there were so many echoes they could never range on the stuff successfully. We had to build this map table, and the question is how to put in these rows of lights. There were about 12 or 14 of these radials, each of which had close to 50 or 60 individual light points. How were we going to do that? There were no such things as LEDs, it's before LEDs. Were we going to stick lights bulbs in there? How did we feed the light bulbs, and how many of those damn things were going to burn out on us? I came up with the idea of taking a stepping relay-- a telephone stepping relay that goes "click, click, click, click" -- put a bulb on its arm, and put an optical fiber, just a plastic fiber, into each one of the positions where the contacts had been. Now I commutate a light into a fiber, I stick the fiber through a hole in the board and then you have the fiber come flush with the board and then there's a nice, bright point there. I can punch this right through a map and it shows up on the face of the map. If you want to look at how this monstrosity, there was about 20 of these relays, stepping relays and this huge bunch of fibers, what that looked like, go to my web site at www.ralphbaer.com. Go to the history section, I think it is, and dial down a bit and you'll see pictures of this monstrosity from the outside and the inside.

Hendrie: Wow, yeah. Oh, that's a great idea.

Baer: It was fun and the poor… The engineers actually took it with them. It sat in a bunker in Vietnam in the dirt and the mud and, yeah, the poor bastards tried to range in on artillery and never quite made it.

Hendrie: It just wasn't a good enough scheme.

Baer: But the table worked. It worked like a charm.

Hendrie: I think we're going to wrap up now, and we will reschedule and come back and pick up where we are and take the next chapters in the story.

Session 2: November 27, 2006

Hendrie: We have with us again for a second session Ralph Baer, who's graciously doing an oral history for the Computer History Museum. Ralph, just before we started filming, you were talking a little bit about the education of various entrepreneurs and particularly you got to your own technical education, and how you've had to get most of it through studying. Maybe you could just share that story.

Baer: Sure. I think what triggered that was an article in this morning's *Wall Street Journal* on Stanley Ovshinsky of Michigan in his 30-year -- maybe it's more like 35-year -- quest, making crystalline-type solar cells [a] practical device. He finally built a humongous piece of apparatus. It turns out rolls and rolls of material, basically roofing material, coated with this semiconductor material that he has been championing. Now here's a guy who never went to college. Totally self-educated, although he was married to a biochemist, a Ph.D. wife who was also instrumental in the business, I think who kept him on the straight and even.

Ruminating about that, I was reminded of my education. I think we recited earlier that I came from Germany in 1938, settled in New York, taught myself radio electronics from a correspondence course, had three service shops on the East Side and on the West Side of New York and I got drafted and went in the Army. When I came back out I had the opportunity of going back to school, courtesy of the G.I. Bill of Rights, but there was one minor problem. What was the problem? I had no credentials. I left school at age 14 and outside of some correspondence courses, which I think we also talked about the last time we got together, I didn't have any formal training. I couldn't get into any college or university because they were all full. They were jammed with G.I.s who had gotten out of service before I did. I think I remember telling you that I came back with 18 tons of small arms, but very late in the picture. We came back in January of 1946. By that time, everybody from Europe had already been repatriated, gone home. It was kind of hard.

Getting back to the subject of education, when I first got back to New York, and I got discharged in March of 1946, what did I do with myself? I lived with my folks on West 181st Street in the shadow of the George Washington Bridge, and every morning I'd be on a subway going down to 42nd Street where the main library is, on 5th Avenue. There's a side entrance that led to what was then called the Technology Section, and I'd be there every morning, spend the whole day there. When you think about it, you know, today we sit at a desk at home. We go to Google and we type something and bingo this stuff comes up. In those days, you went through the catalog file, arranged in the Dewey fashion, I think it was, and looked up what you wanted to know for the day and went to the librarian or a couple of librarians behind the desk, checked out a bunch of books and came back balancing tons of books and made notes by hand. That's how

we got an education. I think when I finally wound up in this so-called college in Chicago, it was really a technician's school which got accredited halfway through my stay there, lucky for me.

What I learned there just put the finishing touches on stuff I had already learned myself through the years, mostly through doing it, building stuff, and reading. To each his own. Some people learn by going to school and listening to teachers, which I never did. I made notes then transcribed the notes into, if you look at them today, what will look like books. That's another funny note, a kind of aside: On occasion I've shown my math notes to visitors here and I've been tempted to look through them and maybe refresh my memory, but I can't get past the first page. I thought they were a paragon of lucidity, like, anybody could study from them, but I can't get past the first page.

Hendrie: That's funny. That's very good. Good.

Baer: We talked about [Steve] Wozniak this morning and how he did a lead-off speech, a keynote speech at Bozeman, Montana, when I got inducted there four years ago, or three years ago. In 2002, four years ago, into the American Computer Museum along with bigger luminaries like Leroy Hood with the DNA sequencer and another guy who did the original GPS, and another guy who did the original cell phone at Motorola way back when, etc., etc., and sitting with Wozniak and commiserating about the fact that being away from the bench for decades means that we probably lost 90% of what we ever knew. I've been fortunate to be close to the bench, but Wozniak lamented that he couldn't begin to do what he did back then today because it was just gone.

Hendrie: Yeah, you just don't remember. You can't remember it all.

Baer: You just don't remember. That which you don't practice you lose. If you don't use it you lose it and it's, unfortunately, altogether too true. Maybe someday in the future we could get into the brain and reconnect some of the missing connections and bring all that stuff back, which is probably buried in there someplace. Except for the synapses, the connections are gone.

Hendrie: Yeah, you're probably right.

Baer: Or they're blocked.

Hendrie: Exactly. Well maybe what we can do, let's continue with the game story. I wouldn't worry if we repeat a little bit, but we sort of left off [when] Magnavox was going and they were building the game and they're going to go and put it on the market, and maybe we ought to start there and continue the story.

Baer: Might back up a bit. Magnavox had indeed, you know, built the game, the engineers designed it between 1971 and 1972, but during that period as soon as they finished three or four working models, in whatever physical shape they were, I never got to see them. They went out on market tests. It's not like Magnavox committed themselves immediately to production. They wanted to see whether people would really be interested in this totally new form of interactive television. So there was quite a bit of activity taking two or three of these units around and doing a very thorough job of selecting different groups of people and doing market testing. It wasn't like they just threw it out there.

Hendrie: They didn't just guess.

Baer: In fact, we have records. If you go through my book, "Videogames: In the Beginning", I reproduce some of the records that were done taken at a time where they filled in the responses by participants in these tests. And they were all very satisfactory, and very enthusiastic without exception. The product was in the hands of professionals, unlike the Atari side who were a bunch of amateurs, who sort of leveraged themselves up into the arcade game business but quite different. Two ways of doing the same thing. In any event, I think I recited earlier that because the engineers were given less than a half-a-year to go from prototype to something producible, they had no choice but to more or less copy, circuit-wise, what we had built, which was kind of unfortunate because we built that stuff in 1967, 1968, now we're into 1971. We've already gone technologically from early transistors, to transistors being commonplace, to early integrated circuits, which basically combine a bunch of transistors interconnected on one chip to form whole circuits, to a more complicated, more reliable integrated circuits. We're already in the CMOS age by 1971. And here we have a design that's built out of 40 transistors, 40 diodes, a bunch of resistors, capacitors -- and they had no choice but to go with it. Later on that would cause a lot of negative comment from others, who started four years later. But that's history. That's how things went.

In any event, I think I already recited that the product was shown in March of 1972, both in New York at Tavern on the Green in Central Park West where I attended the demonstration, which was very, very well received, and also out west where it shown in various places, including Burlingame, California, where Nolan Bushnell played one of the ping-pong games and then went off and got Allan Alcorn to build what he called the Pong game. Once that was done, I worked on my corporate director of patents to get me into a contractual and legal relationship with Magnavox so I could serve both masters. Both Sanders on the one hand and Magnavox on the other hand in the following manner. I figured I had lots of ideas up my sleeve but I wasn't going to hand them to Magnavox. In fact, I couldn't unless there was some legal relationship because, after all, I was a Sanders employee and they [Magnavox] were an exclusive licensee. It took about six, seven months before something like that was generated on paper. In actual practice, it never worked. It's the same old story. People from two companies working together is a huge problem. Everybody's got their own company politics. My objective was to help them, but help isn't always appreciated.

Speaking from a point of view, a toy game designer in a non-video area, I can tell you that guys like me, the independent inventor, weren't altogether appreciated by the engineering counterparts in places likes Milton Bradley or Hasbro or Mattel, because the guys inside figure

that we, the independent inventors, come in with a half-baked idea, sign a contract, get a lot of money, and they wind up doing all the hard work of converting this concept into a real piece of hardware that'll show up on the shelves of Toys-R-Us or whatever. And they're right, to a large extent. Having been on both sides of the fence, I can appreciate how they feel about it, and I think that was the kind of feeling, and problem I encountered in dealing with the Magnavox people. For example, in the winter of 1972-1973, obviously having been out there and sold about 80,000-90,000 of them were in people's homes by Christmas of 1972, I'm sitting here wondering what new games we can play on the machine that haven't already been thought of. If you recall my recitation of how the Brown Box worked, or how the Odyssey works with plug-in cards that basically interconnect existing circuitry on the inside, changing the logic, I decided that we just about mined all the game content which we could get out of those cards, and that maybe the thing to do was to put active components – transistor, resistor, capacitor -- circuitry on those cards and encapsulate it, and when you plugged it in you got a new ballgame. You got additional capability. It's not inside of the box. So I sat down in my lab, which was down there at the time - since moved it, and built a card that played ping-pong, but it had a speaker on it, so it could make sounds, which we neglected in the first go around. It also had two control knobs so the players could independently control the speed with which they can play. Then I made another card that played a handball game, in which there's a wall on the left-hand side from your point of view, with a switch that in one position of the switch the wall would move in slowly, make the game faster and faster and faster and faster until you pushed the reset button when it would snap back and it starts coming towards you again. Well I showed that stuff to Magnavox and all I got was a big yawn. They never did it. And again, there was that "not invented here" problem, yeah.

Hendrie: Now, did you do design these things here in your house?

Baer: Yeah. Right here.

Hendrie: Okay. So you were not doing this at Sanders, then?

Baer: No. In 1972, I think I was still chief engineer of the Electro-Optics Division, chronologically. Backing up a piece, the concept was before video games came and was documented on 1 September 1966, I'm running a big division of five hundred people. I barely spent more than 15 minutes on the subject, with a technician and engineer in a little room off to one side. It had nothing to do with what I was doing on the job. We were done by 1969. It took from 1969 to 1971, the final licensing, namely Magnavox. So t here was a hiatus during which I had nothing to do with videogames.

Hendrie: So you were just running the division.

Baer: I'm just running my division. And then they talked me into running a different division, which was a disaster. Printed circuit operation. Nothing to do with videogames. Before Magnavox's first showing in 1972, at the Tavern on the Green exhibit, just prior to that I had a double hernia [operation] done and I was kind of depressed and I figured this is the time to get away from it all, take care of my insides. While I'm in the hospital, the corporate director of

patents and the director of IRD, independent research and development, come in, and they unfold this big thing, big sheet of paper about this big.

Hendrie: You were in the hospital?

Baer: I'm in the hospital, horizontal in bed, and they're coming up with this thing. They unfold it and it's an enlarged replica of a check. A check for $100,000 bucks, first license check from Magnavox to Sanders, and my depression went poof! Just like somebody had flipped a switch. It was the first indication that maybe, just maybe, we hadn't wasted our time. But in any event, going back to a chronological history of Magnavox, here it is December, January of 1972. They didn't really push videogames, the Odyssey, in 1973, which really bothered me because they were our only licensing company at the time. They made another big push in 1974 so that by the time 1975 came along, they had produced and sold roughly 350,000 units. If you multiply that by, say, four people that might've seen it, because the average family is, say, three plus visitors, that's a couple million people.

Hendrie: Well, that's pretty good.

Baer: Probably, with visitors.

Hendrie: Now did they make any changes in the design? Or it's still basically just transistors? Is it individual components?

Baer: If you hung two of the schematics – and they're big foldouts like this-- side by side, the one with Brown Box, and the one for the Odyssey, you'd be hard pressed to see the difference.

Hendrie: Even after the second or third year they were still just making them the same way?

Baer: Yeah, they built the same damned thing for three years going. The third year they had the next model, which was still transistorized but it had a couple of chips in it. I think for scoring – no, there was no scoring yet. I don't really remember what the Model 200, I think it was called, had inside. It came out about simultaneously with Atari's home Pong game, which they sold to Sears, which was a very successful product. They sold a couple million of them, I think in one year, Christmas 1975. It's funny because we, "we" being Lou Etlinger, the corporate director of patents who just passed away a month ago, Lou and I and my technician, by this time I think he was an engineering associate; we had made an engineer out of him. We all went to Chicago to visit some buyer at Sears, and all he wanted to talk about, the buyer wanted to talk about his history in electronics, the ham gear he had seen or built or sold. We couldn't get him to pay much attention to the little white television set we brought with us and the ping pong game we're playing on it. Meanwhile, this is about 1968 -- no, it must've been 1969. How many years later? 1975. Six years later Nolan Bushnell goes to Chicago with a working model, and he gets the most enthusiastic reception, and advances of, I don't know, how many million bucks, and he's in business, right?

Hendrie: Yeah.

Baer: And he was damned lucky too, because at that time, I think, the company was in financial difficulties.

Hendrie: Yes, all right.

Baer: I assume that sooner or later, if you haven't already done it, you'll talk to Nolan. You'll talk to Al Alcorn, and don't forget Ted Dabney, who is the guy who really did the design of most of the early hardware.

Hendrie: Is that right? Okay.

Baer: Find out what really happened. But they had their ups and downs, you know, in the beginning, because I don't think they really knew how to run the business. But that's for them to tell. It's their story to tell.

Hendrie: Exactly.

Baer: Going back to the Magnavox story, I had Magnavox people come in to Nashua to Sanders repeatedly. I went there repeatedly. We demonstrated all manner of things, which I'll describe in a minute. We never, ever sold them a thing. Fortunately, by 1975, they had awakened to the fact that maybe there was enough business out there which infringed our patents, which had issued by that time that it made sense to go after these people. We'll do that in a minute, but I want to go back to some of the things I worked on that never found a home there. To begin with, in the late 1960s and early 1970s, I figured that I might want to go back to the original idea of bringing videogames to the cable, making cable transmission interactive. I believe I recited earlier my bringing Teleprompter people up to Nashua.

Hendrie: Yes, that you tried to sell to Teleprompter.

Baer: Right, and of course the whole idea was then to put good-looking graphics, backgrounds, up on a screen instead of nothing or making use of transparent overlays like the ones in back of me up here, because the state-of-the-art didn't allow us to put anything up there, and then key overlay the video background, whatever game symbology we had. Well, by 1972, 1973, video tape recorders were a reality. So it made a lot of sense, I thought, for a cable company to reconsider playing games and providing not only colorful backgrounds, in fact moving picture backgrounds, but also transmit data nested in the video which you could extract and use for the interaction. That also, in an effort that lasted the better part of 10 years, and if I go through my day books, it's amazing how many places I went to. I talked with the Jerrold's, who built the set-top converters, the General Instruments, who built the guts and the chips for the converters and lots of other good stuff. And, of course, built the AY-3-8500 single chip Pong game, ping-pong

game, which became extremely popular as the device that went into millions and millions of videogames, made mostly in Hong Kong and China and Taiwan in the mid-1970s. I lost the train that set this.

Hendrie: You were talking about the different ideas you had. You were talking about cable.

