THE DEPARTMENT OF ENERGY ORAL HISTORY PRESENTATION PROGRAM

OAK RIDGE, TENNESSEE

AN INTERVIEW WITH JOHN E. BIGELOW

FOR THE OAK RIDGE NATIONAL LABORATORY ORAL HISTORY PROJECT

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STOW: Today, we're going to be talking with John Bigelow. John came here many years ago to get heavily involved with the transuranic program. He was a cornerstone in the development of transuranic processes for target materials and other activities here. He has a lot of good stories to tell about those years in the transuranic program. John, how did you get started in chemical engineering? Was there a particular person or event that got you interested in that?

BIGELOW: Well, I got into chemical engineering when I went to Purdue for undergraduate school. I went to Purdue because of my admiration for my elder brother, who also went to Purdue.

STOW: All right.

BIGELOW: But, he was a mechanical engineer, so I think I got into chemical engineering because of a professor who gave a lecture to all of the engineering students. From what he said, he basically reinforced my interest in chemistry and chemical engineering. So that was my curriculum at Purdue. And, then my dad said, "If you can get into MIT, I'll send you." (laughter)

STOW: And, you did it too, didn't you?

BIGELOW: I did, and he sent me. I was there quite a while, and toward the end, I was a researcher who was paid by the Department of Energy.

STOW: Okay. Well, there have been a number of other MIT graduates that have come here to the Laboratory.

BIGELOW: Yes, I know that.

STOW: Did you overlap with any of them while you were there?

BIGELOW: I don't think so. Or, at least I didn’t know them at the time.

STOW: Okay. So, you got your advanced degree in chemical engineering at MIT.

BIGELOW: Yes.

STOW: And, then, did you come directly to the Laboratory at that time?

BIGELOW: I got into a group known as the MIT Practice School.

STOW: That's right.

BIGELOW: The Practice School at that time was sited at K-25.

STOW: Okay.

BIGELOW: Although at a later date when I was here, the Practice School staff moved the offices here to ORNL.

STOW: That's right. It was still here when I came in 1980.

BIGELOW: And, it was a good thing -- the Practice School. I was asked a couple of times to supply problems [for the MIT students to solve]. And, on one of those occasions, I did supply a problem.

STOW: Yes.

BIGELOW: And, I got some good work from the students. But, I just got too darned busy to do that routinely.

STOW: What year did you start at the MIT Practice School?

BIGELOW: In 1971 I first arrived with the Practice School. There were six of us in that particular group. We had relatively little to do with ORNL. We were sited at K-25 and most of our problems dealt with K-25 activities.

STOW: All right.

BIGELOW: At the Practice School office, there was a pretty good size room, which could be used for chemical engineering experiments.

STOW: Well, what year did you actually come to the Oak Ridge vicinity?

BIGELOW: It was 1971. Incidentally, my older brother took a position here in the medical staff several years before that.

STOW: All right.

BIGELOW: My mother and I came down and visited him once or twice. His presence here was one of the reasons I got into the Practice School, because my dad was very good at reading catalogs. He said, "I see they have a Practice School in Oak Ridge. Why don't you look into that?" So I did. And, actually the location of the school here reinforced my interest in chemical engineering. especially radiochemical engineering.

STOW: I was going to say, your work here has been with transuranic elements, for the most part.

BIGELOW: Yes.

STOW: Is that an interest that developed during graduate school in any way?

BIGELOW: Well, yeah. After I returned to MIT and finished my Ph.D. work, a program developed in the Atomic Energy Commission for production of transuranium elements. That program sparked my interest, which continued throughout my career. However, some of the various positions I held here did not involve transuranium elements.

STOW: What was your first job at the Practice School here?

BIGELOW: Well, we didn't really have a job -- we had projects or problems. I don't specifically recall what all these problems were. But I remember one of them involved an ORNL staff member, who had devised an idea for how to reduce the volume of radioactive waste by crystallizing out the sodium nitrate, which takes up space and is not radioactive.

STOW: Sure.

BIGELOW: One of the problems I had was to do a paper study, using physical-chemical parameters that we could get from the literature and his paper as a guide. Our approach was to calculate the amount of money that would be saved [by sodium nitrate crystallization]. It turned out it wasn't very much.

