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Richard Volz

An interview conducted by
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with
Peter Asaro

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Q: Where and when you were born?

Richard Volz: I'm Richard Volz. I was born on July 10th, 1937 in a small town outside of Chicago, Woodstock, Illinois.

Q: And could you tell us a little bit about your early education and how you got into college?

Richard Volz: My early what?

Q: Education.

Richard Volz: Oh, sure. Yeah. At that time, Woodstock was a small town about 5,000. High school, I think there were just 77 in my high school class. And had a typical, at that time, college prep sequence where you'd take a little more math and science. So I went through that sequence and enjoyed it. And wound up going to Northwestern, I think because my mother had wanted to go there and wasn't able to afford it when she was growing up. I started out at Northwestern as a math major and after about two years, the funding ran out and they had a co-opt program in engineering so I transferred to engineering to be in the co-opt program and be able to help support getting through school. I also picked up a scholarship at that time. I picked electrical engineering I guess for primarily two reasons. I'd started out as a math major and I had this perhaps incorrect notion that there was more math involved in electrical engineering than some of the other branches and also when I was in high school I had built my own amateur radio equipment and had an amateur radio license so it seemed like a natural fit.

Q: And were you involved in any lab work during your undergraduate at all?

Richard Volz: Any what?

Q: Any work in the lab or some projects in the university at the time?

Richard Volz: Just those that I took as classes. I wen through the standard classes. I did take several extra classes that weren't necessary for graduation. I probably graduated with 20 or 25 extra hours just because I was interested in things. But that was really the only lab work that I did. Other than being involved in the amateur radio club at the university that got my hands on some equipment.

Q: And then after your undergraduate, you stayed at Northwestern?

Richard Volz: Stayed at Northwestern. I went through, as my undergraduate. I was actually pretty active in other activities though as I'd been very active in Boy Scouts in high school and before and that continued in college. There's a scouting fraternity, Alpha Phi Omega, which had the local chapter had quit operating a number of years ago and together with some friends we got that restarted and then I also served as assistant scoutmaster for Boy Scout when I was going through undergraduate school and a different one when I moved and was in grad school. Also was involved as an undergraduate in a variety of activities. Got involved in the undergraduate magazine, The Northwestern Engineer, and served as editor or co-editor of that for four terms. I guess maybe that was a premonition of things to come or something. Also got involved in pretty much the standard honor societies. I was selected to the freshman honor society and got in Eta Kappa Nu and Tau Beta Pi, wound up serving as president of most of those things as – not Tau Beta – excuse me. Phi Eta Sigma, but I did end up being president of Beta Kappa Nu, Tau Bet Pi, and Alpha Phi Omega and I stayed at Northwestern. I was fortunate to be able to win a National Science Foundation Fellowship for three years for graduate study and so I stayed at Northwestern and did my graduate work there.

Q: That was also in electrical engineering?

Richard Volz: Yes. Yeah, I was – I had gotten. At that point, I was becoming interested in computers. Early '60s there wasn't that much in the way of computer programs around so I really wound up working in control systems and doing some things on discrete control systems. My advisor was Gordon Murphy, who was also the department head, learned a lot from him particularly about hard work. He had 22 doctoral students.

Q: Impressive.

Richard Volz: Yes. He was an impressive guy.

Q: What was your thesis project?

Richard Volz: I did some work on sensitivity – parameter sensitivity of control systems and sensitive – what the control system would behave like in response to changing parameters and did some optimization. Got me interested in optimization. I did some optimization work, how to optimize the parameters and that led me into different optimization techniques. And actually wound up as part of my dissertation, kind of an appendix but it made it more useful than the dissertation itself, a technique for using calculus at variations to generate a correction factor for one of the newer optimization techniques.

Q: And you did both your masters and your Ph.D. there?

Richard Volz: Did both my Masters and Ph.D. there.

Q: What did you do afterwards?

Richard Volz: Well, I interviewed both industry and universities and wound up deciding to go to the University of Michigan and joined the faculty there in 1964 and became part of the control there, which the control activity at Michigan was spread across several departments. And so they had an interdepartmental program systems engineering lab, which was physically housed in adjacent to the electrical engineering. So it's basically my home department, I didn't – no having to move around for offices or anything. And, you know, continued to do some control work there and got interested in using computer systems for helping to design controls. And so we built up a couple different systems that we shipped to various places around the world for helping to design control systems, inputting things in a more natural language. Didn't realize the terms at the time that we were basically building <inaudible> mathematical expressions for entering things like transfer functions and doing analysis – graphical analysis on them including some optimization things with that.

Q: Where did you send your systems?

