Interview of Ed Roberts

Interviewed by:
David Greelish

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David Greelish: Hi, this is David Greelish from classiccomputing.com. What you're about to hear is an interview that I conducted with Dr. Ed Roberts at his medical office in Cochran, Georgia sometime in early 1995. I transcribed a portion of this interview and included it as the feature story in *Historically Brewed*, Issue number nine, which would be the last magazine issue of the series that I published. The issue has a copyright date of 1996. And frankly, at this point, I don't remember exactly when it came out. But I believe it was in the spring. For a number of years now, the written interview has been available at virtualaltair.com, as the owner, Tom Sanderson asked, and I gave him permission to post it. He logically attributed the date of the interview as 1996. In any case, having listened to the interview again in its entirety, I can authoritatively date it as early-- or pre-June 1995. During the interview I made a reference to the state of computing in 1995. And I mentioned that I am thirty years old. I turned thirty-one on June 4th of that year. I created that issue of the magazine throughout the end of 1995. So, that's probably why I say, "Earlier this year," in my write-up as to the interview. I didn't actually get the issue completed and printed until early 1996, thus the copyright date. I recorded this interview on four sides of a microcassette in a vintage 1983 Convergent Technologies Workslate computer. In my blog article, you can see two pictures of Ed at his desk with the Workslate in front of him. The noises in the background is a medical device of some kind, plus my two children. At the very beginning of the recording, I thought that Ed perhaps had a bird in the office. But it turns out that was our infant son. Also, my wife and I had our toddler daughter there, too. You'll definitely hear her a few times. Ed was very gracious, conversational. And I think it was an excellent interview with some interesting general discussion. It runs about an hour and forty minutes. I would love to hear your comments. So, please email me at david@classiccomputing.com.

Greelish: Well, first question is where were you born?

Ed Roberts: Miami.

Greelish: And you were born and raised in Miami.

Roberts: Right.

Greelish: And you went to school there. I read something that you built a relay computer in your teens.

Roberts: Right.

Greelish: Can you tell me a little more about that? About that little relay computer and what it did exactly?

Roberts: It didn't do much more than turn lights on and off, but it was-- relays are a pretty good analog to digital--

Greelish: Mm-hmm.

Roberts: You know, digital devices. And it really became my first exposure to digital circuitry or doing any kind of digital design. It wasn't anything of any-- the computer itself wasn't any great in consequences. I did use a similar design. I built a heart-lung machine when I was in high school. What I-- but a long story, but I used a relay controller for that. And that was kind of how--

Greelish: Like a demonstration with the heart beating and the--

Roberts: This was actually for--

Greelish: Medical use?

Roberts: Yeah, for medical use.

Greelish: Really?

Roberts: Uh-huh. I was-- I had a fellowship when I got out of high school. Actually, my senior year of high school I worked in experimental surgery at the University of Miami medical school. We were doing open heart surgery on dogs.

Greelish: So, the medical field was always your first love?

Roberts: Yeah. Well, yeah I was really-- I started college as a biology major. But I had a-- I shouldn't say friend, one of the docs that I worked with in experimental surgery at the medical school said what I ought to do-- he knew I had an interest in engineering. And said if I was smart I would get my engineering before I went to medical school because once you get out of medical school you don't have time to do any of this stuff, which turned out to be true. I changed my major from biology to EE [electrical engineering] while I was at the University of Miami. This would have been back in like '60 or '61, but still with the idea of ultimately going to medical school.

Greelish: I was going to ask you were you-- like as far as like you built the little relay thing. Were you-- I have a Brainiac. Have you ever heard of Edmund C. Berkeley and the Geniacs and Brainiacs? They're just like these big wheels that you can set up circuits on.

Roberts: Yeah.

Greelish: Were you exposed to any of that as a youngster?

Roberts: Yeah, I had one of those. As a matter of fact, I bought one when I was a freshman in college and played around with it.

Greelish: Really?

Roberts: And-- yeah.

Greelish: I haven't tried it-- even tried-- attempted. It's got everything with it. Mine's from 1959. And yeah, it's real nice-- nice piece. And I haven't attempted to really put it together or make it work. I know you were in the military. So, you were an Air Force officer?

Roberts: I was in the Air Force for ten years. I went in-- I was enlisted when I went in and taught electronics. I spent two years in tech school, electronics tech school, and then taught for about a year, year and a half, and got accepted into a program called AECP, which is officer education and commissioner-- urban education and commissioning program. And I was sent to Oklahoma State. Got my EE degree from Oklahoma State while I was still in the Air Force and got commissioned after I finished that and then spent the last four years as a research officer at Kirtland [Air Force Base] designing laser weapons-- actually, I designed fire control systems for laser weapons. This was in '68 to '72.

Greelish: But you got out after ten years? So, you didn't see it as a way-- you didn't want to retire--

Roberts: No. No. Super good experience, but I had no desire to retire.

Greelish: Forrest Mims and two other gentlemen were your partners that started MITS. They were all Air Force?

Roberts: Forrest Mims, do you know him? Does that name ring a bell at all?

Greelish: Well, just from what I've read. I've never met him.

Roberts: Okay because he's written a huge number of articles and stuff, not on computers, but on-- when we started a telemetry company. We were all still in the Air Force at the time. That's where the name MITS came from. It stood for Micro Instrumentation Telemetry Systems. And we built telemetries for

model rockets. And we didn't sell very much stuff but got a lot of experience in developing and direct mail marketing and things like that.

Greelish: You had that luxury while you're still--

Roberts: Still had an income, yeah. And actually, before I got out, this would have been about '70, I got interested in building and designing a calculator for home use.

Greelish: Mm-hmm.

Roberts: Electronic calculator, because the technology was there at that time. This was-- using medium scale integrated circuits. And I get the design about finished and a company called EAI-- I believe it was EAI that introduced a set of large scale integrated circuits. It was actually six to make a calculator. So, by today's standards, it wasn't very sophisticated. But then it was big step.

Greelish: That time-- sure.

Roberts: And so we built a calculator. And it was the cover article in Popular Electronics, which actually came out before I got out of the Air Force. But my other partners decided that that wasn't a good idea to get into the calculator business. And they all bailed out before we actually did the calculator design. And I--

Greelish: Except for Forrest Mims?

Roberts: All of them. They all got out.

Greelish: But you pretty much remained more friends with the _____.

Roberts: Friends, but I bought out their interest, which I think you know was like a few hundred dollars.

Greelish: It was just a hobby to them at the time.

Roberts: Yeah. Yeah. And they didn't think it was going anywhere. And they certainly didn't think there was going to be a market for a home calculator. Anyway, we introduced-- matter of fact, that is the calculator there.

Greelish: Yeah, if you wouldn't mind maybe talking about a couple of the different models. That was the very first one called the--

Roberts: That was the first one. That was the one that was on the cover. As a matter of fact, that was the cover photograph was of that machine. That was the prototype, which actually if you see in the photograph looked a little better. That's been knocked around for twenty-five years since. It's looking a little rough. That basic machine--

Greelish: That one's called the Comp 100? Is that right? The Comp I?

Roberts: That was a Comp 816 I think is what we called that. Yeah, it was eight bits of display, sixteen bits internal. It had displayed eight digits at a time but actually carried sixteen digits internal, decimal digits.

Greelish: In designing this, how hard was it finding that casing for it, and that-- I guess it's LED display.

Roberts: We made the casing. That's electro and fluorescent display, the-- and that's an injection molded bezel. We made all that stuff, designed all that stuff and made it.

Greelish: See, I don't know anything about manufacturing.

Roberts: Huh?

Greelish: I don't-- personally, I don't know anything about manufacturing so that--

Roberts: Now that was a vacuum form. All of the production units were injected molded case.

Greelish: Did you design-- you totally designed it and everything?

Roberts: Designed everything, yeah. That keyboard is made out of an elastomer polymer for the connections instead of pins, which had become pretty popular recently. But that was the first commercial product that ever used those. And we sold maybe--

Greelish: Those are very-- yeah, those are big old LED like tubes.

Roberts: Yeah, they really not LEDs. They're electrofluorescent. They glow green.

Greelish: Okay.

Roberts: And--

Greelish: That's neat. Those are probably harder to come by. Now, how many of those were sold?

Roberts: I think including kits and assembled, probably of the basic machine about five thousand.

Greelish: Really? There's just got to be some of those floating around somewhere.

Roberts: Yeah, there's a few of them around.

Greelish: I'll stumble on one one day I hope.

Roberts: Then there's-- if you see the production version of them, they're tan. And they look a lot more professional. The keyboards look like conventional keyboards, bigger keys and all that.

Greelish: Was it real common that-- oh, I'm sorry. As like as far as they used a prototype for the cover. I know they were going to use a prototype Altair for the cover as well. How many other covers did you have that had your products on them? I don't expect you to be exact necessarily. I mean, quite a few of them?

Roberts: We probably had several-- three or four, over a period of time, four or five.

Greelish: Was it generally done that way where they took a picture of the prototype for the cover?

Roberts: Yeah.

Greelish: And then just depending upon response I guess on how much you hopped up production?

Roberts: What they were doing of course was, for those cover articles, they were kits. So, we had to-- to get them on the cover we had to provide the stuff, the schematic for them to build the kit. And actually on

the case of the Altair, this is kind of skipping ahead, the production version of the Altair had no resemblance at all to the kit.

Greelish: Right, that's what I've read.

Roberts: The front panel looked the same, but--

Greelish: Even in the pictures in the issue, the guts of it is very different. Right?

Roberts: Yeah.

Greelish: Yeah.

Roberts: It's an entirely different shape. And that was not because we were trying to trick anybody. We just made a whole new design.

Greelish: Well, because you lost your prototype, right? In the train--

Roberts: Design-- and REA-- REA was kind of UPS in 1970. That would have been '74, I guess.

Greelish: Four, yeah.

Roberts: And they went bankrupt about the same time we loaded the thing on their truck.

Greelish: Do you know that story? The first one's lost. It's got to be somewhere I bet.

Roberts: I think it may have ultimately showed up seven or eight months later. Something after they came out _____--

Greelish: That's one question I was going to ask you. Did you ever-- have you ever heard anything?

Roberts: I don't think we ever got it back. I think Popular Electronics ultimately got it. But we'd done enough articles then that we had some credibility. That and the prototype they had worked. It was a functioning machine. And it did use the other kind of technology. It was before I did the bus design. Now,

the original machine, which is probably the thing I did as much as anything else for getting the personal computer up and running was we used an open architecture bus sort of like the-- as a matter of fact, IBM probably copied our concept more than anybody else.

Greelish: Well, I know that's what helped the Apple II along so well is that third party manufacturers and even users could do things on their own for it.

Roberts: But the system, we did switch to a hundred pin bus and on the final production unit. And everything was bus-- you've seen the early Alt-- well there's two of them in here I think.

Greelish: Yeah, a friend of mine-- well of course you read the article about the guy in Albuquerque who used to be an employee actually right near the time you left. He's got a bunch of Altairs.

Roberts: Yeah, he was the guy that--

Greelish: And a friend of mine in Florida--

Roberts: He was their answer-- he became apparently a few months after I left Pertec.

Greelish: Yeah, right. He was in the final days.

Roberts: I never had-- I still know a lot of people, and I never have really talked to them about those last few days of MITS. And I-- it's really a shame. When they took us over, eighty-five percent of the personal computers in the world were Altairs. We were probably still shipping maybe sixty or seventy percent of the machines in the world that were being shipped…

Greelish: Mm-hmm.

Roberts: We literally controlled the market. All the dealers that amounted to anything in the world were all dealers we'd set up.

Greelish: Yeah, he was saying that he used to get-- and he was a service person. And that he got Altairs from all over the world to service them. And yeah, Pertec really messed things up though because like when they shut things down they had a whole warehouse-- he had a whole bunch of people's Altairs he didn't think anyone ever got back. They used to deliver whole pallets of big old eight inch Pertec disk drives to be worked on. They wanted him to try to start working on that stuff over fixing people's machines

and things like that. Just some things he told me. I don't think I'd put this in the article because I couldn't fit everything. But yeah, they-- I don't know what they were thinking. I guess they just had a different--

Roberts: They didn't understand the market.

Greelish: They wanted to redesign-- they wanted to redefine MITS totally, I guess. And that wasn't probably the right move. I don't think people liked that.

Roberts: They didn't understand what we were doing at all. As a matter of fact, I had some fairly heated discussions with all of them. The last meeting I had was a guy-- I was the division vice-president when I left. And the guy that I worked for was the executive vice-president.

Greelish: Kind of funny you had to work for somebody.