Baer: Got it, thank you. A long-winded sentence, and I lost track of where it started. In any event, I never got anywhere with the cable people. We got so far as to convert an Odyssey so it could take a signal coming in from a cable station in Malden, Massachusetts, where one of them made their facility available to us late at night. We transmitted a nice looking background from a camera pointing at a colorful chart on the wall, and decoded all this stuff in an Odyssey which we had modified, and played four-handed ping-pong on top of the stuff they were transmitting. Well, that went nowhere either. There was a lot of money spent in the 1970s by cable companies, like Warner on interactive video. It all went nowhere. This is one unsuccessful relationship. Going back to my relationship with Magnavox and my attempts to bring new stuff in there. One of the things I tried to do was to show the relationship between a video tape recorder and videogames. A tape recorder being another logical source of background information over which you could overlay things. One of the things we did early on was to take a video of a … uh, flipper game. Help me.

Hendrie: Pong game?

Baer: No.

Hendrie: I know what you mean.

Baer: We're both tongue-tied. Anyhow, flipper game. [Means pinball.] We'll come up with it in a second. So we pointed a camera at this very colorful playing field, with all the bumpers doing their gyrating, the lights blinking, stuff you would never in your wildest dreams imagine producible via electronics. A lead-pipe cinch nowadays. Then we developed a piece of equipment that took the tape we generated by pointing it (the camera) at this playing surface and coded the frame-by-frame positions of the various bumpers and flippers and the positions of the walls, so that when a synthetically computer-generated ball moved around the playing field, it knew where it was. It knew what to do with it when it hit one of these real-life bumpers. That was quite a job and it took us quite a while to do that. Before we had a chance to really demonstrate this functional game, a couple of the military people inside Sanders came and looked at it and their instant reaction was, "Well, can you shoot at Russian tanks?" So I thought about it for about ten microseconds. "Of course we could shoot at Russian tanks." What's the difference? It's just a bunch of Russian tank models running through the grass, which will probably look like trees or bamboo or something. If you want to shoot at it and have a symbol come up in the place where we're aiming, that we can generate by computer. Nesting data, we'd figured out how to do that on the flipper machine. So we said "sure".

The next thing we know is we're launched into interactive videotape-based and later on videodisk-based, analog video disk, and then data on DVD-based interactive video training and education, which put Sanders into a new small business. We got several contracts out of that. One of them was for a simulator for the Army for what they called the CEV, Combat Engineer Vehicle, which was a converted tank from which they fired satchel charges at embankments and other places they couldn't move with ordinary artillery rounds. The gunner had a hand wheel with which he directed a canon and a monocular from which he was looking at the scenery. We emulated all that except that what the monocular was looking at was not outdoor scenery but the screen of a television set on which we were running video, outside scenes. Then if you aimed at a particular target and you pushed the button it would fire the round and there would be an explosion symbol generated by hardware, which was an Apple IIe. I'll talk about that in a second. That explosion symbol would show up in the exact spot where we were aiming; if that coincided with a target we were looking for, you got a hit and you got scored. The Apple had a high resolution graphics mode which drew a pretty respectable-looking symbol so you could make nice flames in red and white and yellow out of it, and of course it has an audio capability so it could make a percussion sound. So we used it, but there was one problem with the Apple. The Apple's output delivered non-interlaced video. You know, it did not interlace every other line, whereas the stuff coming off the videotape player of course was interlaced.

Hendrie: It was a standard television thing.

Baer: So we had to rebuild the Apple and make it run interlaced, which was a major production. It required three or four cards full of hardware and a good six months of development work. But all of that led to a patent, which I tried to palm off on various people for several years thereafter with notable lack of success. Everybody talked a lot about interactive video but nobody really did much.

Hendrie: But the training -- they bought and used it.

Baer: Yeah, and after that I think we got a contract for emulating the light anti-tank weapon. It was the first. The CEV, the Combat Engineer Vehicle, I think was second, than several other shoulder-launched missiles were emulated. That sent us into a new business. It was small but it was worth doing. We had an ex-Army Special Forces guy on board who became a marketeer. He sold that stuff and I guess he was fairly successful. I remember going to the Pentagon once, and if you've never been to the Pentagon, you can't imagine what that place looks like. It's several concentric rings of this pentagonal building which goes on forever and ever. I mean, it's miles and miles and corridors inside. And here we are. We have our light anti-tank weapon shoulder launch thing that looks like a tube about four inches in diameter, black, which you hold on your shoulder and point at the screen. We have with us a Kloss projection television set which produced a six-foot diameter picture, in color of course, a videotape recorder. All of this on a big cart rolling through the expanses of the Pentagon and wound up causing so much enthusiasm that the next thing we know is we're surrounded by two or three-star generals and they made us demonstrate to the doctor of DDR, the director of research and development. I wound up in the Assistant Secretary of the Army's office and he called in a bunch of generals and they all stood there, firing the LAW (Light Antitank Weapon) at Russian tanks going by on the screen, and out of it came <makes "phht" noise, holds fingers making a circle>.

Hendrie: Nothing. They had a lot of fun but nobody--

Baer: A lot of fun, but not a buck to be had. Typical. If the subject is what did I do with my time in the 1970s, I spent a lot of time trying to introduce video disc, video tape, video disc-based interactive video to whoever I could find that would hold still, whether it was the military or commercial application, with notable lack of success. When you think about it, how stupid could they be? Take a set-top converter, for example. You have a relationship with a cable company, you pay them every month and they give you this box that's called the set-top converter, that sits on top [of the TV]. What does a set-top converter have in it? It certainly has a power supply in it. It's got a chassis in it. It's got an electronic circuit board in it. It interfaces with your television set. It knows how to spit stuff into your antenna terminals. It's got about 80% of what you need to do a videogame, right? Why don't we just stick one of General Instrument AY-3-8500 chips in there? They already made the rest of the stuff. It never happened.

Hendrie: That is sort of interesting.

Baer: And I was at the highest levels of General Instrument, and everybody always got very enthusiastic when I first brought the ideas in, and it all went nowhere. I tell you what: don't send an engineer out to sell anything. It doesn't work. No matter how enthusiastic you think you are, or how persuasive you are, there's something missing. I'll give you an example that's out of chronological order. Ten years later, in the 1980s, when I'm down in my little lab in our condo in Florida, I built a whole bunch of backpacks for G.I. Joes. They all do neat electronic things like shoot at each other with infrared rays and topple each other over. I had one that was a mine detector. Another one was a medic who administered blood pressure measurements to a patient coming off a helicopter. All this good stuff. Those electronic backpacks were shown to Hasbro by a marketeer whom I met briefly in a hotel room in Boston before he took it out to Rhode Island to Hasbro, and I was dumb enough not to go with him. Maybe just as well. He came back with a humongous advance. He didn't even really look at the hardware when I showed it to him in his hotel room. He was confident that the people at the other end, the toy company people, would know what to do with it when they saw it. In any event, what's the bottom line? He probably plays golf with all the right people every Sunday, and he knows how to sell. When I saw that, I got busy and built two more -- I think it was two more -- items, and this time I went with him to Rhode Island and I'm crawling around the floor. This time I'm in my 60s, I guess. Out of it came another $15,000 or $20,000 grand.

Hendrie: Oh my goodness.

Baer: Advance, mind you, on potential royalties. Then Hasbro, in their great wisdom, decided not to do the whole thing. But that's beside the point. The point is: don't send engineers out to sell.

Hendrie: Yes, all right.

Baer: And I think that was my big problem, and I didn't know any better.

Hendrie: And it took you a long time to figure that out.

Baer: Well, it didn't really take me that long, but I couldn't find the people to work with me. I mean, its one thing to know what you want to do, it's another thing to make it really happen.

Hendrie: Exactly.

Baer: Yeah.

Hendrie: All right. Why don't we change the tape right now.

Hendrie: Good. We're back again. One thing I wanted to ask was if you knew a little bit of the history of the PONG chip at General Instruments. Where did that come from?

Baer: That's a very interesting story. I went there on a visit for I don't know what. I went to see the general manager of GI in Hicksville, Long Island quite often. And he said, "Hey, I gotta show you something." He introduced me to two guys from Scotland who had developed the chip that became the AY-3-8500 chip as sort of a back room operation. It wasn't authorized, just something they did at first against the better judgment of management. They brought that to-- I guess when Hicksville learned about it - I forgot the general manager's name right now. He became the manager of General Instruments, now Microchip in Arizona later on. When he heard about what was going on in Scotland, he had these guys come over with their developmental units or system. He got very enthusiastic and knew he had something. He had enough confidence in me to show it to me. I don't know who else he showed it to. But, boy, I got really excited when I saw that. It's basically a state machine, a bunch of transistors hooked up to make a game, all on one chip with very few external parts. The external parts consisted of one transistor as sort of a clock oscillator running at about a megahertz. But free running, it wasn't precise. And of course, the RF oscillator/modulator, that operated on channel 3 or channel 4, that was external. The potentiometers that moved the spots around the screen, they were external. A few push buttons. But that was about all the external hardware needed. Everything else was on that chip, which now made it possible for any dunce to build a videogame.

Hendrie: Yes, and all the circuits and all the logic.

Baer: Yes, it was all done, all engineered for them. So as a result of that, eventually we had upwards of - I don't know - maybe 100 to 150 licensees in the general China/Taiwan area alone. We had -- I think I may have mentioned it earlier -- we had one company, Radofin, a major electronics, radio, television set accessory producer in Hong Kong, monitor the activities of all of these Far East producers of video games. I guess they took a percent or so of our license income in return for making sure that all of these guys came under the license. We made a hell of a lot of money off of those AY-3-8500 game chips. In any event, in Hicksville, when they showed me this, my instant reaction was to get on the telephone and call the president of

Coleco in Hartford, Connecticut and suggest that he get his or somebody else's tail down to Hicksville, Long Island in one hurry - he had expressed an interest in video games before - and see what was being demonstrated there. So as a result of that, Coleco got on the list for deliveries of AY-3-8500 chips at a time when they were still having trouble getting the first batch through production, and eventually was the recipient of chips when everybody else was standing in line trying to get chips that were so rare because the yield was still low. We forget these days that when integrated circuits were started, transistors, anything in the semiconductor industry, there was as much as scrappage as there was good stuff. The yields were low, especially on more complex chips [where] the yields were even lower. That basically put Coleco into the business of producing their earliest game, the Telstar game, which was very successful. I guess that exhausts the AY-3-8500.

Hendrie: Well, the other question I would have is: did the designers in Scotland, did they copy anybody else's circuits, or did they just said, "Well, we'll just figure it out from scratch"?

Baer: Oh, sure. It's not that complicated.

Hendrie: Yes. Okay. It's not that hard to do.

Baer: No. You start out with a clock and you use some dividers, flip-flips and others, or shift registers to generate horizontal and vertical sync frequencies, which since they didn't bother with interlace, were linear relationships. You divide the original clock frequency to come out with roughly 15750; 15750 Hertz for horizontal, 60 Hertz for vertical sync. You generate a ball by using, again, using shift registers. It's not that hard to do. Any good digital hardware designer can do that.

Hendrie: Can go figure that out.

Baer: Yes. So they figured that out from scratch. Within a year or so, several other companies did the same thing. The company that built the microprocessor in Pennsylvania - I can't remember the name right now -- MOS Technology, got into that business too, made a chip set. Several other companies that don't quite come to mind. Read my book.

Hendrie: Okay. It's all in there.

Baer: It's in there. They all made chips and they wound up in a few pieces of hardware. But by and large, the business was dominated on the one hand by Atari making their own and having their chips made by a California company. I forgot which one right now. They went through two different companies to make their chip. By and large, everybody else used AY-3-8500 chip and successors, a series of variants -- improved versions of the AY-3-8500. That had additional capabilities like four players instead of two players, like other games including, later on, tank games with tanks fighting each other, all of which were developed in Scotland, as far as I know. But I'm not too sure of that because one of the two individuals who came from

Scotland, the two designers, stayed on at Hicksville for the next five or six or seven years and eventually went into business for himself. So it might have all been designed in Hicksville. I can't be too sure.

Hendrie: Okay.

Baer: Enough of that.

Hendrie: Yes. Good. So now you've told me about a relationship, some things you did with Coleco. Some ideas you had that you tried to sell cable companies, the interactive video.

Baer: The Magnavox relationship.

Hendrie: Yes, what else?

Baer: What else?

Hendrie: What's going on?

Baer: Well, what else? In the late 1970s, I branched out into a totally unrelated business, the toy and game business, the non-video toy and game business. At that time, I had already been a Sanders, later a Lockheed Engineering Fellow for a number of years. Being a Fellow meant that you're supposed to be a mentor to other engineers, walk around, meet the guys in the hall or in the bathroom, at the fountain, and listen to their problems and help them solve their problems, which was fine. But at the same time, I was already extremely busy going in and out of court. I guess that's another chapter we have to cover.

Hendrie: Yes, we need to cover that.

Baer: In fact, we should cover that before I go into--

Hendrie: All right. Let's do that next.

Baer: Yes. Let me finish the sentence though. I got into the electronic toy and game business because I wanted to do something on the bench myself. I'm an engineer and one of the things that really bothered me is that, as a manager, you get further and further and further away from hands-on acquaintance with the hardware and software. It doesn't take long in this fast-moving field to become totally, irrevocably obsolete. That's what put me in a depression in the late 1970s. I'm the father confessor all day long. I'm turning my collar around, listening to people problems. That was the major job of a division supervisor here, solving all the damn people

problems, and less and less technical content in everyday activities. I kept myself alive somewhat by convincing the corporate director of patents to give me money to do some R&D.

As a result of that -- I think we've been through this -- I put the company into the thick film and thin film business, meaning that we could build stuff on ceramic modules like everybody else was doing. But nobody else was lifting a finger in that direction at Sanders. So I took it upon myself. Yes, we went through the business of building high-speed displays, which got us a NASA contract. So some of that was satisfying me as an engineer, but it still wasn't hands-on. I directed somebody to do something in a vacuum chamber or put a couple of guys who were really good at making multi-layer printed circuits into building a thick film screening capability. That wasn't enough. I wanted to get back to the bench, and the way to do that was to sit down at home and build stuff at home after hours. I did some of that during the Brown Box period. Since I couldn't do it in the daytime, I'd sit there at night and work on some of the problems, had the technician come over to my house, all of which was probably completely and thoroughly illegal. It violated all of the rules, and insurance company's rules, and who knows what…

Hendrie: And everything else.

Baer: --Federal rules, because we're all working on classified stuff during the daytime - not the technician, but me. But hell, we just did it. Back to the subject of lawsuits, I mentioned earlier that by the mid-1970s, there were so many coin-op manufacturers of games that had symbology in which there was interaction between machine controlled and manually controlled spots on the screen, symbols on the screen, which is what our patents basically covered. We weren't so much interested in pursuing people for having videogames. That would have been a much tougher road to hoe because then it would have dragged in all the work done at MIT back in the Spacewar! days and all that stuff, which really had nothing to do with it. It wasn't raster-scan technology and nothing to do with the concept of playing games on the home television set. All that stuff got dragged in anyway, but it had much less impact because we weren't really suing based on that. What we were suing was, whom we were suing was, anybody who produced a game in which manually and machine controlled spots interacted, and specifically in ways in which the machine controlled spot would change its direction, its motion, its characteristics or whatever after coincidence with a manually controlled spot. In a ping-pong game, the manually controlled spot is the paddle. The machine controlled spot is the ball. If the ball hits the paddle, is coincident with the paddle, it does something like bounce off in a different direction. Bingo. That's what our claims covered.