Richard Volz: First one went to – one of the earliest ones, which I really built a front-end to, came from IBM. They had done some original work. I got their codes and then we modified them and added to it. And that went to Stanford for one place and from there and then some industry – I don't remember a lot of it. The second one I know we went to Rensselaer, University of <inaudible> in England, a university in Spain, a University in Australia, a few companies. I was really pretty naïve at that point and I had no idea how useful some of that stuff could be. I would have been much ahead if I had privatized that, gone off and started a company and tried to market and build upon it because at the time I was ahead of were MATLAB was. This was, of course, was 1969, '70 timeframe.

Q: And did you, for the places where you actually sent your systems, did you know the people from there before? Did they request it?

Richard Volz: Not really. No, they had seen reference to it somewhere and contacted me.

Q: And who else did you work with on the project?

Richard Volz: I'm sorry. What?

Q: Who else did you work with?

Richard Volz: On that project, a fella named Jack Kuipers [ph?], a very bright guy. Was into a lot of – he got into a lot of sensing things for – and some of which – his son Ben Kuipers – or was at the University of Texas. I think he's moved to – well, Michigan or Northwestern now, I think. Jack was a very bright guy and did a lot work with that. And then a lot of it I did with undergraduate students in senior design courses and then working with them on independent study projects afterwards.

Q: What would you consider your first robotic system to be?

Richard Volz: Oh. That came much later actually. Kind of wandered around and first robotics system? I got into robotics kind of by chance. I had been doing various things at Michigan and we'd set up a lab there just for basically facilities, computer equipment mainly for imaging processing with the med school and from there I had been on the University Committee of Computer Utilization and then asked to be associate department head at Michigan, and then associate computing center director. And in 1981 Michigan had a new dean, Jim Duderstadt. Very, very bright guy. Very energetic, incredible amount of work that he could put out. And his first day in office he had our department head in his house saying he wanted to start a Center on Robotics and Manufacturing and he pointed to an Air Force program by the Air Force, Office of Scientific Research, and said he wanted to get a team working on that. An hour later, George Haddad who was our department head, one of the individuals who have had a great, great impact in my life. It's why I mentioned some of the earlier things because I'd been associate department head with him and he had me in his office and said he wanted to get the proposal written for this. They wanted to get a team from the college. So they had Walt Hancock who was department head of industrial engineering, Dan Atkins who was becoming associate dean for research under Duderstadt, and they pulled me in. And the timing was right at the end of the term and finals had been given, but not graded. I moved into a different office, came in early, went home late so people couldn't find me. Gave out provisional grades and didn't grade my finals for a month. And Walt, and Dan, and I worked on that proposal pretty much solidly for a month and lo and behold, we won and that started the robotics activity at Michigan and from there then things really developed pretty rapidly. And you say the "first system" that's really hard to identify. I had along the way got very interested in real time. I said I was interested in computers when I was in undergraduate and wasn't really too much chance to study them. So when I took my first sabbatical what I did was put myself through training of operating systems and compilers, after which I became one of the instructors for the compiler writing class. So I was getting into languages and computers and I got very interested in real-time computers for controlling things because you have to worry about, how fast are the great responses going to get done? Is it going to get there in time? It doesn't – An example I like to cite from NASA is I've seen them use AI techniques for docking satellite with let's say a service vehicle and they run this beautiful simulation that docks just nicely. "Well, how do they manage the time?: Well, they adjusted the

simulation timescale so that it came out. It would do you no good to calculate the right answer and have it arrive after the thing smashed into it. So I was very interested in real-time systems and we had actually started a real-time class that was extremely popular. And so I got interested and then that carried over to some of the robotic activities and the computer activities. We were interested in – about that time the Federal Government said that they were going to create a new language for real-time systems called Ada, which you may or may not have heard of and I got involved in that community. So actually one of the first projects was we had – and Intel had gotten on board with that or at least partially and they had built a machine, the Intel 432 Computer that would run the Ada and they built an Ada Compiler for it. And so we had gotten that machine and dealing with some students and a faculty colleague or two, we built a vision system. We'd gotten a – we had purchased a Puma robot like most universities. We'd gotten a C02 donated robot to us and so we built a system for recognizing objects, and doing insertions, and all. We programmed it all in Ada. I'd gotten my fingers in many different things and not just robotics in the course of my life, which made it more interesting. In about that same time, you had asked earlier about the NASA connection, and I think it was 1984. I think that was when President Reagan announced that they were going to create a space station. And in conjunction with that the emphasis at that time was, "We're getting our pants beat off by the rest of the world on robotics. Our manufacturing is suffering. We really need to do more research on robotics and manufacturing." And they created a committee to look at what they could do for research with robotics and automation in space. And I guess because I was involved in the setting up the center. It was actually the center was broader than robotics. I should point that out. It was a center on integrated – for research in integrated manufacturing and Walt Hancock was, who I mentioned earlier, was the director of that center and I became the director of the robotics research lab within the center, but through that connection somehow I was asked to be on this committee. Was chaired by Bob Cannon from Stanford and Bob was one of the leading people, early people in the field and this committee went on for about 18 to 24 months. It issued a report on things that they could try to do in space with robotics. I don't know how much whatever actually got implemented. I'm sure some did, but there were so many changes in the space station over the years. But as that committee was finishing up, again from people I didn't know, nominated me to be on the Aerospace Safety Advisory Panel, which in the history – I don't know if you know much about the history of that particular panel. It was set up in 1967. In 1967, there was a fire in one of the Apollo cabs and three astronauts, Grissom, White, and Chaffee perished in that fire unfortunately. And following that Congress set up the Aerospace Safety Advisory Panel to look over NASA's shoulder on anything to do with safety. And so there were I think about 10 formal members and somewhat arbitrary number four or five consultants who operated just as panel members on that committee. And it was a big time in that. It was like 25, 30 days a year of activity and so I was invited to be on that panel as a member and one of the very fun things I've done in my life. Excuse me a second. <coughing> I'll give you a few seconds there to edit and I'm going to take a drink of water as well as – am I talking too fast? I got the feeling I'm talking fast.