Roberts: Well he was-- I didn't have any supervision per se. But he was really, in the chain, he was the next guy.

Greelish: He represented Pertec as far as being over you?

Roberts: Yeah. And he and I had a pretty heated argument. I don't mean unfriendly, but it was a fairly active argument about I thought they completely were missing the perspective of what they should be doing. And he kind of patted me on the head verbally and said I should come back. And he was going to invite me back in a couple years when they control-- when this was a multi-- he was forecasting it was going to be a hundred million dollar industry in a few years, like PCs.

Greelish: Right.

Roberts: And he was going to invite me back to sit at the table when they celebrated their hundred million dollar year at PC. And I said, "That's great. I'll look forward to the invitation."

Greelish: You never sat at that table.

Roberts: They died about <inaudible>. And you know I may have been wrong too. But they certainly were wrong. They didn't understand any of it. They did all of the things that are wrong when you hear all kinds of stories about bigger companies taking over small companies. They made all the mistakes that you can think of. They were called "the suits" when they came in because we were all pretty casual at

MITS. Everybody was pretty laid back. And they showed up with all these guys with their pinstripe three-piece suits and all that. And we were like a bunch of bums I guess to them as far as we didn't fit the California image of high tech, I guess.

Greelish: Right.

Roberts: So, they kind of discounted everything we did. Instead of taking a look at the good stuff that we'd done and kept that, and thrown away all the stuff that-- and we knew-- we knew where our weaknesses were, or at least knew a lot of our weaknesses. But they weren't interested in hearing any of our thoughts about anything. They had a better idea when they walked in. And they ended up going from a position-- well, this is kind of interesting. It's kind of an aside. They had-- but it's sort of related to that in the fall or spring, I don't remember which one, which used to be the big computer show twice a year. They had one in San Francisco the year before they-- or the year they started the acquisition on MITS. And at that show they did a thing trying to get name recognition. And the fourth best known name in computers at that time was MITS. And we were a little tiny company. I mean we're talking about a group of people like IBM, and Burroughs, and Duran [ph?]. They were big names then. And Pertec didn't even make the top twenty. And Pertec was maybe a hundred and fifty million dollar company when they acquired us.

Greelish: Because they weren't important. They were big in what they did, but they weren't-- you know Pertec's worked with the computer, not-- it wasn't the main part. That's why.

Roberts: But we were-- they acquired us for about six million dollars in a stock swap according to what the stock was worth when they-- and that's what the MITS stockholders got was six million dollars' worth of Pertec stock. And they were a hundred and fifty million dollar company. So, we were a tiny part of Pertec. But when they announced they were going to acquire us, their stock went up two or three points in a matter of a few days. It had that much effect on their stock just because people knew who we were and didn't know who they were.

Greelish: So, for six million dollars, they made sixty million easily or something like that. Yeah.

Roberts: And--

Greelish: Do you know what happened after they closed down MITS though? Are they around today?

Roberts: They were bought out by Triumph-Adler. And the reason I know that is I had the stock. I was the largest stockholder in MITS after-- in Pertec actually after the acquisition. And I got a notification that I had a choice of either selling my stock or something. But anyway when they were acquired by Triumph-

Adler, which was a division of Volkswagen, which I think since then somebody else acquired them. And I don't know what don't know whatever happened to them. I kind of lost track after the Triumph-Adler acquisition.

Greelish: But now, after they-- if you don't mind me asking this-- you don't have to be specific, but as far as your stock then, did it go way down then after they closed down MITS? Was there--

Roberts: Well, I was out of--

Greelish: Do you still have it, or did you sell it?

Roberts: No, no. I was out of it by the time they closed MITS. So, when they closed MITS down--

Greelish: You had sold everything, moved here, bought a farm.

Roberts: Yeah, that was Triumph-Adler had probably actually taken over Pertec by the time they actually closed that down because that was about two years later I think when they were acquired. I think MITS survived another couple years after I left.

Greelish: Yeah, until Steve Shepard, the guy in Albuquerque, he kind of inherited since he's there in Albuquerque-- he's one of the last employees. He was able to get a whole bunch of-- he's got a bunch of MITS brochures, and just tons of stuff. And he's got stuff copyrighted like '79 even, '78, '79. So, I think they were around like '79. Somewhere in there.

Roberts: That sounds right.

Greelish: And I couldn't find the picture. I was going to bring this neat picture I have of the Altair office. And I don't know-- excuse me, if that was from when you were there or maybe after. I was-- I couldn't find it anyway. It may have been, was it the 8800 B then with the disk drives and the MITS terminal and everything. You're-- I think you were still there when all that-- you're pretty much-- they didn't really introduce any products after you left, did they?

Roberts: Not much.

Greelish: Everything was established by then?

Roberts: I don't know of any new concepts they came out with. There was a-- I introduced or I designed-- they set me up in a skunk works because they said I was a trouble maker. This is after they acquired me. So, I'm meaning in a matter of a few days after they took over I had this skunk works where I had do my own development. And we, in a matter of a few weeks after that, came up with a handheld unit, essentially a handheld PC.

Greelish: Yeah, I read something about that.

Roberts: And we went to a conference in Phoenix with them about this-- with this machine. And got an enormous amount of interest with the marketing people at Pertec. It generated a lot of jealousy internally in the engineering department at Pertec. And that was really the final thing that made me leave. It just wasn't worth it. I mean there were no hard words, but it was pretty clear that they resented anything we did. And it was going to be a battle.

Greelish: That really makes no sense, does it?

Roberts: But they were-- the engineering people said, "Oh, nobody needs a portable computer." The sort of thing we did when I was trying to find somebody felt we-- somebody needed a home computer. Everybody said, "No, there's no market for that."

Greelish: Mm-hmm.

Roberts: And that was kind of the attitude about portable computers. There was no real market for it. And it turned out, if they had they done that-- this would have been in-- this was in '77, they could have been in market by late '77, early '78 with a full-blown portable computer with an integrated-- with BASIC built into it. But--

Greelish: But I think the first one was sometime in mid '78. The Byte Saver I think was the first one? It looks kind of like an Osborne or something, you know, big, luggable. So, if you had done that, yeah you might have came in with the first one too, the first portable one.

Roberts: Well, we had a machine operating in the summer of '77, a portable machine operating in the summer of '77. We figured it would take it several months to really get that into production.

Greelish: So, whatever happened to that? I wonder where it is?

Roberts: I had a set of blueprints and I loaned them to-- it's like a lot of the stuff. As a matter of fact, there were some people at NBC that were here about three or four months ago. And I gave them bunch of the-- I collect-- my last day at MITS, I had a--remember I had Dave Bunnell, I told Dave to get me a kind of a representation of a bunch of ads and articles we had. So, he made up a couple of notebooks that were just kind of representative of what he had. And I gave them to this lady that was from NB-- that was here from NBC, did an interview several months ago. And she promised me she would get them back to me. And I haven't gotten them back yet.

Greelish: Do you know what show she was from or anything?

Roberts: Tom Brokaw was going to be doing the interview supposedly. And it was one of these deals, they interviewed him, but he apparently-- they replaced her voice with his, which I guess is pretty standard on like that kind of stuff. And it was supposed to be out the first of the year is what she told me.

Greelish: Oh. Okay, so it looks like he's--

Roberts: Looks like he's doing the interview. But he's really not.

Greelish: Oh, that's how they do that sometimes where he's like turning around looking at the screen like he's talking to you live and--

Roberts: Yeah.

Greelish: I hope they follow up with it. It's a-- I just can't believe that-- I'm really shocked that Popular Electronics did not at least acknowledge you and the Altair. I mean it's their own universe. They should be proud of the fact that twenty years ago, they launched first Altair--

Roberts: Well it's a new magazine. The new Popular Electronics is a different mag even-- Popular Electronics went bankrupt. And then they were--

Greelish: But I mean still even for a regular people, as far as they know it's Popular Electronics. So, it should be-- it's just should be something they're proud of. I have a-- from CompUSA, some reseller computer magazine or something. I brought it because I was going to show you that I was looking at this at work. And they had some big thing about it's the twentieth anniversary of Byte magazine. And Byte magazine launched their first issue in December of '75 or dah dah dah dah. I'm going, well I mean that's nice. It's a great magazine. That's cool and everything. But if it weren't for you and the Altair-- You know

what I mean? Why are they acknowledging Byte's anniversary and not the personal industry's anniversary? It's kind of--

Roberts: That was a magazine we built at MITS. I got a-- this has been about three or four years ago. They were-- I guess maybe five years. They were doing a fifteen year anniversary. How long ago would that have been? Maybe five years ago. It's been since I've been in Cochran though. And they sent a-- they called me one day. This guy said that he wanted a phone interview. And they were having an anniversary. And I said, "Okay." I said, "Well, when do you want to do it?" And he told me whenever it was. And I said, "That'd be fine." And I said, "What did you want to know." And he said, "Didn't you have something to do with computers some time back." I said, "Yeah. Let me give you a call back." And I just let it go. I didn't even return the call after that. It was clear they didn't have a clue. Their magazine-- if you take a look at any of the-- all they had to do is look at their old Bytes. And they could see who-- see where it came from. They're even claiming credit for the term personal computer which is a phrase that I made up. But I like I said, they were claiming credit. Then they had-- they got some sort of dictionary that said they were the ones that originated that phrase.

Greelish: I was trying to think of what I had read. I'm only thirty years old. So, everything I know about computer history, I've read. I've got to take other people's words for it. That's why it's nice to be talking to you. I get the real scoop here. What have I read that-- where personal computer-- I do have the Byte book, which it's a good book. It's the best of Byte with all their old issues and stuff. So, for me it's real good. As far as how accurate everything is-- I can't remember where I read-- I have a really interesting article out in the car that I want to show you. And it's all about this guy who invented the personal computer back in '72.

Roberts: Oh, really?

Greelish: Yeah, I can't remember. I'll show it to you. Tell me what you think about that. But I guess a lot of people could say they-- I mean, you could say the guy that invented the Mark A, he invented the personal computer. You launched the first commercially successful personal computer. To be totally accurate about it, I guess that's where credit is due. You may not have necessarily been the absolute first person that created a personal sized computer, but one that was commercially successful, that's what counts.

Roberts: Yeah, if you want to talk about everybody that's put some logic in a box, then you can pick any time you want to about that. Matter of fact, one of the very first ones as far as I'm concerned, in my model, people who are contenders for that would be an HP 9100, which is a desktop unit. It was a calculator, but it was a programmable calculator that was introduced in '68, which was a real interesting machine. You had a printer that went with it, a tower that went with the little tiny CRT, programmable. It was two hundred lines of program and all that. But it was really basically a desktop computer. It wasn't a personal computer from the standpoint of cost. Our definition of personal computer, when the phrase was originally

coined, what we were trying to describe-- that's-- we talked about calling it the home computer. A lot of those terms have been used since then. But we didn't like the term home computer. We didn't like the term small computer, or the-- we talked about the-- I can't think-- we had a whole bunch of different names. But all of them connoted something different than what we wanted to connote. We wanted to connote a machine that was--

Greelish: Single user.

Roberts: Single user, but something you could have yourself. But at the same time, not some sort of degenerate toy kind of thing. And that was one of the-- that's where-- that's the reason we came up with that phrase, "personal computer." To be a personal computer, it had to be-- you had to be able to afford it. You could by a PDP-8 pretty cheap by that time.

Greelish: Yeah, some people consider it the first personal in a sense that-- it's the size, but not necessarily-- no one could afford ten thousand dollars.

Roberts: Well they actually had some versions of PDP-8 that had come down quite a bit. But still you had cost. Cost was an issue. And all the peripherals to make it play were expensive. And it was not-- it was never really designed for amateur users. It was a professional machine. But it needed to be low cost. It needed to be pretty much self-contained. It needed to be understandable by the user in terms of how it worked in general, that was a requirement, not so much now. But it was then. And there's no-- none of the machines meet any kind of a-- any machine you want to pick has got big holes in it. The-- and it had to be a real computer. It didn't have to be some sort of toy that demonstrated something. It was a machine that-- they had a deal that-- they invited me up to speak at the Boston Computer Museum. And I didn't know what was-- if I'd have known what was going on, I wouldn't have gone up there. They awarded some guy an award for coming up with a computer. And what he did was generate a serial-- a set of serial logic. This was in '71 and '72. And he sold like twenty of them that demonstrated computer concepts. It was not a computer, but he didn't even claim it was a computer. But somehow or another they decided this was the world's earliest computer, personal computer. It was stupid. It's absolutely nonsense. And it was a machine that used the 8008. I think that may have been the Mark 8 you're talking about. It was an 8008. And no matter how you cut it, that 8008 processor did not-- you couldn't make a general purpose computer out of it. It only had like eight thousand bytes of memory. You couldn't do anything with that little bit of a memory. That was really intended-- it was built originally to be a controller. And it was-- I think the article, if I'm not mistaken, was basically the idea of that being a controller, not a home computer or a personal computer. But the first-- and the thing I've always said in the past, and everybody debates that is before the Altair, there was not a personal computer. And after the Altair, there was one. You call whoever. You can say whatever you want to say about that. But the fact is--

Greelish: Let me ask you then about two computers that seem to-- I guess the only two really significant ones prior to Altair is the Mark 8 and the Scelbi. I think the Scelbi was prior to Altair, wasn't it? One model or something? Or just, what do you know about them? Have you ever seen one or?