[Nolan] Bushnell recognized it. He knew he was going to lose and decided to come under contract. The first lawsuit took place in Chicago. I spent a whole week on the stand, going through every one of the several hundreds of pages, more like 500 pages of documents, which the lawyers had xeroxed. Fortunately, they didn't have the originals in court, which was very fortuitous because within the last two years, we were able to find them and salvage them, send them to the Smithsonian. They scanned them. You can go to the website at the Smithsonian and see them, all 500 of them in high-resolution. In any event, there was all this stuff spread out in box after box on the floor. A "Brown Box" connected to a television set was sitting next to it. All the other pieces of hardware, all eight different video game models that we built as we developed the technology were all in the courtroom, several of them functional. So I spent an

entire week basically going page-by-page, which meant virtually day-by-day through activity between 1966 and 1969 for the judge, who was an extremely interesting guy. Young; my guess is he was still in his 40s and had been a private practitioner of law, just a year or two before he went onto the bench. A big football player type and very, very sharp, very smart judge, John F. Grady. He was taught electronics first, over the first week. Television technology over the second week, and he absorbed it all, unlike other judges in subsequent trials who sat back like this [hands behind his head], eyes closed. You couldn't quite tell whether you were getting through or whether he was sleeping. This guy really wanted to learn and he was very personable. He'd always turn from the bench and look at the witness box where I was sitting and ask for elucidations, explanations, in a very informal way. He was a pleasure to be with. And of course we won that lawsuit. It went to appeal in the Court of Appeals. The judgment was upheld and we collected a lot of money.

Hendrie: Now, who were the plaintiffs in that lawsuit?

Baer: The plaintiff was Magnavox/Sanders and we were suing Atari, Bally -- or Bally-Midway; I don't remember if they were already Bally-Midway -- Seeburg, two or three others.

Hendrie: You were suing them all together?

Baer: All joined together.

Hendrie: All the cases were joined.

Baer: Yes. They were all joined. They were all arcade manufacturers, because there were no home videogames yet. Oh, yeah, the Atari Sears game was already there. That's true. But primarily, we were fighting these arcade manufacturers. They all lost and they eventually had to cough up a big chunk of money.

Hendrie: Can you give me some idea of how much money was involved here? How much money actually they had to pay?

Baer: Millions.

Hendrie: Millions. Okay.

Baer: Well, I mean at the tail end of six or seven years of litigation in the 1970s and some more for past infringement as late at the mid-1990s. I was deposed in Chicago once in a case against Taito, Data East and a couple of other coin-op manufacturers where Sanders/Magnavox, Sanders and Philips collected - I forgot how many million bucks - again, as late as 1995. Close to $100 million was collected over that period of time.

Hendrie: Oh, really.

Baer: Yes, it was a big chunk of money. You multiply that by at least a factor of 2 to 2.5 for inflation over that period of time. So that's $200 to $300 million, which was a lot of money then.

Hendrie: Right. Well, that was a lot of money for Sanders. I mean Sanders was a good size company, but not that big a company.

Baer: Well, first the lawyers took their take, and then the rest got split 50/50 between Sanders. That was the agreement. It was a lot of money, especially since there was no effort except to pay me. I had a full-time job, on which I didn't do a hell of a lot. I had a lot of years for the company, but-- Well, it depends on how you look at what I did. I got them into the interactive video-based education and simulation business, and I helped other people solve their problems as an Engineering Fellow. I probably earned my money that way too; meanwhile I was producing so much money for the company that they really didn't care what I did.

Hendrie: They said this is just payback for that skunkworks you were operating in the 1960s. It paid off.

Baer: Of course, they used me as an example of how much foresight the company has, how insightful the company policy is, how supportive they are of inventors inside, all of which was total nonsense.

Hendrie: Just for the record, Sanders eventually grew-- How big were they at the peak of their success in the military business?

Baer: Well, they're still very successful. In the 1960s when I started with them, they had a really tremendous run into the late 1960s when the military electronics business took a big dive. At that point, we had 11,000 people mostly in Nashua, New Hampshire, [but] a sizeable plant on Long Island where we were doing commercial stuff. We were building Hertz's registration system. They were the first to have a computer-controlled registration system. I don't know if you remember back then. They had red typewriters -- IBM typewriters -- and red control panels. That was built by Sanders in a Long Island plant. We had a small place in Virginia, one or two others. Oh, yeah, we had another division in Nashua that was concerned mostly with ocean systems, submarine warfare. We were the biggest employer in the State of New Hampshire at the time.

Hendrie: Do you remember how much revenue, roughly what the annual revenue was at that point?

Baer: Yes, maybe $400 to $500 million, which was a lot of money then.

Hendrie: That's a lot of money. Okay.

Baer: Yes. I mean today, a company like Google starts off from nowhere. Two years later, they have a capitalization, or whatever the heck that artificial number means, of several billion dollars of paper value. When I went into business in the 1950s and 1960s, man, we were damn lucky to have $2 million worth of business a year and be profitable and pay everybody, and then maybe have $3 million the next year, and $4 million. 200? 300? One billion? Totally different world.

Hendrie: When was Sanders sold?

Baer: Sanders was acquired through a series of steps. First, my old alma mater, Loral, made an unfriendly tender for Sanders. Sanders wanted to do nothing to do with it. So they got themselves a white knight, which was Lockheed. The reason why they were interested is because there was a relationship between Sanders and Lockheed's president at the time, who was my boss when he was executive VP, Harold Pope. Harold had been chief engineer of some aviation division at Lockheed. He was a very senior person there for many years. He was a known quantity. He had all of those relationships. He brought Lockheed in, which was very fortunate for guys like me because through the early days of videogames and even before that, I got substantial stock options, which weren't worth a hell of a lot in the beginning. But when Loral came along, they bid up the price from the 20s to the 40s, I think 47, which instantly doubled what--

Hendrie: What you had, right.

Baer: --what we had. Then along came Lockheed and bought us all out at something, I think, like $68. So we all went crying all the way to the bank.

Hendrie: When did this occur? What year? Do you remember?

Baer: In the mid-1970s. Yes, we were all the way into the videogame business in the mid-1970s. Of course, then it became Lockheed Martin. Sanders became a Lockheed Martin subsidiary, and then a division, and then BAE bought them out about five or six years ago. The name Sanders disappeared and they just became an operation within BAE, British Aerospace, I guess, it is.

Hendrie: I see. All right.

Baer: But if you go inside, it's still the same old company.

Hendrie: Same old company.

Baer: Not quite, because they branched out into some civilian stuff. I'm not too familiar with what they're doing because it's the same old hush-hush stuff. There isn't much publicity. You don't really know what's going on inside. When I go there physically -- I get invited every once in a while to things like award ceremonies for engineers who get annual awards -- I don't recognize anybody except one or two people, senior people and one or two engineers who worked in my division at one time who are now outside consultants and show up for the same affairs. Outside of that, it's two generations ago that I was there.

Hendrie: That's right. That's a long time.

Baer: Two generations of engineers. It's a long time.

Hendrie: That's true. That is a long time.

Baer: It's a long time. All the old timers have died off, left, right, and sideways. Sandy is still around – Royden Sanders. He walks with a cane and sometimes a walker, but he still runs a little company nearby here. [Sandy died in 2007]. Harold Pope died. He had Alzheimer's the last several years. Marty Richmond, who was a terrific engineer whom I worked with on a little project in Florida where we wintered for six months. He came down for a month at a time. We worked on a rear-looking vehicle detector to be put on a bicycle, basically a radar. It didn't work because we couldn't solve the interference problem .... all the trees and other stuff going by. He died four months ago. He also had a touch of Alzheimer's. It's really sad how these old guys, all these brilliant guys lose their marbles and disappear. I think there are two of the original associates left. Ok, back to the topic.

Hendrie: Yes, back to your story. So I gather you got connected with some independent… started doing independent toys. Tell us about that.

Baer: Well, I might have mentioned it, but I'll say it again. I'm downstairs in the Canal Street building at Sanders where I first started, and I think I'm talking to a vendor, a semiconductor vendor, about some component parts. I tell him that I've been doodling with electronic toys in my basement lab. I said, "I'd really like to do more in that area." He says, "Do you know Marvin Glass? Have you ever considered working with them?" I said, "No, I never heard of them." It turned out that Marvin Glass and Associates is a toy and game development company, the largest independent toy and game developers in the country at the time, located in Chicago, for the last, by then maybe 15 to 20 years. Marvin Glass, Marvin himself, as I found out shortly, had just died a year before, and he was the heart and soul of the company. If you go back in the history of toys and game, you recognize what he did almost instantly. Things like Mr. Potato Head, half a dozen other home staples, which I can't come up with right now. They were all products of his imagination. By the time I got in touch with them, they had maybe 20 or 30 designers working with them. (They had) a very large model shop downstairs below the design area where they made really beautiful-looking prototypes. They had very good drill presses, vertical millers, latest molding machinery, and good craftsmen that could really make beautiful stuff. But I'd never heard of them. So I picked up the phone. I called them. The next thing I know is one of the partners came to visit me here in the lab, looked me over and invited me to

come to Chicago. I went there and left with a handshake agreement to become their outside electronics capability. That's how my electronic toy and game career took off.

Hendrie: Okay.

Baer: I think we already talked about that, but I'll just mention what we did. At first, the managing partner, who was a non-toy guy but must have been a friend or relationship to Marvin Glass himself, wanted me to build a microprocessor-controlled pinball machine. That's the word--

Hendrie: "Pinball," that what we were looking for.

Baer: That's what we were looking for. It came to me - pinball machine. I started to look at the design and picked a Motorola microprocessor and they decided otherwise. I was happy because I really didn't want to design a pinball machine. I wanted to build electronic toys and games. Then the next idea was to build a record player, which could differentiate between lands, bands, and grooves, so that you could command it to go to the third band or fourth band on the record. These are the 33-RPM days.

Hendrie: Yes. Okay.

Baer: So you could program it to play selected bands, repeat bands, go back to play earlier ones on command. I wasn't too crazy about that too, but I got into it. That turned in to be quite a job. On that job, we needed a processor. So we used a TMS-1000, which was a four-bit processor made by TI. It was low-cost, one of the earliest low-cost processors. We cut our teeth on that one in this record player project. It turned out that when we finished the record player, there was really only one record player company that made 90% of all the record players, including the millions of record changers that were being made at the time. It was a company whose name, again, escapes me, located in Scotland. BSR. BSR ! They sent representatives, very high-level people, to Chicago and I remember standing there and watching the guys while they were looking at the machine doing its thing and their faces were like down to here. I knew there was something wrong. It wasn't our demonstration. To make a long story short, it took us years to find out why they wouldn't do anything, wouldn't move off a dime. It was an ideal product for them. They had just spent one million dollars on an individual inventor in Scotland who had come up with a concept of controlling, computer controlling--

Hendrie: Of how to do this.

Baer: Yes, same damn thing. So they were committed to this guy. They actually produced this player, which was sort of worthless because just going back and forth on a single record is not good enough. What I said early in the game is we have to do this to a record changer. First of all, there were 100 record changers to every single player at the time.

Hendrie: Yes, everybody had a record changer.

Baer: Everybody had a damn record changer, in their radio, or next to their radio. Not only that, I came up, a little later, I came up with the concept of remote control. You think remote controls have always been around? The hell they have. They were early.. In the-- we're talking about early 1980s now- late 1970s. I forget exactly when - around the beginning of the 1970s. Motorola, Magnavox and a few other television manufacturers had remote controls like the acoustic ones, ultrasonic--

Hendrie: Yes, exactly.

Baer: Twang.

Hendrie: They go "twang." I remember those.

Baer: Yes. A piece of metal made it resonate at 20 or 30 kilohertz or something like that, and the microphone in the television set. All it did was have a motor, a stepper motor move the channels. So "click, click, click," from two to three to four to 13 and back around the tube. There was no volume control or nothing. That was the state of the art of remote controls. What I came up with as a remote control, it was wired. It had six or seven functions like: you're playing a song, the telephone rings, you push the stop button, the pause button and it lifts up the arm. It doesn't move it though. When you're off the phone, you push the pause button. The thing drops down and continues playing. Your wife says, "Hey, that's really nice. Play it again." You push the repeat button. The thing cycles back and plays it again. It had all these neat functions, which were much better than the original model we showed. By this time, Marvin Glass had already gotten kind of tired of "N" number of models I built and they money they spent without any return in sight. In fact they had sent me to England to deal with the possibility of licensing another record player company. They took the machine and kept it for a month. They paid in advanced and then decided not to do it. They were in Swindon. I remember being picked up at the airplane in Swindon, which is west of London. On the way back, on the airplane, British Airways, I came up with a remote control idea for the record changer. Had we done that in the beginning, things might have been different, but hindsight is 20/20. My recollection of that flight; the flight was a TWA flight. I remember standing in this huge crowds at - what's the big--

Hendrie: At Heathrow.

Baer: At Heathrow, right. Thank you. At Heathrow, and everybody was bitching about the way they were being served by British Airways. The guy in back of me was saying, "I'll never fly the ruddy flag again." The service was so poor. I don't know whether they've cleaned it up since. I've been there a few times since, but it was a mess. Anyway, my concentration at Marvin Glass began with two non-toy related items. But after that, I worked mostly on things I came up with, or on stuff that Howard Morrison, one of the associates who was in daily telephone contact with me. It was like I was--

Hendrie: Like he sat next to you at a desk and you were working there.

Baer: --Right next door in the next room to him, but I was working down here. We'd talk about things, either his ideas or my ideas. I'd be grinding out an idea a week, sometimes two. I'd build the hardware. FedEx was here at least twice a week, picking stuff up or delivering things to me and somewhere along the line, the relationship got so good that when I was in Chicago at one time, where I was every Monday for the longest time, they offered me a partnership, which I considered and was very generous and probably would have put me a million dollars ahead of where I am right now. But I decided I wasn't going to live in Chicago. No how, no way. I get in the car in the morning and travel for an hour and a quarter, and hour and a half on the Eisenhower or some place like that. Forget it. So I remained the outside electronics capability. One of the first things we did was build a game for Coleco, based on our experience with that TMS-1000 four-bit microprocessor. Amaze-a-tron. It's a nice little game. I don't know how many hundreds of thousands Coleco did. The next one was Simon.

Hendrie: What did it do? Tell me a little bit about it.

Baer: It's a little game in which you actually plugged little pegs into an X-Y matrix and you're supposed to get from here to there. You have to use some reason or rationale for doing it. The machine knows where you went and it tells you whether you did the right thing or wrong thing. I already forgot exactly how to play it.

Hendrie: Okay.

Baer: One thing about me is I'm no game player.

Hendrie: All right. You invent them, but you don't play them.

Baer: I invent them. I don't even necessarily invent the game action. I invent some concept that might be translatable onto some decent game action. Some guy whose psyche is all geared up to think about games day and night and crank out and make a real game out of it. But I'll do the electronics; it's cooperative.. So in this case, Howard Morrison was always my counterpoint who polished up the things that I came up with, or he originated some of the things by himself. Then I took up the challenge of creating the electronics to make it really work. It was a good relationship. From Simon, we went to--

Hendrie: Now, you didn't mention Simon before.

Baer: Oh, sorry.

Hendrie: You haven't done Simon yet. You did Amaze-a-tron.

Baer: Amaze-a-tron. Right after that we did Simon, and that came out of a conversation I had with Howard. I think a couple of years before, I had seen a game, a coin-op game, about this tall, called Touch-Me by Atari, which had four buttons on it, big, huge buttons and played a sequence game like Simon Says. It made really ugly, raucous noises, and it was an ugly looking cabinet. Never did well as an arcade game. But I said repeatedly to Howard, "That game has the makings of being a really good game if we clean it up." Nothing happened for two games and somehow, I guess Howard decided, "Well, we ought to do something." We actually bought a Touch-Me game. We played it repeatedly in the studios. Out of it came the concept of Simon.

