Jack Higginbotham Oral History Interview, November 3, 2015

Title
“A Nuclear Engineer Leads Oregon Space Grant”

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Location
Valley Library, Oregon State University.

Summary
In the interview, Higginbotham discusses his upbringing as an "Air Force brat," his early interest in aviation, and his decision to pursue nuclear engineering as an academic discipline. He then recalls the two summers that he spent as an intern at the Black & Veatch consulting firm, and the work that he did that anticipated the accident sequence that struck the Three Mile Island nuclear facility several months later. From there, Higginbotham details the eleven years that he spent as a student at Kansas State University, commenting on his academic progression, his student jobs as a reactor operator and supervisor, his master's research on coal fly ash, and his experiences as a Ph.D. student during the Chernobyl era.

The session then turns its attention to Higginbotham's rich and varied career at Oregon State University. In this, Higginbotham shares his memories of arriving at OSU, his early impressions of the OSU Radiation Center and the university itself, his activities as senior reactor operator and senior health physicist, and his interactions with important OSU colleagues. He likewise reflects on his involvement in the collective bargaining process with OSU's graduate student union; trends in faculty support for the Radiation Center; research that he conducted on irradiated foodstuffs and probabilistic risk assessment; his tenure as chair of Radiation Health Physics; his association with Hewlett-Packard as a consultant; and his years as associate dean of the Graduate School.

The final third of the interview is chiefly devoted to Higginbotham's leadership of Oregon Space Grant. In recounting this time period, he provides both an overview of the history of the Space Grant program nation-wide as well as the program's arrival at Oregon State. He then details the mission of Oregon Space Grant, shares his memories of assuming leadership of the program, and discusses the arc of program activities over time, including it's emphasis on robotics and K-12 outreach.

The interview concludes with a discussion of spaces on the Corvallis Hewlett-Packard campus that were purchased and are now occupied by OSU; Higginbotham's recollections of his stint as president of the OSU Faculty Senate; and his thoughts on the current direction of OSU as it looks toward it's 150th birthday.

Interviewee
Jack Higginbotham

Interviewer
Chris Petersen

Website
http://scarc.library.oregonstate.edu/oh150/higginbotham/

Transcript

Chris Petersen: Okay, today is November 3rd, 2015, and we are with Jack Higginbotham. He is the director of Space Grant at OSU and has a long connection to Oregon State through Nuclear Science, amongst other areas. And we'll talk about all that, but we'd like to begin at the beginning and talk a bit about your early life. Where were you born?

Jack Higginbotham: I was born in Kansas City, Missouri.

CP: Is that where you were raised?

JH: No, I'm an Air Force brat, I moved around a lot, so I'd been many, many places before I finally ended up graduating high school.

CP: Was there a place where you went to high school for an extended period of time, or was it just year to year?

JH: I ended up in Kansas City when Dad retired and was on my way to the Air Force Academy, and in 1976 I failed the physical because of my vision. So once you decide, what do you do now? Because it's pretty cool to put your résumé together and get that kind of appointment. So my girlfriend at the time – my wife's gonna shoot me when I say this – she said "well what about nuclear engineering?" I said "okay." Well, I was in Kansas City, Kansas and Kansas State was local, in-state, so I majored in nuclear engineering.

CP: Can you give us a sense of life as an Army brat?

JH: Air Force—

CP: Right, sorry, yeah.

JH: It was exciting in many ways because you learned not to dig deep roots but to move quickly from one school to another, one house to another. I learned that family is really the only thing that's core of your values. So I think that's what I remember most. The places are obviously important, in memory of my childhood as well. I loved Texas, I loved Arizona.

CP: What were your interests as a boy?

JH: Well scouting, I was an Eagle Scout and I really enjoyed that. That provided a lot of continuity. I was very involved—again I'm an Air Force brat—in aviation. I loved aircraft and I had a chance to see many of those because of the bases that we were on. I was also an avid model builder, I built many plastic models. This was en vogue at the time for very young men to do. And I look back and realize that was probably one of the best things I ever did, because I learned 3D modeling, dimensioning, assembly, following instructions, and I think that's really the beginning of what I found to be exciting.

CP: Was there a specific interest in science? Or was it more applied through your interest in aviation and that sort of thing?

JH: Oh, completely through aviation, and science was just a way to get there.

CP: How about the space program?

JH: Well, you know, I grew up in the late sixties, early seventies, so that was what everybody did. I mean, how could you not avoid that? Because of my current job I know so many people will talk about the lunar landings as influential in their life, and naturally I have that as part of my story. I distinctly remember Skylab and what happened there. I remember the beginning of Challenger, I remember when it actually had its last flight, and that was very pivotal. I had a friend who had research on that vessel when it disintegrated. So I guess that's my interest in science and NASA. It actually - also, I didn't really pay attention to the rest of the world at the time. The Berlin Wall fell during that time, I did pay attention to that.

CP: So you wanted to join the Air Force then, it sounds like.

JH: I did, yeah. Desperately.

CP: And that fell through because of your vision.

JH: Correct.

CP: And so you made an alternate plan then?

JH: I don't know that it was a plan, it was "okay, I'll go that way." There was no long-term vision or anything like that associated with it.

CP: Nuclear science?

JH: Nuclear engineering, nuclear science was where I went. So I started the first year there and did well, worked at the library as one of my work study jobs, and I learned to catalog things, which is really great. I absolutely enjoyed and am enthralled to go into the stacks and get lost in the books. Second year I decide to apply for an internship for a co-op position with a company named Black & Veatch, consulting engineers in Kansas City, and that was really when my nuclear engineering passion came to fruition, was during that period.

CP: Can you tell me more about that?

JH: It was, you know, you start off in the traditional stereotype of internships, of you get sent to do copying, which for an engineer means you're running blueprints, so I ran blueprints for a while. Then I got a chance to start serving as a calculation checker for different projects. One that really struck me was an electrical load analysis being done for East Kentucky. They were looking at the projection of electrical demand growth over time. And I was surprised because they were using a growth factor of seven percent, and when I asked "why seven percent?" they said "we always use seven percent." "Isn't there some, is there anything other than"—"no, that's just, Jack, do the seven percent." I go "okay, yes sir," but it seemed kind of silly to me at the time that you would arbitrarily just pick a growth number and make your projections for hundreds and millions of dollars worth of investment based on that one assumption. So that struck me.

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Later on I got involved with a much more important project, for me anyway, which was looking at what happens when a pressure rise, a pressure vessel of a reactor begins to have a leak. Okay, these things are high temperature, high pressure, and if you have a small leak coming out, the tank starts to depressurize. So I learned a lot about how the reactors work specifically in the real world and how to use the cutting edge tools of the time to analyze those kinds of failure modes. So, to make a long story short, the project that was pivotal, and probably the pinnacle of my career, was I was given a - this is BWR/6, it's a General Electric reactor and there's a number of small pipe systems that are associated with that. One of them is the recirc riser system. This is a series of small pipes that come up around the side of the vessel and pump water back down to maintain reactor core cooling. So I asked my boss "what happens if we have a failure of one of these pipes?" and he goes "well, that can't happen" and we talked about why it couldn't happen, but I asked him to let me go ahead and do an analysis anyway.

So I modeled that system and came up with the amount of steam, both in pounds of steam as well as the energy of the steam coming out of a postulated break of one of those riser systems into the main reactor containment building. It took me my entire semester of work at that time to do that. I went back to school, got some more classes out of the way, came back for my next intern, my co-opship, and things had changed. Before, I was sitting in this long row of desks and I was one of many. Now I had my own cubicle and I was like "what's going on?" So I went to my boss, I said "Joe, why? I mean I appreciate the raise" because I got this huge raise as well, I mean back then it was huge, and he says "Jack, where were you? Three Mile Island happened." I said "well, yeah?" and he goes "Jack, you've got design base for the Boiling Water 6 design." I said "excuse me?" Well apparently the reanalysis that I had done was an un-reviewed safety question for that type of reactor, and it predicted the accident sequence that happened at Three Mile Island.

My employer, Black & Veatch, were on contract to a company called Public Service Company of Oklahoma because the reactor we were actually analyzing for was to be built in eastern Oklahoma. And because we were under contract with them, all my work was proprietary and filed away. When PSO, Public Service Company of Oklahoma, cancelled the

plant, all that information got archived and has never seen the light of day. But that was sort of the pinnacle, and probably the first time I've ever talked publically about this. So thanks for that chance, appreciate that.

CP: So this was, Three Mile Island happened in 1979, you started college in 1976, so your third year of college you were doing work that—

JH: I was actually second year.

CP: So you did work that anticipated what happened a year later?

JH: Correct. Well, six months before it happened is when they reviewed my calculation.

CP: Wow.

JH: So I had done it the previous three months before that.

CP: What did you think about that when you heard it?

JH: I was a bit dumbstruck at first, then really excited and wanted to keep doing that kind of work. I was very interested in that. By that point I had a child on the way and the nuclear reactor facility at Kansas State was needing some help, so I decided to stay on at Kansas State and become, ultimately, the supervisor of that reactor, operating that facility. So I kind of orphaned my nuclear side with Black & Veatch and went on to finish my bachelor's degree, which then turned into my master's degree.

CP: Well let's talk a little bit about the work that you did at the reactor at K-State. My notes say neutron activation analysis technician, what does that mean?

JH: I was in charge of doing the chemical—let me step back; one of the uses of a research reactor is that it provides a source of neutrons. When neutrons irradiate materials, any material that exits, those neutrons will be absorbed by those materials and they'll become reactive. You can then look at the gamma radiation that comes off and identify what the composition is of the sample.