Q: No. That's great.

Richard Volz: And I'm afraid I'm running ahead of your questions because of what you told me you were going to ask last night.

Q: Oh, no problem at all. As long as you explain it, it doesn't matter if I ask the question or not. And we need to get you done by noon, right?

Richard Volz: Right. Okay. Yeah. That shouldn't be hard at this point.

Q: So I was just going to ask. You mentioned that there were a lot of kind of recommendations made by the committee that was looking into space robotics that may or may not have been implemented. So what were some of the recommendations? What were some of the discussions?

Richard Volz: I don't remember. I really don't remember. I'm sorry. I do know the one event that sticks in my mind most was a tragedy. We were at a meeting out in La Jolla at the Scripps Institute on the day that the Challenger accident happened and nobody could do anything. I mean we just – Bob came through the door about nine o'clock. We had all been gathered for the meeting and told us and all we could do is watch the re-runs all day and feel sick. But I don't remember much of the recommendations that came out of it. The tragic thing. I actually got on a panel about six months after that and then they had set up an office. They had an associate. The organization of NASA is the top person is the administrator and then there are a number – some varying number from time to time of associate administrators in charge of specific activities and there was an office, associate administrator for safety and he was the one that the panel dealt with most. I mean, occasionally there would be somebody from congressional aid or maybe a congressman or senator that would meet for the panel, but not all the time, maybe once every couple of years. But the associate administrator's office was – it was just wallpapered with diagrams about all components of the space shuttle because they reviewed everything. Everything that went into it in great detail, and then he was checking things off, and looking at what had to be done. The panel looked into various things. The first thing they asked me to look at had nothing to do with robotics at all. It was a computer thing and I don't know if you want me to talk about that or not.

Q: Maybe you can mention it a little bit.

Richard Volz: Okay. The first thing they asked me to look at were the general-purpose computers. The shuttle is got a growing number of computers in it, but there were five main computers called, The General Purpose Computers that go with – do all the flight avionics, all the landing – take off and landing and a lot of the experiments in space. And so it was an old design. The original computers were based on a chip that was designed in 1969 if you want to

get an idea on how old and it was modified slightly for NASA. They had put one additional – one or two additional bits in for addressing, but they had to do some funny things with them. And it was all based on core memories because the – in space you have a lot of atomic particles that don't get footed out by the atmosphere and if they hit electronic solid state memory, you can flip a bit and so all the memory was core. In 1983, they had commissioned a re-design of that computer and built a whole lab just for testing it. They were getting ready to fly the new one and the new one was solid state. And now the organization of those computers, it's five computers. Four of them, one identical software, and they're conducted to four – actually four parallel actuators. The idea being that if one computer fails, three can out muscle one on the actuators. And then if you take that one offline, two can outmuscle one and you've got doubly redundant and that was for any hardware failure. For software failure, the fifth computer was identical specifications for the software, but written by a different company. Now, the question that was posed was, "All right. We're going to make this change. How do we change the computers? Do we change all five? Do we change just this one and see how it behaves? Do we change these four and not this one? What's the best way to do that?" Of course, they were looking for problems. I was just a, you know, what do I think? Do I think they're doing it right and whatever? And came to the same conclusion they did, and they flew in May of 1991, which made me a little nervous for that flight.

Q: What were some of the other robotic systems that you have done?