Hendrie: Okay.

Baer: I remember the design for Simon, especially the software. That was a real chore. The guy who did the software was Lenny Cope. Lenny had worked for me for several years at Sanders. He was a mathematician by education. Very smart. Very, very clever programmer. Those were the days where memory was so limited, you really had--

Hendrie: You had to be a clever programmer.

Baer: You had to be damn clever. It was all of 1K of four-bit memory on that processor. So how did Lenny program this machine? He had a terminal, a teletype terminal in his bedroom that was connected to the telephone line, a paper tape reader. Do you remember the little half-inch wide tape, punched tape?

Hendrie: Yes.

Baer: And his machine would communicate with a computer sitting somewhere in Pennsylvania, on which TI had their program for the chip resident. Every month, I would get a telephone bill that looked like the national debt. Lenny would plug away at making the basic functions, and then we would burn a ROM, take the whole thing to Chicago and they'd play it, make some changes with several iterations. It was finally shown to a client who was one of the VPs for Milton Bradley, Mel Taft. Mel and Marvin Glass, they were very close because Mel had been there many times. A good friend. He saw the product instantly. So they were talking about going to license, but that's when our problem started. They sent in Dorothy Wooster, who was Ed Shea's, the president's, psychology sidekick. I think Dorothy was his daughter-in-law. The next thing we know, "Yes, this is fine, but can you do this? Can you do that? Can you add a switch to do this? Can you play this variation?" The memory didn't get any bigger, but the demands on what it was suppose to… The [camera] light's blinking. Does that mean your battery is low?

Hendrie: That means we're almost through the tape.

Baer: Yes. So poor Lenny had to repack the suitcase “N” number of times over again to find another free bit in memory here, another couple of bits here, rearrange a couple of things to salvage another bit. I don’t know. He’s really clever. So he deserves the major credit for making that machine what it is. The irony is that I don’t think most of these optional game functions were ever played. People play the basic game because--

Hendrie: Because the basic game fascinating. It’s really fun.

Baer: With a couple of switch positions to speed things up and make it tougher. But they didn’t play these all these other versions. Like one version involves your putting your own sequence in, instead of following the sequence of lighting up one of the four segments in a certain sequence. I don’t think anybody ever played that.

Hendrie: Okay. Good.

Baer: It's amazing when you think about how a person's mind has to function to keep a thousand balls up in the air when he has to write software that has to take into consideration that you’ve only got three bits here and four bits there, and if he does this that happens, if he does this, that happens. It's like, I guess the equivalent in hardware design is building something complex that's got lots of loops where one thing affects another. It takes a mathematical mind to do that kind of software, and I guess mathematicians are in demand these days by videogame companies because a lot of this stuff is so complex that unless you have that kind of a mind there's no way you're going to come up with solutions when you think about things like handling the shading in a modern videogame. That's probably three guys’ exclusive job, taking care of shading.

Hendrie: Yes, exactly.

Baer: Yeah, shadows, shading. What kind of a mind does it take to do that? Well in case of shadows and shading maybe it's an artistic thing, but the guys who wrote the software that allows the artistic types do their work now, what kind of a mind do they have? They have a mathematician's mind.

Hendrie: Yes. Well I think it was particularly - I agree with you - in the era when memories were very small, it was almost a puzzle to solve to how to fit everything in.

Baer: But even today you have to create these algorithms that solve problems in creative ways, and I don't see how you do that unless you've got a mathematician's mind. I never had that bent; my oldest son was that way, he's still that way. It looks my - his son, my grandson also has that ability. He goes through school, he never studies, but he's always ahead of the teachers in math because he works things out his own way, he never does it their way; but gets the right result.

Hendrie: Good; so getting back to Simon. So eventually all of the features got settled. What happened then?

Baer: Well, Simon was followed in short order by several other games that were built around that same TMS-1000 chip. The next one was a game called Maniac for Ideal, the Ideal Toy Company. Then Computer Perfection, for Lakeside. I've got a picture of me sitting at a workbench trouble shooting an early production model of Lakeside. I used to spend my weekends that way. Never fear, Friday afternoons Fed Ex would be at the door and the doorbell would ring and there's a box from somebody like Lakeside, and would you kindly spend your weekend fixing our problems? That kind of stuff. It never failed. Every weekend there was some problem I had to spend my weekend on. After about ten years with Glass I changed partners. It turned out that towards the end I was pumping in new ideas two or three times a week and they weren't going anywhere. The reason was simple, that unless you're physically in place in a company to protect your turf and push your product against that of other partners, you'd always be sucking hind tit and you'd be the last one in and out of the model shop and nobody else would have any interest in what you're doing because they're all pushing their own stuff. I just wanted – I got tired of sending in new concepts without them ever getting anywhere, or going nowhere fast. So I left and acquired another partner, who at the time wasn't doing well, but we did quite a few things on -

Hendrie: Now how did you find this? Who was this new partner?

Baer: Yeah, well I met him - this is Jay Smith -- Jay Smith ran..... Smith Engineering and Western Technologies, were the names of his company, still are, and in the lat ten years or so he's been doing mostly videogames. Jay was an engineer from way back when, good salesman, good marketer too, good negotiator. When I first met him at a CG Expo - no, not a CG Expo, but a CES Show in Las Vegas I think. I have this mental picture of having met him briefly then we went up to some elevated platform where they had built a little restaurant inside this large hall. We sat there and talked, and the next thing we know we exchanged agreements and he did all the marketing for me, and he finished the hardware that I built, and we did quite a bit of stuff together. First thing we did…

Hendrie: Now where was he located?

Baer: In Culver City, California.

Hendrie: So he's in California, okay.

Baer: Yeah. Well in those days it was a fax machine and telephone that kept us connected -- there was no web -- and Fed Ex to ship stuff back and forth. But what did we do together? Quite a few things. To begin with...

Hendrie: Yeah, remember what the first thing was?

Baer: Yeah, I'm trying to remember. I'm pretty sure it was a - one of two things. I had picked up a product of Fisher Price's which was a unit that looked like a television set, you plugged in a plastic cartridge about this big, this wide, with a crank on it. Inside it had an endless loop of eight millimeter film and you could project movies on this ground glass screen and the whole thing looked like a television set. I took the cartridge, motorized the drive, and than I put code between the sprocket holes so you could tell which frame you were next to, so you could home in on a frame, you could run a sequence, a moving picture sequence on command. In other words, I brought that old game whose name I've long since forget, it's like a household word; I brought that into the 20th Century. It was a nice product. We took that to Fisher Price in Aurora, New York. They went to contract, they spent about $100,000 on developing prototypes and than it disappeared. They didn't make the product. By coincidence, the mechanical engineer who was assigned to that project, had just started on the job at Fisher Price, was a young man from Russia, an émigré whom I met many years later when he became a friend of my oldest son at Boulder, Colorado. We talked to each other in a conversation, we discovered that we were both on the same job at one time and just didn't know it.

Hendrie: That's funny.

Baer: Small word.

Hendrie: Small world.

Baer: Yeah. After that I decided to go back to my videogame roots, and I did a scheme for putting four moving picture sequences on a screen simultaneously. It's like running video productions with three out of the four covered up by a screen. In the process of going through the one that was visible, you had to make choices, as in a multiple choice quiz, and as a function of your answer, one of the other windows would open up, so you had a branching capability in a linear medium like videotape. The technical problem here was what to do about voice, you had four sets of pictures - I mean that's no sweat that's easy enough to do- (but) how about four audio tracks, what do you do about that? So I came up with a scheme of modulating the video with audio. It had two tracks in the beginning, two tracks at the end of each horizontal line or sometimes all four tracks on one side, Where they were in the overscan where you didn't see them. The problem to be solved there, which I had to solve, is the fact that there is a discontinuity every time you get to the bottom of the screen during the vertical interval when the beam goes back up; there's a break in the horizontal lines and it produces a horrible 60 hertz buzz unless you do something about it. So the answer was to compress the audio so it would fit within the legitimate scan area, and then store that on videotape. On playback you'd have to expand it again, and how to do that - in those days you used a device made by the Japanese. It's basically an analog shift register where you could clock things in at one rate and clock them out at a different rate. That worked very well. It took a lot of doing to make the junctions between the end of one and the beginning of the next segment come out perfect but you could suppress the buzz until it was almost unnoticeable. That system went to TI. TI spent close to a $100,000 I think on helping us build a second generation version which I had little to do with. It was all in the hands of my partner and an outside engineer he hired for the project. Eventually TI also decided not to anything with it. So that's two jobs gone pretty far down the development pipe but not successful commercially. Then we landed a hot one with Galoob. Galoob is

another company that's disappeared from the scene. A South San Francisco Company, were successful about ten, 15 years. Run by three brothers. I think it was three brothers who when you met them always seemed to be floating about a foot and a quarter above the floor on some San Francisco substance, but very energetic, very, very clever, very smart and very gutsy. I called up my Culver City friend Jay Smith one November and said, hey Jay have you got a plush animal with a motorized mouth, a mechanized mouth, and preferably moving eyeballs or moving eyelids? He said yeah, yeah I just finished a job for Galoob of a plush bear which responds to button presses on his paw and his belly, and has a microprocessor and a voice chip inside, I'll send you a couple. The concept I had was to have the bear talk to his friend on the screen while a videotape was being played, with this cartoon character on the screen, and they talked back and forth with data nested on the videotape that would control the plush bear which the child was holding, mouth and eyeballs, and ping pong the sound back and forth. Between November and Toy Fair, which is, or was then, the second week of February in New York, I built two successive systems, meaning both an encoder to put codes on the tape, and the decoder which would be the product that would be sold to the end customer into which the bear gets plugged and into which the videotape player get plugged. I did both of those, and Jay convinced the Galoob people to make a 15 or 30 second, I forgot which, commercial. Two days before Toy Fair they're sending me this cartoon commercial....and I remember my wife and I are sitting on the floor in my lab playing that commercial from one videotape player and dubbing it into another one with the encoder box in between and one of us pushing buttons to operate - to put the codes to the eyeballs and the mouth on it in the right places -

Hendrie: So the bear -

Baer: - yeah, and I forgot what the other one was doing, but it was a two person project to encode this tape. I took that tape and the hardware, decoder hardware, to New York and installed it all in their booth at Toy Fair, downtown. When I met the guys, the Galoob guys, I said there, what do we charge for this thing? What a question to ask, what do we charge for this thing? So I sat down and worked up a bill of materials from memory on the back of some envelope and priced it from memory because I was pretty good at pricing Hong Kong prices at the time, and they took my numbers and they took orders on the basis of those numbers. You talk about guts at the Toy Fair! It went into production, but they didn't have enough engineering capability on board to get the thing moving, so I got another $30,000 or $40,000 separate development contract to help them engineer the production model. That was really nice job and they made a couple hundred thousand of them.

Hendrie: Very nice.

Baer: Yeah, very nice. Coincidentally, when, I guess it was early this year or late last year, when the gal who was in charge of making a video presentation for the gala affair at the Ritz Carlton after the National Medal of Technology ceremony in the morning, when she came here to make some video to describe what I did, I flipped on the VCR with the Smarty Bear and ran a tape that was arbitrarily at some space. I swear nobody believes me, I did not know where the tape was or what it would play, but it happened to at a place where Argyle, Smarty Bear's friend on screen, this cartoon friend on the screen, is flying on top of a bird across the country and he's on his way to Washington and what does he say? He says, “Oh well we're finally on our

way to Washington, maybe I'll even meet the President, maybe I'll even get a medal". Honest to God that's what he said.

Hendrie: Oh my goodness.

Baer: Of course the woman who was doing the taping, the videotaping, recorded all that and I didn't think much of it and that's what was part of the five minute video that's shown– on…

Hendrie: Oh and everybody loved that didn't they?

Baer: - three big screens and the Ritz Carlton when all the families were there, dignitaries from the government, it was really funny. So now I keep the tape reeled up to *that* place so when I demonstrate Smarty Bear, it is right there -

Hendrie: It's right there.

Baer: - he is at the right spot.

Hendrie: Oh that's cool.

Baer: But I didn't do it on purpose and nobody believes me.

Hendrie: Wow, okay.

Baer: Anyhow that was a successful job. Then I did a couple of early G.I. Joe Backpacks, of which the concept sold through. I had one figure shooting at another figure standing on a platform which would topple the character. I had another similar set up where a truck would explode and a door would fly off and Kenner went with that idea, Kenner in Cincinnati, Ohio, now a Hasbro Company. They made a successful product for their M ask series, not for G.I. Joe. That was a small figure series for several years, that kids collected, where the figures wore masks, so it's the Mask series. They made this very neat truck, which was attacked by this shipping crate that opened up into a flying vehicle with a masked guy sitting inside shooting an IR beam at the vehicle, and at first the vehicle's hood would fly off, then a door would fly off, and than the wheels, the front wheels would fly off. They did a really nice job, and that made a few bucks for us. Smarty Bear had a second go around. Worlds of Wonder did a bear, it was designed for them by an independent, also in San Francisco, who took a license under the patent that issued to Jay Smith and me. I did some consulting work for that bear, which was different from the one that I had, by getting rid of the umbilical cord between the bear and the box, and than doing it all by RF radio transmission.

Hendrie: Oh wow, okay.

Baer: It was wireless, but basically it was the same thing. So we collected a few bucks on that too. Not that many, and not for a year or two after the product was out there. The company was in financial trouble and I think the independent developer/ inventor, had to sue them. They finally got the money, and then paid off Jay Smith who quietly neglected to pay me. It wasn't until years later that he finally paid me in the form of shares of a small company he was running in New York, in addition to his California operation. Then he switched to another company, acquired another company, and the shares I had were switched for shares in the new company. I thought that it was worthless paper; I figured maybe it was worth a few bucks. Somehow the stock took off about a year after I acquired it, just in time from the one year waiting period to expire, which when you get stock, you need - under those conditions, you need to hold onto it for -

Hendrie: For a year

Baer: …for capital gains. It took off and it rose substantially and I had the good common sense to sell it right then and there and I about tripled the money that Jay owed me.

Hendrie: Oh very good.

Baer: So for once I wasn't totally taken advantage of. Other products with Jay - what else did we do that went anywhere? We did a lot of stuff that didn't make it into the marketplace. Anyhow, we split company and I got together with Phil Orbanes, ex-V.P. from Parker Brothers, who was in charge of acquiring new product there. Very nice, very honorable person, very bright, “Mr. Monopoly” for years after he left Parker Bros. He was in charge of the Monopoly contests all over the world, places like Japan, and Korea, other places - Phil was the guy who ran those shows. Phil and I did a whole lot of - he's a board game person. I mean he's the antithesis of me, he loves board games, he understands them, he knows what makes them tick. So he came up with a number of games which had electronic content. I built them for him. Went with him to places like Hasbro to demonstrate them and try to get them under license. Found out that he was pretty poor presenter at the time. He had never done that before, he was a V.P. Engineering somewhere else, but as we presented products I could see him learning and growing. Every time he got in a meeting he was a little more self assured and more effective, but we didn't place anything. We had a neat thing like - I think we called it Sick Puppy, in which a puppy had electronics inside and you had to guess at what was wrong with him, and than feed him medicine by putting tablets in his mouth, which were encoded so the machine knew what you were feeding him. If you fed him the right stuff in the right sequence you won. That was shown all over, in fact we gave it to a marketing agent who took it to Europe, to Israel and other places, and it just didn't make it. We ought to try and do it again because the content - the electronic content -- now is probably a lot cheaper then it was then. A lot of things didn't go simply because the price was incompatible with what the product might be able to bear in the market place. We did a number of board games, we did Sick Puppy, and than we had the concept of doing a recordable talking book. Talking books were very common at the time. This is late 80's I think. Kids were given or bought these books where you push buttons and they make pre-recorded sounds or noises or speak. Well, my concept was to leave the buttons unrecorded and put a recordable voice chip into the machine, so a kid go to the first page of the book and say, well the green button requires that you make a horrible sound, and the blue

button requires you make a sound like a pig, and whatever the story called for. The kid puts his voice in there and reads the story, when he gets to the green, the red, and the blue symbols and pushes the corresponding buttons his voice comes back to him. We sold that concept to Western Technology, Golden Books, up in Wisconsin somewhere. They did not have enough engineering capability on board, so a friend of mine who worked for a company that became an IBM company, he lives in Billerica Mass, not too far from me, maybe a half hour. He did the software, and we basically production-engineered this thing for Western Publishing. They put out two books; they went quite well, they were nice. One of the big problems was that we had to protect the book in its shrink wrap form in the store from being abused by some kids going by and pushing the button and putting in four letter words, right? So that when Mother came along after him and pushed the button and the book would speak whatever was in there. We wound up having to put four separate button cells in there, and a piece of software on the processor, and as long as you didn't take the shrink wrap off and flip a switch, whatever got recorded on it by a customer walking by would disappear. It wiped out five seconds after it was recorded, or ten seconds, some such thing.