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So the classic one is the work that was done on John Kennedy's assassination bullet. Lee Harvey Oswald fired a shot at him, one of the bullets was found on the gurney when Kennedy was actually put into the hospital, and that bullet was provided to a gentleman from California and also a very good friend of mine here at Oregon State, Roman Schmitt. And they used this technique to look at the elemental composition of that bullet and they matched it to the shells that were existing with the rifle that Lee Harvey Oswald had, and that was one of the fundamental science linkages between the two. So that's sort of what I did. But most of the work was geologic in nature; rocks, I got a little bit into astronom—meteorites, things like that as well. So I ran that laboratory for the facility.

CP: That's the first time I've heard that about Schmitt, the connection with the JFK analysis.

JH: Yeah, Roman was with General Atomics in the fifties after it got out of University of Chicago and he helped formulate that particular technique. That technique was also the fundamental analysis technique that was used to look at the iridium concentrations for samples across the globe, and it was those iridium variations that led to the theory that there was an asteroid impact on the earth during the dinosaur ages that led to the extinction of the dinosaurs. But it was that activation analysis technique that Roman Schmitt developed and promulgated. It was his colleagues and him who actually came up with that. So obviously you see I'm a Roman Schmitt fan, so it was a good thing. Of all the scientists I ever met he's the one I found to be my role model. The perfect gentleman.

CP: Interesting. Well it sounds like you're at Kansas State and your undergraduate work is obviously going quite well, and you've developed this association with the reactor. Was that kind of a natural evolution then, just to go into graduate study at that point?

JH: Yeah, my second child was on the way and I needed another, needed to keep my insurance. By that point I'd had, you know, I'd interviewed like everybody else, and I had offers to go many places, and each time I chose to take the stable path and continue working at Kansas State. And when I was going to finish with my master's degree and go take a job, but a friend of mine was having—wanting to take the doctoral prelim examinations and the faculty would not provide them for just one student. It had to be two people taking it. So as a lark I went ahead and started taking the doctoral prelim exams so that he could have a chance to go onto his PhD. And naturally I passed, so then it was like "well, now you've passed the prelims, you might as well get your PhD and you can be reactor supervisor for another few years." So yeah, I stayed.

CP: Well as a master's student you were the reactor operator. What does that mean?

JH: I was in charge of starting up the reactor, doing all the routine maintenance, operating the reactor for clients, that type of thing.

CP: And then you graduated as senior reactor operator.

JH: That's just the next level of responsibility and oversight. Eventually I was qualified for that as well.

CP: Tell me a bit about the research you did as a master's student. I have, "research on coal and coal fly ash."

JH: Yes, I was using the neutron activation technique to look at the elemental composition of the various types of coals, but also looking at the bottom ash that comes out of burning that coal in an electric generator system. And you could say then the net, what's missing between the two, is gone up through the stack, is basically the assumption we were making at the time. Back then Black & Veatch was the prime contractor for the development of Jeffrey Energy Center, which was one of the largest coal fire burning, generating facilities in the Midwest, and Black & Veatch was building on that. So I had an interest because of my time in Black & Veatch, the energy side as well as because of the neutron activation connections.

So we pulled samples from the piles of the coal that they got from, not just Jeffrey's, but every other coal facility in Kansas. They came from a couple of mines, primarily in Wyoming but also some from the east and the Appalachians. And tracking the elemental compositions of the gas, of the coal as it burned. I also pulled filter samples from the environmental monitoring program that was going on around the Jeffrey Energy Center. One of the concerns they had at the time was wind erosion of the coal piles across the adjacent farm fields. At the time, basically what they would do is they'd bring the coal in on trains and they would just simply turn the train upside down and dump it on a conveyor and build a big pile, have that pile ready to be burned, and then the—but while it was in that waiting time, the coal would actually be blown off into the adjacent fields.

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So we were - I was surprised at the mount of heavy metals that were actually becoming airborne as a result of that particulate disbursement across the neighboring and adjoining fields. Obviously everybody'd get all weirded out when you say "uranium is blowing across" but uranium is a very natural element. But it was the other things, the cadmiums and things like that, which were a concern to me. That was what I did for my master's degree. Nobody's talked about that for thirty years, thanks for asking [laughs]. You know, most graduate theses just go in the library and nobody touches them again.

CP: Well, so, and then you made the shift to being a doctoral candidate as a lark, you said, but obviously became serious about it pretty quickly. Could you tell me about the shift that occurred?

JH: Okay. So I started working with, obviously because I was doing the neutron activation stuff, I knew all the instrumentation of the building. And one of the faculty was working on looking at what the energy distribution of beta particles would be. At the time what was happening in the power industry, nuclear power industry, was, as maintenance was being done on power reactors, they would have to depressurize the system and then open the top lid of the reactor vessel in a pressurized water or boiling water reactor, or they'd have to pull one of the pumps out and replaces veins and stuff. At the time, fuel, reactor fuel, would have a certain amount of leakage and failure, so there was radioactive material that would be in the water. Also they learned with time that there are certain bearings and stuff like that actually are from

stainless steel origins that have a high cobalt concentration. So you would have these small particles of cobalt coming out of these maintenance activities. Well these tiny particles could be intensely radioactive, so much so that you could get a very, very significant radiation dose from them. They're called hot particles.

So at the time, the work that was being done was, how do we assess what the radiation risk is for getting these hot particles inadvertently on the skin of a worker while they're doing their job? And if it takes them twenty minutes to do the job and that particle's sitting in the sleeve of their glove, for example, what's the radiation dose going to be in that very localized area? So we began working in that type of question; once that radiation goes from a very tiny particle. Also involved in that is, you need to have an understanding of how much energy is coming off from the sample, and most of that is coming off as beta energy for a skin dose. And so the ability for us to actually measure that energy distribution of those beta particles or electrons was really quite limited. There were lab instruments that could do that but in the field they didn't exist.

So the professor that I worked with, Gale Simons, came up with an idea of using a couple of detectors in combination with each other so that you could know when a beta particle was coming, versus a gamma-ray or a neutron or something else, or an alpha particle. Just a beta particle. And then have a detector that would be sensitive to measuring the energy of that beta particle once it struck. And so from there you could measure the actual energy distribution of the beta particles that are coming off, and then the radiation dose. So we came up with that radiation detector system that I did for my doctoral work.

I'll just jump a few years into the future so we don't have to come back to this, but that led in to another phase of my career when actually here at Oregon State, which is another project that didn't get the light of day. Battelle Pacific Northwest Laboratory picked up the concept and were interested in looking at using that type of detector technology for sensing whether a country is enriching uranium for proliferation uses. So they evolved the technology to where it was a large plate detector. My detector was only about that big around [shapes a circle about three inches in diameter with hands]. This is a much larger plate system but used the same concept, and it was designed to be put on a Humvee. That was one of the vehicles that the Army used at the time to actually move around.

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So when we—we being the United States—decided to move into Iraq in retaliation for them invading Kuwait, one of the things that the United States wanted to know was, was Saddam Hussein actually doing enrichment of uranium? And if you do that type of activity, the products that come off would be distributed around the environment around the facility. So you could drive up to the facility with one of these Humvees - and he refused to let you do an inspection - but if you look at the radiation distribution, at the energy distribution of these beta particles as you move up to the plant, you can determine whether or not proliferation activities were ongoing there or not. Obviously that was all black at the time. No one could talk about it. I didn't get any credit for it or anything, actually, but that was a pretty cool application of my work. So, long story.

CP: Did you do any teaching at K-State?

JH: I did. I taught reactor operations and I taught instrumentation, radiation instrumentation, so I did both of those.

CP: So it sounds like this was very much a program of study that had a real strong applied side to it rather than theoretical.

JH: Right.

CP: You're on the reactor, I assume you're running the reactor for other people's experiments as well, is that true?

JH: That's right. By that point I was reactor supervisor, so I had other people helping me run the reactor, as well.

CP: What was your perspective when you learned of the Chernobyl disaster? You were at K-State at that time, were you not?

JH: Well, it's one of those events that is vague in my memory. At the time I was working on finishing my PhD, at the time I wasn't involved in going to power reactors necessarily. Again, the RBMK type reactors that the Russians had where Chernobyl was built were rare. And I understood the failure pathway, the cause of that accident. I did get more heavily interested in the political repercussions—I almost said fallout—but repercussions of that, actually, when I came here and found out what was happening in the economic world as a result of Chernobyl. But at the time I was like "ah, okay, there's only one of those reactors in the United States that's even close to that method," and the university and the Department of Energy all decided very quickly they didn't need to run that reactor anymore, and they shut it down. So that's basically what I remember of that moment.

CP: Well, you spent eleven years at K-State, and before we move on to Oregon State I'd be interested in getting some broader reflections on that time period of your life and what it meant to you to be there for that long.

JH: It was nice to have a home. That was the longest time I had spent in one place. It was during that time that I defined myself as a Kansan. I was given an opportunity to do things, and the responsibility to do things, at a very young age, which I very much appreciated. It allowed me and many others to grow beyond their potential. I mean, there's no way that I knew going in that that was what I was going to have an opportunity to do with those eleven years. I mean, obviously I came from a moment of failure when I started, you know, my eyes. And after that I was just doing one exciting project after another and had the responsibility to do it and had some great faculty. In hindsight I realized just how great they were, that they trusted me to carry on and kept letting me take the next step and didn't put any walls in my way and didn't judge as to whether this person or that person would be the one that would succeed, but just to let them kind of evolve. And pretty soon you find out everybody can succeed, and that was just an amazing thing that I learned from Kansas State.

CP: Did you have a mentor during this time?

JH: I did, two: Dick Fall, he's now passed away, and Gale Simons, who was my doctoral mentor. And then Ken Shultis was a PhD out at Michigan, worked there. Again, those three guys are just amazing.

CP: Well you came to OSU in 1987; how did this come about?

JH: Well, once you finish your PhD, now what are you going to do? So throughout the years, after I had left Black & Veatch, the people that were there stayed in touch with me, and they very much wanted me to come work for them or whatever. And one of them, in particular, his name is Joe Miller, had moved from Black & Veatch and gone to work at the River Bend Nuclear Facility outside of Baton Rouge, Louisiana. It was the same type of plant that we were working for, for Public Service Company of Oklahoma. He had a lot of expertise there; he was doing a really good job there.