Richard Volz: Other robotic systems. Well, one of the things that we did and actually probably the one that I'm most known for was some things we developed something called the "time clutch." Again, the idea is if you're controlling for telerobotics. If you're controlling something remote, as opposed to directly sending your signals, you may not see it, you may control it by looking on a screen and seeing it. And you can basically control in the simulation and then parallel sending the signals to the robot. Now, Tom Sheridan initiated some of that at MIT and what we were looking at and not just – when you're controlling it, you're controlling the simulation. There's not any fundamental reason why the simulation has to stay in time synchrony with the real robot. And so you could be controlling the simulation and do it faster and the real robot moves along the path that you're doing, but slower. And then you can do other interesting things like if you see that you made a mistake, you can back up and redo it and sometimes for final positioning you want to move things around and get it in position before you do the final move, where you could kind of clip all those out with what we call a "position clutch" and that was kind of the idea behind that. And I'll give you an example of where something like that could be useful. One of the things that and I don't remember where it was through the safety panel or if it was because of other reasons that I was able to see this, but at Johnson Space Center they have a lot of simulations for training the astronauts and one of them was for control of the big robot arm. That big Canadarm arm that was on the space shuttle and there's no way you can adequately train that on earth with a physical arm. The masses and momentums and gravity, and everything would be all screwed up so they trained it with simulation. And they had a simulation built where you look through a screen. You look like

you're looking out the back of the shuttle window looking at the bay of the shuttle and you had a joystick to control the arm and you would view the movement. I got to play with that for an afternoon or a morning or something. But, you know, you're lifting large masses and you might be lifting something like 30,000 pounds or something. Well, you're coming out of the shuttle bay with something that massive, you've got to be very, very careful because if you slip, do something and it bangs against the side you could screw up the shuttle and not be able to land. So one way – the way that they used to try to help with that, was everything was very, very slow. I mean it was painfully slow to try to just simply use the joystick to raise straight up out of the shuttle bay raise a load to get it clear of the shuttle. Many minutes and actually it's much harder to do that. The concentration and doing it so slow, it's much harder than just going in and in a few seconds smoothly moving it out. So with something like disconnecting the time synchrony you could do it and if you screwed it up you could see it in the simulation. You could back up and correct it. I don't think they ever implemented that but that was kind of a motivating idea behind it. And then later after I moved to Texas A&M with a grad student we carried that idea a little bit further, a different kind of a motivating example. They had built about a basketball sized three flying device called AirCam that had jets mounted all over and had cameras in several places and the idea was to be able to get out and inspect the shuttle without having to exit the vehicle. A lot of concern about every flying because if that ran into the shuttle it could do damage and so we were looking at the telerobotic control of that. We had got the simulation codes that they developed, extended things. And essentially what we did then in terms of the control again was through simulation and you had time delays. And if you're doing it from earth, the time delays are like 10-20 seconds. It took me a long time to come to grips with that because the propagation delay is not long at all, but all the electronic delays and equipment that you go through and relay stations and things, it's actually a very long delay. And so we kept a history of all the commands that we sent as well as our verdict of simulation and then we would get feedback from sensors on the shuttle telling us where things really were. But, of course, that was where it was so we back into our history, reset the state so it didn't drift apart, and then simulate forward again and so we would be updating the state to try keep forward. But at that time, NASA dropped that project, decided not to do it – not to actually fly it I think.

Q: What were some of the biggest challenges in the telerobotics work that you did at that time?

Richard Volz: Oh. I think without a doubt the biggest challenge is the time delays and the further off you are. And you had some points you got to shift – have to shift into a mode with some autonomy that can act independently on things.

Q: And were any of the systems that you developed implemented by NASA?

Richard Volz: Actually, I don't know if they were. I did – well, we did. I don't know, but maybe. We did patent that idea of the time clutch and position clutch. From my perspective, I

think it was more just to do it and have a patent than trying to make money out of it. I had two close colleagues on that, Lynn Conway who was associate dean for research – she's associate dean, not for research. I don't know exactly what her title was, but associate dean, and Mike Walker. It was the three of us that principally did that and we patented that. And Lynn called me up. I was at A&M. At that time, I had moved to A&M to be department head of computer science and I was horrifically busy on all fronts. And she called me up one day to say that, "Hey, NASA was using that idea in something and they weren't referencing us or contacting us about patent rights and I should go after them." And I was so darn busy because I had taken the position as department head of computer science at Texas A&M in 1988 and was really struggling with trying to build up a new department. Plus, that was the early days I was on the NASA panel and Lynn was another one who influenced my life, she and Dan Atkins a great deal. Lynn had served on the Air Force Scientific Advisory Board in the late '80s and she had nominated me for a membership on the Air Force Scientific Advisory Board. And low and behold, about 1990, '91, I was contacted and asked to serve on that board. And because of the NASA connections, I had been asked to serve in the Space Station Advisory Board. And because of some of the earlier AIDA work, I was serving on the AIDA Board, so I was on four federal advisory panels trying to build up a department. I just did not have time to pursue anything that deals with patents. Excuse me; I'm going to, yes. I could feel it, but I was trying to get to a breaking <blows nose> point before I drift off. <blows nose> I don't know what the cause is but my nose runs 24 hours a day.