Hendrie: That's pretty complicated.

Baer: Yeah, that turned into a fair mess. But we worked that out and the product was reasonably successful, but Western Publishing went out of business right about that time.

Hendrie: Oh wonderful.

Baer: I think they're back in business; it must be a totally different company under different management, Golden Books. I did go on and produced another version of that book which I thought was a hell of a lot of better then what we did the first time around. I put a capability into the system for shifting the pitch of the voice when it was played back so that when you recorded a word you could play it back at a lower rate sounding like a much lower register voice. Or it could get played back at a higher clock frequency which could sound like a much higher-pitched girl's voice or something. You could implement stories wrapped around three different characters, which was a lot more interesting. When the kid put his voice in there, his normal voice in there, when he played back the appropriate button, it would come back as a high pitched friend or his own voice, or the low pitched friend, three distinct characters. I still have the book on the shelf here. By this time, the electronic book business had come close to vanishingly close to zero, so we couldn't market it anywhere.

Hendrie: Okay.

Baer: Now if I had enough energy and a good marketer, I might try to sell that stuff all over again because it's quite a few years have passed by, the technology's available for much less money now then it was then. So maybe I can convince my younger partner in the Florida area whom I'm going to work with this coming December, January, to take a look at some of these old things and revive them. I don't think that many of these old products ever quite made it - – (they are) not even memory in anybody's subconsciousness, so we're not too likely to wind up

presenting this stuff and being told, oh we've seen this, as is so common when you present a product.

Hendrie: Right.

Baer: So maybe we'll try it again but there's just so many hours in the day, can't do everything that would be desirable. I could do about a thousand things if I had the time and energy.

Hendrie: Okay.

Baer: In any event, what else did I do with Phil Orbanes? Oh yes, I came up with a concept of doing electronics for kid bike riders. The first thing I did was get a helmet and put a radio into it, and a microphone boom and some electronics, so the kid could say anything he wanted, yell at the mike and switch from mode to mode. Switch from the radio mode, to a mode where the sensor on the wheel made the unit talk the speed at which he was going, like “you're doing 12 miles an hour”, and yell at it again and up would come the motor sounds, like the horn or whatever. Forgot all the modes I had. In addition to that we did two or three other bike related things. Yeah, one we called Spokesters, a gadget you slide on your spokes and when you get up beyond a certain speed, a centrifugal switch closes and it makes sounds or noises, or speaks things, which is a lot of fun. In fact, when I built the first model I put it on my bike in Florida in this gated community where I lived. In my condo there's a mile track all around. I used to drive on that, and you speed up and the thing would sound off, and you slow down and then speed up and it would sound off again. It was just a lot of fun; there was real game content to it. We never placed it. What we did place - we showed all this stuff to Milton Bradley -- and what survived was the talking speedometer that became their product which they named Bike Max. Bike Max was in the store for one year. It's a very nice product. It speaks the speed, four button keyboard on the handlebar, you can bring up either the speed where it says, “you're doing nine miles an hour”, another button brings up “you've done 12 miles, you've traveled 12 miles”, another one tells you the time, and another one has three different horn sounds. What I realized when we put out this product is that there's a real need for a talking speedometer for anybody's bike. You really have no business putting your head down trying to read the damn little LCD display which you can't see half the time, because the sunlight is wiping it out, to figure out what speed you're going at. Have the thing talk to you. In fact, I'm going to try and do a re-birth of Bike Max for general purpose bike installations. I've got all the bits and pieces, I'll work on it down in Florida next month. That turned into a real nice product except that they stored it in Toys R Us and other stores with electronic toys and games. That's not where it belonged. It belonged on the peg board that's next to the bikes where all the other bike accessories were. We kept calling Milton Bradley, we kept telling them, get the damn things out of the electronics section and put them up on the pegs. Nobody paid any attention to us. They had produced I think 160,000, sold 120,000 and than they quit. In fact, they gave us back our patent at no cost a couple years later. They weren't going to make the product anymore, so I have - Phil Orbanes and I have -- the rights to that product and maybe, just maybe I can revive it. It's really nice. Then we got in touch with Bell Sports. Bell Sports makes all that stuff that's hanging next to the bicycles in the toys stores and bicycles stores on the peg board. The saddles, the helmets, the locks, the bells, all this stuff. No electronics to speak of except for a speedometer. I built three different devices, of which they picked up a talking noise maker

which made motor sounds. When you pushed one button it made the sound of an engine revving, when you started riding the sensor on the wheel, just like on the speedometer, changed the pitch of the motor noise so as you went faster the motor went faster and faster. A third sound was the sound of screeching brakes being hit, and the fourth sound was a horn sound. Well, they cheapened the product and reduced the cost by taking away the sensor, so that it was all just a noise generator. But it went well, they sold a couple hundred thousand of them. I brought some more product in to them, including a proposal for a revised Bike Max. Unfortunately, it got into the hands of a marketing type who screwed up, and all the samples were lost somewhere in Hong Kong or _____.

Hendrie: Oh my goodness.

Baer: I never got them back and no product resulted. The marketing manager who was new there at the time, and not the same guy I had worked with before, this time was a woman, never answered my mail, never answered my email. I spent a lot of time and energy on a big fat technical package for cost reducing and making a new version of Bike Max. She never answered my email until one day I sent her an email in big red letters to get her attention. Well it got attention all right. After not answering any of emails for nine months I got an instant reply. She was very insulted, very put out by big letters, the tone of my memo. My reaction was that if you can't deal with me like a normal person I don't want to do any business with you, so I never went back to her. She's no longer there and the President of the company who was her friend and was an acquaintance of my partner Phil Orbanes is no longer there. So I don't know whether they're potential customers again, but we'll find somebody who will take on the new version of Bike Max, at least I hope so. What else did we do, Phil and I, that was successful? Talking books, Bike Max, there was one other thing but I can't remember it. In any event, Phil went into business for himself, got too busy, he runs a company called Winning Moves nearby in Massachusetts. Mostly into board games and traditional board games with a new pitch to them, a new flavor to them. For example, he did a lot of international Monopoly boards. In fact, he gave me one based on the City of Cologne where I grew up.

Hendrie: I see.

Baer: In German of course with all the Cologne benchmarks, many of which I recognize, a lot of which I don't recognize. I was there in June and most of the city doesn't look anything like what I remember because in World War II we did our best to level the place, did a real good job. Although my school is - both schools that I went to in Cologne -- are still there.

Hendrie: Isn't that interesting.

Baer: In fact, I went into the high school and its there and it's sort of gothic building with a statuary outside, on the outside, all in good shape, very much intact. I went inside, walked around, looked just like the old place did back 70 years ago.

Hendrie: Wow.

Baer: Same dark interior, sort of a gothic building.

Hendrie: Yes.

Baer: In any event, after Phil, who was my next partner? Well, Bob Pelovitz, with whom I worked at Sanders during the last four or five years of my tenure there, who'd been very busy working with me on interactive video, especially the business of weapons simulation. He and I got together and tried our hand at several games.

Hendrie: Now what year would this be?

Baer: This is much more recent; this is about six years ago.

Hendrie: Okay.

Baer: One day I walked into his house and there on a table is one of his kid's toys. It's a tape measure of which you could pull the tape and than you could reel it back up again. It didn't do anything else but that. I looked at it and I had the instant idea of making the tape talk, right? Like when you pull it out says, "you measured a foot and two inches". So I took the tape measure home and installed hardware. Bob Pelovitz who is a damn good programmer, programmed the microprocessor required to run the whole system. We started offering the thing around, and it wound up as a product at Hasbro, a Talking Tool. In addition to that, I took a plush bear, gave the plush bear a tool belt. I put three different tools on a belt. One to measure weight, which had a little spring scale inside, and when you push the button and hung something on the scale, it would say "you're measuring blah, blah, blah". Another one was a gadget for teaching kids time, like it would mark one second intervals, one second, two seconds. Kids have no sense of distance, they have no sense of time -- none of these things -- so it was basically a teaching tool. The third one was -- weight, time -- what was the third one? Anyway there was a third one, but I forgot what it was. They took a license to that about '99 or 2000. Unfortunately we're in a dispute with them right now because a major product in the line which is still very much alive, after six years of production, five or six years in production, of Talking T ools, they make a workbench which they claim is not covered by our agreement. We disagree and we are in litigation right now, I'm sorry to say.

Hendrie: Oh.

Baer: Yeah. I've already been deposed a couple of time in Rhode Island.

Hendrie: My goodness.

Baer: It's unfortunate you know. Major toy companies make a lot of noise about the need for the outside inventor to bring in new ideas. Then when they do invent, when the inventor brings stuff in, they don't necessarily treat him -

Hendrie: Treat him very well.

Baer: - very well.

Hendrie: All right.

Baer: So much for that story. That's really the only thing I've done recently, except for a return to the videogame arena. About a year and a half ago I showed a California young man, who was then 28 or 29, he's now 30, he just got married, Joe Grand, who runs a development and invention studio in San Diego, I showed him technology that I had demonstrated ten years ago to the videogame industry which involved such things as tossing a Nerf ball at a screen and having the object on the screen drop if you hit it. The technique for having the videogame essentially track you physically as to where you were in the room so you could have shootouts or laser tag games where the guy on the screen knew where you were, you of course knew where he was, you could duck behind furniture, all this sort of stuff. Most of it's done with infrared transmission and reception. Out of this conversation came an idea for modifying an existing product that's out there and I can't talk about it, using this IR technology. I'm happy to say they've finally signed the damn contract about a month and a half ago, and -- today is Monday -- last week, Monday the second, we got the big fat check of the advance was in the mail.

Hendrie: Excellent.

Baer: The problem now is that unlike the toy and game business, where if you bring product in October they try to hustle like crazy to try and have something to show for February Toy Fair, then you get involved if necessary to help them get the stuff out there at the Toy Fair. In this case, they have to go to their client. They have to go to either Sony for the PS2 or the PS3, or to Microsoft for Xbox, Xbox 360, and get permission to interface. Because whatever you're doing that interfaces with a box requires specific interface chips that are the property of the company -- of Microsoft, or Sony, in particular, requires a license on the part of what is essentially a third party supplier now.

Hendrie: Oh wow, all right.

Baer: And not only that, I think the product is going to come out under the Konami name because Konamiis involved in similar products and had a lot to do with development of the product, the pre-production development. They will probably sell it and market it, so it's a round robin from the people that we licensed, to Quiname, to Microsoft. Whether all this will ever happen…

Hendrie: All right, here we go.

Baer: Talking about my association with Bob Pelovitz and now more recently with Bob and another young man called Gary Carlin who was our marketeer and sold the concept of Talking Tools to Hasbro. Gary is an ex-Parker Brother person, has been an independent inventor for the last umptiump years. He went to Florida about two years ago from I think his Massachusetts residence and went into real estate and probably made a lot more money selling real estate down there then he ever did in the toy and game business, which is a tough road to hoe unless you have one big success. Like, for example, Furby. My good friend Richard Levy, who is a very astute marketer and inventor, he brought Furby into the world six, seven years ago or so. It recently had a rebirth. A little animated animal which made him a millionaire a second time around. He had done it once before -

Hendrie: And he did it again.

Baer: - and he did it again. Has this real nice house he just built himself five years ago, not too far from Delray Beach where I live. I saw it when it was just finished and he still didn't have any furniture inside except for his computer and a bunch of toys all around the wall, and a few pieces of furniture in the bedroom. He and I will go over a bunch of ideas I have and we'll see if we can get something started up again.

Hendrie: Okay.

Baer: I've got an idea for Furby; make Furby do something entirely different. I just wrote it up and I just sent the disclosure document off to the patent office that covers the generic idea and I'll see if he goes for it. If he doesn't go for it, it dies right there.

Hendrie: Yeah, right.

Baer: If he goes for it then the next question: is the engineer who, way back when, came up with the whole concept, the invention of this intelligent animal that grows and learns and becomes sort of a quasi pet for the owner, if he's still around, he would be the ideal person to do what I want done to that animal. We'll see. Anyway, it'll be fun and it's one of the things I want to do when I get down to Florida.

Hendrie: All right.

Baer: Gary Carlin, on the other hand, the guy with whom we're in business on the Talking Tools, will get together with me down there to see what we can offer Fisher Price. He sent me the wish list for 2007 that Fisher Price publishes and sends out to two dozen independent inventors every year. It's a five or six page list that lists the various items in their inventory that they'd like to have modified or added to, or replaced by new stuff and we'll get our heads

together and see what we can come up with. I sent him a copy of my bio. In my bio there's about 20 or 30 pages describing the period that we just discussed. It lists all, virtually all, the games that I ever worked on, including those that never made it in some detail, including pictures of things that I've built that never made it, and of course of those that made it and we're just going to go down that list and see what triggers -

Hendrie: Triggers ideas?

Baer: - yeah, new ideas that might match up with that wish list that Fisher Price gave us.

Hendrie: All right, would it be possible to get a copy of that?

Baer: It's very confidential; I ain't supposed to have it.

Hendrie: You aren't supposed to have it?

Baer: No.

Hendrie: Oh these are - oh this is from Fisher Price?

Baer: From Fisher Price.

Hendrie: I was saying there was some - you were mentioning your bio.

Baer: Oh the bio? You're welcome the bio.

Hendrie: I'd love a copy of your bio.

Baer: You can walk home with a CD today and if you read at least a part of it and give me some feedback I would be very grateful, because I've already been through at least three editors to whom I've paid several thousand bucks to give me an opinion on what we could do with this 450 page thing.

Hendrie: It's 450 pages?

Baer: Full of pictures -

Hendrie: Yes.

Baer: which no publisher wants to touch. In every case it always came back, like, “well, if you do this, and if you do that, and every other thing then I think maybe we can place it”. To which my response was always I thought the idea was that you do this or that or the other thing.

Hendrie: Right, exactly.

Baer: I've been through this process over the period of the last seven, eight years, I don't want to do it all over again thank you very much.

Hendrie: Wow.

Baer: So there it sits and you're welcome to it and of course all that stuff is in there.

Hendrie: Yeah, I think that would be very val… You know, even if it doesn't get published it's there forever in the archives.

Baer: Well I gave it to the Smithsonian too.

Hendrie: Yeah, exactly. So we all ought to have a copy of it. If it's on a CD that's easy. That's good.