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I applied at a number of places, I don't remember, a dozen offers or something. But my wife and her family had spent some time in Oregon, and actually she was born in Portland while her father was in seminary, and so the family thought that Oregon was always a really great spot in their collective life. And so I happened to see an advertisement in, I think it was Nuclear News, for faculty positions at University of Idaho in Moscow, as well as Oregon State University. So I went ahead an applied to those as well. "Sure, why not?" And I was given a phone interview in both of them, and the position at Oregon State was in thermal hydraulic analysis. It was to basically do what I did for Black & Veatch.

And so I started the interview and discovered that they actually had another need which they hadn't had a chance to get the position out for yet, and that was to be with the reactor facility here at Oregon State. And given my background with our reactor at Kansas State they felt that I fit that also, and very strongly fit that. So in hindsight, what I was told was, during the evaluation process for the position I applied for, the faculty member who was in charge of the reactor facility reached over and grabbed my résumé and pulled it out of the pile and said "he's not in the finalist group, we're going to put him at the reactor."

So that pool, it was great. We were able to hire Dr. José Reyes, and José came to Oregon State to—I actually, because my position that I was given was a twelve-month position, I actually started a month before José, so I try to tell everybody "I'm actually senior to José by a month," but he and I started at the same time.

CP: And he's gone on to make a big splash with NuScale.

JH: He has, he has.

CP: Well, I'm interested to know how OSU's reactor facility compared to what you were used to at Kansas State.

JH: OSU was—it had, well it had Roman Schmitt here, and with Roman came the science credibility, the science analysis work that was focused particularly around NASA. So the workload here at Oregon State was probably three times higher in megawatt hours produced than in Kansas State. The reactor here was also a higher power, about four times higher in its neutron levels than the reactor I had at Kansas State. So it had a larger staff; they had three professional staff plus some academic people associated with the reactor. So it was a larger operation.

CP: Can you say more about the connection with NASA?

JH: In the result of the lunar work when the Apollo missions came back, the samples, those rock samples, were sent to various university laboratories for analysis, geochemical analysis, and some of those rocks came to Oregon State, and Dr. Roman Schmitt had the contracts to do those analyses. So then I came to Oregon State as the senior health physicist in charge of radiation protection for the reactor facility; I was able to be in a position to help Roman as he started winding down his career. Everybody gets to that point. And he needed to return the lunar samples to the archives in Houston, so I went into the safe with him—we had this safe that they had to be kept in—and I was able to package the lunar rocks. So in a way, I got to handle lunar rocks, which is kind of a high point in my life, but that's totally because of the strength of Roman and the reactor that was here.

CP: What do you remember about your initial impressions of the university?

JH: You know, it was...let me answer it this way, because this is a personal reason. It's June, it's June of 1987 and the facility in Louisiana wanted me to come work there. The guy I was working for knew what I did with the Black Fox Station, he knew what we did with design base accident. By that point, the Nuclear Regulatory Commission was aware of that and requiring all boiling water reactors to go back and do a complete reanalysis of the design bases of their reactor. This is a very serious licensing issue, and they wanted me to come down there.

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So I had interviewed, they gave me an offer. We weren't sure we wanted to live there because my wife had horses, so they sent us back down for the second interview and I said "well, okay"—and they said "what would it take to get you to come here?" I said "well I've got my house"—I had bought my house, I'm the first person in my family on either side to buy a house, that's where I came from—and they said "that's fine, we'll buy your house." I said "excuse me?" and they said "we'll just buy your house," like "oh my goodness. Okay, well I have one more interview I agreed to do, and that would be at Oregon State." And so we left St. Francisville, Louisiana outside of Baton Rouge and went to Omaha where my in-laws were living and saw the kids, and the next day flew into Portland, Oregon. And it was June, as I said, so there were no hotels in town, it was commencement. So they decided to put me up at the Inn at Otter Crest on the coast.

And so I've never been to Oregon before and I'm driving down Highway 18 coming from Kansas, and the Van Duzer Corridor and the trees. And it was late in the evening and we got to the coast, and we had this nice little shuttle drive down to the room and it was about 8:30. And I asked my wife "well, you want to just eat here instead of trying to find someplace outside?" because we don't know where we're at. So we went down to the Flying Dutchman restaurant, which if you've not been there, and maybe the audience hasn't been either, it's on this point into the Oregon Coast. And my back was to the ocean, it's about 9:15 in June, so the sun is starting to set and my wife is watching the sun set over my shoulder and we're just talking about what do we want to do, and she made it very clear. She goes, "if you blow this interview, you're divorced." So again, a woman decides my future. So I turned down the job in Louisiana and decided to stay here in Oregon State. So that was my impression of Oregon State.

CP: How about of the university itself and where it was at, at that point?

JH: Then I jumped right into the tenure push, and it doesn't matter where you're at with your tenure push, you've just got to do that stuff. And so Oregon State had the same feel as Kansas State, it's about the same size, the fields that I was working in were the same, so for me it was just a carry on with it kind of - with what I was going for.

CP: You mentioned the tenure push; what were the duties of your initial position? Was it just teaching and research like most...

JH: Yeah, so I had a thirty percent academic appointment and a seventy percent service appointment, which is one of the challenges that I've suffered through in my entire career at Oregon State. So most of my time was spent working with the reactor, maintaining the radiation protection program for a facility of that magnitude. I had a couple of people helping me along with that, and that was wonderful, but I still had to mentor graduate students, teach classes and all that on my thirty percent appointment.

CP: What did it actually mean to be the senior reactor operator and senior health physicist? How does that play out, day to day?

JH: I had the senior reactor operator license, because I already had one, and so it was an easy step to do. As a university facility you would like to have as many SROs as possible, because it takes time to get up to be able to qualify to those exams, so it gives you some defense and depth if people leave or whatever. So it was just sort of, well, I had one before, so I had one here. So I maintained the first few years, just did the minimum operating requirements to keep the license. I wasn't part of the operating - routine operation of the reactor. I was part of the routine process of shipping radioactive material and overseeing that, in charge of the radiation dissymmetry work, to meet with new people coming in who needed to do work with the reactor facility. So I did a lot of that kind of project management work.

CP: How frequently was the reactor in use?

JH: Oh, daily.

CP: And you're shipping material out on a regular basis, as well?

JH: Usually weekly, yeah.

CP: What goes into that? What's the protocol for moving something from Corvallis to points unknown?

JH: It's its own regulatory nightmare. There are people in the United States who are incredibly valuable because they are able to do this well, and I got to know some of them. A guy named David Pratt, Dave Pratt was here - his wife Clara was a faculty member at Oregon State - wonderful gentleman. He eventually retired, but he was very, very good at this type of work. But it's basically, the simple form is the reactor material, the material comes out of the reactor, you make sure it's how much radioactivity you thought it would have, so there wasn't a mistake, and then you seal it inside of a, usually a plastic vile or a can, like a Campbell's soup can. You can actually seal it in that, and you put material around it in case it leaks and absorbs inside the can. You put that inside of a box and then you spend a couple hours filling out all the transportation forms required for the US Department of Transportation, Title 49. And then you call up FedEx and they have their own paperwork which you fill out, and they take the package from here to wherever it needs to go. Most of our work went outside the United States at the time.

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CP: So FedEx is the one moving the material?

JH: They are. They're one of the prime ways of getting material around the world.

CP: Wow. That's interesting. Well we talked about Schmitt, and he obviously was very important to you, made a big impact, but I'm interested in other OSU people who were important to you during those early years.

JH: First and foremost was Art Johnson. Art was the director of the reactor facility, he was the one who hired me, he's the one I worked for. He was a traditional health physicist. He went to school in Missouri in the fifties, went to work for the Atomic Energy Commission, the precursor of the Nuclear Regulatory Commission, and was involved in the early work in the development of the profession of health physics, and you have a chance to see and use the radioactive material licenses of the time. He came here when he was hired by Dr. Chih Wang, who was the gentleman who brought the reactor here, and he had Art as his person in charge of radiation protection. And he hired a guy named John Ringle to be the

reactor administrator, to handle the operational side. And he hired a third guy, Terry Anderson, to be the supervisor of the reactor facility. Terry had been working with operating reactors for the Idaho laboratory.

So that triad are the ones who started up the reactor; when this reactor first started, he came on board. Terry was still here when I became the senior health physicist and John Ringle had gone on to be the associate dean of the Graduate School at the time, and Art had moved up to be director. So obviously I owe my career at Oregon State to Art. We had some exciting times during those first six, seven years. I ended up having to step in onto our analysis side. We had a gentleman who became very ill very quickly, so we needed some help there, some temporary help, so I got back into NAA and doing all that again, and I got to—which I loved—did that as well, so I took on that other duty on top of what I was doing before. But he was unfailing in his support and I found him to be a very organized man, a very precise man for operating a reactor facility. He was not selfish in his view of the world, he encouraged people to continue to grow in their profession, which is what I had come from, so I appreciated that very, very much. And it was a great loss to the university when he decided it was time to retire. So he would be one...I don't know how you want to transition, do you want me to keep going, or you just want to stop?

CP: If there's others that stand out, sure.

JH: Okay. This one, I don't want this one to—I'll just say it: Ed Ray. I got a chance to know Ed over the years, and I've known a number of presidents, not just him. I knew, personally, David Frohnmayer before he passed, I knew him very, very well also. And by far Ed is, I think, the best president that we could ever have at Oregon State. His ability to handle the economic issues of the university, his vision for how to lead us into the future while not dictating what it should be, his willingness to listen to people outside of his little circle of friends - every president has a circle of hanger-on'ers and they can, unfortunately, lead a university down a bad path. And Ed has, I think, been very astute in reaching outside of that pool. So I have immense respect for him and what he's been able to do for this university since he came.