Q: It's not also easy with these kind of dry environments.

Richard Volz: And my throat's getting dry so I'm going to take another drink of water while we're stopped here. So while I'm taking a drink, where do you want to go next with this?

Q: So do you want to tell us a little bit more either a little bit more about the things that you did for NASA? Also where you got funding for some? Was it mostly NASA-based, any other robotics projects that you might have taken part of? And then also we should talk to you about your, how you got involved in RAS and some of the things that you did there.

Richard Volz: Yeah. The RAS backs up. I was, let's talk about it offline first.

Q: Sure.

Richard Volz: Or are we still being recorded?

Q: We can – if you say it's off the record that part is.

Richard Volz: Okay. Well, we – the RAS stuff goes back, I was – I sat in on one of the first meetings to decide to create the council back in about 1982 or '83. I'm trying to think of how to transition between all these different things at the moment.

Q: Well, we're going to edit it eventually.

Richard Volz: Right. Okay.

Q: So don't have to make a clear transition.

Richard Volz: Can I request to see the edited version before you use it?

Q: Yeah.

Richard Volz: And comment on it?

Q: Mm-hm.

Richard Volz: Oh, okay. So where did I leave off? <laughs> I don't remember where I was.

Q: You were just talking about Lynn Conway and Dan Adkins as some people, and that you were talking about the different course.

Richard Volz: Oh. Oh, that's right. I was asked to be on the – well, I guess so I didn't pursue anything.

Q: Mm-hm.

Richard Volz: But I was – it was a very busy time because when they hired me at Texas A&M, well, give a few seconds, 'cause I started that, you wouldn't be able to edit it. It was a very busy time. As I said, I had four panels and I was also I haven't – we haven't talked about it yet, but I was an editor for the Transactions on Robotics and Automation for IEEE and the society. And I was department head trying to build up an department, which was quite small when I got there, only 14 tenured or tenure track faculty, half of whom were on tenured and they had 800 undergraduate students and somewhat over 200 graduate students and that quickly grew to 1,200

undergraduate students and almost 300 graduate students. And so I was just very, very busy at that point in time.

Q: Can you tell us a bit about the startup of the Robotics and Automation Society?

Richard Volz: Yeah. As I said, part of that was being involved in robotics and automation, we had gotten this grant from this Air Force, the Office of Scientific Research in 19, I think '82 to '88. And in somewhere around 1983, maybe early – late, 1982, there was talk beginning about doing something more formal within IEEE that dealt with robotics and automation. They're informally; they're through the Control Society, which had been my home society after I got my degree, also Systems, Man and Cybernetics, which obviously makes a lot of sense with the telerobotics things and a few others, there had been activity getting starting. But we wanted to build a more permanent home for it, so there was a, I sat in; I think, on one of the first meetings George Saridis, a chair at the meeting. I know George Bekey was there, Tony Bejczy, Lou Paul, probably another half dozen people. And it was decided to form a council within IEEE. And in IEEE, you have the societies and you have councils. Councils are partnerships amongst multiple societies. And so we formed a council in robotics and automation. I didn't have a whole lot to do with it. I think I was invited because of the role we had with the grant in Michigan and me being director of the center. George Bekey started the transactions. At that time it was called a journal. Councils don't have transactions, they have journals. It was the Journal on Robotics and Automation, and he asked me to be one of the – get involved with the editorial and activities on that. And he was editor through 1988, editor-in-chief. Terminology changed. I'll try to use current terminology. He was the editor-in-chief. And the council was formed and I was involved with the editorial activities. And in 1988, when George stepped down, Russ Taylor took over as editor-in-chief and I was asked to be one of the editors. And so from 1998 to 19 – or maybe it was '90 to '94 something like that. And in 1980, in 1988, oh Tony Bejczy can give you this 'cause he was the president that did all the work for becoming a society. And it was in the 1987, 1988 timeframe. And Tony can give you all the, that's one thing you want to –- he'll be very proud of the work he did on that. He really did a great job and it's a lot of work to get these – societies that kind of own this are in this partnership to agree to let the council become a society and have its own money and its own operations. And it's a great job that Tony did with that. Became a society in 1988, and somewhere in there George finished his term as editor-in-chief. And one of the things that was talked about was should there be term limits on editorial positions. And Georgia's recommendation, which the rest of us heartily agreed with there should be, it shouldn't become something that's owned by one person for decades. We had seen some examples of that in other journals. And the – and Russ Taylor took over as editor-in-chief, and I was an editor. And then in 1994, when Russ stepped down, I was asked to be – or asked a couple years ahead of time to get ready for it, to become editor-in-chief of the transactions. And I also, one thing I skipped over is that while I was still at Michigan, we started the conferences, the ICRA conference, it started in 1983. The first one was in Atlanta and we participated every year. And in the mid-to-late '80s, we submitted a proposal, kind of a joint thing with – for chairing the, holding the conference. And so kind of joined with Antiquevo[ph?] from Purdue.