Baer: It may never get published -

Hendrie: Or we may put it on the web.

Baer: - and the only copies may be in the hands of my kids who I guarantee you will not read it unless they get to be 75 years old, and finally decide that maybe they'll take a look at some of the family history. When they come across this thing that they can no longer read because the technology has changed 17 times in the interim -

Hendrie: And they don't understand.

Baer: - yeah, and they can't find anybody who will convert the thing into some current format.

Hendrie: Right exactly.

Baer: Which is going to be a huge problem.

Hendrie: Right, that is true.

Baer: All that archiving we're all doing, how readable is it going to be umptiump years from now?

Hendrie: I know you have to constantly update your archives and re-record things.

Baer: You have to update your archives with new equipment.

Hendrie: We're just going through our video collection and taking these oldest -

Baer: All the VHS stuff is -

Hendrie: - well the - we have stuff considerably older then that and changing it and putting it -

Baer: Of course you have -

Hendrie: - and digitizing it and putting it in digital format.

Baer: You would have film that dates back to the 20's -

Hendrie: We have film too.

Baer: - and earlier.

Hendrie: All right. Well, that's really impressive that you are still inventing, still working.

Baer: Oh yeah and I'm still making money, hooray.

Hendrie: Very good.

Baer: In fact, my current problem is - and it's instructive and you might as well get it on the record, because this is the kind of thing that people ask me about now, especially students who come up to here to sit at the old man's feet and learn. I had three guys, three youngsters from WPI here last week, Worcester Polytech, three juniors who are coming back to finish up the interview next week, who want to know: how do we do things, what do we look out for, and how do we get there from here? There's been more and more of that lately, which is beginning to take up an ungodly amount of my time. This morning a guy from Forbes Magazine emailed me,

he wants to do a telephone interview. Last week I had two requests for interviews, one from Venezuela and one from Brazil.

Hendrie: Oh my goodness.

Baer: Yeah. I've had articles written within the last six months in at least eight or nine magazines in Germany, in England, in Spain, in Mexico, and on and on and on, and it's taken a lot of time. Almost every day there's a request from somebody in the mail, “would you kindly send me an autographed picture”, which I never do, because this invariably means that somebody wants to put a picture on eBay and sell it for $100.

Hendrie: Yeah right.

Baer: But there's all this traffic that goes on that takes a lot of time, and time is becoming more and more precious because my energy isn't what it used to be.

Hendrie: It must have been amazing when you were young because you seem pretty energetic now!

Baer: Yeah, when we were young we were able to keep six, seven balls in the air at the same time.

Hendrie: Right exactly.

Baer: I'm lucky to keep one up there as it is. But there is a tremendous amount of stuff going on at the moment. Right now the major objective is get all this stuff [motions behind him] packed up into the Museum of the Moving Image in Astoria [New York].

Hendrie: Okay.

Baer: In fact I was inclined to take it down there myself. But I think what I'll do is I'll have them hire the company they normally use to package and ship stuff, have them come up here, pack it, take it down there. Oh, I know how we got into this track. The subject was having collected a substantial amount of money from income from royalties this year, how do I protect myself from getting hit by Uncle [Sam] for a big chunk of it? It's a consideration for anybody who wants to be in the independent invention business. If you license people, the return from licenses is a capital gain, [so] It's already down to 15% at present, which is a lot better. The only problem is that if you're running a one-man company and you book this money, it winds up on a Schedule D - Capital Gains side of the tax form and not on Schedule C which you typically file as a one man business. So you have all expenses, no income on Schedule C with no reference on Schedule C to the Capital Gains page. So what does that do the computer at the IRS? It rings a big bell, right? “This guy's is forever losing money in business. I mean, how long do we allow

this to happen", right? So bingo you get examined. Now of course the first reaction of the examiner [is] "no, that's not allowable", and my reaction always is "go back to your supervisor", and then ten minutes later he comes back or she comes back, "yeah it's allowable". But stupid IRS hasn't figured out yet that you put a reference to capital gains on the page, or list the number on that page, so the computer can do a comparison and say "aha that's where the money is", that all this expense is accounted for, right?

Hendrie: Yes, exactly.

Baer: Anyway, so much for [that]. Now I have the problem of trying to figure out how to donate this stuff in such a way that I get maximum tax advantage out of it. That's not easy because all the stuff I gave to the Smithsonian this past year, they will not evaluate it. They can't by law tell you that what I gave them is worth…

Hendrie: They can't. No, you have to get some independent person to.

Baer: Yeah, how do you do that?

Hendrie: I don't know.

Baer: Well I'm trying. I've been through several people, unsuccessfully. Just this past Saturday I wrote a letter to one of the larger auction houses, Christie's in New York, who hopefully will respond to the letter and send somebody up to look at all this stuff, or send somebody to the museum, which is a lot closer in Astoria -

Hendrie: Do some evaluation.

Baer: - when stuff is down there, and put a value on it.

Hendrie: All right, let's just take a break for a second.

Baer: Sure.

Hendrie: Well let's see, maybe you can demonstrate some - or go through the sequence of the things as the Odyssey got developed. I think this is most interesting.

Baer: [Standing in front of a table of artifacts.] I'd be happy too. If you recall, it was September 1, '66 I came up with a concept of playing games on a home television set and drew some schematics, and put a technician to work. The first attempt was to make sure that we knew what we doing. I mean, what was required, at a minimum, in the way of circuitry to put together

a signal that replicated a standard television signal with its horizontal and vertical sync signals and color burst and color content and all that good stuff. So my response to that was to put a technician on the bench, give him a piece of equipment like the one that's standing back here, which was a generator we used way back when in the olden days to line up television sets. The older people might remember that way back television sets had adjustments in front and back for things like linearity, height, width, all this good stuff. A generator like this provided a grid pattern for making adjustments, that made bands of color for making color adjustments, and it had the ability of going by Channel 2, or Channel 3, or Channel 4 into the antenna terminals of a television set to put that stuff on the screen. So I decided, well, we'll use one of those, buy one of those, put it together, a Heathkit, put it together and save ourselves a lot of trouble. We won't have to design and build horizontal/vertical sync circuits, modulators, RF oscillators, all that stuff. And then tie some hardware to it to put a spot up on top and see if we can move the spot around, color the background, color the spot, to get some experience on how to do all this stuff. Well, being a manager of a group of 500 odd people I'd been away from the bench for quite some time so I wasn't too sharp on transistor circuitry design at the time. So guess what? The first hardware we built, Unit #1, looked like this. What's on there? Four vacuum tubes. Would you believe it, right? So I recreated - amongst these replicas I recreated the old unit just as is, however what's inside is decidedly more modern. When you plug it in, and it plugs in on this generator over there, it puts up a spot on the screen, which you can move around horizontally and vertically with these knobs. And then you can flip a switch - which one is the switch here? Here's the switch.. and either show the image in black and white, or add color to it. I think I got red and green and blue in here. It demonstrates what we did back in '66 to give us a little experience on how to design extremely inexpensive videogame circuitry. Well, out of it came a design of the transistor circuitry, which one by one were built up on little boards, were thrown into a big chassis like this one right here. You got a good view of that one? Or do I need to -

Hendrie: Yeah, can you tip it up?

Baer: Yeah, there it is, right? Little by little, more and more capability began to develop inside. By this time I brought up the independent research and development director at Sanders and showed him how to shoot at the screen and how to move spots around on the screen like this. Here's a joystick -

Hendrie: So you're saying - can you stand over on the other side?

Baer: - here's a joystick -

Hendrie: That would be wonderful.

Baer: [Drops something] Oops. Here's a joystick which moves one spot around. The other spot is trying to avoid this guy, and if they meet one of them disappears. A button push resets it. So it's basically a chase game, one chasing another one, and if they caught up, bingo, you wiped out the spot that's being chased. There are seven games in here. They all came together individually. When you look at the bottom of the original of these there's a conglomeration of separate boards in there, all of which came together. When time came to

become honest, namely declare to my boss, who was the executive V.P., that I've been fooling around with this stuff, he laid on a demonstration to the president of the company himself and members of the board of directors who happened to be there. When I heard that, I figured I better not blow it, and I recorded on audio tape an introduction to each one of the seven games that the box was capable of playing. So here for the first time in the history of humanity we had videogames with a verbal introduction of the game, where the sound came through the speaker of the television set on which the game was about to take place. And that's what I got in here. For example, let me go to Game #2. I push a button, and here's what happens. [Recorded sound from the equipment.] "In the second game let's have a steeple chase. One player is the hunter, the other is the red fox. The hunter chases the fox to wipe him out." [Screen shows capture.] Bingo. Game #3. [Recorded sound.] "The third game is a fox and the hounds chase. The object is to have a red fox run away from the white hound without getting wiped out." If I were playing this game, with the joystick I'd be moving around the outside very rapidly. It turns out to be… Right now I'm walking right through the hounds. It turns out it's extremely primitive, but it's still a fun game. Here's the other joystick that moves the hounds around. Game #4 is totally different. "Our fourth game is target shooting. The game is to hit that big bull's eye on the screen. Shortly we'll start moving the target." Boom, bingo. And so on and so forth. "Game 5 is a color guessing game."

Hendrie: A classic light gun, literally.

Baer: "The color gold is worth five points. Use the joystick to keep score." Well, how do you use the joystick to keep the score? Well here's how you do it..... You put an overlay [on the screen]. This one may not stick. Yeah, it's sticking. You move a spot over there, bingo here's how you score, right?

Hendrie: Very good.

Baer: Here's how you score. The background can change color from green to reddish to black, to white by spinning this, like so. You guess at a color beforehand; it's sort of roulette type thing.

Hendrie: I see.

Baer: You win if you wind up on the right color. Another game that illustrates the use of overlays is #6 game. Let's do #7, "Number 7 is a pumping game. Push the left button to lower the blue level until it disappears out of sight. Start the timer. Now pump the blue water up the hose to keep the house from bursting into flames. If you can do that, you win." Going the wrong way. [Presses button.] Here comes the water.

Hendrie: Oh there it is.

Baer: Up the hose.

Hendrie: Yep.

Baer: Incidentally, that overlay was done by one of the draftsmen at Sanders who was a good cartoonist . I didn't get there in time and the house -

Hendrie: The house caught fire.

Baer: - caught fire.

Hendrie: Blew up; that's beautiful.

Baer: I think that's enough with Game #2.

Hendrie: All right, good.

Baer: So think back of what it is that we innovated. Shooting at the screen with a light gun, that was brand new. The use of joysticks, very primitive ones, very easily manufactured. Joysticks playing chase games, playing all sorts of basically board games as an example. I didn't demonstrate it to you. We had overlays that looked like this, for which we had rules to move the spots and the equivalent of checkerboard games.

Hendrie: What technology did you use for the joystick? Is there -

Baer: If you can see it, let me hold it up. Can you see the inside of the joystick?

Hendrie: Yeah, just let me use -

Baer: There's a potentiometer here, there's one here. Look at how simple it is. In this direction I'm moving the shaft of this potentiometer, in this direction I'm moving the shaft of that potentiometer. So we get different voltages out; it's analog.

Hendrie: Very good, yeah so you have two potentiometer's mounted orthogonally.

Baer: Look at how much hardware's involved: one bracket and another bracket.

Hendrie: Yes, very good, beautiful.

Baer: This reminds me, at one time, we had a contract with Sanders that required making a joystick for a vector display. I'm walking down the hall one day and I see this guy come by with this big package of hardware. He's building the joystick. It's got two motors in there, and God knows how much other stuff. I said, “quit”. I went into the model shop and half an hour later came out with one of these things. It's like everything else. Circuit designers can design stuff using five parts and some other guy will do the same damn design and use 15 parts.

Hendrie: Yes.

Baer: All right. After this was demonstrated, the boss’s question was: now that you've got it, what the hell are you going to do with it, right? How do we make money off this thing? The first thought was, well, maybe the cable people can profit from the concept that we have. They can provide the background visuals and we can overlay pictures on it. We went through this much, much earlier. Well, by this time Bill Rusch, the third in our triumvirate, had joined us. He sat at his desk coming up with ideas all day long, and he came up with the idea of a machine-controlled spot.

Hendrie: Could we stop for just a second?

Baer: Sure.

Hendrie: I need to make an adjustment.

Baer: All set?

Hendrie: Yes.

Baer: All right, going back to where we were. Where were we?

Hendrie: You were saying that Bill Rush came up and -

Baer: Yeah, thank you.

Hendrie: - figured out how to put a computer–controlled, or a device-controlled, machine-controlled spot up.

Baer: Correct. At any rate, by middle - I think it was the fall -- of '67, that machine-controlled spot idea came along and within days the concept of doing games like a tennis game, a ping-pong game were on the table. Bill Harrison, a technician, started building stuff. By October of '67 we had a ping-pong game going. That's when the concept of selling the idea of videogames

to the cable company came to me. I picked up the phone and cold turkey called up Teleprompter in New York and got Hub Schlafly on the phone. If you go back to what I told you the last time we got together, he came up in January '68 in the middle of a blinding snowstorm, saw a demonstration of a ping-pong game and some other games that played on top of pictorials provided by the cable, which were emulated by pointing a camera at a picture on the wall and modifying equipment so we can get in sync with the signal that was coming in from the quasi-cable station. That became Unit #4. The next month he brought up Irving Kahn, the President of Teleprompter, and from there he got enthusiastic, we went to New York, we negotiated a license and it all fell apart because there was negative cash flow in the cable business. But the unit we built looked very much like this. In fact this is built so that you can plug in a DVD playing a video scene, replicating, or imitating, the signal coming down from the cable station. Then the machine generates the ping-pong game. It gets overlayed – key overlayed -- over the background, and it comes out and plugs into a monitor. When I deliver this [to the museum] I'll deliver it along with a little DVD player. I intend to make a DVD with me demonstrating, talking about just what I said a minute ago, the genealogy of it all - how it all happened. Then actually playing a game on top of something, that I'll point the camera at. I just built that within two or three months.

I skipped a unit. I have to backtrack in history. When the big box was done and the boss says -- the President of the company says -- what are we going to do with it? We said, well let's build something that looks manufacturable, that has a potential for being sold at a reasonable price. It had to be something small, so out comes Game #3, which looks like - I've got to untether it here -- it looks like this. It has two knobs at each end, one for vertical, one for horizontal control of two spots on the screen. It has the ability to plug a gun in, here's the gun, very simple thing. So it's basically a chase game, one spot chasing another and wiping it out. Now you've got a game just like the one I demonstrated to you earlier. But along the way, when we did a bill of material, and priced the bill of material, it came up to something like $15, which translated into something close to $50 at retail. We knew we were dead in the water. It was not enough game play for 50 bucks. Back to the bench. That's when, genealogically speaking, when the concept of the machine-controlled spot came along. Ping-pong game came into being, and my next attempt at trying to sell the product was this venture into the cable business, which got us nowhere. But meanwhile we had ping-pong games, and once we had ping-pong games we knew we were in business, because it was such a compelling game, there was no question that we could sell that somewhere. - The next game after this was one developed was a totally different thing. Bill Rush, sitting at the desk every morning after he finished talking to his broker for an hour, he got busy. Came up with the idea of moving the ball dynamically in a such a way that the ball would bounce off the paddle or the hockey stick, like a puck, in the direction at which it was hit, with the velocity that was proportional to how hard it was hit. Make a really natural looking dynamic game, which we called the de/dt games because the voltage that moved the ball around was a derivative of the motion of the joystick. If you moved it fast the ball would fast, and if you barely touched it you could actually walk the ball like - what do you call it in hockey when you dribble a puck across the ice? I think it was "sticking" or something, I forgot the term. But you could move the ball by moving your stick relatively slowly, you could have the ball stick to the stick and move right along with it. If you moved back and hit it, it would take off and fly in the direction in which it was hit. That unit was never quite completed. We never recovered it either. The original one is not at the Smithsonian because we never found the thing.