STOW: Do you remember who it was that you worked with at the time?

BIGELOW: Well, I worked with the other fellows in the Practice School group. Erwin Higgins was the staff member who made this suggestion.

STOW: Okay. But then, when did your work actually start on transuranic chemistry?

BIGELOW: Not till I came back to Oak Ridge after getting my Ph.D. at MIT. Even then, when I first came back, I did not work in transuranics, but it interested me. I got into it solely by working in Building 4507. A small-scale facility was built there to make curium-242 for the military to use in the same way plutonium-238 is used now -- to generate heat to create electric power in satellites and space probes.

STOW: Let's step back and look at the entire Transuranic Program here. What can you tell us about the origin of the Transuranic Program, your involvement in it, and the importance of it?

BIGELOW: Okay. Well, it turns out that for awhile, I worked for the Atomic Energy Commission. I was in there at the time the staff of the AEC Division of Research decided that they were interested in transuranium elements as a new large field of inquiry that wasn't possible before. There were surely a lot of interesting things that could be done. I was up in Germantown when the program began.

STOW: And, this would have been what year?

BIGELOW: Oh, golly... Well, it was in the mid '70s. I'm not sure exactly what year. The Division of Research saw this as an opening field and felt that it was well worth supporting. And they organized it quite well, I think. They got together a group of staff members from the various laboratories. Besides ORNL, there was Berkeley, Livermore, Los Alamos, and Brookhaven. Basically, all of the national laboratories were involved.

STOW: All right. So, we had representatives from the various AEC national labs.

BIGELOW: Each laboratory nominated a senior staff member and formed what was called the Transuranium Program Committee, later called the Transplutonium Program Committee.

STOW: Okay.

BIGELOW: This group would meet periodically -- initially, twice a year, and in later years, once a year. And finally, it just disbanded. The program was laid out with the aid of this committee, and it was necessary to irradiate plutonium initially [to make transplutonium elements].

STOW: Yes.

BIGELOW: This was done at Savannah River, which has large reactors. A substantial amount of plutonium -- I think it was about twenty-five kilograms – was irradiated, not all at once, but in a series of irradiations. They sent those irradiated plutonium targets to us.

STOW: Yes.

BIGELOW: By this time, we had the Transuranium Facility operating. And, we processed the plutonium to recover the curium-244.

STOW: All right.

BIGELOW: The curium, in turn, was irradiated in the High Flux Isotope Reactor. This reactor was specifically designed for that purpose. That's why the Transuranium Processing Plant [TRU Facility] was built right beside it. I'm glad it was because we got a lot of flak in later years about transporting these materials.

STOW: Okay. I understand.

BIGELOW: But, we said, "Heck, it's seventy-five yards from their door to ours." And, both buildings are inside of a fenced area.

STOW: Yes.

BIGELOW: So, we felt they were being unduly strict over safety issues in the things they requested of us. That was later. In the early years, it was reasonable. I won't say that we were doing anything we considered unsafe, nor [was] the reactor considered unsafe.

STOW: Well, the standards have changed a lot over the years.

BIGELOW: They sure have.

STOW: I mean, it's gotten really stringent today, to say the least.

BIGELOW: Yes.

STOW: You mentioned Savannah River Lab. What was our relationship with Savannah River at the time?

BIGELOW: Very close, actually. SRL converted the plutonium into curium. But, they did not have the processing capability for recovering the curium by separating it from the plutonium.

STOW: Okay.

BIGELOW: So, those assemblies were sent to us at the TRU facility. And, we carried out that step. Plutonium, at this time, was a small portion of what we started with. I guess ORNL was allowed to keep it. We did not keep it in our facility. The plutonium-239 we had was not weapons-grade plutonium.

STOW: Okay.

BIGELOW: It had a lot of the heavier isotopes in it, such as 240 and 241.And one of the plutonium isotopes that the research people thought was pretty good was plutonium-244, which is very difficult to come by.

STOW: What's the half-life of 244?

BIGELOW: It's the longest-lived plutonium isotope.

STOW: Oh, is that the one with a half-life of 24,000 years?

BIGELOW: Something like that. It’s an isotope in big demand, because it's not very radioactive.

STOW: Sure.

BIGELOW: And, you can do chemistry or metallurgy or whatever you want with it, with little effort to keep [what you make] from being irradiated.