Another person would be Tim White. Tim was provost, actually acting president. I knew him in different modes in my career. But Tim had a way of putting people at ease, which I admired very much. And I also admired his decision-making ability. At that time, there's a time when you get in your career where you can't know everything that's going to happen but a decision has to be made, and many people don't know when that moment happens. And Tim White was one of those few people who had an instinct just to know when a decision had to made. You didn't know whether it was going to be right or wrong, you didn't know what the definitions of right or wrong were going to be; somebody just had to make a decision – "we'll go that way" – and he showed that.

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And it happened during the time that I was in the Graduate School - I was associate dean of the Graduate School - and the graduate students had gone through the process of forming a union on campus. And so I was in that mode of dealing with that, and we had gone through arbitration and it was myself and Ken Krane and a few others, Caroline Kerl, were part of the bargaining team. And our perspective was, as the university, was we wanted to provide this...advantage. Even now I'm very careful in what words I choose. This advantage for our graduate students to stay at Oregon State University. And by providing insurance for them, or an opportunity for health insurance, and how you take that as your goal and work through a labor bargaining process to get to that goal, was eye-opening to me, to learn how to do that. And I had great mentors; again, Tim and Caroline were a couple of the people who helped me understand that.

But when it came down to it and we were in the final phases of bargaining, it was 11:30 at night, and I remember what night it was, it was in the evening, we were over in MU-110 and we came out of the bargaining and Tim White had his—this is when cellphones were new—we had his cellphone number. So I called Tim on his phone and he came over, and he goes "Jack, what do we do?" I said "sign it," and he goes "done." And he went in and signed it. It was that easy. It was like—so from the time of union organization to the time we had a contract was less than fourteen months. That doesn't happen in labor bargaining anywhere in the world. Does not happen. But it happened here because the university was dedicated, that students are important, that the success of the students is so tied to the life that they live when they're here, and we as an institution had the ability to provide a reasonable support for them. And despite all of the rules that we all have to live under, we were able to come together very quickly to provide that benefit, and that was a very exciting time in my life. I think I just realized I got very animated, so that's clear.

CP: Yeah. Well, and I gather probably a pretty unique experience, probably not something you had a lot of experience with before.

JH: And one I don't want to do again. Once I left the Graduate School I had many opportunities to go to other universities for different senior positions, and I went, "you know, I've done enough labor stuff, I'm done with that, I'm not going to do that stuff anymore." So deanships - not interested, you know? Don't want to go to a university that has unionized faculty. You know, when I was asked to lead a unionization effort for faculty here on campus I said "thank you, no thank you, been there, I don't want to do that."

CP: Well, back to the reactor real quick; the reactor had been here for a while, I think, when you'd arrived.

JH: Yes.

CP: But was there ever any sense of pushback from the faculty over the idea of having a reactor or the work that was being done there? Or was it pretty status quo?

JH: There was support from the faculty for the reactor. If you take us back to that time - this is now the early nineties - the way that research reactors at universities were disappearing were primarily because the faculty - the nuclear engineering, nuclear science, nuclear chemistry faculty - weren't utilizing the facility anymore, so there wasn't a group of faculty who had a research need for it. And then, second, you would get a university administrator - usually a vice president for research, is usually the position that would do this - who would come in with an anti-nuclear agenda and they need to make their stamp to make on to their next level of the ladder climb, so they would target a reactor. Because reactors without university faculty support were easy targets at the time, because everybody was against reactors.

So reactors were getting shut down at universities around the United States. Virginia was an example where that happened. The faculty can also get to the point with their own divisiveness to actually use the reactor as a pawn against each other, so a subset of the faculty could go public and say the reactor is unsafe or not being used right or whatever, and they could vote it to be shut down. The university administration then follows up on the faculty demand, because that's what university faculty administers do; "faculty say we have to do this, so we're going to do it," and that happened to University of Washington's reactor.

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So at Oregon State, at that time, we recognized these things, and we meaning—the conversations I'm having now are with José Reyes and Andy Klein. We were of the same generation and we recognized that our futures here at Oregon State were going to be tied strongly to the continued operation of that reactor and other reactors in the state. The power reactor that was here in Oregon at the time was on the block to be shut down, and so we knew that we had a, you know, what's the reason for existing as a Nuclear Engineering department in the northwest?

So we made the decision - the active decision with faculty and me, José and Andy - that we would support the reactor's continued operation, we would broaden its academic use. We encouraged faculty from other departments, obviously Walt Loveland in Nuclear Chemistry, already there; we reached out to Ken Krane in Physics, he came over and helped us. We reached out to Geology, and I won't go through all the names but we broadened with forethought the base of academic use of the reactor. And then we also looked at the longevity of the reactor as well, to make sure that it would outlast our careers. So that was another step we started to take in our little, I guess, at the time we were doing strategic planning, but we didn't realize that's what it was at time, because that wasn't in vogue yet. So back to the question, was the faculty here in strong support for it? The older faculty, the established faculty, and then the next generation, us, decided that it had a future as well and we would support it.

CP: Has the facility changed much over the years?

JH: It has, it has. There was a—with the expansion of, development of the experimental facilities that didn't use radioactive material, these are basically the testing facilities that came about because of Westinghouse investment at Oregon State with José's leadership. And that changed the dynamic of the building. You had the radioactive side and the nonradioactive side of the facility, and the number of people involved in the nonradioactive side became numerically larger than those using radioactive material, so that changes the building in many ways.

CP: Well, in the thirty percent of time that you had available to do research, or maybe less—

JH: No, it's more.

CP: Is it?

JH: You have to remember, a faculty member on tenure push, you've heard, as I know, in a hundred other interviews, it's not you're doing thirty percent here and—you don't turn it off. It's a hundred percent all the time and you don't sleep that first six years, and otherwise you don't succeed. My first department head, Alan Robinson, actually told me that. And this is an example of the change of the culture; his example is that, when he got tenure, it was simply he got a call one day from the dean and said "you're tenured" and he went "oh, thanks," you know. When I was in year two or year three he told me "you've got to tell your wife to quit working"—my wife's a nurse at Good Sam—"because there's no way you're going to get tenure with your wife working. Your wife has to support you." And that was the way it was done at that time. And I said "no, my wife's going to work," and we just charged on, you know. So it was all-encompassing. So what did I do in that thirty percent? Well, I did a hundred percent, so I did all the papers, mentored the graduate students, did the normal tenure push.

CP: A lot of late nights.

JH: And days, I mean they all blend, they all blend.

CP: What were some of the topics that you were exploring as a researcher?

JH: An outgrowth of Chernobyl, going back to that story; as a new professor without a track record, you know, you need graduate students. So the first student who I agreed to take on, who wanted to work with me, was from Kuwait. This is before all the issues there. And he and I worked on using my detector technology to measure the contamination of foodstuffs coming out of the eastern European countries following Chernobyl. The political issue that he brought to me and to my awareness, that was also a technical issue, was that when he left Kuwait to go to college - he went to American University in Cairo, Egypt - and one of the things that he made me aware of was that, in the movement of foodstuffs in the international community, you know, grains would be grown, wheat for example, in Ukraine. And there would be some trace cesium and strontium-90 in those grains, a very low level. But because it was measurable, they weren't admissible to the food chain in western Europe, so France, Germany, et cetera. They just embargoed, you were not going to ship this.

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So you've got all of this foodstuff with measurable but very low levels of reaction material that is a result of the Chernobyl environment. So these grain ships would be loaded with this grain, and they would move along the Black Sea and the Mediterranean Sea, and they'd stop at different ports and see if they could just offload it. And Cairo became a point where they would just offload the grain, because there was no radiation monitoring at all. So they didn't know. So these grain ships would come and they would just offload the grain on the Egyptian market, which then moved to the Arab countries. So he was curious as to how much radioactive material was in that pathway? Is there a health hazard? So he and I started working on that kind of project. I didn't have any funding for it; he says "not a problem." So I became aware of what happens in the Middle Eastern world is "no problem," so the Kuwaiti government funded the work that he was doing. So that's how we got started in kind of looking at environmental radioactive material transport and monitoring, so that's one thing that I did.

CP: And did you stick with that line for a while? Or is it—

JH: Well, for a while. I mean, part of what I had to do was to move with the projects that were aligning with the reactor as well, to keep my sanity. So at this time we, the three of us, we recognized that we all had to do equal amounts of research, teaching and service. Every faculty member had to do that. And at the time it really didn't matter if you were .3 faculty or 1.0, it didn't matter. So in order to survive, Andy Klein took on the teaching mission for the three of us, so he took more than his share of the teaching functions, and then I did the service piece. So when people called up and said "we need a tour of the reactor for a high school team," you know, I did all that kind of stuff, which can be a big time thing. And we helped José buy out and keep his time focused on doing his work in thermal hydraulics, because I felt very strongly that was the future for nuclear research at the time.

And so we kind of, shield isn't quite the right—we just agreed that that's how we would sort of divide things up. So as our elders would do all their stuff, we would just sort of agree to do these this way, and that's just how we divided the work out. I still had to publish, so the publications came as they connected with my daily work with the reactor. Harry Ahn's work, my master student, second master student, was in probabilistic risk assessment; a way of looking at the different types of failure pathways that the reactor could undergo to cause a breach of the reactor cladding, which is what you want to prevent. And we needed that for relicensing of the reactor facility, so I got that going. Another student continued my beta spectroscopy, which led to the expansion of the work of PNNL and eventually the proliferation application of the detector, so that sort of—so I started going in different directions, but I did stay out of the thermal hydraulic area. We hired José to do that.

A couple times I started putting proposals together for Department of Energy, programs in thermal hydraulic analysis, and my department head, Alan Robinson, said "I'm supporting your proposal" and refused to sign it. And so I learned that I have to stay out of that area - I was prevented from going into that area, and that's sort of when I began realizing the ugly side of research.