Roberts: The only Scelbis I ever heard of-- I don't think I've ever seen one. The only Scelbis I ever heard of was after the Altair. And I think that was an 8008 machine too if I'm not mistaken. The early ones were.

Greelish: I think so, yeah. I think that he 8080 one definitely after the Altair, but I'm not sure.

Roberts: I think it was an 8008. And to the best of my knowledge they never-- it was never really a full up system that you could actually do something with.

Greelish: Kind of strange looking thing. It's only got like a little LCD-- or not LCD, I guess, LED little window or something. I mean I've only seen pictures of course.

Roberts: But that was one I didn't know anything at all about. A contemporary of that is one that was introduced within months after we came out with the Altair that got a lot of splash. As a matter of fact, if you look at some early issues of Byte, you'll see it mentioned: it's the Sphere machine that used the 6800 Motorola processor. And they followed our van. We kind of got the personal computer going around the country. We had this van that went around that we'd advertise these shows. We didn't think we'd have like five or six people showed up, but-- would show up. But the first place we went was Amarillo leaving Albuquerque coming east. And we had a whole hotel full of folks that showed up for that meeting. And when we got to Dallas, it was crazy. It was just insane there in Dallas.

Greelish: So, you had other people following you around?

Roberts: The Sphere, the folks from Sphere in Utah followed us around with theirs. They introduced a-- they called theirs a 6800 I think, or may have something like that.

Greelish: Bountiful, Utah is where they were from.

Roberts: Okay.

Greelish: Yeah.

Roberts: Nobody ever actually saw an operating unit. And you may have been-- when I talked to somebody recently that said they knew a dealer.

Greelish: Right, Stan Veit.

Roberts: Yeah.

Greelish: He was the kind of a historian guy, and-- yeah, I brought you his book, by the way. So, you can when you have time read his book and check it out. He was going to be-- he was going to-- the first thing he looked in was being an Altair dealer. And after a time, I think you had a policy that if you're going to be an Altair dealer, that's all that the party can sell, exclusive Altair. And he didn't like that. So, he didn't go with you. And so then he-- Sphere was the first contract he got. And that was the first computer he got. Then he went with IMSAI and a few other people. But he got one Sphere, and it never worked right. It was this demo. And he never sold it. He says it just sat there. Actually, he did get it to run some little-- funny little demo or something just to catch people's eye. And that's all it ever did. He never sold any. And then that's all I know about it. He said also, I believe in his book or maybe when I talked to him, he has said he doesn't think they ever made any.

Roberts: I'd heard that. That nobody ever seen a-- saw a production version of that machine.

Greelish: Yeah.

Roberts: But that would have been the only machine that I know of that-- at that time, that we considered any kind of competitor. And this was not based on the fact that we saw a machine. But I was going by the ads that were appearing and all that. That's why some of this other stuff kind of came out of the woodwork afterwards, like the Mark 8 and the Scelbi. The Mark 8 is the only one I've ever heard mentioned in recent times.

Greelish: Yeah, but did you ever see one? You ever know anyone that actually built one?

Roberts: No, I never actually-- we're talking about at least-- now they may have later on after the Altair came out. But I'll bet the original Mark 8 that you're talking about--

Greelish: But now also then they're-- in their article, the radio-- well, that company-- you sold the Altair. This is the Altair. You order it from us, and we'll send you all the parts, right?

Roberts: Yep.

Greelish: In the case of the Mark 8, you couldn't do that. You had to go and get all the parts for yourself, right? I think that's why--

Roberts: I don't even know.

Greelish: I believe so. And that's why it's a different thing than what MITS was doing.

Roberts: Wasn't even a mail order. Well majority of Altairs, contrary to again to a lot of the stuff that's said, the vast majority of Altairs were sold as assembled units. In that original article, you can even buy them as an assembled machine. The vast majority, probably ninety percent of them were assembled not kits.

Greelish: There you go, okay.

Roberts: You know, it became I guess of some value to say you were the first from a marketing standpoint. And I didn't grant any interviews. After I left MITS and left Albuquerque in '77, I didn't do any more interviews until I think like '84. I was at medical school, a year or two into medical school, when I did the first interview, maybe three years into medical school.

Greelish: Who was that one? Do you remember who the first interview was with?

Roberts: It was the guys that did "Fire in the Valley", which turned out they grossly distorted everything. And I didn't do any more interviews after that for a while.

Greelish: Yeah. I was going to-- I have "Fire in the Valley" out in the car as a matter of fact. And I was going to ask you--

Roberts: Did you get the revised one that they came out with?

Greelish: I'm not sure. It's from '84. I don't know if it's the first one or second one.

Roberts: That would be the first one. They came out with a revised article and threw out all that stuff from the original one. And they actually acknowledge in the revised thing that the Altair was the first one-- the fire. The real problem was they were trying to say the fire in the valley being Silicon Valley. The problem was the valley was the Rio Grande Valley. And we were two years ahead of anybody else.

Greelish: Right. Yeah, that's one thing just-- I guess because the rest of the book kind of does center around Silicon Valley in California. You're the only real exception, significant exception I guess. Yeah, what have you-- you read "Fire in the Valley". So, there's some things that--

Roberts: I looked at pieces of it. It's so grossly inaccurate, that it's not--

Greelish: Are there other things-- other accounts of MITS and Altair that you can think of that are also incorrect?

Roberts: Well, I haven't seen really a good history of any of the early computing-- the best history probably of the early computing is in the Time Life series. But they kind of missed the point that the Altair was really the first personal computer. They kind of-- they operate on the assumption the first personal computer occurred later. And I don't think any of those people that have written stuff early on, they count. They all leave-- and part of this was probably generated by people that came after that that had their own axe to grind or were trying to convince people they were the first computer, implied that the early machines were not capable of doing anything other than watching a bunch of lights flash because that's kind of how they're always described.

Greelish: That's kind of beside the point though really, rather than who did or didn't.

Roberts: The thing that's frustrating about that, the original Altair, Altair A or B, either one of those two machines-- actually there was the original Altair, and then there was an A, and then there was a B. But the original Altair and the design of that original Altair, people have kind of missed the whole thing. The design was fairly elegant in this sense. We didn't know what software people were going to put on it. We didn't know what they were going to try to do. So, instead of using any memory inside of the machine for startup ROM, there was none. The machine-- you could do anything you wanted to on those machines. You could load any software. There was no hardware on that machine that interfered with the operation of the thing in any way.

Greelish: It was totally user-configurable.

Roberts: Yeah.

Greelish: Right.

Roberts: And if you didn't want to do that yourself, you wanted to do it with us, you'd load the front panel switches. You'd load the boot loader. Now, the reason for doing that, which now seems kind of odd, but

anybody that worked with minicomputers, what we did was model the system after a minicomputer, but modified the model in that we didn't have any internal memory at all or operated as if there was no ROM memory at all, where you could do anything, where you weren't dependent on anybody.

Greelish: Right.

Roberts: And that was an elegant design. But from Day One there's all those machines that could be configured with a ROM because the machine when you hit reset will always start at zero, which is the basis for all that stuff. So, when you hit reset, you want to put a ROM in there and bring the thing up without the front panel switches, that was great. You could do that. There was everything.

Greelish: Let me ask you something only because it just popped in my head and I want to ask you while I remember it. A friend of mine, and I'd be interested myself, he cannot find that Chase the Bit program anywhere. Would you have that anywhere listed?

Roberts: I might, but I don't-- I mean I haven't played with an Altair in ten years.

Greelish: Okay, well if you think of it down the road, then email it or something. But I have a writer now so I can do it--

Roberts: I can tell you the first program that was ever run on a personal computer. I can give you that one off the top of my head.

Greelish: Which-- what's that?

Roberts: It's called Jump to Zero, the first test-- the first time we tested the Altair, we didn't have any-- we didn't have any test--

Greelish: Hey, I'll write that down then.

Roberts: We didn't have any test equipment when we did the Altair. We didn't have a scope that would look at the signals that were in there. Matter of fact, some of the noise problems we had in the early versions is because we didn't have any equipment to-- we couldn't see the stuff.

Greelish: That's why that guy-- I think the story is in "Fire in the Valley" or "Hackers", I think it's in "Hackers". Have you read the book "Hackers"?

Roberts: Mm-mm. No.

Greelish: It's a good book. Whether or not it's totally accurate, I don't know. But a guy at the Homebrew Computer Club, he took his Altair and made it make music because of the FM interference. He was able to mimic a radio.

Roberts: Yeah. As a matter of fact, that'd be true of one of these machines. You take one of the machines right now, there's a lot of RF that comes out of them even if you meet the government's requirements. The last designs that I did, the requirements are pretty stringent now on machines. They've changed. But all those machines-- you know you-- kind of interesting, this is a total aside. It has nothing to do with anything. When I was--

Greelish: That's okay.

Roberts: When I was in the Air Force I designed-- one of the things I designed were laser power supplies for laser weapons. You're firing flash tubes. And we were hitting flash tubes. And these numbers may not be exactly right. It seems like three or four thousand amps into the flash tubes with about I think they were ten or fifteen thousand volts, a lot of energy, right?

Greelish: Mm-hmm.

Roberts: As a matter of fact, there was so much energy as we were pulsing the flash tubes at thirty times a second that the cables that ran to the trailer literally beat the trailer apart. You know the vibration, it was banging like that. They would literally over the period of an hour or two running tear the trailer up. And my big concern, I was using an eight bit machine for a fire control machine. And my big concern was this big pulse we were generating was going to screw that up. It turns out that if the computer will tolerate itself, it will tolerate anything. Because the noise level inside the computer is so great, there's nothing that approaches it in a short distance. You're di/dt [instantaneous change in current over time]-- I don't know-- are you a-- I don't know what kind of education you have, but the rate of change occurring--

Greelish: I have some electronics training just because of the military.

Roberts: Okay, well the di/dt on a pulse-- you know a pulse when it goes up the rate of change of current, which establishes the strength of the magnetic field, is intense, even in the old-- in the early machines. So, even though the total currents weren't high, the noise they generated was enormous. So, anyway to that effect, if the computer will tolerate itself, there's almost nothing that will screw it up. Now that's not true with the magnetic memories and stuff like that. But the logic itself is pretty tolerant of external noise, which is a big-- anyway, that was one of the problems with the original Altair. We didn't

have any test equipment to do that. As a matter of fact, it was designed using a digital logic analyzer that we had at Popular Electronics. They used one of them-- the calculator-- old calculator cases, handheld cases, that was a bit detector. And we just sampled it. And what you do is get a bit-- the up or down bit pattern. Have you ever used a logic analyzer?

Greelish: Mm-hmm. Yeah, I fixed radios in the Army. So-- not extensive electronics, but you know, it was basic pluck and chuck cards and stuff.

Roberts: Well, that's the way the Altair was designed anyway or the design was done with that. But the first program that we wrote was a thing called Jump to Zero. And the command is Octal 303, which is 11000011. And that says jump. And so, you put Jump as location zero. So, when the machine comes up, it reads the instruction at zero. It detects that as being-- it assumes that's going to be an instruction when it first powers up. That's the only assumption a computer makes is that that location, you're going to have a jump-- or a command of some kind. The first command was jump. And the next two commands-- the next two bytes would be the address. It was a sixty-four bit address-- or sixty-five thousand possibility, sixteen bit address. You set those all to zero so what it would do is say jump zero zero, which meant come back to the first. It would sit there and cycle. It was just the first three bytes of memory.

Greelish: So, as long as it's doing that, it's operating-- for the most part operating properly?

Roberts: Yeah, it was a pretty good test. So, it was a test we used for checking machines out real quick. I mean it didn't check every switch and every bit of logic in the machine. But it told you if the machine was grossly-- if the clocks were okay. Then it was reading memory okay and writing memory okay and stuff like that.