STOW: Okay.

BIGELOW: So, we separated the curium from the plutonium, and the curium was put into the HFIR, which was specially designed to irradiate curium targets. The targets were designed and fabricated in the TRU Facility and sent over to the reactor. Now, because HFIR was a high-flux reactor, what you put into it required a lot of very careful consideration.

STOW: Sure.

BIGELOW: So, it fell on my shoulders to examine the isotopic composition of the curium, determine how much we could put onto one target, and oversee the target fabrication in our building to make sure the workers did what they were supposed to. And, it worked pretty well.

STOW: Now, you haven't mentioned californium.

BIGELOW: No.

STOW: Can you tell us about the struggle to get good target material, and so on?

BIGELOW: Yes. The californium program had to be built up. The initial irradiation of curium produced modest amounts of californium. When irradiated, the heavier isotopes of curium produced californium at a higher rate [than the lighter ones]. We separated out the californium produced in hot cells at the TRU Facility. As the targets were recycled over and over, the amount of californium grew each time. Later, we decided it would be nice to have another facility where we could produce californium.

STOW: Yes, all right.

BIGELOW: So, we managed to get some money and upgrade a portion of Building 7930, which has been known as TURF from the beginning. TURF stood for Thorium-Uranium Recycle Facility.

STOW: Okay.

BIGELOW: TURF was a program that was originally assigned to that building but was never really carried out.

STOW: What are the uses of californium and some of the other transuranic isotopes? Can you enlighten us on that?

BIGELOW: Well, yes. Except for californium, the uses [of transuranic isotopes] are primarily for research.

STOW: All right.

BIGELOW: The chemical properties of each of these various elements were of great interest to scientists who develop theories of atomic structure. That was over my head. The chemical engineering ...

STOW: I was going to say ... this is getting a long ways from chemical engineering, isn't it?

BIGELOW: Right. But, in the TURF building, we built a californium facility, which is currently in use. And, we transferred californium recovered in 7920 to 7930 by means of a pneumatic tube, like the banks use [for accepting deposit checks and transferring cash to customers]. The problem was that the tube was a one-inch stainless steel pipe that was welded, so there weren't any seams in it. And, as a precaution, we sent a dummy through every time before we'd send a californium-loaded rabbit. We had no problems through the years.

STOW: What's the purpose? What are the uses for the californium?

BIGELOW: Californium-252 has a fairly short half-life, two and-a-half years roughly. It is primarily noted for its neutron emission. It spontaneously fissions and provides a fairly high flux of neutrons. So, the main use of californium -- other than for a small amount for research -- is as a neutron emitter.

STOW: All right.

BIGELOW: And, the reason that neutron emitters are of interest is that neutrons will strike an atom and render it radioactive, so it gives off gamma rays.

STOW: Sure.

BIGELOW: And then, you can identify that atom by the nature of its gamma ray emission. Neutron emitters have an incredible number of applications. Some of the more interesting ones are for one of our main customers for californium. He actually buys a fairly small amount of it. We sell it to them in needles about two inches long -- three or four of those in a package ...

STOW: Yes.

BIGELOW: We put the californium in a big shipping container and ship it up to the Frontier Technology Company in Xenia, Ohio.

STOW: Yes.

BIGELOW: Xenia is best remembered for a big tornado that went through there a few years ago.

STOW: I remember that name, now that you mention it. Yes.

BIGELOW: But, the city founders gave [Frontier Technology] a subsidy to build this facility.

STOW: All right.

BIGELOW: And, they buy the californium needles that we provide. They're a paying customer.

STOW: Okay.

BIGELOW: The californium sent to DOE facilities is loaned from us, and they can return it when they're through with it. They pay only transportation costs.

STOW: Just transportation? And, what do they actually do with the californium?

BIGELOW: Well, they do the same thing, basically, as I'm about to describe.

STOW: Okay.

BIGELOW: They use the neutrons to irradiate materials and identify the materials, based on their characteristic gamma emissions.

STOW: It's the neutron activation time process.

BIGELOW: Precisely. It's neutron activation. Neutron activation can be carried out by other sources of neutrons. But, our samples of californium are convenient because they can borrow them from us ...

STOW: Okay.