CP: Well, in '94 you became chair of Radiation Health Physics here at OSU, is that correct?

JH: Yes. Alan Robinson came in one day and he says "you're chair of Radiation Health Physics." I said "what's that?" and he goes "Chair. I mean I don't know, I just appoint you to chair." Well, what was happening was we had Art Johnson and Brian Dodd were the two guys who were maintaining the Health Physics Program. The program was actually being offered through the College of Science at the time, and the College of Science was making a strategic decision to eliminate low enrollment programs, and so with time their senior faculty retired, leaving just these, you know, leaving Art Johnson with his tenure there. So they moved the program over to our department because we had, obviously, a synergy with the courses there, and again this is in the early nineties when enrollment in Nuclear Engineering is dropping, and dropping crazily. So we were needing to also continue to look at what the future of the program would be in a reduced enrollment environment. Bringing in the extra degree program would boost our enrollment and our ability to recruit more people into the department, where they may not be necessarily nuclear engineers but they can still take many of the same courses.

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So it was our collective vision to embrace that Nuclear Engineering and Radiation Health Physics joint department. In order to bring the degree program over from the College of Science we had to do a curricular proposal, a Category I proposal to move that from one college to the other. As the junior faculty member and the health physicist for the reactor I was tagged to write that. So I said okay, and not knowing anything I just did it, and then that's when I got the chair. And the reason I got the chair, I realized later, was because somebody had to go to the floor of the Faculty Senate and stand up to defend their proposal in the event anybody had any questions for it, so that was when I became the chair.

And so I went to the— Kathy Higley was hired by that point, and so we went to the Faculty Senate, and this is where I got to know Ken Krane. Ken Krane was the department head of Physics at the time, and the only statement—it wasn't a question, it was a statement—about our proposal was from Ken Krane. He stood up as a Faculty Senate member and he says "if anyone else wishes to add the name Physics to their program, they have my hearty endorsement." So that was the only question I got with the challenge of moving that degree program over. So the word "chair" was anointed to me by Alan Robinson. It didn't hold the position that most of us think about now as being in charge of an academic unit, but he did give it to me. So it got on my résumé for my promotions because he wanted it there, and so it stayed.

CP: Not a heavy administrative burden though, it doesn't sound like.

JH: Well...in hindsight, knowing what a chair does, I was serving as a chair. It was a low enrollment program, the majority of the graduate students were mine at the time. I think I had like nineteen graduate students at the time. So they were all in that field. Kathy had just come on board, she was beginning to take up some of that slack, so I wouldn't say it was a small administrative function, I was doing my share. More than my share, I guess.

CP: Something else I want to ask you about is, you've been a consultant to a lot of different places, and I'm interested in, specifically, you spent six years consulting for Hewlett Packard, which of course is a strong, or had a strong, presence in Corvallis.

JH: Right.

CP: Still around, but tell me a little bit about that.

JH: One of the things they had in their production process is, the inkjet printer technology was developed here and in Corvallis. And that was the major business line that they had here. And one of the steps in that process was they had to drill very tiny holes through silicone, simplistically, to send the jets of ink through. To drill those holes they had an air system, an air supply system, so you have a very high velocity air stream that you would blow an abrasive along with. Okay, so you would send this stream of abrasive through this silicon wafer and it would bore a small hole through it. And so that was the basic thing.

Well, one of the chemists began looking at the chemical analysis of the specifications of the sand that they were using. The sand had to have some very specific crystalline requirements to be able to drill the hole like they need it, and it's a subset called zircon sand. So they would have requirements of the sand that would also look at the trace elements of the sand, and in the process of doing that she found uranium. Well people, again as I've alluded to before, are always "oh my gosh, it's uranium, it's going to be a health hazard," so she raised the flag that we had this potential radiation hazard for our workers.

So the state of Oregon at the time had gone through a process, gone through an event, where down near the city of Lakeview there were uranium mines during the fifties and sixties. And when you mine uranium, you dig it out of the ground and you set the rate, the low enriched uranium into a tailing, just kind of a pile of waste material, but it has the radioactive decay products of the uranium that have accumulated over all the time that the rock was in the ground. So this pile of soil, basically rock, had a higher radium concentration, which is a daughter product of the uranium decay series.

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So to be able to be able to minimize the impact to the public of that tail, the state of Oregon moved through a process - and this went across the nation - of how do you handle radioactive material that doesn't come about because of reactors? For all reactors, radioactive material is human made, either through reactors or accelerators, and that material is licensed by the nuclear regulatory commission. What about the stuff that isn't? It's natural, but it has radiation levels which hit the thresholds of some of these other legal limits, so how do you handle that? So they promulgated some rules that said that if you have the natural material and you do something to it for a society benefit, maybe a commercial benefit, that you then have to license that natural material. It's called beneficiation.

So as a result of that uranium tailing system, the state law was written so that if you had an industrial process that beneficiated their natural material, then it had to be a licensed process. So Hewlett Packard found themselves in this problem. HP—and I give them great credit, HP corporate at the time, I don't work with them now—but at corporate they were very serious about worker safety, absolutely very serious. And I give them immense credit for that. Even though they knew that technically there was no radiation hazard, they still wanted to make sure they did the right thing. And they didn't know about this beneficiation stuff. I was working with the state on that, as were others. So they brought me in as a consultant to help them through the process of getting a license from the state to actually do this type of work with this zircon sand, which actually came from outside of the United States. It had a uranium concentration in it; very low, but it had a measureable uranium concentration.

And because of this legal position that the state had, they had to have a license to use that material. Along with that license goes radiation worker training, so I had to also provide training for the workers who used these machines, on the radiation risks that they were being exposed to, which were zero, but the license required it. So for a while, I helped them get up to speed on doing that process. Eventually—this is the beginning of PowerPoint, video conferencing, and so I had done the same talk over and over and over again and so I asked, you know, "we can save some time if you just video it." And then I realized that my likeness, because of one of these forms [holds up oral history permissions agreement] I had given up my

likeness. So they continue to use my video to do that licensing, and I don't know where they are now [laughs]. So that was Hewlett Packard.

CP: Were you able to glean a sense of what the environment was like at the Corvallis campus during those years? It was a more vibrant place back then, for sure.

JH: Oh, by far. There was I-5 - there's this corridor down the buildings which went from one building to the next and it was like the hub of communication and people would run around. I was there - because of the nature of the radiation training, I was there all shifts. So I got to know quite a few people that I had met through soccer and other things, and church, and camp, around town. So it was a very exciting time, very exciting place, all those people were proud of what they were doing, they did great quality work, they could see what their product was. It was just a dynamic time. And I don't know what more to say about it; it was a great place to work for all those people. You know, that's when I got to know the campus, that's when I got to know what Building 10 was or Building 11 was, and that, later on, came into my story at Oregon State as well. So I want to leave that so it leads you into that to come back to later.

CP: Okay, I'll make a note of that.

JH: Yeah [laughs].

CP: In the meantime, you talked about what, I'm guessing, was one of the signature experiences of your time as associate dean of the Graduate School, but you were there for four years, is that right? Associate dean?

JH: Yeah, I guess. It's been a while, I hadn't thought about it that way.

CP: How did that come about?

[1:04:55]

JH: Oh, this is going to be touchy. How did it come about is not touchy. You know, the...I had been promoted, I was associate professor and I had enough, you know, I'd done enough now that other universities were interested in seeing if I would come work for them. University of Texas - Austin, a gentleman named Dale Klein, he was vice chancellor for research or something, I don't know what his title was, but he and I knew each other from a reactor when I was at Kansas State. I had actually gotten new fuel for the Kansas State reactor from the University of Texas - Austin reactor, so he became a - I sort of knew who he was at the time and he became aware of my name.

We then crossed paths again at the US Geologic Survey in Denver. They have a reactor similar to the one here at Oregon State and I was involved in doing radiation safety work for them as a consultant. So he was looking for a new reactor director, and it was, I guess, '98. You have my résumé, about '98 or so. So University of Texas called and said, "we'd like you to come down, we'd like to recruit you to come be the director of the facility." I had immense respect for him and, I told you before, it just so happened that I loved Texas as well. I had a great interview there. It was just amazing what they could do; the support for their reactor from very high administration blew away what we had here when we were fighting from down below to survive here. There it was top-down. Texas is a different financial world than we have in Oregon, so that was exciting as well.

John Ringle, senior faculty member in the department, he had been the reactor administrator when Chih Wang started the reactor. He was always one of my mentors. I guess I went to talk about it with him, but he was retiring and knew of the —he was one of the very few that knew about the opportunity in Texas. So he asked if I'd be interested in his position, in becoming more involved with the broader campus than just the reactor. And so the simple story was that, at that time, my wife and I talked about it and I decided to stay at Oregon State and become the associate dean of the Graduate School, working for Tom Marsh, the dean.

CP: Big shift, I'm assuming.

JH: It was. You know, I had been on a very technical path and I enjoyed the reactor very much. It was, you know, to step away from the reactor and to go do something different - I had a very large student group at the time, I mentioned how many master students, because by that point Kathy had been here a few years and Brian Dodd had picked up a few. So

we had a—the Health Physics Program was moving along pretty well. The other thing that we knew we—Andy and I—knew about the future was we had to try to get us, one of us, moving into administration, university administration. We had John Ringle, but at other universities where the reactors were taken down, I guess is the way I would say it, from our world, it happened because of central administration. Somebody from that position made a choice. You needed an advocate in there, and so this was a way to get one of the three of us this point of advocacy for the reactor. And obviously that was a rather naïve way to look at it at the time, but that's how I looked at it, as a way of getting support for the reactor by moving into the Graduate School.

CP: That's really interesting. Well there's an overlap in the dates here I think, but the Space Grant work began in the midst of this in 2000, is that correct?

JH: It did. Andy Klein had been the director of the Space Grant Program during his time as a normal professor before he became a department head, and he was doing that and he needed some help. So I became associate director to help put proposals together and stuff to keep the grant going.