He and I ran the 1990 conference which was held in Cincinnati. And we had picked Cincinnati because we had looked at the number of student members and that was a place where we felt we could get the maximum 600 mile radius where students can drive in a day where we could get – try and get the maximum student participation in the conference. And at any rate, so I was general chair of the 1990 conference. But other than that my principal role was through the editorial work.

Q: What was it about '83, '84 that kind of brought all of these things to a head where the Robotics Council was being formed , ICRA started?

Richard Volz: Tony could give you a better answer than I. I participated in the meeting, but I didn't – wasn't involved with IEEE at that time and any of the activities and getting it formed.

Q: I think but do you have a feeling for just why did robotics suddenly become something that was worth –

Richard Volz: Well, there was a great deal of interest in it once we got it – once we got the con – once the conference got started there was a great deal of interest. And there where a growing number of papers being submitted every year and rather than having four or five societies trying to compete with each other on all these things, it seemed to make more sense to have a single organization that would be responsible for it. Of course, other organizations still had papers on robotics and automation, but that's normal in any field.

Q: And so could you tell us maybe is there something more you'd want to tell us about the RAS stuff or –

Richard Volz: Well, from there, yeah, I say I was editor-in-chief and through 1999, and then on the ad con for a year and then I was asked to be vice president for publications. And that went through, I'm trying to remember the years, through 2003, I think. Yeah, it had to be. Yeah, it had to be 2003. And so at that point in time, one of the last things that I did, the last year that I was editor-in-chief, created a kind of an ad hoc system for electronic submission and sending them out for review. And it's just something that I built up with a little help from one of my sons. Yeah, we just to get these things and we built like a system for generating the random numbers and things that low, very low probability of somebody picking off the reviewed key things for people reviewing. And Peter Lu took over as editor after me and then created a much more formal web-based system to do it, which has grown since then.

Q: Mm-hm.

Richard Volz: And while I was vice president for publications, I sort of got involved in many other activities. We started the work I think then to create; Ken Goldberg really carried the brunt of it, but to create the new transactions in Automation, Science and Engineering. Somewhere toward the end of that period is when I was vice president. And in 2003, I was at a small workshop and was asked if I would consider running for president of the society. And I originally said no because, but then after talking with a number of people, decided there was quite a bit of support, people did want me to do it, so I did run for president and was elected president-elect in 2003, and served as president-elect 2004 president then and '04 and '05 and '05 and '06 as president. And worked, spent my years – two years as a president-elect. We set up committees in all the major areas of the society just to review where or what do we want to do. And so came up – we did quite a number of things, I think, in terms of making changes, either while I was involved in that through my predecessor, Kazuo Tanie was ill with cancer and died the year after his term finished, and so just helped with a lot of things. There was, we – that was the point where we created the Conference Editorial Board; we created the Electronic Products and Services Board. We – and continuing into my years as president, we went through the society review for publication reviews, passed those with flying colors. We started some initiatives because we were doing quite well financially to start projects and things that would be funded by the society and I initiated in activity, a formal way of handling that. We created a business plan for the society. We looked at how the conferences were being held and it was until this year it's been every other year it was in the United States, but if you look at our membership, it's really spread around the world so this will be the last time that's true on out. We set it up in 2006 or '07, but it took we were far enough ahead on scheduling, but it now will rotate into every third year in the U.S. and rotate between, U.S., Europe and Asia, which is a fairer way to do it. There was quite a bit of difficulty with getting some of the awards approved at the IEEE level. Things weren't clear as how they would – we prepared a pretty extensive manual on how to manage awards and avoid conflicts of interest and undo influence? We had a fairly long-term effort to took, should've been, but it took years to get through a dispute with another society over the mechatronics because it was a IEEE entity involved, the ASME, and there was some disagreements over how the finance were to be handled with respect to ASME. It took us four years to resolve that and lots of time. What else did we do? Oh, we started the joint Transactions on Haptics, we got that started.

Q: Who were some of the people you worked with most closely?

Richard Volz: I can't here you.

Q: Who were some of the people you worked with most closely?