BIGELOW: And two DOE labs, Hanford and the Pacific Northwest National Laboratory (PNL) operate a pretty large system that uses californium. They routinely replace their californium sample with a fresh sample about every eighteen months to two years.

STOW: When about half of it's gone, or so.

BIGELOW: Yes. Now, going back to Frontier Technology in Xenia, Ohio, they take our little, tiny needles and put them in their hot cell, which is equipped to handle up to ten milligrams.

STOW: Yes.

BIGELOW: And they have precision equipment that can shave off a piece of that needle crosswise along with the californium in it. It's a cross section.

STOW: Okay.

BIGELOW: That way they get a little piece of californium that they put in a needle-type source of their own ...

STOW: Yes.

BIGELOW: And they're responsible for the testing and the purity of the sample -- the amount of material in it, and so forth. And then, they sell it to their customers. And, the price per gram of californium gets pretty high.

STOW: I guess it goes higher every time.

BIGELOW: Their customers build neutron activation analysis systems, frequently in a mode of continuous throughput. For instance, if you had a cement plant and you wanted to determine the [relative portions] of lime and silicone or sand in the mixture, you can put the mixture on a conveyor belt. As the conveyor belt runs along, an instrument underneath it ...

STOW: Gives you a continuous reading.

BIGELOW: Right. It'll continuously tell you how much sand, sulfur or whatever you've put in there.

STOW: So then, what we're saying is that technologies developed here at ORNL have really multiple uses out there in industry.

BIGELOW: That's right. And, they have something on the order of 150 units like this worldwide that are based on ORNL californium.

STOW: In the mid 1970s, we transitioned from the Atomic Energy Commission to ERDA to DOE ...

BIGELOW: Right.

STOW: What were some of the results of that transition from one organization to the other? Did that impact the Transuranium Program here in any way -- positively or negatively?

BIGELOW: I think it did, really. But the Department of Energy, or, for that matter, ERDA, continued to allow us to make californium and sell it or loan it. So, in a sense, there was relatively little impact. But, the Department of Energy feels that they have to do things their way, and I can't blame them.

STOW: Yes.

BIGELOW: But, it does introduce ripples into what we do.

STOW: Well now, is there anything we need to go into about HFIR and the design and construction of HFIR and its relationship to the Transuranium Program?

BIGELOW: We might mention that. The HFIR, for some time, was the highest flux reactor in the world, long before the SNS was thought of.

STOW: Sure.

BIGELOW: HFIR is used for neutron scattering experiments. And, the necessary equipment was designed into the reactor. This included shielded devices that receive a beam of neutrons and then have instrumentation to scatter these neutrons. Then outside of or along a path, one way or the other, detectors measure [the scattering of the neutrons].

STOW: Okay.

BIGELOW: And, in fact, the initial neutron scattering experiments were done at the Graphite Reactor.

STOW. That's right.

BIGELOW: But, that's a pretty weak source. And, the Solid State Division, which controlled [neutron scattering studies of materials], really jumped at the chance to use the High Flux Isotope Reactor [with its] much larger flux of neutrons. But, of course, as you know, the SNS is going to make that look like a toy.

STOW: Yes. But, that's kind of the ultimate in our neutron science work that's gone on here over the years.

BIGELOW: Right, right.

STOW: You haven't mentioned, with one or two exceptions, coworkers and other people you worked with who contributed to your career, and so on. Does anybody come to mind?

BIGELOW: Oh, yes. First, when I came here as a permanent employee, Floyd Culler was the division director, and I had the utmost respect for Floyd. He knew his job and did it very well.

STOW: Yes.

BIGELOW: Yeah. After Alvin Weinberg left, Floyd was made acting Lab director.

STOW: Yes.

BIGELOW: But, only acting. We always figured it was because he only had a bachelor's degree.

STOW: Okay.

BIGELOW: But, I think his grasp of what went on at ORNL far more than compensated for a lack of a degree. He knew everybody and what they were doing.

STOW: He did.

BIGELOW: And, how well they were doing it and what help they needed.

STOW: True.

BIGELOW: So, in my opinion, he would have made a superb Lab director. He certainly was a division director ... on top.

STOW: But, you're right -- he was acting Lab director until Herman Postma was [hired as Lab director in 1974.]