Greelish: I'll have to write that down before I leave here today. I guess my mind jumps around, too. I don't know if yours does. But let me go-- I'll knock out some of these questions here. Oh, when did you begin your relationship with *Popular Electronics*? Did you also write ever for *Radio Electronics*? How did that kind of come about?

Roberts: We wrote articles for both *Radio Electronics* and *Popular Electronics*. As a matter of fact, I've written articles for *Radio Electronics* recently, also for *Modern Electronics*. I wrote a series of articles for *Radio Electronics* on an EKG machine that you could hook up to your own personal computer. And that was a series of articles that came out three or four years ago, three articles-- two, three, or four articles in that series. But I wrote both those and also for *Modern Electronics*. We wrote a series of articles. Did I answer your question?

Greelish: Yeah, well-- I read that as far as when you met Leslie Solomon, he actually came to see Forrest Mims. And but then you guys met and hit it off real good. And that kind of was an initial

establishment of a good relationship leading up to the Altair article. Do you still talk to Leslie Solomon at all?

Roberts: I haven't talked to Les in years.

Greelish: They're still around, though, right? Both of those guys?

Roberts: Les is retired. I understand he spends part of the year in Boca Raton and part of the year somewhere else. And I had a home number for him. As a matter of fact, I got-- as matter of fact, it was from one of the reporters that I've seen fairly recently. And I called the number-- yeah, Les Solomon. I've got two numbers here. But I call the number, and he wasn't there. And I never have called him back. But I haven't talked to Les in probably fifteen years at least, maybe longer ago than that. I haven't talked to hardly any of those people after I moved back here. One kind of a-- we started talking. And I got off the subject. But it was right after I came back. There was an article in Playboy that would have been probably '78 or '79 because it was pretty soon after I came back to Georgia.

Greelish: It was about you?

Roberts: It was about personal computers.

Greelish: Oh, okay.

Roberts: And the article talked about how that MITS was the company that created the first personal computer. Now, you've got to understand, if you'd been looking at this in 1976, '77, '78, there isn't anybody in the universe that would have questioned where personal computers came from. It's only been recently that's become a question. But people who were close to the industry before it happened, nobody thought Apple did it. That's kind of standard thing right now.

Greelish: Right, they didn't come in until a few years later.

Roberts: Apple hadn't shipped their first machine when we were bought out by Pertec. The reason I know that, they guy that started Byte magazine was a guy named Green, Wayne Green.

Greelish: Right.

Roberts: And Wayne came by and saw me the day we were closing to go to Per-- we were closing out the deal for Pertec, which is in like May of '77. And he had just come back from California. And I always like to talk-- I talk to all of them editors and people that were doing the _____ because that was a good source for G2. I mean everybody did. Nobody-- everybody knew that if you told them anything, it wasn't going to be secret. But you could kind of get a feel for what other people were doing. And he made the comment to me at the time, and it stuck with me, I probably _____ been that long since I thought about it, but it stuck with me a year or two later when I first saw them. But he says there's an outfit called Apple, a couple of guys working in their garage out there, that he thought was an interesting concept. And he thought if they could ever get the thing going, they would do all right. And he said they had advertised two or three times. And every time they advertised, they'd withdraw. They would never ship them. But he thought they were getting ready to ship. So, they were pretty close to shipping at the time. But we were selling out to Pertec. We were a big company by that t-- in that industry.

Greelish: Right.

Roberts: But anyway, that's just to get a perspective about where Apple fits in with--

Greelish: They only played around pretty much with the Apple I. That was generally the beginning of their company when they said let's really be serious and start a company. But they had like two hundred Apple Is. They sold fifty to the Byte Shop in California. Then they-- I don't know. They toyed around with the other ones. Of course, it wasn't until the Apple II in mid '77 or late '77 or whatever like you said. They didn't ship until probably after you left MITS. Then, of course, that's when they took off. And they had a lot of help.

Roberts: They got a lot of financing.

Greelish: And they had-- they were in the right place at the right-- I mean they met some key individuals that, if it weren't for them, they would have never taken off. They were just two guys, two hippies in that garage.

Roberts: Well, the first thing that happened with MITS when Pertec took us over was they killed the dealer network. We'd set up the first dealer-- if you pick anything you want to in the personal computer, and I made this offer to a number of people, you tell me something that you think somebody else did first. And I can almost guarantee you it was done first at MITS. And the dealerships were certainly first. I don't think anybody would question that. All the original dealerships that were set up were Altair dealerships. And we were the first one to have the concept of dealerships. But anyway, I keep getting away from my story. This thing came out in Playboy. Like I say, it was probably '78. And it gave us credit. I don't know if it was a comment in the article, something to the effect that they didn't think that-- they suspected we didn't have an idea how big the industry was going to be at that time or something like that. Well, about

four or five years later, somebody-- and every time something bad came out, I guess I quit looking at it. They had a big article with Steve Jobs that was an interview with Steve Jobs, the inventor of the personal computer, which just pissed me off.

Greelish: Really? I'm going to try to look that up.

Roberts: But anyway, it talks about how he invented the personal computer. And their own magazine told them that was wrong.

Greelish: Right, well he's also credited with inventing Macintosh, which he did not do at all. I mean he took over the project, but he didn't create it. It wasn't his brainchild or anything. It was another guy who actually started it in the late '70s, the whole Mac thing.

Roberts: Is that right?

Greelish: You know the Macintosh was originally supposed to be totally just a utilitarian, just a people com-- personal computer, inexpensive, like a thousand dollars, eight bit little computer. It's going to have a cassette drive, be very simple and inexpensive.

Roberts: We were the first one to do the cassette drive.

Greelish: Yeah. It came out at twenty-five hundred dollars and a lot more-- I'm a big Mac person. So, I like the Mac. But it wasn't exactly what it was originally-- Steve Jobs did not deliver the Macintosh the way it was initially going to be-- let me ask you this question. I've read in a couple places that you're a great designer, engineer, all positives, except on the business aspect, weren't the best businessman… Obviously, you had to be a somewhat decent businessman because you had your-- you built MITS up to certain-- so, do you kind of resent that when people say that about you?

Roberts: No. Some of that's come from me because my theory-- this is-- I think there's plenty of data to support this, is you take a-- you find an entrepreneur that's a good businessman, and they've got to be, probably, because none of them were. All entrepreneurs, good businessmen won't ever start companies either by that-- for the same-- there's kind of two-- but there's a point you reach with company. And the companies that are successful, I think-- and I've thought this for years before any of this-- before we were even bought out by Pertec, that people that have the entrepreneurial spirit to get things going are not the same group to do the day-to-day maintenance. They're not very smooth. It's just not-- it's a different kind of-- it's a different kind of mentality at all. Things that work good when you're trying to get things up and running where you're doing everything by the seat of your pants and making really gutsy decisions are

stupid things to do, it's a stupid management style when you've got an established company. It's just dumb to do that.

Greelish: Yeah, I think that's true with a lot-- I think people are generally good managers with an established business, and then you have like gutsy entrepreneurs who are good with startups. And let me ask you this question, too.

Roberts: For what it's worth, I hired my own replacement at the time Pertec took over, a guy named Bob Tenley, who's president of the bank that we'd been using there to—in New Mexico. And I hired him in-- I mean I understood the problem. And I hired him to replace me. And I didn't make any bones about it at the time, but I was not-- that was not my forté. As a matter of fact, Bill Yates, not Gates, Bill Yates was the other partner in MITS. He bought out after I sold out.

Greelish: Bill Yates?

Roberts: Bill Yates.

Greelish: Right. Okay.

Roberts: After I sold out-- or bought out the other guys that were in MITS. And I sold Bill Yates fifteen percent interest in the company I think for a thousand dollars or a number like that. And that's what we used to buy the parts to build that calculator. And Bill stayed with me up until the time I left. He stayed with Pertec. As a matter fact, Pertec had a motto that he was guru of what was going on. They weren't too concerned about losing me at the time because they felt like they still had the guru. But Bill-- I had a point there. Bill came up to me one day, this was maybe a few months before we sold out, said, "Ed, this isn't any fun anymore." And he was really right. It was a lot of fun initially developing the company.

Greelish: Because that's how you felt as well? That's why you wanted-- you were ready to get away from that?

Roberts: All I was doing was dealing with problems. We were having people threatening to strike because they found out some girl that worked next to them on the production line was making a nickel an hour more than they were. And we had the OEO on our backs because we had a-- some guy apparently had told somebody he was going to start a union. And I had fired. I fired him. And I fired him maybe a month or two after he had some witnesses he said that. I had never heard a word. Nobody ever seriously thought about a union. I fired him because he kept giving customers bad information. He'd been warned about half a dozen times about it. But anyway, he went to the OEO or somebody. And they said it was not-- anyway, it ended up that we had no reason-- no problem showing there was good reason to fire him.

It had nothing to do with his union activity. It was that kind of nonsense. I mean I didn't know any-- I didn't know he was-- I might have fired if I'd have known he was starting a union. But I didn't even know he was starting a union. But it was all that kind of-- it was like running a soap opera. And--

Greelish: You never intended to be running a large company with lots of employees where you have to deal with all their problems and all that stuff, right?

Roberts: That was not my forté. Sometimes everybody kind of Walter Mittys about doing that thing, but it's not much fun when you get there. It was fun designing products and getting them into production and all that kind of stuff. That's fun. But most of what we were doing was not fun.

Greelish: Let me ask you this question. Looking back on this one particular business decision of yours, as far as saying if you're going to sell Altair that's all you can sell, did you regret that? Or looking back on it, do you think maybe I shouldn't have done that? What's your viewpoint about that?

Roberts: That may seem like a bigger deal now than it was then. At the time, when it was originally done, there wasn't any competition. I mean all we had to do was say if you want to sell our mach-- and actually, we never said that. What we said was if you want to sell Altairs that won't guarantee you exclusivity of Altair. If you're not going to sell Altairs exclusively, then we won't guarantee you exclusivity in your area. And that was interpreted as saying they could do that because then-- and as a matter of fact, it almost has that effect because we accounted for ninety percent of the machines at that time probably up until maybe six months before we were acquired. I mean if you had a dealership and you wanted to sell machines, they had to be Altairs. There wasn't anybody else there.

Greelish: As matter of fact, it just came in my head what I've read. Someone said that-- and I don't know where I read it, but they said that you wanted to make your Altair dealership-- you used the automobile industry as your model because-- and you can correct me. This is what I've read. I don't know if this is true. Which it kind of goes along with it because generally speaking, up until last ten years or something, you sold Buick. That was it. Do you think that-- was that pretty much what you did model it after them?

Roberts: No, I think our real concern was that if we gave somebody exclusive rights to an Altair territory--

Greelish: They would need to be exclusive back.

Roberts: Yeah because if you didn't do that, if you gave somebody exclusivity in an area, and they took some other machines, they could take you out of the market. So, we just said if you want an exclusive Altair dealership, then you've got to be-- you've got to agree if you want to be exclusive. If you don't want to be exclusive, then don't worry about competition being there because you're going to have it. And we

had plenty of people that wanted to be dealers. We really set up dealers slowly just so we could sort of support them. We probably never really supported our dealers like we-- we never supported anybody. We could never keep up with-- we always had a backlog. No matter what we would do, we had a backlog. A lot of the management problems that existed at MITS, which none of those have been talked about in the press or anything. But a lot of the problems that I saw were related to the fact that I'd make a policy decision-- even given that I was not a good manager from the standpoint of that kind of thing. And I'm not trying to be-- I'm not trying to be one way or the other. I mean I wasn't a-- I don't think I was a terrible manager. But that was not my forte. It was not something I enjoyed doing. But we would make a-- forget management--

Greelish: Well, I don't think there's any shame in just like we were talking about that you were better as a-- you did all the hard work starting the thing up and getting it going. It's easier to main-- not necessarily, but it may be in some cases easier to walk in and just do the everyday keep things going. The hard part is just getting the idea and the work-- the hard work of getting something going. So, that's-- like you said, that's what you enjoyed more too is coming up with the ideas and making them happen and stuff.

Roberts: But what would happen is you'd make a decision that made a lot of sense about the way you were going-- like a dealership decision. A month from now, everything changed because we doubled our volume. We were doing-- so all decisions that seemed pretty logical this week, two or three weeks from now or two or three months now were very illogical. And there was no-- everything we did, we set new ground rules for every decision we made. We made the decision for the tape drive, the interface, what that interface was going to look like. There wasn't anybody else to ask about that. We were the only ones that had done that. You name it, the formats for disks, all of it, there was nobody else that had done it. It was all new ground. And some of those were not-- with the exception of maybe the last two or three months of MITS, there was only the one electrical engineer in the whole operation. I was the only electrical engineer in the whole operation of MITS. We had-- by that time, we were up to, including everything, maybe five or six hundred employees including all the dealerships.