Richard Volz: Oh, many people. Ken Goldberg carried the brunt of things on TAs. We got – I was president at the time, so Bill Hamel carried a lot of the work on getting haptics through

'cause it's a pretty extensive approval process, you need at IEEE level. I had been also and along the way somewhere I was asked to be on the publication service as a products board for IEEE, which I served on for several years. And so I got to know all the people at IEEE headquarters who were involved and so I could point people to the right place, but they carried out all the work on it. And we – Xiaoping Yun as treasurer. The role of the treasurer is immense. I don't think many people in the society realize just how large a load the treasurer has to carry. And we had split the position. Prior to that, Dave Horn did it and when Dave finished he recommended that we split it into a vice president for finance and a treasurer just because the load is so high. And IEEE keeps piling more and more work on that position, more reporting, and so it – it's just an immense load. So I have immense respect for Xiaoping. Didn't work with him that closely. Well, I did on some things when we were develop – and with Tony Maciejewski, and then Ian Walker, when we were doing the business plan. And, of course, filled in the conferences with all kinds of people there, and T.J. and John Hollerbach and people that we set up, getting that board started was quite an effort. And I brought as one of – the way the presidents are elected is two years ahead, so when Bruno was elected as president to secede me, I brought him into all the activities right away to try to involve him as much as possible so that he'd be in a position to deal with things when he was president.

Q: Mm-hm.

Richard Volz: And at that point I was also became a member of the IEEE TAB, Technical Activities Board. And I couldn't keep my mouth shut enough and got involved in some committees there. I was on the finance committee for a few years and then appointed to be on the conference – IEEE Conference Committee for a couple of years and probably and then some ad hoc committees where I couldn't keep my mouth shut, so I got asked to be on a committee or two to work on some specific issues at the TAB level.

Q: You mentioned that one of the things that IEEE was doing was funding certain projects? What was that?

Richard Volz: We – it turned out to be something that we really dropped after it was an experiment. But we took a sizable amount of money, $100,000 to $200,000 out of our budget because we were doing quite well financially. And we were one of the few societies that's growing. We've been growing constantly for probably eight years now, and that's rare in IEEE. In fact, I spent much of last evening talking with Peter Staecker, the President-elect of IEEE because I've known him for a number of years through my previous work. And he was comment – he'd like to know what our secret is for the rest of the society 'cause most societies are losing members and we've been growing. So we set up a chunk of money. Xiaoping could tell you how much. And we set up a formal review process, a formal proposal acceptance process. I mean we weren't funding 50, we weren't funding $100,000 projects, but $5,000, $10,000. We

did find something. We funded a project called Second Life for the group in Italy that you may have seen. It actually got quite a bit of positive review at IEEE and it was one of the things that they talk about quite a bit. And I think we formalized some funded for the Gold dinners, luncheons rather, and a few other, some student award activities and funding. But we accepted proposals. We had like 20 or 25 proposals. But then we became a mini grant agency and the work load was immense. And, of course, because they're small, a lot of them are not that well written and it was such a hassle that after two years we pretty much dropped it. And I mean it will still – can always accept specific, and individual requests can come in, but it's not like we're – they're not publishing any more than hey, here's a formal program and submit. But it was an idea and we tried it and I think that some of the things that we funded worked out fairly well, but.

Q: And during all that time were you still doing any robotics research?

Richard Volz: <laughs> It's – well, I was department head for nine years from '88 through '97. And we grew – it was really hard for a time 'cause we – by the time I stepped down I had hired half the faculty in the department there. Our publications I think had gone up by at least a factor of 10. Our funding had quadrupled. It was a huge change in the department while during my tenure. And I had kept research, kept my fingers and we had – there was an outfit called the Amarillo National Research Center for Plutonium that got set up out of Amarillo. There's politics behind it as there are lots of things. But its mission was to figure out what you do with plutonium when you disassemble nuclear weapons, which is the right way to treat a nuclear weapon, take it apart. But here's something with a 25,000 half-life, a gram of which will kill you chemically, aside from the radiation. What do you do with it? You can't – and this weapon's a great stuff. You can't just leave it running around, you've got to protect it and inspect it. So it was attacked on several fronts, so the principal ones being, can you change its character to not be so useful in explosives? Can you bury it three miles deep under silicon? But there was also the manipulation and handling of it side which led to some robotics projects that we did for a few years. That pretty much went through the '90s, and we had a, there was a, actually John Junkins, who was in our aerospace department, was the principal in setting this up and I was sort of a co-leader, tagging along with him, but then he dropped and it became my project with through the United Space Alliance. They did all of the work for NASA on maintaining and shuttle and did a lot of things for the shuttle. And we had a series of projects, generally small, that came through and we probably had six or eight faculty on them most terms. And they would funnel these projects every term or two, there would be new set of projects and the proposals would be short and reports and we did a series of projects with them and I had some that I carried along with a number, usually master students that were doing things there. And then, as you've noticed, may have noticed, the simulations have been kind of a theme through some of the things that I've done. I got interested in and I talked about that some of the use of simulation for training the astronauts. So I got interested in training and in haptics and we got interested in could you put a glove – haptics glove on and feel things? Which if you think about, when you put a key in a door at night, you usually aren't using your eyes, you're feeling, so what could you do? And when you think about after, if you've ever seen the cockpit, a photo of the cockpit of the shuttle,