BIGELOW: Right. That's right. And, as a matter of fact, since I had worked with Floyd as division director, I was talking to him one time and he was saying that he had a lot of arithmetic to do.

STOW: Yeah.

BIGELOW: And so, I loaned him my hand calculator -- because I thought it would help him, and it did.

STOW: Yes.

BIGELOW: But, after a while, he said, "I'd better give this back before I get too dependent on it."

STOW: Anybody else come to mind that you feel deserves some mention today?

BIGELOW: Well, yes. A later director of the Chemical Technology Division, Don Ferguson, certainly deserves mention. And, actually, we've had a string of very fine people as Chem Tech division directors.

STOW: We have.

BIGELOW: It's not Chem Tech anymore, I guess.

STOW: No, it's Nuclear Science and Technology now.

BIGELOW: I don't really know the gentleman who's director, but apparently, he got involved in a much broader field than we did in the first place.

STOW: That's correct. That division has really expanded and has got a lot of things going that were not here in the '60s and '70s.

BIGELOW: Right. And then, Russ (Vaybarse?) -- I don't know if you ever met him or not.

STOW: No, I have not.

BIGELOW: He was a chemist -- worked in Chem Tech in one of the chemical development sections at the time -- and he specialized in transuranium chemistry.

STOW: Okay.

BIGELOW: And, he was an excellent chemist. And, he also had an excellent knack for building equipment to do the experiments in.

STOW: What year was he here? Do you recall?

BIGELOW: He was still here by the time we opened the TRU Facility, which must have been '76 or '77, but unfortunately, he had a heart attack and died.

STOW: Well.

BIGELOW: It was really a great loss to the Lab as well as to his family. I would say he was a transuranium chemist extraordinaire.

STOW: Is that right? Speaking of extraordinary transuranic chemists, did you ever have an opportunity to meet Glenn Seaborg?

BIGELOW: Oh, yes.

STOW: Any recollections of him as an individual?

BIGELOW: Well, Seaborg and I are like this -- he was kind of a guide ... (laughs)

STOW: Yeah, very much so.

BIGELOW: I never really felt like I was a colleague of Seaborg, but he knew me and recognized that I was deeply involved in producing transuranium elements, and that was what he wanted. And, he was pretty satisfied. He knew me when he saw me in a meeting, and he would speak to me.

STOW: Yes.

BIGELOW: But he was Mr. Transuranium Elements.

STOW: Very much so. As you look back over your career here at ORNL, what are you personally most proud of? What do you get the biggest kick out of as far as what you've been able to accomplish?

BIGELOW: Well, I think organizing the work, making the arrangements for fabricating the targets, putting them in the reactor, and qualifying them are things I'm proud of. And, before I left, I made darn sure that there was somebody who understood how to do [what I did].

STOW: And who was that person?

BIGELOW: Well, actually, it ends up being several persons. There are some young fellows who are doing the job of making targets now, and they're quite on the ball. They're not educated in the sense of having high degrees or anything.

STOW: Well.

BIGELOW: But, they're excellent technicians, and they know how to read a procedure.

STOW: Well, that's all it takes sometimes.

BIGELOW: The ability to follow procedures that were developed by the engineers previously.

STOW: Yes. As you look back on your years here, John, if there were something you could change or redo, or do better, does anything come to mind? Or are you pretty satisfied with the way things went while you were here at the Laboratory?

BIGELOW: Oh, pretty satisfied. Something I could certainly do better was to keep my office organized better.

STOW: I heard you were quite a pack rat.

BIGELOW: (laughs) When I retired, I decided it was necessary for me to actually go through my papers.

STOW: Yes.

BIGELOW: And, throw away something that was unneeded, or keep things that were important.

STOW: Yes.

BIGELOW: And make sure the right person got the [important papers]. I spent about nine months doing that.

STOW: I heard that [for a time] after you retired, getting into your office was a challenge.

BIGELOW: Yes, I finally got it cleaned up, and I thought Chuck Alexander would move in ...

STOW: Yes.

BIGELOW: ... but, he didn't. The fellow who is head of the group has my office. And, I forget his name, but I understand he's well respected by the people still there.

STOW: When you were here, you were always interested in making presentations to visitors, and I think you got involved in ...