Greelish: With all the dealerships, too.

Roberts: We had two hundred and some odd in Albuquerque just in the production facility.

Greelish: Was the-- I've read that you checked out the 4004. No way, that's primitive, 8008, then they came out with the 4040. You pretty much put [that] on the side because they were just not sophisticated enough to run a personal computer. But at the time that you created the Altair, the 6800 was available. Was the biggest factor, though, in selecting the 8080 just because you could get them cheaper? Or did you seriously consider the 6800?

Roberts: We seriously considered the 6800 after the article had actually already been submitted to *Popular Electronics*. And the thing that we actually ultimately built [was] a 6800 machine.

Greelish: Right.

Roberts: The Altair two [Ed: Altair 680?] was a 6800 machine. And the thing that killed the 6800… probably finally kept us from doing much with it, is the director of marketing stopped by Albuquerque. This was in the fall of-- I don't remember dates real well. But I remember a lot of these because there are certain key points that I can remember kind of when they occurred before and after that. This was the fall of '74, which would have been a couple of months before the Altair actually appeared in the article. And the director of marketing for Motorola came in here. And we told him what we were doing. And the standard thing-- nobody can believe this now, but every time I talk to anybody about that, we were going to sell a computer that people can have at home, they said, "Number one, nobody wants them. Number two, what can you do with them? And there's no market." I did not find a single person, I'm talking about from the time we started until it was an established business, that thought that it was a good idea. Everybody thought it was a dumb idea. Nobody wanted computers. Now, everybody thinks that's a totally logical thing to do.

Greelish: Right.

Roberts: If they could-- that's what frustrates me when people are taking credit for things. I mean I had to fight constant battles, I mean with vendors. The reason we ended up buying disks from Pertec was that they were they only company that would talk to us. Everybody else laughed when we told them what we were going to do with them. The first printers we used were Okidata. Okidata was the only one that didn't laugh at me when I tried to-- Okidata didn't even realize they were the first supplier of printers for personal computers, but they were. That's because everybody else laughed at me.

Greelish: Did you get to a point where you were just saying no matter what happens I'm just going to do it because I'm sick of them saying I can't? I want to do it because I'm sick of people saying it's not going to work.

Roberts: Yeah. I thought there were some other idiots out there just like me that were fascinated with the idea of owning their own computer. And I was betting there were some other people in the world that were interested.

Greelish: Well, it's kind of like-- not that this is a good-- necessarily a good comparison, but like me… starting up computer history, I tell people, "Oh yeah. I collect old computers. I'm interested in computer history." And they're like, "Why?" But I just said, "I know there's got to be other people out there who find

it interesting too." And I found them. So, there's always people. It's a big world. And people are interested. You can always share interests, I think, with other people.

Roberts: Sure. You were asking me about something else. I was going to answer that and I'm--

Greelish: Yeah, I'm sorry. We both got off track. Well, I was asking you about the 8080, and the 6800.

Roberts: Oh, the 6800. Now, the guy from Motorola came out. And now I'm just saying this is kind of-- he was kind of representative of the flavor. I told him what we were going to do. And he said, "Well what are you going to do?" I said, "We're going to put BASIC on it." He said, "Well, you can't do that." He said, "We've already looked internally at Motorola. And there's no way, and no way in the next few years--" I don't remember what number of years that the technology was going to allow a higher[-level] language to run on a microprocessor. It was going to be impossible to do it. And I remember I had a long discussion with the guy. And he just wrote me off as a complete idiot. And it made me so-- because here's the guy from Motorola. He was the director of marketing for the 6800. They had all the engineering staff. And they had decided that what we said we were going to do was impossible to do. And we hadn't done it yet.

Greelish: Yeah, at that time you didn't have any BASIC at all.

Roberts: We didn't have BASIC running, no. And this was months, a year before-- this was six months or seven months before Bill Gates-- or Bill Gates and Paul Allen ever even heard of the Altair for that matter.

Greelish: Did they write it-- end up writing it though for the 6800 as well for your machine?

Roberts: No. It was actually somebody that approached us with a copy of it. And there's-- it's a long story. But they-- everybody that came to us with software-- Paul Allen was in charge of-- was vice president of software. I hired him on the spot the day that they came in with their version. And everybody came to us that looked like they had a piece of software, this is towards the end, he filtered off to Bill Gates. And they start-- that's how they started their company. And all their company was based on people who were bringing software to MITS. And they would take it and say that MITS didn't buy it directly. And I-- some of this stuff I found out later that there's a BASIC called XYZ BASIC that the guys made two or three trips trying to meet me in Albuquerque. And never could get to me. They always speak to Paul Allen. And Paul Allen said, "You have to go around the corner and see Bill Gates to sell it."

Greelish: Have you ever talked to Bill Gates or Paul Allen since the last-- back in the '70s, they moved back up to Washington state or whatever. You ever talk anybody?

Roberts: Yeah, I talk to-- I met Bill-- he and I were at a wedding together. This was maybe six or seven years ago, something like that.

Greelish: He wasn't quite as big either then, huh?

Roberts: No, he-- MS-DOS was just really getting off the ground good then. No, I guess MS-DOS was going pretty good by that time. This may have been closer to ten years ago. But he had somebody-- I saw him when I came in. As a matter of fact, one of the things, I've got so I almost quit giving interviews recently again. I kind of go through this cycle because the big interviews now is my only claim to fame is the fact that I knew Bill--

Greelish: You knew Bill Gates.

Roberts: Yeah, and all people want me to do is to trash him. And that's-- there are plenty of things that I'm unhappy about or I could get unhappy about I guess if I dwelt on them. But I'm not going to make a career out of trashing those guys. And I still--

Greelish: And it's always-- it would just be unhealthy for yourself anyway to try and--

Roberts: I still have some kind of friendly feelings. They're the residual-- Microsoft is the residual MITS. That's all that's left of MITS is Microsoft.

Greelish: Right.

Roberts: Even though I'm not trying to take anything away from what they did. I mean they built up-- and that's where Microsoft came from was from Micro Instrumentation Telemetry Systems. And they-- I answered the thing about the 6800 though. Anyway, that was basically the reason. We couldn't get Motorola interested in doing it.

Greelish: And you got such a good deal on the 8080?

Roberts: No, we didn't have that good a deal. I don't think-- I think we could have probably gotten a better deal on the 6800. Even though--

Greelish: Really?

Roberts: I don't think Motorola felt we were very serious. If anything--

Greelish: Did you feel--

Roberts: Nobody believed it.

Greelish: As far as comparing the two, the 8080 and the 6800, which one did you feel just as far as design-wise was a better chip build, more efficient or easier--?

Roberts: The 6800 was a much easier interface. We had software folks internally look at the two. And I think the general feeling was-- and this was even-- I think I had Bill and Paul look at it even. This was later on. And they both kind of liked the 6800 over the 8080, at least some of the things that were in it. The problem is they hadn't written any software for it. So, they-- it's always easier to kind of look over the fence and say you don't see the flaws if you're just looking at it casual. They--

Greelish: Stick with it, yeah.

Roberts: But we did have them look at it, or had the software department look at it.

<break in audio>

Greelish: That on tape.

Roberts: That's good I get to meet--

<break in audio>

Greelish: Yeah, I learned basic electronics. And electronics is not necessarily my forte. I know the general things about amperes and wattage and voltage and transistors and so on. But I'm certainly no engineer or anything. And at the point-- fixing them was pretty-- like I say, it's all pluck and chuck. It's pretty much-- you don't go down the components level, you just isolate the problem. And pull out that card and make some adjustments here and there. I got pretty decent at it. It was okay. But it wasn't my thing. And actually the Army wasn't my thing I have to say.

Roberts: How long were you--?

Greelish: Four years. And I'll never regret it. But I have to tell that last year, I was pretty miserable in the Army. I didn't let it--

Roberts: Where were you stationed?

Greelish: Fort Bliss, El Paso, Texas. And Jacksonville's my hometown. So, right when I got out, that's why I moved back to Jacksonville.

Roberts: Fort Bliss is a lot like Jacksonville.

Greelish: Yeah, actually in a lot of ways. Really the weather is a lot like it other than just it's very dry, more dry. There's not as much greenery and stuff. But yeah, we liked El Paso.

Roberts: The ocean.

Greelish: Yeah. That's the best thing about Jacksonville, though. That's why I like it there in Florida is because I love water. And that's what I missed the most, though, in El Paso. I really-- my big dream is to have a big sailboat one day and go down to intercostal waterway, the Keys.

Roberts: That's what I'm going to do. I'm going to-- at my rate I'm going, if I ever get some money, I'm going do some world cruising. That's what I would like to do.

Greelish: Really? Yeah, I don't know how to sail. But I'm going to learn, by golly, and get a sailboat one day.

Roberts: I bought a fifty-eight foot Hatteras after I sold-- when I moved back here.

Greelish: Really?

Roberts: Actually, I moved to _____ [Ed: Grand Cayman?]. And I used to go to the Bahamas all the time. I've got a twenty-five foot whaler now that I-- it's actually it's got a whaler drive. I dive. And we went over to the Bahamas-- we drive down to Miami, put the boat in in Miami and went over to the Bahamas.

Greelish: Yeah? That's nice.

Roberts: Or go down to the Keys.

Greelish: That's about the size I'm looking at starting with something like twenty-three to twenty-six. Something that's trailer-able. So, you don't have to keep it up in a--

Roberts: This is a power boat I'm talking about now, not a sailboat.

Greelish: Oh, okay. I may end up getting maybe a power boat for starters because I don't know how to sail. All right, let me ask you this. Do you remember the TV typewriter article in '73? I guess it was in *Popular Electronics* or *Radio*… [*Electronics*]. Do you remember anything about that, the TV typewriter? And did that influence you at all, or did you get excited about that when you saw that? No?

Roberts: I remember the TV typewriter. We were building, I think, at about the same time. We built a computer terminal, which we actually sold off and on until I guess the time Pertec bought us out. It used a Burroughs display, a neon display, sort of like the new-- it's a dot matrix display. And it had a modem built into it where you put the phone receiver at the top of it. And-- which would have been a similar kind of product to that. But I remember that was one of [Don] Lancaster's.

Greelish: Right. You know, he's still around. *Nuts and Volts* magazine, he's still writing for them. And he's got his-- he's got some little company. I can't think of what it's called, where he still publishes all his books and all kinds of stuff.

Roberts: He was actually a guy-- some of the stuff that he did-- as a matter of fact, a lot of what we did at MITS was modeled after-- he was the pioneer in putting together these kits and selling them to the magazines that way. And so, he was kind of my model for that. The one thing I remember he did that was really impressive at the time, really got excited about, this would have been probably in mid '60s, I guess, was a decimal counter, which you made out of small scale integrated circuits. But it would count from zero to ten. You could put stacks of them together, make your own digital counter. And that was really neat. It doesn't sound like much now by modern standards, but that was really a neat project. He did a number of fairly interesting projects. The TV typewriter, I don't remember it being anything I was particularly impressed by. I remember him doing that. There were some people later that used the TV typewriter as terminals or modified it. As a matter of fact, he may have even offered that as a terminal to be used on Altairs.

Greelish: I think he did. I think he actually did start producing some of them.

Roberts: We used the Teletype more than anything else on those initial machines, which people don't think about now, with those old-- those KSR or ASR--

Greelish: -33s, right?

Roberts: Yeah, -33s. It had the paper tape… gave you a way of input-output, as well as a way to load data on the paper tape. So, it sounds pretty primitive now, but you could buy them on the used market, [the] surplus market, for a few hundred dollars.

Greelish: That was like a gift from heaven at that time, huh? The ultimate peripheral.

Roberts: Yeah, I mean that was-- you got your line printer, your input-output device, and your mass storage.

Greelish: Everything.

Roberts: If you didn't mind ten characters a second, that was--

Greelish: Let's see. My last question on this little slip is when you first decided, I'm going to design a computer, a computer kit, what were the type of things that you said, "I want it to have these features. And I don't want it to be like this"?