you've got this big array of instrumentation and buttons, and they're looking and doing all kinds of and a lot of it has got to be by touch and feel. So we did some work on that and graduate students do some very fundamental things with haptics. And then that would carry through oh, early 2000s. And in the process, the training came through. And when I stepped down as the department head, got together or got some funding for – tradition was when you stepped down from department head, you got a little bit of funding from the college to try to get your research program back up and going again. So we set up a lab, got some equipment, started looking at training and about three or four of us got together with a fellow in the psychology department and wrote a proposal to be Air Force Office of Scientific Research for looking at using technology and things for training. And so we happened to win so we had another five or six year grant at not quite a million a year. The original one was a million a year, a little bit less, something in that range. It ran through about 2005. And in 2004, after I'd been elected in late 2003, after I'd been elected president, I decided that enough's enough. I'm never going to do all the things I want to do in my life and still be able to do all the service things at IEEE, I was going to retire. So I informed the department that I was going to retire in August of 2004. And then so that, at that point I really was just finishing up with my students. And I had stuck around for actually part-time through a good part of 2005 because I still had this big grant to finish up. And I still hung around, I still got an office. They've been very good about leaving me with an office space. And I kept going in and meeting my – not until my students were all done because I didn't feel it's fair to just drop students and make them go find a new advisor

Q: Where has most of your funding come from over the years?

Richard Volz: Well, the biggest chunks I think clearly has to be the Air Force. Because the original six-year grant when I was at Michigan, that was about a million. But that wasn't just me. Now that's the many number of faculty and, but I was the project director. And then we, and then we had the one in training for the Air Force Office of Scientific Research. I've had through USA and NASA, I've had a number of funding through NASA. This Amarillo National Research Center and Plutonium, we had funding from there for four or five years. You know, Jeff Trinkle worked with me on some of those, your advisor, on some of those in the early '90s. And then I've had a variety of industry funding.

Q: Any particular –

Richard Volz: General Dynamics funded me some. Some of the AIDA work was funded by industry. And we won't – probably not relevant to this. But I had several grants from, probably three from companies that funded me from AIDA-related things from industry.

Q: And just to wind up, I know you have to go, but what's your recommendation to students who might be interested in pursuing a career in robotics?

Richard Volz: Oh boy. I think it's a field with great – is going to go somewhere. And it's got great potential and a lot of that potential is going to be realized. I think it's going to depend a lot on the sensing and when sensors get developed what sensing modalities they can exploit. It's going to take a lot – I'm starting to talk about the directions. I suppose that's not really the answer to the question. But I would encourage them I guess to don't be too narrowly focused on just one aspect of it. Be sure you look at the sensing; look at the AI that's going to coordinate things. Look at the communications and as well as the mechanics of things that go into it. I think it crosses many disciplines, and I think where some of the biggest advances will get made and where the biggest opportunities would be with people that understand and can deal with modalities of things.

Q: And just I just wanted to ask a final question. But you mentioned some of your collaborators, but who have been the people that you talk about robotics the most to?

Richard Volz: I've what?

Q: Who have been the people who you've talked with the most about robotics and who have influenced your thinking on robotics the most over the years?

Richard Volz: Well, I would say there's three people who I felt really influenced my career a lot. Not always about robotics. George Haddad, who was department head for a very long time that Michigan, brought me in as associate department head, we got along very well, and he then – he's the one that got me into this and got me going in this direction. So he was extremely important. And then two collaborators, Dan Adkins and Lynn Conway, both had great influence, not only on the technical aspects but also, like I say, Lynn got me nominated to the board for the Air Force Office Scientific Advisory Board. And I know that it was Dan who recommended me for the department head position at Texas A&M. They've just both had great influence on my career. Technically, a lot of talk with Lynn. Mike Walker, who I had not been able to track down for a number of years, but is a really talented guy, Jeff Sum[ph?]. And there's a friend who, I can't even remember his last name right now, from mechanical engineering at A&M, Lewis – Mary, do you remember? Okay. Sorry.

Q: No. No. Thank you. Thank you very much.

End of RichardVolz.mp3