CP: What can you tell us about the pre-history of Space Grant before you were directly involved?

JH: I love this story, because it's another serendipitous story. So Congress established Space Grant in 1988. There was legislation that was sponsored by Lloyd Bentsen of Texas, and Lloyd saw that Land Grant had been a huge success and that Sea Grant had been created in the sixties and was also a huge success, and saw that there was a space for Space Grant as well, to be involved. So the program that he proposed and was voted on by his colleagues created something that had research, teaching and service - the same as the other three - the cognizant agency being NASA, which would make sense. And so the program started at that time.

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The reason I'm smiling is because I got my academy appointment to the Air Force Academy from Lloyd Bentsen when I was in Texas. So for me it was kind of like "wow"; when I became director of Space Grant I went "huh." So I actually got a chance to meet him later. He was also very important in my life in the early nineties because that power reactor I mentioned before in Oregon that had been shut down on political reasons, but really economic reasons, there was a ballot measure. So I got involved in politics. And the utility had hired an outside political advisor to help work to keep the ballot measure from shutting down the facility, so it was Ballot Measure Number 4.

And so they brought this consultant in from the outside, and this is when I learned about politics. I was asked to serve as one of the people they would use in their marketing. Their polling showed that the measure would be defeated or passed based upon the voting demographic of the eighteen to twenty-two year olds in Multnomah County. Didn't matter what happened in the state, it was only that particular group. And they needed somebody with a credible voice to that particular audience, and so they needed, they said, a youthful person with credibility. Professors are ranked high in credibility, I was the youngest professor of nuclear engineering in the nation at the time, and Andy and then José were in there as well. I guess I auditioned; they asked us to come in and we did stuff in front of the video camera.

And so this consultant guy came in, and this is back to Lloyd Bentsen, he says "well, one of the things that I bring to this table is that I was the person who helped Lloyd Bentsen when he was the vice presidential candidate against Dan Quayle." And so he described the tools that they used to help Lloyd prepare for the vice presidential debates, about how it took forever for Bentsen to learn how to unbutton his coat with one button on his right hand, to put his hand in his right pocket. And how it took another day to get him to lean over the podium just precisely to engage with the camera and then to deliver the line "I knew Jack Kennedy, you're no Jack Kennedy." So I learned how to do that kind of technique and how powerful it could be. And so I did my spots for the ballot measure; it was defeated, naturally. [laughs]

But I then saw those techniques being used at an American Nuclear Society meeting in Nashville, Tennessee. The keynote speaker came in and he came down the aisle and there was this crowd of people. And he went up on the front, and I'm sitting with Andy Klein, because he had done this training with me, and we're watching this guy. He's just doing this amazing pro-nuclear talk, which was very rare at the time, even in a nuclear engineering conference, very rare. He was just powerful and we went "wait a minute, he's using the techniques." And we went through, we measured the bullet points he was hitting in time; all the techniques that we were trained to do, this guy was great on it. And I said, "Andy,

this guy's going to be president of the United States." I was wrong, his name was Al Gore, he missed. But it was Lloyd Bentsen and the training that he took from this guy, and that this guy then trained me to understand the power of the tools of the media for moving public persuasion. And so Lloyd Bentsen has been a very important part of my life, and now that he's passed, obviously, it's unfortunate. So that's how Space Grant started, Lloyd Bentsen had passed a law saying "hey, let's have Space Grant."

CP: And how did it arrive at OSU?

JH: The dean of Oceanography called - well, there was a call that came out from NASA to actually establish the Space Grant, so different universities could apply to have the Space Grant. And a faculty member from COAS actually Oceanic and Atmospheric Science applied and got the grant here.

CP: And what is the mission of the program, I guess specific to OSU?

JH: It evolves with time. And this is one of the challenges that I face as the director. There's a common understanding, I think, of what Land Grant is; that it's a partnership between the state and the feds and the local community. That's well established - almost two hundred years or a hundred and fifty years of history there. So that's sort of the benchmark most people come to when they think about either Space Grant or Sea Grant. The Sea Grant was embraced by NOAA, National Oceanic and Atmospheric Sciences Program, and they realized that it actually could serve a research function as well. So they've actually had, I think, an advantage in that their federal agency has seen the value of doing local interest research using the Sea Grant as the vehicle for funding that kind of work. And that work often, in their world, is quite long term, because you just don't do ocean ecosystem work in three months. I mean it takes time.

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So the presence of a Sea Grant to the research realm, it provides that administrative decision-making in NOAA to permit that type of work to be going on. It's also an opportunity to be very locally based. Because they were formed out of the Land Grant organization they also had an understanding of how the system would be administered. So they have - the Sea Grant Extension faculty emulated the Land Grant faculty - so that history came about because of the decision of the NOAA administrators to replicate what the Department of Agriculture had done with Land Grant.

When Space Grant became an entity, NASA didn't ask for it. There wasn't somebody at NASA, a NASA administrator, saying "I want to be like Land Grants," no. I mean this guy from Texas made us have it, so then they said "what are we going to do with it?" Well NASA's organized differently than the Department of Agriculture, or even NOAA, and they have ten very distinct research centers across the nation. Most people know of Kennedy Space Center, Johnson Space Center, JPL. So when they were given this program, they were a very diffuse organization and they were in the beginning phases of the ISS creation, that was going to be their focus. They really didn't have time for another Congressionally mandated program.

So they actually, administratively decided to house it in the Office of Education headquarters. So the Office of Education in NASA then had this program which, by the federal law, is research, teaching and service. But their expertise, by their definition, is through the education realm. So Space Grant has been administered from NASA headquarters to be primarily an education program - not research focused, not outreach focused, but education focused. In the early 1990s when it was here at Oregon State, that was seen primarily to be graduate student research. The program wasn't as well funded as the other two grant programs, but graduate research was seen as the goal, the educational goal of it.

As we move into the late 1990s, there was a turnover in the leadership of that program, and that leadership was actually very strongly tied to Oregon State University. There was a professor, Julius Dash, who was here at Oregon State in the eighties. He did a lot of lunar work. He was a colleague of Roman Schmitt and the Apollo missions. With the downturn of NASA funding after the Apollo missions, his research area was orphaned. So his dean at the time—he told us the story this way—said "you've got to earn your keep, and you're doing research so you've got to start teaching." And Julius, who's just a wonderful guy, and he said to me, he goes "well okay, fine, I'll just earn the most student credit hours possible." So he created a class called Rocks and Stars. And Rocks and Stars was in the lexicon of the campus when I came. It was the most popular class. Everybody took the class, thousands of students had enrolled in it every, you know, it was amazing. Milam Hall was packed out. He did a great job with that.

The faculty then said "well, you know, they're all in there because it's an easy A," and Julius said "no, it's rigorous." And anyway, he just finally got fed up with, just—and that's where I really began to understand what can happen in later phases of a faculty member's career when your research area that you build, due to political realms or reasons, moves a different direction. Then what do you do then? What are you forced to do. If you're forced to do it and you succeed, there's no recognition of that success. Then what do you do? Well, what he chose to do was to apply for a position at NASA in the Office of Education to administer the Space Grant program nationally.

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So Oregon State was very, very instrumental in how the Space Grant program evolved nationwide through the 1990s because of Julius's leadership. And I think they did a phenomenal job with understanding the role of the university in the development of scientists and engineers for the aerospace industry. He made that the vehicle by which Space Grant would have impact for NASA. He also recognized, in his vision, the opportunity for people to move into this path was very constricted. And what I mean by that is, at the time, in order to get into NASA, you had to come from the right school, because all of the NASA decision-makers were hired in the sixties. They were all brand-new, they came from traditional schools and they were all hired from the—it was just growth, so they all came from Caltech, and you know the names. So if you didn't come from those places, you didn't get into NASA, and this is in the early nineties timeframe. And he also recognized—and Julius is one of my mentors in this—is the opportunities for these types of career should not be restricted based upon where you were born and who you are because of your DNA. You are more than that. And he became an advocate for diversifying the student portfolio, diversifying the faces of the people that came into Space Grant, and actually made that part of what we tried to achieve.

So Space Grant within NASA became a strong voice for including other people - other people meaning we still have to stay US citizens, because there are restrictions on the money that we were given by Congress. But we needed to include more women, we needed to provide opportunities for them, we had to look at the pathway which you got from when you're in high school and you're going to go to the Air Force Academy and you fail, what do you do next? Who opens up the opportunity for you? That next step and then the next step, and grows it. It's not a matter of one day you wake up and you're a JPL scientist. No, that doesn't happen. It's this progression. And you can see how I became very excited about his vision for Space Grant, is it often, it gives you an opportunity to bring people who are excited about NASA, because every American's excited about NASA, and how do you bring that into your next step? And if you want to do that, you can keep going and eventually become a NASA engineer or a NASA scientist, or working for one of the contractors. So I became a very early advocate of what Julius was trying to achieve with Space Grant, and I was fortunate enough to be in a position to stay on as the director. That's a very long answer, but I hope you got some of what you wanted out of that.

CP: Yeah. Well you were—so you were helping out for a while and then you became the man in charge at some point.

JH: Yeah.

CP: So tell me about the shift for you at that point.

JH: So I was helping out with Space Grant, Andy was doing that, and I went off and did the Graduate School thing. You know, in university administration there's a time when you have done your work and it's time to go back to be a member of the faculty. And my time came, so I went back to the faculty. And I did that for a while. The associate vice provost for research, Toby Hayes, decided that he needed to move on to other things, so he was going to step down. And I was called by a member of his staff, because they knew of the work that I had done in the Graduate School. Toby and I worked together when I was in the Graduate School. And so I was asked if I would come over to help them for four months as they do the transition from Toby's leadership to the new vice provost for research. I said "well okay, it's April, okay I'll do it for four months, that's fine."