Roberts: Basically ground rules for the first computer from a technical standpoint is it had to be real full-on computer, a computer that was fully expandable and had at least, in principle, the capability of doing anything any other general purpose minicomputer had to do. And "minicomputer" was a term that was popular then. It was sixteen-bit machines or eight-bit machines. And that was our ground rules. We wanted to make a machine that was in term-- from a user standpoint was not degenerate at all. But the main difference between our machine and what were out [in the marketplace] was [that] we used microprocessors and used the latest state of the art-- we didn't use-- we never used core memory even though we did look at core. At the time we started doing the Altair, core memory was still significantly cheaper than [integrated circuit memory].

Greelish: Did you have static [RAM] at first and then dynamic [RAM]?

Roberts: The original machines had 256 bytes of static. And that's a minimal machine. That board came that way. And it was expandable, that board, I think to 2K. And then we had 2K, 4K, and we ultimately had 16K boards before I left, maybe even went to 32K boards, both static and dynamic, both kinds.

Greelish: I've got some of those. I've got some Altair MITS four [?] stuff. Any particular minicomputers that really influenced you? I think I've read that there was a [DEC] PDP that most influenced you.

Roberts: We had a Nova 2 [by] Data General in the office that we used, we sold timeshare on. That was how we got into building a terminal. And this kind of predates the Altair a little bit. But as a matter of fact, the front panel on the Altair essentially models every switch that was on a Nova 2. And that was because I had the machine to kind of look at. And somebody else has kind of gone through all that. And that's one of those things about standing on the shoulders of giants. That's kind of true of technology in general. If you have to re-decide what switches you need and all that, you could-- but these guys already figured it out. So, we just kind of used it, which is pretty much standard of any front panel machine. At the time, we had a front panel controller on it. If you were going to build a machine today that you wanted to allow front panel control to, it would look just like an Altair or a Nova 2 or a PDP-10 or any of those that had front-- or a PDP-11, that had front panel controls. There are certain things, you need a way to get address in, a way to get data in, a way to single step it, all that kind of stuff, reset it, look at output.

Greelish: This is a question I kind of wanted to ask you early on. I'm jumping around. That's the way my mind works. What was kind of-- the series of products MITS had? You had your radio, your remote control devices. Then you went to calculators. So, you have the Comp One, or the--? How many different--?

Roberts: We had the [Model] 816 calculator. The very first product we made was a-- it was in *Popular Electronics*, was an optical communicator. It was a laser communicator, except it used LEDs. It was infrared diodes. They weren't really lasers. We had lenses that we made ourselves that we injection molded ourselves. And we sold that as a kit. It had a range of five hundred or a thousand feet. It was actually a pretty good little product. We sold hundreds of them, which we were-- for the size, it was only two working out of a garage. But that was probably the first product that we did was that system there. And--

Greelish: So, how many different calculator models did you make?

Roberts: I think we only had one that was in the magazine if I'm-- we may have had another one that was in the magazine. But we made the 816 A and B. We made the 1440 which had square root. We made a machine that was fourteen digits but had square root, you know square root in memory. We made a-- we-- a scientific machine, a handheld scientific machine. I think we made two or three of those. We had several different handheld scientific machines. We made a scientific metric converter.

Greelish: I think you produced an oscilloscope, too, didn't you?

Roberts: That was that logic analyzer I was talking about.

Greelish: Okay, that's another name for it.

Roberts: We had function generators. We had a whole bunch of different products we made over the years.

Greelish: And as far as the Altair, you had the original 8800, 8800 A, B, the 6800. And then you had your turnkey models. And then of course, then you had a terminal and printer and a couple different disk drives.

Roberts: Yeah, when I left MITS, we had something like forty different peripherals that went with-- that you could buy for the Altairs. And probably two or three different memory variants, but input-output cards, parallel cards, serial cards, printer controllers, A-to-D converters, D-to-A converters, relay cards.

Greelish: That's right. You had whole bunch of different kind of cards, too.

Roberts: And then we had floppy disk controllers. We had hard disk controllers. We had tape, audio tape. I think we actually had a controller for big tape drives that we made for somebody. I don't know they were ever marketed very much, nine-track, the commercial based. It was something-- forty something, I think, different cards that MITS was making when I left. You could do color graphics on MITS. We had a--

Greelish: I have a Dazzler.

Roberts: Huh?

Greelish: I have a Dazzler.

Roberts: Do you?

Greelish: Yeah.

Roberts: We had a machine that was-- that I don't know what they ever did with it. It was a self-contained, had a-- one was a forty bit-- or one was a forty digit. One was a sixty-four digit disk, sort of an Apple before the Apple. As a matter of fact, the first-- the first Apple, it's a little bit like-- when I was in college, there was a textbook in differential equations. And I remember a line that came out of it said that the reader will find that Laplace transforms, like many things, were being used for Euler when Laplace was minus fifteen years old. And the idea of been-- some people end up with credit. Well, the Apple, that Apple kind of concept, the guys had probably did more to that than anybody else was a company called Processor Tech[nology]. It was an Altair based machine, but they had-- I mean it was-- Altair bus, but they

incorporated the keyboard and the display control all on one box. But it was still [an] Altair bus. You plug everything into the Altair bus. That's another one of the sore points. People change the name of the bus.

Greelish: Yeah, I've read that.

Roberts: And they did that to-- nobody ever wanted [to] steal the name. They hated to give us credit every time they said they built a machine. So that's why they said they had an Altair bus machine. And so, that's what they did. They got together and all agreed to do that. We should have copyrighted the bus or patented it. We never did any of that. If we had of we'd have stopped this. But anyway, there's was an Altair based bus machine, but it was an Apple before the Apple. And it was a good machine. Those were good competitors. As a matter of fact, of the companies that I think about-- you were talking about earlier machines, the company that I think about more than any other at the time was Processor Tech for a couple reasons. Number one, they were good competition. They were building good products. They were mostly add-on products. They were the first people who built add on products for the Altair that I thought were any quality. There was a lot of junk stuff being built, tons of junk stuff being built. But those guys built good quality stuff. And not only that, they did some stuff, like they came out with a terminator card that lowered the noise for the Altair. And they were not just competitors. They were actually contributing to personal computers. And that made them truly unique. And then that SOL machine they made, which was an integrated-- was an Apple before the Apple--

Greelish: I have one.

Roberts: That was a good machine. It was a good design. Those guys did good work. And I-- and the funny thing, every time I've ever been interviewed in any depth by anybody, I've made that comment. And the only story that's ever told about MITS and Processor Tech was the first computer convention that was ever-- personal computer was the Altair convention. It was done in Albuquerque. Dave Bunnell-- it was Dave Bunnell's idea. I said, "Dave, this is crazy. We're not getting people to come all the way to Albuquerque to go to this convention."

Greelish: But they did, huh?

Roberts: They did. Tons of people. He was absolutely right. But he-- it was his idea. He was director of marketing, our advertising at MITS. And Processor Tech showed up. And they had a suite up on the ninth floor of this airport marina hotel we were in. and they had a sign down in the lobby that said Processor Tech. And he tore up their sign or something. Dave Bunnell did this, or made them take their sign down because we rented the whole hotel. I was present, but I didn't have anything to do with it. And it created more flap-- hurt us [more] than if we'd just ignored the thing.

Greelish: I've read that. I've read about that.

Roberts: And those were good competitors. They just-- it just set Dave off--

Greelish: I'll be printing what you're saying here, so.

Roberts: Dave worked real hard at-- me and Matt and those guys were in there taking-- were going to get some benefit out of what he had done. But anyway that's the only story that's ever printed is that story. And all the stuff I've ever said good about those guys has never got printed. I mean those guys did some great stuff. They identified some of the problems in the Altair. They had some fixes for them. They printed the products they made, the memory cards, they made were good memory cards. They worked good. They were competitively priced. It's hard to say anything bad about them. I didn't mean to get off on that. But that's all--

Greelish: Oh, that's--

Roberts: But people-- the stuff that sells, if you're writing an article in magazines are--

Greelish: All the bad stuff.

Roberts: Yeah.

Greelish: The dirt, huh? Yeah, I'm not trying to-- for me, it's just interesting just to talk to you and hear what you have to say about it all. And I know I'm asking a lot of stuff that's other-- I'm trying-- constantly sit here and try and think of something to ask you that's totally different, too because a lot of people read my little magazine have also read some of the books out there. And you know, the basic story, everyone's heard, not everyone of course, but most people have heard it. I know one silly question I was going to ask you. What kind of computer do you have now? Something you prefer now? Or do you not really mess with them too much other than just at work? Still kind of thirst for that?

Roberts: All the machines I have are PC-based machines. We've got-- at the house, I've got a DX4, hundred meg DX4 and thirty-three megs DX2. I've got a Versa, NEC Versa portable thirty-three. And I've got a Z Lite. It's a forty-six _____ new black and white. I really like it.

Greelish: You still like-- I read something you like your gadgets, too. That hasn't changed.

Roberts: That's true. Isn't that true of everybody that likes computers, though?

Greelish: Yeah sure, you're right.

Roberts: I made a comment at the show which got some publicity, and I haven't heard much recently. But it was kind of a takeoff-- when Carter ran for election, he talked about how he lusted after women or something like that. But all of us that were into computers early on, it's a different group than now. People that use computers now for the most part-- most of the computers that are sold, people use them because they need them for business. But all the people that were there originally, all the original Altair owners-- I'm talking about the first only five or ten thousand Altair users. We lusted after computers. That was better than sex. To have your own computer was really something exciting.

Greelish: Right.

Roberts: And--

Greelish: I can tell you, though, from experience now, after working at CompUSA, the majority of people buying computers don't even know why they're buying them at this point in time. They just think they need to have one. "You should have a computer." And that's not necessarily the right reason for buying it. But that's what's going on. In 1995, that's what's happening. I'd say half the people I talk to at my job-- "What computer should I buy?" And the first thing I ask them, "Okay, I want you [to] think about why are you buying one and what do you want to do with it. You should base what you're going to buy around these things." "And well, I want to write letters." That's the biggest thing, write letters, and play games, and do home finances with Quicken or something.

Roberts: Well, that's kind of-- I get sort of the same impression when I talk-- my models-- my database is a lot more limited than yours about that. But it's a different-- I'm just going to put my coat on for the--

Greelish: I didn't know if you were on the go right now, or-- we'll try not to take too much time either.

Roberts: Oh, it's no problem. It's a different group of people than the people there. The people that would buy a machine, they wanted the machine. They lusted after them. And to a large extent, they didn't know what they were going to do with them in the sense that it wasn't so much they had a particular application, but it wasn't like-- it was a different thing than what you're talking about. These were people that just have been told they ought to have a computer. These were people that wanted-- they used computers professionally most of them. And--

Greelish: Right, and they liked-- they enjoyed what they're doing at work. And they just wish they could go home and have something to fool around with, too.

Roberts: Yeah.

Greelish: What do you-- what do you still own now? Do you have one of everything you invented or you marketed?

Roberts: No.

Greelish: Do you have some particular favorites? I think you do have some Altairs. So, you saved--

Roberts: There's two Altairs in here. And that's the only two Altairs I have. As a matter fact, those--

Greelish: Oh, I see them. Oh, okay.

Roberts: Both of those are brand new Altairs. They've never been used.

Greelish: You never switched them on?

Roberts: I've switched them on. That's about it. As a matter of fact, I brought the disks back. And they're still wrapped.

Greelish: The top one's a B, isn't it?

Roberts: There's a B in there and an A both.

Greelish: Yeah, they certainly look brand new, too. Those are nice.

Roberts: They were wrapped up until recently. They had somebody came in wanted a photograph. This was a Japanese group came in.

Greelish: Yeah, if you don't mind, I'll get a photograph of it, too.

Roberts: Normally, this place isn't all that neat. But it's not as messy as it is right now. We've just got stuff piled in here. In the process of trying to-- we're redoing the walls.

Greelish: Have you ever been surprised as a-- are you a celebrity at all? Every so often they go, “Hey, aren’t you Ed Roberts?” No? Never?

Roberts: No, nobody knows who I am. Nobody-- there’s only like five people in town who know who I am or that I’ve ever done anything in terms of-- people even that knows who I am in town, they know because I’m a doctor here in town. There’s some notoriety associated with that in a small town. But as far as knowing anything about me as a-- in terms of my background. It’s interesting, I have-- I have never--

Greelish: They’ll probably build a big monument after you die, though, right? <laughs> In Albuquerque or Silicon Valley or something.

<child laughter>

Roberts: You think that’s pretty funny? You’re right. You’re right. Yeah, there’s no monuments to them is there? No monuments to him. It is kind of funny, though, that nobody here has any idea at all. And I run into it all the time. I went to-- this has also been several years ago. We were developing-- I had a five year non-compete agreement with Pertec. So, I couldn’t do anything with computers for the first five years after I came back here. And then I started a company. As a matter of fact, I sold the company when I started medical school-- it was some software that I’d written, farm software. And I sold that when I started medical school. But-- lost my train of thought.