So I went down and reproduced Game #6 which is right up here. If you look closely -there's a three position switch here, this gun goes with it, here are two hand controls, this and this, which allow moving in the tennis game, the ping-pong game or handball game which these first two positions can control. In the handball and ping-pong game the hand controls can move the paddle up and down, sideways, and put English on the ball with one of the knobs on top. When this was done -- and it also has an input connector to plug the gun in -- but when this was done we had ping-pong, handball, chase games, and gun games. We should have quit. We had a nice little box with relatively few parts inside. But did we know that ping-pong was going to be the Holy Grail? Hell no, we didn't know that.

Hendrie: Right.

Baer: We're engineers. So we look and say, well add two more transistors here and one more here and we can do this, we can do that, and the other thing. The next thing we know is we got a box twice the size with all these intimidating switches out front. That's the famous Brown Box, which is the predecessor to Magnavox's Odyssey Game of 1972. This was completed in late '68, early '69 and is programmed by flipping these switches according to some matrix. It can play chase games, pingpong, handball, volleyball, volleyball being a horizontal line with a vertical half height line in the middle, very difficult to play. Chase games, of course gun games. There is a golf ball on the end of a joystick, which when you place it on the floor and you tap it with (well, that's a driver) but with a putter, takes a spot which represents the ball over here to the hole, which is over there. I think I have an overlay that - yeah here it is -- that illustrates it, right? Like so. Then if you hit it just right the ball travels towards the hole and if it matches the hole it disappears and you got a hole in one, right?

Hendrie: Right.

Baer: The original one of this joystick we found in storage in Chicago, in the lawyer's storage, and it's at the Smithsonian now. This is a replica.

Hendrie: Okay, very good.

Baer: That plugs in on the right hand side of the Brown Box over here. At any rate, by '69 we have the Brown Box which is right here. Let me get rid of this. If I flip that on, I think it's in the ping-pong position right now. There we are. The hand controls do what I said. You can move the paddle back and forth, or in close, which speeds up the game of course, or back up. Most importantly there is a third knob, English control, which – hang on: it's hard to play the game by yourself -- which puts English on the ball. Watch. If I -- when the ball leaves my paddle I can put motion on it, which obviously is what makes the game. Without that there is no game.

Hendrie: Right.

Baer: You can play rules, like you have to preset your English control before the ball leaves your paddle. Like I'm moving – whoops, I did that wrong. As the ball comes towards me - let me move it up. The ball comes towards I decide that I'm going to go up, so I notice that - I did it wrong again. Come on. It's hard to play by yourself. As the ball leaves the red, my opponent's paddle, I decide to move the ball forward. No, no, I moved the wrong one. I move my English knob up, and up it goes.

Hendrie: Yes.

Baer: See? He has to respond to that by going up there and grabbing it.

Hendrie: Very good.

Baer: Let me get back into it. Of course he has the option of doing the same thing like this, up and down, trying to walk (the ball) around the opponent. The switches out front here provide the means for going from - to handball, to volleyball, to chase games, to gun games, to gun with a moving target. What's that other one? Tennis, hockey, soccer, football, these are overlays. Finally, in the last position, in conjunction with Unit #8, which is sitting back there, it's just a box which plugs in on the right hand side here in the same place where the golf ball accessory plugged in. We can play what I characterized earlier as a de/dt hockey game where the ball bounces off of the walls and where the ball moves to the function of velocity of the -

Hendrie: The movement of the -

Baer: - joystick. Here are the joysticks that go with the Number 8 Unit. The Number 8 Unit looks like this. It's just a box with connectors for the joysticks. These joysticks happen to be commercial ones. This one is rescued from an Apple IIe, and the other one is rescued and modified from an Atari videogame. But they work.

Hendrie: Wow, good.

Baer: Once we demonstrated to and licensed Magnavox under the potential patents -- they hadn't issued yet - for the Brown Box -- they went to work and designed Odyssey.

Hendrie: Can you hold up the Brown Box? Can we get a shot of what's inside the Brown Box? Can you see anything inside it?

Baer: Well you can certainly get a view of it, but I warn you that that's not what the original Brown Box looked like -

Hendrie: Okay.

Baer: - nor is it what - is it what's inside the Brown Boxes I give to various people like Museums of the Moving Image. This is a hybrid. When I built it I had to reproduce the spot generators which are in here -- a spot generator, wall generator, ball generator -- with discrete transistors. These things are transistors. The black ones here; I don't know if you can see them.

Hendrie: Yeah.

Baer: Because… there are technical reasons for that, but the logic, instead of doing it with a pile of transistors, I obviously did with integrated circuits. In fact, that's a little microprocessor up here that provides a horizontal/vertical sync and color bursts and all that good stuff.

Hendrie: Oh yeah. Cool.

Baer: Brown Boxes of the type that I donate or sell, or loan to museums these days have a single board in them, with a PIC microprocessor on it, plus one, two, three, four IC's and very little else.

Hendrie: Okay.

Baer: Crystal control, very little else in it, and they're extremely reliable. And above all, compatible with modern television sets. That's one reason for not reproducing the Brown Box exactly the way it was. We took a lot of liberties with the signal, which worked fine with old television sets, but will not cause the modern television set to do anything except produce a lot of noise.

Hendrie: Oh, really.

Baer: You have to be right on the button these days.

Hendrie: Okay, so the tuners -

Baer: Almost everything in there is digital.

Hendrie: It's a digital tuner and it just -

Baer: Yeah right. It's not just a digital tuner. It's the sync separation business, the color generation. It's all done under precise crystal control and it's got to be right on the button or else it doesn't work. Well, we had lots of liberties in those days because we could put -

Hendrie: You said you had no crystal control in there.

Baer: - a pretty sloppy signal into a television set and it would do fine.

Hendrie: Yes exactly.

Baer: What I do now is obviously is something that you can reproduce and plug in on an LCD monitor and it has to last. It can't be the stuff we designed back in the 60's, a 40 year old design, might as well be 400 years old.

Hendrie: Right, well you probably can't get the transistors that you originally used.

Baer: As a matter of you can, but it doesn't really matter, I can build it with 2N2222's, which are a sort of garden-variety transistor that everybody's used who's an engineer a million times over, and it'll work.

Hendrie: It would work.

Baer: I did buy some of the 2N5135's, I think they were, a year ago, in order to reproduce some circuitry that Rusch had built, which never did work right. It was able to produce different shapes rather then rectangles, round shapes and rings, but it was extremely component sensitive, temperature sensitive, voltage sensitive. It was horrible, so we had to get rid of it, which made Rush into - I mean us- into an eternal enemy, because we buried his baby.

Hendrie: Yes, but it wasn't a reliable design.

Baer: Yeah, in any event, the point is that I did buy those old transistors and instead of costing a nickel like the 2N2222, it cost me like 5 bucks apiece.

Hendrie: Oh my goodness.

Baer: They're very rare, and when somebody's got a bunch of them -

Hendrie: He just doles them out at $5.00 each.

Baer: - he’s not letting them go for a very little money.

Hendrie: All right good, we need to change tape now.

Baer: Okay.

Hendrie: Ralph, could you maybe go a little bit into the progression into the Odyssey?

Baer: Right. Once we demonstrated the Brown Box -- the original of which is at the Smithsonian, as I told you earlier -- once we demonstrated that to the Sylvania's, the Philco's, the RCA's, all the manufacturers of TV sets that were in the United States at the time, and we had an agreement with Magnavox, we turned over the original Brown Box to the engineers. We made several trips to Fort Wayne to help them get started and out of all this back and forth cooperative effort came the 1972 Magnavox Odyssey System, which is right here. I'm moving the programming cards so you can get a closer look at the Odyssey. There it is. With its hand controls, which have the same horizontal and vertical and English knobs on them that we had on our Brown Box controls, and which was programmed not with switches as the Brown Box was, but with plug-in cards that go in here, and interconnect the digital logic circuitry.

Hendrie: Can you hold up one of those cards?

Baer: Just like the switches did on the Brown Box. That was Magnavox's contribution, which was very clever. Along with the Odyssey machine came a gun, which looks like this, and which you reset like this, fire it like that, made a shooting noise. That was sold separately in a box that looked like ...that. It was, I think, a $25 or $30 product. Whereas Odyssey itself cost $100.00 at retail, which was a lot of money but sold well. In any event, in the winter of '72 to '73, I decided that we had just about milked all the combinations of games we could out of plug-in and ordinary cards such as these and that we might be able to increase the repertoire of games by adding active components, meaning resistors, transistors, diodes and stuff -- extra circuitry on the card. So I built a couple of cards that looked not quite like this because these are built much more recently, where if you turn them over, lift up the cover, there's a bunch of circuitry on here, including a little loudspeaker. This card, this happens to be a ping pong card.

Hendrie: Can you turn that over and show me again what the components? I missed that. Very good.

Baer: Now finally we had sound, and independent speed controls of the left and the right player. Another one is the handball card, which also has a loudspeaker over here. It looks like that from the rear, and had a switch which in one position made the wall on the left hand side come in slowly towards the players and speed the game up constantly until it got to be ridiculously fast and somebody lost the ball. I showed this stuff to Magnavox in the Spring of '73, and I guess I drew a big loud yawn, and that's about it, and (they) never did anything with it. So that was sort of characteristic of my relationship to Magnavox.

Hendrie: The various cards, did just some of them come with the game? Were those extra cost to add?

Baer: That's correct. I think there were seven or nine cards that came with it, plus many overlays like the ones up here. Then there were individual cards, and sometimes some accessory things like playing chips, or dice or whatever, sold separately, also usually with their own overlays. If you look at these overlays -- this one here for example is my favorite. Just visualize that in front of the screen. If the background is fairly dark you don't see much except for the general outline of the building. If you move a white spot around behind the building, you light up these windows. Now you can shoot at the windows. You have one guy running, the intruder, the thief, who's running around inside the building, with his hand controls and popping up randomly behind different windows, and the other guy standing here with a gun trying to pop him off, right?

Hendrie: Oh very good.

Baer: Same with that [points to another overlay], you highlight, backlight, highlight the windows on that one. This one's sort of typical of a sports game overlay, obviously a hockey game. I don't know if you can see much of it, but the two pages of illustrated, color illustrations on the wall back there show all the various games that came with the Odyssey. I don't know whether I'm going to be in the field of view. One, two, three, four, five, six, seven, eight, nine, ten, 11, 12..... all these games, these four overlays came with the gun. These are all optional games that came with their own little small package with a plug-in cartridge and were sold separately for $25 or $30.

Hendrie: Very good, wow.

Baer: I think that sort of completes the display. Once more, all this is going to go and reside at the Museum of the Moving Image in Astoria. They already have a #2 Game and a Brown Box and have been exposing both of those to large groups of kids who come through, school groups, of course other incidental visitors, so by this time perhaps 10,000 kids have played the Brown Box at the museum.

Hendrie: That's wonderful.

Baer: Yeah. And of course they all do what other museums do, if anyone wants to have a temporary display of all this stuff you can loan it out. They do that.

Hendrie: All right good. Let's stop from this right now.

<change of scene>

Baer: [Looking at photo] Straight shooter -

Hendrie: This is Royden Sanders?

Baer: Yeah, no that was Harold Pope.

Hendrie: Oh Harold Pope had the -

Baer: The exactly. The old chief engineer of Lockheed something or other.

Hendrie: Lockheed Electronics?

Baer: No, I think it was Lockheed Airplanes. He was a mechanical engineer.

Hendrie: Okay. He just - you could go and -

Baer: Are you taping this stuff?

Hendrie: Yes.

Baer: Oh sorry. I didn't realize that.

Hendrie: That's okay. You can go in and see him, make a proposal, or talk to him while he's in.

Baer: Well yeah, he was just a regular guy. Also, he was a perfect supervisor. Never, never talked down anybody, never made anybody feel like an idiot even when we knew we were idiots. He just knew better. He knew that when you screwed up, you're in the same position he'd been in himself 16 times before, so why make a big issue? Support the people, straighten them out, get them on the right road. Have them do their thing. There's so little of that now. Got to be an awful little of that, because every other day the Wall Street Journal on the second section on the left hand column carries articles of how to handle your boss, how the bad boss handles you, different kinds of bosses. It's all nonsense. Let the bosses act like human beings, instead of like idiots.

Hendrie: Yes, then you'll be fine.

Baer: Yes, support the people that are working for them instead of -

Hendrie: Respect them as human beings.

Baer: But some people cannot open up to other people, and some people are suspicious of everybody in the world. There's all this nonsense which makes life difficult instead of a pleasure.

Hendrie: Now you were going to - you had forgotten a couple of things. I think that you mentioned Hallmark -

Baer: Right.

Hendrie: - and flower. Flowers.

Baer: Yeah, FTD Flowers.

Hendrie: We ought to get these on tape.

Baer: Okay, well somewhere along the line, let's see that's got to be late '70 early 80's, I'm working for Marvin Glass, theoretically after hours. In practice I mixed Sanders activities and Glass activity. In fact, I got the two together, and we spent some of Glass' money at Sanders to build a very fancy hockey game, which we called Monday Night Football, and were never able to place. But in any event, I get a phone call from Hallmark Cards and what do they want? Well they need an expert, somebody with insight into electronic consumer products. Could I come to Kansas City? I go to Kansas City, talk to a V.P. there, walk away with an agreement to become their outside advisor on electronics. So I spend the next couple of years coming up with ideas, which included things like talking cards which they did. The first talking cards by Hallmark were my design. I begin to notice that, in no time at all, that most of the stuff that I came up with wound up in some marketing manager's drawer. It never went anywhere. I had several meetings when I was in Kansas City every three months or so with senior management people, and I began to figure out what was happening. Evidently, somebody up there in management had approached a lower level V.P. and said, “hey we got to do something in electronics”. When somebody from up above said something like that you'd “jump to”, right? You do something. So what does he do? He gets on the phone and finds himself a consultant. Did he have any real intentions of doing anything except turn out some report to shut up the management? Get out from under this requirement? No. So everything I ever did wound up in somebody's drawer, except for a couple of Christmas ornaments that were electronically operated. I've done neat things like Christmas ornaments, like running things on the tree with a remote control - remote IR control. I have on a shelf here a greeting card, which when you open it up has two shiny disks in it, like CD's. You plug them in to an emulated printed CD player, they play the tune that's on the label. You take it out, you put another one in, it plays that tune. It's very simple. You just trigger different switches and you have pre-programmed music on the chip and it plays songs. That was creative, and that was nice, and it all went into some marketer's drawer and never saw the light of day. But meanwhile, I'm working at Sanders, obviously drawing a paycheck. I am the outside consultant for Marvin Glass and Associates, getting a paycheck every month. And now I'm getting a third one from Hallmark for about two and a half years, and I had no problem collecting even though their stuff never showed up in the marketplace. That was kind of a frustrating experience, because I put a lot of creative stuff

together and it went nowhere except for the card. And the card they loused up because they picked a ridiculous subject which wasn't very interesting.