Well, as you can see, it ended up being many years. And so, as my position evolved in the research office - as it took forever to get a permanent replacement - my title changed, as you can see in my résumé. But part of what I helped do in the research office was to be the point of contact for the research centers on campus, and so Hatfield Marine Science Center, Space Grant, the Center for Humanities, they all came through me as the point of contact in the research office. So I got to know all of the—and got to become very involved with what the faculty do when they're associated with these research centers.

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And it was during that time that Toby Hayes gave me a book, it's the history of the American research university, and it's very instrumental in my view of understanding how research institutions like Oregon State and others evolved with time - what their mission has been, and what it continues to change to be, and how that is done. And the research centers are actually the vehicle by which strategic change happens at universities, so it was very exciting then to be involved with the individuals who were not just carrying on the status quo at work, but were actually the game-changers.

So the Linus Pauling Institute was coming to Oregon State and I got involved in bringing that to conclusion. We brought Balz Frei on, for example, to help get that program up and running. We brought the - you know, the collection; I was part of the negotiations to bring here to Oregon State University, because you know the story about Linus's connection to Oregon State. At the research office, I was then able to be in a position to say "okay, what do we need to take the next step?" Because the Pauling family was saying, "well, you guys made a commitment to us for so many faculty member lines that'd be supporting this program and you would build a building for it, and where's this happening? Why isn't this happening?"

So because I was the point of contact, I got some of this suspicion going on. But we were able to move forward on that. "We" collectively; this is not just me, I'm just one of the players in it. And I sat down, I remember, with Balz Frei - and I hope he sees this - and I said "Balz, if you can't raise money with the Pauling name, I don't know what else you could do." So we used the Pauling and we started looking at how we could build a new facility at Oregon State with the emphasis on research. Because it had become clear to us at that time that, to provide bonding authority from the state of Oregon, you had to make a decision where there was an education base or a research base. We also had to be very careful, as we start recovering some of our indirect costs on our research grants, that it be clear what space is defined as research and can be used to optimize the amount of money that we recover from these research grants. Because, basically, universities subsidize research with the federal government; it's not a money-making process. The student tuition dollars, the state dollars, the endowment dollars all subsidize research, because you can't recover all those costs. But you can get closer to it.

So we learned more about that. And so we needed a dedicated research building to optimize the amount of square feet that we had on campus that would be clearly a piece that we could use in our negotiation with the federal government to recover as much of our research indirect costs as possible. So the Linus Pauling Institute was the one that we decided to spend our money on. And I'll always remember sending the email to Balz giving him the authority to spend some funds, which I was fortunate to allocate, to get the architect package done for Pauling Hall. And so that's where you need to put the package together to send out to the donors. So one of the other things that's fun in my life is I walk by Pauling Hall and realize that I played a role in helping that facility get off the ground. You know, a small role, but I had an important role. If I hadn't been in the place where I was doing it, it wouldn't have happened.

So in that role of being involved with the research centers, Space Grant reported to me. Julius Dash was stepping down as the man in charge in NASA and a new person was coming on board. And that new person had a different vision of what NASA Education's expectation was for Space Grants. It was no longer going to be the graduate student-level research, it was going to be more focused on outreach into K-12 to help get further down to inspire kids to go on into college and to provide opportunities at the undergraduate realm. So the de-emphasis of the graduate piece led us to do a transition to the grant at Oregon State, and I had the opportunity to stay with Space Grant as the director and I chose to do that. So that's how it came about; that is, when I left the research office I was director of the Space Grant program.

CP: And that's how it's moving forward now; the emphasis will be on K-12 outreach?

JH: With time, over the little over a decade that I've been in charge of Oregon Space Grant, the national program has moved away from K-12. And in the early 2000s, it was, you couldn't do any work in K-12 because of political changes within the Office of Education at headquarters. So we were then down to undergraduate work. And then, over the last three years, it's even been narrowed even further. So we're to do work in the first two years of the collegiate experience, to focus on activities which provide students a hands-on activity to build something or to get inspired to do aerospace type of work. So we're getting more and more constrained down to working in that particular sphere of influence.

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You know, there's great work to be done there. We in Oregon have been very fortunate to bring, I think, very impactful programs to Oregon's students, and then to find a way to fund those students, so that when the political winds of NASA move away, that those programs continue and grow and nurture and become self-perpetuating. And so I'm going to spend some of my time, if you don't mind, doing a little commercial for what we did. Is that okay?

CP: That's fine.

JH: So in the late nineties, early 2000s, we were looking at Space Grant nationally, and looking at Space Grant here in Oregon, and what can we do to satisfy the needs of headquarters while also making Space Grant relative to the issues of Oregon? The first was to recognize that Space Grant is more than Oregon State. Up to that time, it had been Oregon State, and that wasn't fitting the new paradigm. It had to be broader. So I actually, with my new staff, we engaged our affiliate representatives across the state to be part of the Space Grant organizations in a substantive way. So that's when University of Oregon and Portland State and others - Oregon Tech, Southern Oregon University, Eastern - all became very active and involved in what we were doing.

The other thing that was clear to us as we pulled that group together, was that the way that we were going to impact the number of students coming out of high school into college in Oregon—because remember, this is the focus of NASA Education at the time, was K-12 to college—was to use the excitement about International Space Station, to use the excitement of some of the missions that were coming up to Mars. And that was the beginning of what was happening at the time. And part of what happens - to do those types of robotic missions was to get students involved in that kind of technology. There was no robotics program at Oregon State or any of the other institutions in the state of Oregon; it didn't exist. If you wanted to become involved with NASA missions going to Mars or whatever, you had to go to Carnegie Mellon, they were the place that you went to get your robotic experience to work on missions, or you went to JPL. That was the way you got in. You couldn't get in any other way.

There was a new program that grew out in New Hampshire, it was called FIRST Robotics. It was a program that, a guy had the vision - his name's Kamen - that you could provide excitement to high school students who do robotics the same way that they could have excitement about sports. Their families could be just as engaged with building a competition for robots attacking each other or working together, as you could about a football team. So I was PI on the grant, we got $300,000 to bring that program to Oregon. At the time there was one robotics team in Oregon, it was in Philomath, and it was led by HP engineers. These are people who were technically very confident, high on the—just great people.

And so we had that one moment, one group, and I had $300,000 in my pocket. And so we formed thirteen other teams and began a push to help students realize, in junior and senior year in high school, that you could build robots. And that you could use these new pieces of software and hardware coming out of the toy industry, specifically the Lego field, and use those Lego machines to actually manipulate these machines, these bigger hardware. So the competition was a good way for students to be collaborative in learning, to be driven to study in high school, to actually learn how these softwares work, or why does the gear ratio have to be what it is, those types of things. You know, you learn algebra and you learn differential equations not because you're doing it in class, but because it's part of what you're building.

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So that one turned out to be quite successful and we were able to get those teams moving. They had immediate success, immediate success. And we didn't have any corporate buy-in yet, so Space Grant was able to help those first few teams to get to the regional and the national competitions of the qualified four. They got a lot of attention and as time went along what was happening at Oregon was noticed by the Oregon University System. And a guy named Schafer, who was a vice—or a chancellor, saw that as a vehicle that the state of Oregon needs to get behind. So the FIRST Robotics is high school and under his leadership, the Oregon University System began sponsoring the Lego robotics programs, which is at the four, five, six, seventh grade year level, to get kids involved. So at a very early age. And they put a significant amount of—in my world—significant amount of money into those programs through the early 2000s. And there was a time when Oregon had the highest enrollment of middle school kids in that robotics program nationwide, even including the high-population states like California, Florida and Michigan.

But I give him credit. I give the credit to the vision of the Oregon University System to invest their dollars at a time when students most likely leave the sciences, leave the technology fields, and go into something else and make the decision

that they can't do this. So it was a partnership, in a way, that took care of these two moments at the same time. So we got the programs going at the high school level, so when these kids began moving up the pipeline they have these programs established. Oregon's success rate was so high that we were able to move the regional competition in the northwest from Seattle, out of Boeing's backyard, to Portland, Oregon. And we managed that program for a number of years. My grant was for a three year period of time; I had to make it sustainable by that deadline.

We had corporate and education partners at that point, and I learned how to work in that realm to get others to take on a program that's successful and to make it sustainable in the long-term. And I use that as an argument when I go back to Washington every spring to report back on what NASA Space Grant's done in Oregon, is that NASA has this incredible ability to inspire people to be curious, to engage them with their curiosity, to then accidentally begin educating them, and then pretty soon they're employed by NASA. And so that experience has helped us focus the strategic vision for Space Grant in Oregon over the last fifteen years as a way of using NASA funding to basically serve as the venture capitalist in these kind of education realm things and begin moving it on.

The story we're at right now - when I began the work with FIRST Robotics, there was no robotics program at Oregon State, there was no program at Portland State's College of Engineering, nor at Oregon Tech, it didn't exist. When I approached the leadership of those colleges to do this, they saw no future in robotics. They had their strategic visions; "don't bother me," so they didn't want us to be involved. So fine, I went on without them. The turning point in my world was when we sponsored a university team from Oregon State which was primarily made up of these first generation FIRST Robotics kids who had decided to come to Oregon State for their education, versus going to Carnegie Mellon. And they built a rover that was competing in a Mars competition, a Mars rover competition in Utah.

And these kids are just phenomenal in their ability to do proper PR. They partnered with their friends on the football team, and the Oregon State football team laid out on the 50 yard line, and they drove their rover across all these guys just to show how the footprint and all that. That was amazing for an engineer, you know, to tell these big husky guys "this machine is going to crawl over you, but it's only going to offer you so many pounds per square inch, you aren't really going to feel it." And they don't know that because they're not engineers, but the engineers love that. But it was an amazing moment of PR because then the College of Engineering dean and the other administrators under them started to see the advantage. I then saw what we were hoping to have happen, is the students were coming forward from underneath saying "we want this academic program, can you help us get there?" and we began seeing strategic hires in this field.