Greelish: That you were going to sell it to someone, or--?

Roberts: Oh, we started to do some hardware. I started doing some hardware designing, set up this-- again, this has been maybe eight or nine years ago. It wasn’t-- it was a lot closer to the time that Altair people-- you could still find somebody that had heard of Altair then. And I went into the Radio Shack in Macon. And they had a Radio Shack, which I think they’ve kind of slowed down, that did nothing but computers. I think most of them have kind of gone away now.

Greelish: Yeah, I think so. Yeah.

Roberts: I know the one in Macon finally--

Greelish: And now, I understand AST-- either they bought AST, or the other way around or something. They have AST’s in Radio Shacks now. So, I don’t-

Roberts: Oh, is that right?

Greelish: Yeah.

Roberts: Well, anyway, I went in their store there. And they were selling a machine that's kind of a TRS-80, I think, or it was Z-80 based processor. Well, I was doing--

Greelish: TRS-80, right.

Roberts: With NSC eight hundred, which is an NSA-- is a National [Semiconductor] version of a Z-80 with CMOS, real low power machine. And this design that we did, that's what we used. And there was no good manuals on the-- not good manuals in the assembler for that. And they made an assembler language, or an assembler manual for the TRS-80. So, I went and asked the guy for a manual. And it was salesman. And this is one of the things you may get a kick is being a salesman is-- but I was quoted a couple times on that. My motto for computer salesman in stores is it's from arrogant-- ignorance to arrogance in about three months. And this guy--

Greelish: Oh, okay.

Roberts: This guy told me that first of all, that I didn't need an assembler. And second of all, he could tell by looking at me that I wasn't smart enough to do the assembler if I had it. Those aren't his exact words, but it's pretty clear. He could tell talking to me that I wouldn't be able to handle it. So, I thanked him and left.

Greelish: Have you ever tried to tell someone just every so-- actually, I invented the personal computer. Yeah.

Roberts: I do that in the CompUS-- in the CompUSA one time. I figured this guy kept-- he just kept BSing. This is one of these deals. I went in there. And I asked the guy what size memory it was or something like that, or what size disk it had or something. I guess it was how much memory. And I said-- I think he told us four megabytes or something. I said what would it cost to take it to eight megs. And he explained to me real patiently that we should call it megabytes. We didn't say megs. I said okay. He kept-- he did that to me about three or four times, different things I would say. He didn't like the terms that I used. And I finally said, "Hey, I'm the guy that invented the personal computer." And he patted me on the head and said, "Yeah, right." I said, "Okay."

Greelish: I guess we've covered about everything. Can you-- anything else? If you were me, what would you ask you? Anything I kind of glazed over or missed? Yeah are there other things that maybe you wish people would print about you, you never seem to get asked?

Roberts: Someday, I was hoping, probably nobody will ever do it is the original Altair had some flaws in it. But the design itself was really pretty elegant. And the fact that everybody kind of misses that. The thing that I find-- there's several things that I find frustrating, not so much about people not knowing who I am. But the comment that's made about the original Altair, is it really a personal computer, that's of course-- that's come from Apple. They tried to denigrate it. And their basis for saying that is the fact that it's-- had all those front panel switches, so it couldn't be used very easy. One of this front panels, you never had to touch one. If you put a ROM in there and hit the power on switch, it was up and running. And of course, I think people that probably started that knew that was true. But it makes a good story to sound like they were primitive because they had all the switches on them. As opposed it was the exact opposite. They were very sophisticated machines even by standards today. It allowed you a way-- you could do everything theoretically on one of these you could do on a machine now except you didn't need anything else. It was all self-contained in those front panel switches.

Greelish: Also, I mean Apple, when they started thinking about the Apple II, Apple I is a hobbyist little board. Apple II, we're going to sell a computer, it's a consumer computer, people computer, I guess, novice person's computer. But that's what-- the Altair was not for a novice. It was for a computer-- electronics hobbyist. It's for people who-- it was a very powerful machine for someone who knew how to do something with it. Of course, someone off the street that doesn't know anything about electronics, they couldn't do anything with it. So, there's a different market.

Roberts: That was probably true because the original market for the personal computer, for the Altair, was sort of an aficionado market in the sense that it was people that had some expertise in computers or at least in electronics. But I tell you it was about three or four days after the Altair article that we changed our model-- our model changed of what the typical customer was going to be. It is true, probably the initial few thousand machines or could thousand Altairs were sent to probably people that were-- you know the insider kind of folks. The vast majority of the Altairs that were shipped were ultimately shipped to non-expert users. And we realized that real early in the game. The phone call-- I think I told you on the phone about the guy, the very first customer we sold-- I was talking to somebody about that.

Greelish: I think you did. Please say it again.

Roberts: Was a dentist in Chicago, he was-- wanted to use an Altair to control a model railroad layout. This is apparently a massive model railroad with some club that. And that was the thing that was a real eye opener to us is that we had-- we were finding people with application ideas that were entirely-- that we'd never imagined. And one of the comments I used to think about then, and I'm a little disappointed that it hadn't happened, but you know the old thing about if you gave an infinite number of monkeys an infinite of typewriters that one of them would write "King Lear". Have you ever heard that?

Greelish: No. Maybe.

Roberts: But you can show mathematically that if you had an infinite number of monkeys and an infinite number of typewriters--

Greelish: It'd have to happen sooner or later.

Roberts: One of them's going to come up with "King Lear". Okay. My model always-- the thing that's always intrigued me, when I was Oklahoma State, we had-- it was a real forward looking school, which sounds kind of funny. Oklahoma State's not one of your-- you think about major engineering or anything. But the engineering school, we have a double-E school-- I was there from '65 to '68 when I finished up, got my degree in double-E there. They had an IBM 1620 that was an open lab. I mean literally, there was nobody that monitored the lab or anything. At the time, when computers-- this was a big machine, physically a big machine, a lot of money into this. It was open to engineering students. We'd go down there. You just put your name on a schedule. There was a book that was kept in there. And you signed up for the time you wanted. You could sign up thirty minute blocks at a time. You owned the machine for that thirty minutes. It was fantastic. And that had probably more impact on my feeling later on about computers.

Greelish: Wouldn't that be great if you could do that all the time?

Roberts: It was a real positive forward looking thing because computers had always been sort of Meccas up to that point where just only the high priests were allowed in the same room even with a computer. And you certainly didn't let any user go-- this thing had instructions written on the side how you power the thing up from zero. And this is a lot more complicated now than a modern PC, a lot more complicated than an Altair for that matter. But you could bring the system up from zero. All the I/O was on paper cards, or punch cards.

Greelish: It had FORTRAN or--?

Roberts: FORTRAN.

Greelish: COBOL or something.

Roberts: FORTRAN, was FORTRAN four PDQ, FORTRAN PDQ. All the sort of stuff I wrote programs in was FORTRAN.

Greelish: Hey.

Roberts: But there are several things like that. One of that is the original Altair design was really pretty elegant in terms of what it did. And if it had been done anyway differently than what it was, personal computers would have-- the development would have been much slower because nobody really came out with anything new for probably two or three years after that. And by that time, after the original Altair design-- and that was after everybody had the experience of learning where the market was and all that. Everything we did, all the stupid things we did, which we did plenty-- but everything-- there was no rules at the time. There was no database. You couldn't go look and see what CompUSA does, what markets well, and what doesn't market. There was nothing, no basis. You know you just-- everything you did was a guess.

Greelish: Did you ever get any minicomputer companies buying Altairs just to check them out and stuff that you know of?

Roberts: Kind of a funny thing, this was another one of these kind of aside stories. And this would have, again, been something like '75 or '7--

Greelish: Let me stop it for a second.

<break in audio>

Greelish: Okay.

Roberts: This would have been something like '75 or-- it was before we moved to our new building because I remember we went over to the MITS executive lunch room when we met with the guys from IBM which was a Dairy Queen behind my back office, Across was a Dairy Queen. That's what we called our executive lunch room. And we had, at that time, we had maybe a hundred employees. So, it wasn't a gara-- MITS had been garage operation for a long time. But it was still pretty small. But IBM showed up that day-- showed up one day with several different lawyers. And the basic reason they were there was that they wanted to use us to be a witness. They were getting sued, I believe, by Memorex for-- I believe it was Memorex, or somebody for not-- for monopolistic practices and keeping other people computer business. And what they had done is they generated the data. And we, at the time, this was MITS now, was increasing the supply of computers at the rate of one percent a month. We were increasing the number of computers in the world at a rate of one percent a month, just MITS by ourselves.

Greelish: Right.

Roberts: That's worldwide, one percent a month, we were increasing the number of computers in the world at the rate of one percent a month, which if you think about that number, that's--

Greelish: Yeah, that's real significant.

Roberts: Two thousand computers.

Greelish: There's a couple billion people in the world.

Roberts: And that was only a few thousand machines. But that gives you an idea how many machines there were at that time. And we were indeed making a lot more computers than IBM was making. Of course one of their main systems, you could have bought and sold MITS twenty times over for. But anyway, that wasn't the point. They wanted to use us in court to show that they were not monopolistic. And here was a company that was actually producing more computers than they were and all that. I'm sure they weren't going to spend too much time about the size of the computers and the market and all that. But the interesting thing that came out of it, IBM at the time had something like thirty engineers or technicians internally in IBM working on their machines. I was the only double-E at MITS at the time. And they had more people looking at what we were doing than we had doing it. I mean our whole-- all the technicians including the technicians in repair, we probably didn't have fifteen people. And I remember that was kind of a-- I don't know how I got off on that. But that was kind of interesting in terms of what those people were doing. I know that IBM at least was in it to that extent. And part of the court case, part of it was just looking at what was going on.

Greelish: Do you ever remember anybody who was really-- who bought an Altair that you know of that just, "Wow, this person bought an Altair--" you know, bought a computer from us, or the most impressive person who bought a computer that you know of? This is one of the silly questions that makes good reading.

Roberts: The guy that did the special effects for "Star Wars", I believe for "Star Wars", bought some computers or came out here to MITS and bought some. They were using them. That was some of the first stuff that was being done with computer animation. That's where they kept trying [ph?]. I met that guy. I don't know what his name was. There was a-- I can't think--

Greelish: That's really interesting.

Roberts: I still hear about him. He's a well-known jazz musician who's still-- he lives in New York. I seen his thing fairly-- it's not Tony Bennett but somebody of that ilk that bought some-- I don't know whether it was computer, bought some of the stuff from MITS. We sold stuff to the secret service to the FBI, CIA, all kind of people.

Greelish: Well, pretty much they could take the place of a minicomputer system easily, personal minicomputer.

Roberts: It took the industry a long time to decide, to realize that microprocessors-- people went through this thing where there were supercomputers. There were computers. Then there were minicomputers. And there were microcomputers. Everybody assumed that when you said microcomputer, you were talking that was a performance thing, microcomputer. And still microcomputer is really a technology. And that was one of the big arguments I had at the time. Microcomputer didn't say a thing about its performance. And indeed, now I think the supercomputers were basically microcomputers, now-- parallel.

Greelish: The Pentiums and the Power PCs, yeah.

Roberts: But I think they missed the point that these minicamp-- that these microprocessors were actually, power-wise, were approaching the power of the mini machines even with the 8080. And I'm sure by the time you got to the {Intel] 80386, you could see the power of most of the mini machines that were out at that time, talking about during, say, in the mid '70s.

Greelish: Right.

Roberts: And some of those--

Greelish: I guess the only thing a minicomputer had over the Altair at the time was you had some sixteen-bit minicomputers. That really was about it in order to make it somewhat more substantial and faster and stuff. But functionality, no real big difference. And then I guess it was-- I guess that-- well with IBM in '81, they of course went the first computer with sixteen bit with _____, the biggest one in any case. Yeah right now, you have with a Pentium and a Power PC computer, for the most part, you have the equivalent of a supercomputer on your desk, something that cost millions of dollars with a Cray-1 just, what, fifteen years ago or something. And you wonder why people, again, like customers, someone comes in, drops three thousand bucks on a Pentium 90 just to play games with. They just like-- why don't you just go buy a Sega or something? Imagine even game systems how sophisticated they are now compared--

Roberts: Oh, some of those game programs are some of the most sophisticated stuff out I think is probably in games.