The other thing we left out of the chronology was a relationship I had with FTD Flowers, people through whom you can order flowers over the telephone, which nobody does anymore because you get on the web and you order the damn stuff on the web these days. In any event, an individual in New York who ran a one-man company had come up with a concept which I'll describe in a minute, called me up and asked me, I guess essentially knew me through some mutual acquaintance, asked me would I be interested in working with him. What he was doing was allowing a customer who had just ordered flowers over the phone to put a voice message on the server -- which wasn't even called a server then -- and then have that voice message be delivered to a little keepsake which was unrecorded, waiting for a recording, at the florist location which the florist can plug into a little unit which I eventually designed. By pushing some buttons on the transactor which everybody has -- the unit through which they swipe their cards -- you could get at that program on the server and then download the audio through the telephone line into the voice chip on this little keepsake, plug the keepsake in on the flowers. When you got the flowers, you push a button on the little keepsake and it would speak whatever voice message was initially put into the system via the telephone. Well, today you can do all this through the web without even half trying.

Hendrie: I know but -

Baer: But you couldn't then. We made - I made - I had to learn, for example, how to get into that transactor, how to deal with it, and how do you make use some of the tones that are on the dial tone network, which are not in common use, which you use for control purposes. I learned all that stuff and I spent endless hours helping someone, another friend of mine, who built 150 or 200 of these keepsakes. We were behind schedule, so I went in there early in the morning and helped him assemble that stuff. All of it went nowhere because management decided not to do it. Got cold feet and didn't do it. It was a really nice product.

Hendrie: That sounds like a great product.

Baer: Yeah.

Hendrie: Wow.

Baer: Even today – well, you know what you do today. You can go to the Hallmark or somebody else's card website and transmit a free card to your friends, and if you want you can put voice on top of it.

Hendrie: Yes exactly.

Baer: So it's all there, but it's not the same as getting flowers or something that.

Hendrie: I think that's a wonderful idea.

Baer: Today, I would probably make the thing bigger so you can stick at least a 2 x 3 photograph in there and you press the photograph and it speaks, right? Like this, grandkids saying, “Hi, Grammy, I love you”. Right?

Hendrie: Yes, that would be very good.

Baer: Yeah. Well, variants of it are out of them but -

Hendrie: Yeah, but the one you did they just… again.

Baer: Yeah, they blew it. I spent a lot of time and energy, and got a lot of expenses, and got zip out of it.

Hendrie: And you had to learn a lot of new things that you didn't know about.

Baer: Yeah. Well, that was fun.

Hendrie: Okay.

Baer: Yeah, it was fun. But there were the usual tight pressure situations where the schedule to move the hardware into a display area some place on a certain date, and we weren't quite there yet. Burning the midnight oil. Nothing's easy. It all sounds like it's easy but -

Hendrie: It never is.

Baer: - nothing ever is.

Hendrie: Never.

Baer: Especially when you have to demonstrate something somewhere. All the gremlins either come crawling out from everywhere and nothing ever seems to work. It worked fine back at the lab.

Hendrie: Yeah.

Baer: There you are with a scope and test equipment, soldering iron, trying to make the damn thing work. That's life in the electronic lane.

Hendrie: All right. Well, are there anything else that you can think of that -

Baer: Yeah, there probably are. Yeah. I was contacted by a young man of Syrian descent or Moroccan descent who ran a small company up in Toronto. He imported electronic devices and other things and sold them to mail order houses. He wanted to do handheld dictating gadgets and he sucked me into a relationship that lasted for, like, three years, during which we made first ten second, then 20 second and 60 second recording devices built around ISD chips which provide analog storage on a chip for voice signals. He sold quite a few of them, but unfortunately he was a typical Moroccan trader, and when he owed us a buck we got ten cents. We finally had to break it up. One of the neatest products in that line, a sample of which is next door to you, was a unit which had a heat sensor of the type that you put on the front of your garage door so it turns on the lights when you drive up or walk up the subway, which monitors the heat from your head typically and divides it up into beams by having a serrated lens, so as you're walking across the visual reception beam of the sensor up there you're breaking up the radiated IR signal and making an AC signal out of it, which then can be amplified inside the unit and you add to that the relay switching or whatever that's required. But what I made was a unit you could stick on a refrigerator or set it on a bench, or set it on a couch, into which you could dictate up to ten seconds worth of speech. To wit, for example, you put it on a kitchen table and the wife comes home and there's a message there from the husband, the husband says "sorry I can't pick the kids up from school today, would you kindly go pick the kids up". Or you put it on a couch, when the dogs jumps on the couch it says, "get the hell off the couch Fido". Right? Very nice. In the process I had to learn how this heat sensitivity business worked, which everybody has totally mistaken ideas about. Everybody's thinks that this thing sends out a signal which somehow gets reflected off your body. It's nothing like that. It uses a sensor made by just one company in Japan that's tuned to receive the optical wavelength of the radiation that comes from your body, mostly from your head, because your head does ten times as much radiating as the rest of your body. So this thing changes resistivity as a function of how much energy, at a narrow band centered on what's coming off your head, produces. So you can be 20 feet away and it senses the heat coming from your body.

Hendrie: Oh my goodness.

Baer: The only problem is it's a DC voltage which is hard to handle. So you put plastic lenses out in front which is series of lenses interrupted by dead spaces. So when you're walking across this fan looking at you, this angle over which the sensor sees your heat, it breaks it up into separate images. Which means it goes through zeros and makes an AC signal out it, which you can amplify with simple AC amplifiers and convert to DC to run a relay or whatever's required. But I had to learn to do all that. So what do I do? I just buy one of those units, take it apart, find the element, and I figure out how it works, and then find the company in Japan. I don't know how I did it in those days, because there was no Google.

Hendrie: Yes, you couldn't Google them, right? But you found it.

Baer: I couldn't Google, but I found them and learned how to build this stuff. It turned into a really nice product which really ought to be done again and sold through the likes of Sharper Image and other -

Hendrie: Retailers that would sell some something like that.

Baer: Yeah. It sold for about 20 bucks or so. I think it could easily get that now, and the chips that are in it, the processor and voice storage and playback are much, much less expensive now then they were ten, 12 years ago.

Hendrie: Wow.

Baer: So it probably could be made for under $20. Again, if I had ten lives and all the energy in the world, I'd -

Hendrie: You'd do some of those things.

Baer: - do another one again. That was another effort. I think I've exhausted them all.

Hendrie: Okay.

Baer: There are probably some others sitting in the woodwork somewhere.

Hendrie: Yeah. A couple of just generic questions. What would be your - you have any words of advice to people who might think they want to become engineers?

Baer: Well, to become engineers is one facet, right, of that question. Become independent - do something with what people think are their innovative qualities, that's another thing altogether. To engineers, like the three Worcestor Polytech juniors who came here last week and who are going to be here again next week, I got some basic advice. If you're creative at all, as you make notes -- I don't care whether they're on the back of a piece of used paper or toilet paper or whatever shape they're in -- never throw them away. Never do things - never forget to make notes at the end of day, preferably during the day as you go along, in as much detail as you possibly can. Because seven years later you'll find yourself in court and if it so happened that you were involved in the development of something that became important and was out there and got important enough to invite a lawsuit from others who thought they had prior rights to it, then every piece of paper you have helps to establish your bona fides, and what happened on particular days when you thought you did certain things. Which almost invariably puts the opposition off their stride because they rarely ever have documents that are even the caliber of what you have. So it gives you a big leg up. It just goes to the general principle you got to keep in mind, that memory is totally unreliable and also has absolutely no standing in a court of law.

Hendrie: Okay, good.

Baer: That's my advice to engineers: make notes. Apart from that, follow your gut. When I went to Washington on February 13th to have the President hang the National Metal of Technology around my neck, what was the object of that exercise? The object was to incentivize others to go into science and technology. The problem I have with that -- and I didn't discuss with the President in a private audience we had as a group, all laureates, after the ceremony in another room in the White House -- is that it's awfully hard to have your whole heart and soul into a recommendation to a youngster to become an engineer, because typically you'll wind up in some company that likely will lay you off every second year, you have no job stability, you start off at a decent salary, but you're damn lucky if you get more then cost of living increases every year, so that ten years later you're about in the same place where you were ten years before. Unless you have very unusual capabilities, or you're a good marketeer, can talk a blue streak and manage to get to management ranks early, it's not a great place to be in terms of remunerative vocation. But on the other hand, if you're built to be an engineer, if it's in your genes, you do the same thing that little Chinese girls do when they start playing the violin at age three and concertize in front of an orchestra at Carnegie Hall at age 12: you follow your guts and instinct because you won't be happy if you don't do it. But don't expect it to be a great shakes business-wise, unless you have some creative idea, step out of a job and take the chance and find the way to become an entrepreneur in addition to being an engineer, or associate with yourself with guys who have that ability to attract money and to sell ideas. But outside of that? Not the greatest profession in the world.

Hendrie: Okay.

Baer: Think about it. I want to dwell on it for one more minute. What credit do engineers get in the daily press, or in the magazines, or in books or in stories, for doing what they doing? I mean every year there's another advanced generation of cell phones out there. I mean, did they grow in a pasture, being milked by the farmer? No. There were 100 guys at Motorola and another 100 guys at Nokia working their ass off, and working late into the night, just like people do at Microsoft on software, trying to get that next model out with all kinds of capability and all manner of experience in there, to create this thing. Are they visible? No, there's no visibility at all. It's very rare that a guy like me gets a little visibility at a one time occasion when the President of the United States hangs a medal around his neck. But how often does that happen? I mean that's the equivalent of a Nobel Prize, in these United States, for technology. How often does that happen in Sweden? Not very often.

Hendrie: Yeah right.

Baer: So you have to encourage them, but you have to make them aware of the fact that unless they broaden their perspective and maybe become a good salesman, a good marketer and if they have original ideas, they'll have 99 failures before they have one that makes it, if any, ever. It gets quite discouraging at times. There were times when, even now -- I don't need the money, ten years ago I didn't need the money -- but I'm building toys and games and damn lucky if one of them sells through and gets under license in a year where I made maybe ten or

12, or 14 from scratch. Original ideas, all which I thought had potential. It's hard. For those who want to go into toys and games, there's some really good books. One in particular written by same guy who developed Furby. There are really good books out there, so there's lot of advice available in the literature today. On the subject of - what's the other subject? We talked about engineers, the inventor types, the guys who are born with the genes that make them wake up in the middle of the night with a brand new idea. If you can possibly do it, follow your gut, but as youngsters it's probably advisable to associate yourself with a marketeer who has expertise and a track record in the industry into which the potential product will be sold. There are thousands of marketers out there whom you can hire who will take your money and do absolutely nothing for you. You got to be very careful. There again are books on the subject of that, you should read first and make sure you don't blow it and not only throw away good ideas but spend hard earned money on people who don't really have your interests at heart, don't have that capability. I want to remind you of what we talked about earlier this morning, Sandy Strickard, the marketeer who sold my G.I. Joe ideas to Hasbro without me being present and without even really knowing what the product was, on the strength of his marketing ability, and got a huge advance payment of $40,000 to $50,000. You want to be associated with a guy like him, and not some faker who doesn't really know the business, of which there are ten times as many as there are Sandy Strickards. I guess that's exhausts the subject.

Hendrie: Okay, good. One other sort of general question. Looking back, what was the most enjoyable, from your point of view, what was the most fun part of your career? We've covered a very long, very creative career.

Baer: Well you remember, we really haven't talked in any kind of detail about the 30 years I spent on military electronics and other electronics. I built a lot of ham gear, built transmitters, receivers, mobile transceivers, I built radar test equipment, I built shaft dispensers. For the military I built IFF, the "Identification Friend or Foe" equipment for the military airplanes. You name it. And the NASA stuff I think we think we touched on earlier, I've been all over that countryside and a lot of it was satisfying, a lot of it was just dog work. Certainly my experience with videogames, which really didn't last that long, from '66 through '70, '69 and then off and on with Magnavox in '71, '72. That was great experience but it was not the most satisfying, in fact it was mostly frustrating because it took forever to find somebody who was the slightest bit interested. And then the frustration of not being able to turn over a new and advanced and additional ideas to a Magnavox, even though we had on paper a legitimate relationship -- none of that worked well. So what was the most satisfying? I think the most satisfying was the toy and game period when I sat at a bench, I didn't really need the money anymore so there was no real pressure on me, I could enjoy what I was doing. I did what I liked doing best, coming up with a new idea, going to the bench, and drawing schematics, going to the bench, breadboarding something, having something work in two or three days. Not like two or three years on a military piece of equipment, or even five years. Then building maybe one or two models and shipping the model off to my partner, maybe to dress up because they have the wherewithal to make it look a little prettier. Have them sell the thing or present it and try to get a license. That was definitely the most fun, no question about it. Part of it, of course, was the fact that I did it under conditions where I didn't have to worry about whether what I was doing would put bread on the table.

Hendrie: Yes.

Baer: Makes a huge difference when you're not under pressure to make money.

Hendrie: All right.

Baer: If you live long enough and stay technical long enough so you can do that stuff, it's very satisfying. It's basically an art form. It's no different than painting pictures. The guy who is a natural-born painter, he'll go down to his studio at 9:00 in the morning or whatever his appointed time is, at age 60, at age 70, at age 80 -- if he can still can hold a damn brush and he isn't shaking too hard, he'll do his thing. I mean why would he quit?

Hendrie: Yes.

Baer: And why would I quit?

Hendrie: Okay.

Baer: So that's why I'm on the bench right now.

Hendrie: So you don't quit.

Baer: Yeah.

Hendrie: Good.

Baer: The answer is I don't.

Hendrie: Very good.

Baer: As long as my health holds up I'll be in there cranking. We just signed a contract with Logitech out there and hopefully in the course of next year we can repeat it, right?

Hendrie: Very good.

Baer: Why not?

Hendrie: All right.

Baer: Keeps me young.

Hendrie: That's true, good.

Baer: That's something to be desired. I can't even conceive of growing old and sitting watching television or reading books ad infinitum. Or conversely, I can see being on the golf course, if you're of that bent, two or three hours every day if you live in a climate where you can do that year ‘round, like Florida. That's not too bad, but even that I think would get old. Because though it challenges you -- it's a game, it challenges you – but it's not like using your noodle in a mental way.

Hendrie: Yes, having a mental puzzle to solve.

Baer: Having a mental puzzle and solving it, coming up with clever ways of making it happen is a lot more satisfying. And staying in touch, with which gets harder and harder as you get old, with other guys of your bent, who will work with you or help you in different ways. That part is a real problem because as you get older there are very few guys like myself who stay close to the bench. In fact, it's almost unheard of. So I have no counterpart with whom to commune and exchange ideas, and it's hard to get young folks to come. They got their own life and they got their own job. Unless you hire them, and I don't want to hire anybody. I've been able to work with outside consultants, individuals like my friend David Thomas in Albuquerque. We did the layout and design of the Brown Box microprocessor board. I never met the man to this day. He's already built quite a few things for me, and we get along fine, through the telephone, through the web. But I don't want anybody here, because the minute I hire somebody I got Uncle Sam looking over my shoulder, I will become a paper pusher, I'll fill out 50,000 forms. Like doctors who have to hire four girls to sit in the office to take care of one doctor because of today's regulatory environment. It's kind of a nice way to go through life if you can stand it during the years when you have to make money, it's very hard.

Hendrie: Yes, but if you - once you get to that point, if you -

Baer: Once you get to the point where you don't have -

Hendrie: just get rid of the part you don't like -

Baer: Right.

Hendrie: - whatever it is -

Baer: It's a wonderful way to grow old.

Hendrie: - and do the part you do like.

Baer: Yeah, it's a great to grow old or keep from getting old, -

Hendrie: That's what it really does.

Baer: - an old fuss budget, an old curmudgeon.

Hendrie: Well thank you very much Ralph for taking -

Baer: My pleasure entirely.

Hendrie: - all this time to tell your story for the Computer History Museum. We really appreciate it.

Baer: Are you going to make a hard copy of this?

Hendrie: Yes.

END OF INTERVIEW