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Jonathan Hurst of Mechanical Engineering was the first, and there's many others since then. And I admire the Oregon State College of Engineering embracing this particular type of program, because it's that outgrowth that allowed students to move into significant positions in the new aerospace of the nation, and that's been exciting to me, obviously. I'm going to let you offer the question to say how that's happened, but that's sort of what's happened for Space Grant, is we provide an opportunity for young people to get engaged early in their careers, to stay in Oregon and get their degree, to provide them an opportunity to get their graduate degree elsewhere - because that's basically what they have to do - and then hopefully they'll come back to Oregon and be part of our infrastructure.

CP: Is now the time to ask about Buildings 10 and 11?

JH: [Laughs] okay. Building 10. I'm in the research office, I get this call that the presidential candidate for - right now on the governor's side, on the Republican side - she made a decision on how to—on what the future of HP would be, and it didn't involve the Corvallis campus. And so they were needing to downsize some of their hardware, their buildings. So Oregon State was approached to see if we'd be willing to take—whether we could utilize HP Building 10 as part of what the university's mission would be. Remember a few moments ago, I talked about how we were looking at cataloging the research square footage on campus to assist ourselves in the negotiation for overhead recovery.

So having the entire footprint of Building 10 - and I don't know if I was the only one who had been in Building 10, but I know I was the only one who really understood in that cabinet meeting of what building 10 meant, when we were talking about it at the president's cabinet a little. I said "well that number of square footage is very significant, we could probably do something with this." "Who do we put there?" "Well, we don't put anybody there," but we made the argument that the research centers are the catalysts for new growth in our strategic vision and change in the university. And by using

that particular facility, we could actually provide the locus of intellectual excitement that would bring new research opportunities.

And so, I just drew a blank on his name - Drost, Kevin Drost in Mechanical Engineering had come to us and was working with Pacific Northwest Laboratories on small-scale energy projects, things like cooling for soldiers uniforms, that type of thing, microscale kind of cooling. And we thought well, that would be a good place for faculty associated with that partnership with PNNL to have a home separate from the college, because to be honest, within the college, research space is pretty much divvied up by departments and by seniority within the department, and trying to carve out enough to really do something substantive with research line faculties. Kevin wasn't a tenured professor. I hope this is okay on a public format, I just realized what I said. But Building 10 was neutral ground, it was neutral ground. It was brand-new, it had nothing in it except it was a warm and safe space.

So we moved MECS out there; that was the center at the time. And they began doing their work and it began to grow, and I don't know where—I remember Ron Adams started using the ONAMI acronym, and that started. And I give Ron Adams all the credit for the partnership with University of Oregon and selling that program as a collaborative research venue, and it began to grow there. My own friend José Reyes was beginning to have some success and was becoming space limited and I said "Building 10." So he and others went to the appropriate people at the time and NuScale is at Building 10 now. So just this last month or so ago, I found out we've got Building 11 now too. So we continue to expand our research footprint as HP moves to other realms of the world. We still have the advantage of what HP built here to help Oregon State.

[1:45:02]

CP: Well just a couple more questions for you. I want to ask what your experience was as president of the Faculty Senate in 2011 and 12.

JH: I was asked the question in the last meeting of the Faculty Senate what my experience was, and I - at the time it was not a good experience. And I don't think that the audience at the time really understood why I said that. It wasn't that—it had to do with the point in time when I personally had - during that twelve month, fifteen month period - I had to make a decision whether I would do what was good for the Faculty Senate and what was good for Oregon State, or I would do what was good for Jack Higginbotham personally. And my advisors at the time saw it as a very clear decision - because they knew of me and they knew what my values were - that it would be for the university, it would be for the Senate and I would put myself secondary. But it was hard to stand there in public view as I worked to the benefit of the faculty, because that was my focus, the faculty benefit.

As I worked for collaboration with President Ray and Sabah Randhawa and Mark McCambridge and the leaders of Oregon State University and with the "deanery,"—is the word I learned from when I was in the Graduate School, they call themselves the deanery, the deans of the campus—and worked as we tried to help facilitate strategic change on campus. Because the reality we all understood was that the funding for the university was changing and had been changing nationwide for about twenty years, and we needed to recognize that and be ahead of that. And I credit Mr. Ray for helping us understand that and to work towards that. But you can't bring all of the faculty along, and definitely can't bring the students along, as you're doing that kind of change.

So while I said publically it was not a good experience, it was actually one of the most influential times that I had on campus, to be able to help facilitate that change to the betterment of the faculty. So you'll see things now that have come out of that time where we began the push to have faculty positions - and this includes the professional faculty as well as the tenure line faculty - be evaluated on the fundamentals of their position description. That you can't expect somebody to perform at some arbitrary level when you've defined a position description that says something else, and you can see why that's important to me. So we were able to do that.

We also found that there were areas where it was difficult to determine whether people were being paid for similar work, and I credit our partners in Athletics to help us understand that, and specifically Anne Gillies and Becky Warner and people like that who helped us begin the process of looking at the position descriptions campus-wide. Because before, they had all been through the different units. So how do you have this way of comparing one to another with the different

bases of the formations? So we did this leader—began this leadership evaluation of positions across campus so that we could start addressing some of the inequities.

And what I remember very specifically in a Faculty Senate meeting, Executive Committee of the Faculty Senate, was when the first round of evaluations came about from that process—and again Athletics chose to go first in this process—we actually, to my huge surprise, found out that the male employees in Athletics, in those job categories, were actually being underpaid relative to the female employees. Huge surprise to me. I had gone into this, as everyone has, your own personal bias that it would be the other way, and it wasn't. And to the credit of Athletics, they made a commitment to equalize; no matter how that came out, they would equalize. Equalization occurred. And then as that process was formed, it then went across campus. And my term of Faculty Senate leadership then expired, but it's my understanding that those kind of corrections began to happen throughout the various colleges across campus.

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So when I talk about the Faculty Senate wasn't a very fun time for me, it wasn't because I wasn't having impact; we had huge impact, great things, great partners that we were able to work together with. But I had to make sure that what was happening to me on the outside, to the personal Jack Higginbotham, didn't affect what happened on the inside. And I know the people in the Executive Committee of the Faculty Senate who lived that time with me know that, and I know the university administration recognized that as well, while they had a very difficult time also. So my time as Faculty Senate president was, it's one of mixed feelings, mixed times. My conscious is totally clear, I did the right thing. I know that the words that I said gave us the four percent raise, I know that happened, but I had to endure a lot of other things, and that's part of where I live now.

CP: Well the last thing I want to ask is a question that we've been asking everybody, and that's just to give their sense of where OSU is at right now as it's heading towards its 150th birthday.

JH: I think we're on the cusp of change. We have had - obviously you know my feeling - very strong and powerful leadership for the last decade. But again, times change, and there will be a time when that will shift. Some of the new people that are new administrators that are coming on board will have enough time to get their feet on the ground to help lead that change into the future. And so their own personal biases and strengths and vision will be a part of this story.

What we become as a university is going to be, I think, more globally focused, by necessity. Our faculty are international faculty now. It's very rare that we're going to be hiring our own American citizens as faculty anymore, so we're going to have an internationalized faculty and we're increasingly reliant on the international population to fund our university. So we're going to have to address the needs of that particular student body in the same way we did robotics in my small little world. Our international students and their challenges from their countries and their societies are going to drive what we're going to need to do here at Oregon State.

The time of Oregon State being defined as the Land Grant school of the geographic boundaries of Oregon are limited, in my opinion. I think we have sufficient strength, research and educational strength, to take on that global mission, and I think that whoever the president is after Ed Ray will be the linchpin in that process. That person will be able to hopefully embrace that vision and will lead us into that new global economic and educational powerhouse. Or not.

And I guess the last thing I would like to leave is evidence of my statement. There was a time a few years ago, about ten years ago, when the Premier of China came to the United States to visit with the president. But he didn't visit with the president first; he flew to Seattle and met with Bill Gates first, then he went to talk to the president. But with him came a gentleman who was the vice president for research at Tsinghua University in China. The audience may not know what this institution is, but as a matter of introducing them to this school, I'll share with you what I told this gentleman. I met with him because I was associate dean of the Graduate School and there's this hierarchy of like people meeting like positions. So I was the one who was to meet with him.

He didn't speak English so I had to work through an interpreter, but when he came in I asked him why is he coming to Oregon State? "You lead the MIT of China, you produce the best of the world, there's no doubt in my mind that you do that. Oregon State is not the MIT of the United States; why are you here? What can I do to help you? What is your goal for talking to me?" And he said something that was very profound to me, he said "thank you for"—he was very

gracious about comparing them to MIT and he acknowledged that they do feel they are an equal to MIT. He said the problem they're faced with is that, as their economy grows, as their technology grows, the gap that they are finding in their workforce is the line engineer. The engineers who work to get the job done, who are the genesis of the true innovation of a society. That particular group of people are not educated in the same way or driven by the same goals and aspirations as are the students who come out of an MIT or a Tsinghua who become the faculty of a certain place.

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These people are the backbone of the growth of engineering and the backbone of the growth of an economic powerhouse. "We know Oregon State, specifically the College of Engineering, has been able to do this well and successfully for almost three decades. We want to know what you're doing here at Oregon State to make that type of employee possible."

Then we talked about what NASA is doing, what Space Grant's doing and FIRST Robotics and those types of activities. So that, I think, is the future of Oregon, is it's global, it's satisfying the educational economic needs of China, irrespective of the political things that happen. Those things come and go but the individual relationships that we've developed as we cross-pollinate across these borders I think are key, and Oregon State is positioned to take advantage of that, and I hope the next president will lead us into that realm.

CP: Well thanks Jack, this has been terrific, I really appreciate it—

JH: Thank you.

CP: And best of luck with everything going forward.

JH: Thank you.

[1:56:51]