Greelish: Right. Well, you know supposedly Nintendo and Sega are coming out with sixty-four bit systems now this fall or something. This is what I read. I don't know if this will ever be true. But supposedly, for the first time in history, game systems will start being ahead of personal computers.

Roberts: In terms of sophistication?

Greelish: I read that somewhere. I don't know if that's going to be-- but then again, a game system is not-- is not a general purpose computer, though. It's only a special purpose. It can only do-- it's limited. So, there's a big difference there.

Roberts: The game designers have the advantage over what people are doing right now because they don't have to worry about any kind of precedent or being compatible or anything like that. So, you take the latest technology. If it's not compatible with Apple or a PC and just go for it because everything is going to be custom anyway. You're not going to try to interface with anybody else. It gives you kind of an advantage that nobody else has. I made a prediction, actually, which everybody thought was kind of joke at the time we met with IBM, and that was that the personal computer would destroy IBM.

Greelish: And it almost did, huh?

Roberts: Yeah.

Greelish: Somehow they turned it around.

Roberts: Yeah, then it came out with the PC. And one of the guys remembered that I made that prediction and said, "See, you're wrong. They came out with the PC." And they made a pretty good hit with the PC. And it looked like they were about to go belly up there with that whole business. And I guess they're doing pretty good now, aren't they? I haven't really seen.

Greelish: Yeah, somehow they totally turned it around because one of the hottest products is the ThinkPads. Now, they're desktop computers, I think, are doing respectively. But they're not-- Compaq, I think, Packard-Bell are the biggest sellers. But yeah, their ThinkPads are super-popular.

Roberts: There's nothing gee whiz about their desktop machines is there?

Greelish: No, not that I've seen.

Roberts: ThinkPads--

Greelish: My personal opinion, I still think Apple is the biggest innovator out there. I'm no engineer or anything, but it seems like they still-- Apple still consistently seems to come up with the original ideas and the new interesting things. Then everybody else copies them.

Roberts: You know, Dave Bunnell who keeps up-- he stayed in. and he's one of the guys that I still talk to Dave fairly regular. Dave says that the thing that's kind of interesting to him is that if he goes to a meeting with PCs and people that are Apple users, he says the Apple users look a lot more like the early MITS customers than the PC users. He said the PC users are more toward this is the machine to be working with. And Apple users, he said you still see the same enthusiasm.

Greelish: Are more passionate, yeah. I think it's true.

Roberts: They love their computers, whereas that's the different kind of mentality that you see than with a PC.

Greelish: And maybe that's why my first love, I guess, was-- my first computer was a Commodore 64. Just a little toy is basically, all it was for me. My first real computer that I ever did anything with was a Macintosh. And I got turned onto Macintoshes when they first-- the little ones. This is like 1986. So, you know, at that time, DOS computers-- for someone like me who totally knew nothing about computers, they were terrible. Here's this neat little computer that was so easy. And then here's this-- this is like well definitely I'm going to go for this one. And yeah, I've always been real passionate about it. And actually, I have a LISA computer. Remember those, the kind of predecessor to the Mac? And that kind of generated all my interest in history. It started off as the history of Apple and LISA and Macs and stuff and just built into I just find everything--

Roberts: The Lisa was kind of dead end, wasn't it? It just kind of went.

Greelish: The Lisa, yeah.

Roberts: I don't think I ever saw one.

Greelish: It was just way too expensive. It was ten thousand dollars for the first one in 1983. And they tried to say it was like a workstation. They were trying to position it the way workstations were. But the software that came for it was good software, spreadsheets and what-- but it was business software not design software, software you'd use workstations for. And there was no-- why spend ten grand on that when you can drop three on an IBM PC to be a business computer. So, it just-- but it was a learning experience I think for them because then with the Mac-- and I think you're absolutely right. Mac people are still very enthusiastic. And I guess it's a minority or something.

Roberts: They're still kind of viewed as the little guy. Even I _____ operation.

Greelish: And maybe back in your day, or back in the Altair days, your hobbyists, your electronics guys, you're kind of the minority too, I guess, a specialty group, people that had to stick together because everyone else thinks you're kind of weird or strange or something. So, you kind of bond together. Just like everyone thinks Mac people, "Why the heck would you use that?" when everyone else is IBM compatible.

Roberts: The problem with the Macs now, they're still slower. Aren't they relatively slow compared to the PCs? I'm talking about something I know nothing at all about, okay?

Greelish: Well, actually, I think generally speaking, with applications, I think so a little bit. But the Power PC, I think ultimately, it has-- it will be faster. It's just that there's not as much-- just like when the Mac originally came out, there's not enough native software for it yet. And once that starts happening, it's going to blaze past. I just read something recently that the new one hundred megahertz Power PC totally burns the hundred megahertz Pentium like thirty percent faster or something in native applications. So, I think--

Roberts: That's been one of the problems too with like 386 and the 486. Most of that software was written for 286 software.

Greelish: Right.

Roberts: So, it's not native. And that's even true for the Pentium. It's not native.

Greelish: I think the biggest thing holding back Intel technology is DOS and even Windows. They're terrible, horrible. I try to tell customers that. Yeah, it's basically as easy as a Macintosh, but any time you have any kind of problem, you have to dig all in there to figure stuff out. It's just-- there's no comparison between-- my document's not printing. On a Macintosh, it's real easy to decipher what's going on, what's wrong. Try doing Windows, it's just terrible. You have to go through all--

Roberts: It's too flexible. You're paying for that flexibility with complexity. You can use anybody's printer. You can use anybody's application software on anybody's different hardware and all that. And it turns out with anybody's different BIOS, and it just doesn't all-- sometimes it doesn't always work together. I mean I see that same kind of thing even with the stuff that I'm doing, the _____. Most of that power, the only time I ever run into a place where the power makes much difference is on CAD applications. I'm still doing some design work. And graphics stuff, you can buy a machine with some of the graphics stuff. But if you're talking about word processors--

Greelish: No, you can do any--

Roberts: An 8080 was fast enough for most of that.

Greelish: Yeah, as a matter of fact, faster in some cases. Just running WordStar on a basic Z80 or 8080 computer, I mean it comes right up, no problem with CPM. They're very efficient.

Roberts: I need to put together a system I've still got in the warehouse. We came up with a system. It was a stack. One of the applications which we didn't do very good in the market, we ran out of money to do it, but this was one of the big projects I had. But I just closed the company down a couple… three years ago. But the concept was this, a conventional machine, you modify the software to beat your application, but you don't really modify the hardware. What this thing was was a bunch of stack modules. You've got your processor module. And you get an A-to-D module if you want to control you house. You get this module. You get a whole bunch of modules. And you just stack them together. And they were designed to be instantly compatible. Well, one of the things we played around with to make the thing as-- software that you could do with it was like we bought a version of WordStar that was designed to run on CP/M, the old CP/M WordStar. We made extensive use of this with RAM disks and ROM disks. So, we put-- we had floppy. But the system was designed where if there was a power fail, it would come back up and keep running and all that. So, we tried avoid any kind of mechanical memory system because of reliability problems. But anyway, we had WordStar on the thing. It's the first time I'd ever used WordStar out of ROM. The first time, when you turn the machine on, the machine looked like that. It instantly goes through all the first checks and all that because everything is working out of ROM. You don't-- the only disk requests you make are made to RAM disk or ROM disk. And when you use WordStar, it was much, much faster than the fastest PC we had for doing word processing, much faster.

Greelish: You know the whole concept with your game systems, everything was on ROM. I don't understand why the concept of using cartridges for personal computers, why that didn't stick around longer. It makes-- I mean it's something that, if you're going to upgrade it, you have to buy new software anyway. Well, you'd have to just buy another one. But yeah, ROM software seems to be a great idea. I don't know why--

Roberts: It's dirt cheap, too. Even big ROMs are real cheap.

Greelish: Even CDs, I don't-- well, I guess CDs can hold a lot more. But with a piece of ROM software, it's almost instantaneous when you turn on the computer. I don't know why they didn't stick with that more. I guess it just wasn't professional or something.

Roberts: One of things, you know you think about, everybody pushes machines, you know getting faster and faster process speeds. You get to ninety megahertz or a hundred megahertz. And then you look at

the-- you look at the-- you've got fifteen milliseconds or ten milliseconds random access on the disk, and your transfer rate on the disk, maybe it's ten megahertz… if it is ten megahertz. Even with the system, the system basically, they're disk-- that's what controls the speed. If you had an infinitely fast processor, you know a lot of that stuff, it's still going to be-- business applications especially where you're doing a lot of back and forth.

Greelish: Right.

Roberts: But I would enjoy doing what you're doing for a while. I think it'd be interesting to kind of keep up with what's the hot stuff out there. I still read a lot of the magazines and kind of look through like *PC World* and *Byte* and those kind of things to kind of keep up. But I don't--

Greelish: It's kind of fun. It gets-- my-- I enjoy-- I like people. And I like talking to people. And I think my biggest skill is teaching. But even that, after you've taught, you give the same spiel over and over and over. It gets a little old. Yeah. But I mean I enjoy it overall. This is kind of a transitional job really. It's a good company, though. CompUSA is a very good company.

Roberts: Well, it's growing.

Greelish: Yeah, I think they're going to establish themselves as the big Kmart of computers here. So, yeah I may end up staying with them.

Roberts: _____ I still buy stuff from them. Actually, America Online and CompuServe, you look through the classifieds, a lot of times you get some really good deals.

Greelish: That's right, yeah.

Roberts: But if you're talking about something that you've got to buy, they're still very competitive with most of mail order. I can look around. And I might be able to beat the prices--

Greelish: They'll match, you know? They'll match anything. Sure, you bring it in and say here it is right here, mail order. They'll match it with the shipping price, though. But still, the prices generally are as cheap as mail order on most things.

Roberts: Yeah, it's not-- it's certainly not a big deal difference. The biggest problem in Georgia is the tax. You add the five or six percent tax. So, you've got a kind of built in discount by ordering the mail order.

Greelish: Right.

Roberts: Which more than covers the freight.

Greelish: I usually stick with mail order myself I mean unless it's there. And that's the convenience of at least being able to buy and go home with it. And you have it. But otherwise, to get the best price, if I'm not in a hurry, I usually mail order everything.

Roberts: I bought a good bit of CD software recently off of CompuServe, or off America Online at a really good price. Like Encarta, it's like thirty-two bucks. I think I paid for '95 Encarta CD sealed-- still sealed. It's that OEM stuff. This is a different thing than you run into. But if you're an OEM like the last little company I had, we were buying software. We paid five dollars a copy for WordStar. And which they were selling that CP/M WordStar at the time for like $195 or something like that. I think the retail may have been $295, but nobody ever sold for that high. But it was that order of magnitude. We're talking about eight or nine years ago. We'd buy five dollars a copy. And they just give us a block of numbers. You know like you'd have serial number 20,000 to 20,500 or whatever the quantity we were buying. And we had to produce-- we had to manufacture all the disks or the-- all that kind of stuff. But that's what this software is. All the stuff that I've got like this CD says on the back it'll be some comment if you look. It's for sale with equipment or something. So, somebody bought it OEM, as the original equipment manufacturer. And they've gotten that software. And that's why they're selling it so cheap.

Greelish: Right, and then they sell it online, make some extra money off of it.

Roberts: I was concerned initially. I was little gun shy that it might be stolen software or something where the serial numbers weren't any good on it, or you couldn't get an upgrade or something. But all the stuff that I've gotten has been that stuff.

Greelish: What was the name of the stackables? Did you have-- what was the company name and the name of the product?

Roberts: Which one?

Greelish: The ones with the stackable components.

Roberts: DataBlocks.

Greelish: DataBlocks?

Roberts: We call it the Altair 2.

Greelish: Yeah? Do you have any product information?

Roberts: I have to-- I don't have any. I've got a warehouse full of that kind of stuff.

Greelish: If you even get a chance, I'd really enjoy looking through it.

Roberts: I've got a pile.

Greelish: Send some of it to me.

Roberts: I've got hardware I need to do something with, parts and stuff that need to do something. I need to really-- I kept saying we have a bunch of systems left over. I'm going to put together a bunch of WordStar word processor to just use around here. Of course word processors have gotten so cheap. I guess you can just buy them for, what, a couple three hundred dollars?

Greelish: Yeah, for a dedicated word processor, yeah. Nice one, too, with like what's that one-- somebody totally graphical interface, everything. It's almost like using a little Macintosh or Windows or something. You just--

<inaudible>

Greelish: No, Smith Corona or somebody. But like $299 for a whole ded-- and of course they do spreadsheets. So, you can do that, too. It's like a cheap word processor computer. I'll shut this off.

END OF INTERVIEW