BIGELOW: "Willing" is the word. (laughs)

STOW: "Willing." And, even today, I think you participate in the public tour series.

BIGELOW: Yes, yes.

STOW: And, you've helped out with the Friends of ORNL and come over to the History Room to do identification of photographs, and so on.

BIGELOW: Yes.

STOW: Is that something that you've always enjoyed doing – interacting with and trying to educate other people?

BIGELOW: Yes, yes. It really is. Not my type of job, but I enjoy doing it.

STOW: Well.

BIGELOW: And, I've done it for quite a while; although it's beginning to get harder and harder to get here. (laughs)

STOW: Well, security doesn't help at all, does it?

BIGELOW: No. And, I don't do it often enough, and it's always a strange road to me. I used to basically drive out here in my sleep, but that's gone.

STOW: Well, you still have a badge, though.

BIGELOW: Yeah, I have a badge.

STOW: And, do you still have an office over in 7930?

BIGELOW: No, I do not.

STOW: All right. Are there other things that we need to chat about here?

BIGELOW: Well, you've asked essentially all the questions I know the answers to.
STOW: Okay.

BIGELOW: Have you got any more?

STOW: Well, I was told to ask you about the evergreen in your yard. Do you have a big evergreen?

BIGELOW: That is my brother's. Dr. Robert Bigelow. He actually had a really giant spruce tree.

STOW: Yeah. Okay.

BIGELOW: It was beyond his ability to do the decorations, but he'd hire people to put thousands of lights up there.

STOW: Okay.

BIGELOW: And then they would invite people in and have sing-a-longs and refreshments, and so forth.

STOW: Okay.

BIGELOW: This was a popular activity, but after he fell-- about five years ago -- and injured himself, he just didn't have the capability of doing that anymore.

STOW: Okay. Well, a friend of yours, John Trabalka, who is a very great admirer of yours, asked me to ask you about the evergreen tree, because he thought that may have been in your yard.

BIGELOW: I did try to emulate my brother at one point when I first moved to that house, but the spruce tree I planted didn't make it. It grew for a while ... maybe eight feet, ten feet high, but the weather got to it. It just dried up.

STOW: Dried up and died, huh?

BIGELOW: Yes.

STOW: Anything else that you think we need to touch on, John?

BIGELOW: Well, I did talk about the MIT Practice School.

STOW: You did.

BIGELOW: I would like to plug that as being an extremely valuable experience. I'm sorry that the Practice School activities have ended.

STOW: I believe we're going to interview Alice Maxwell, who was very instrumental in keeping the Practice School going.

BIGELOW: Right, right. Well, she was the secretary when I first came and a very fine lady. And, if you want to take a couple of minutes, I'll give you an anecdote.

STOW: Please do. By all means.

BIGELOW: My co-worker Mike and I were working on the same project.

STOW: Yeah.

BIGELOW: And the project entailed making a connection between a pipe and a way into a post column we were working on. So, I decided to make a fitting myself. I had a piece of metal in a vice and was using a tap to tap a hole through it.

STOW: Sure.

BIGELOW: Of course, the hole was drilled first. And, I steadied the tap with the heel of my hand. As I was turning the tap, everything slipped all of a sudden. The heel of my thumb went across the triangle ...

STOW: Oh.

BIGELOW: ... and it bled pretty badly. Actually, it turned out it wasn't all that serious. But on the way out of the lab area, I stopped in front of Ms. Maxwell's office and told her I was going over to the infirmary.

STOW: Yes.

BIGELOW: But I stood there long enough to drop three, four, five drops of blood at that spot. And, she saw that and said, "Mike, get a chemical." Well, Mike got a chemical but couldn't get the blood up. And he got another one and couldn't get the blood up. And, when I got back, he told me about this ...

STOW: Yes.

BIGELOW: ... and I said, "You should have used water."

STOW: Well, did he clean it up then with water?

BIGELOW: I don't know.

STOW: You don't know.

BIGELOW: I don't.

STOW: And, your hand's okay?

BIGELOW: Oh, yeah -- the hand's fine. They sewed it up at the infirmary.

STOW: Okay.

BIGELOW: And, it's great.

STOW: Well, we may ask Alice Maxwell about her recollections of that when we get her down here.

BIGELOW: (laughs) All right.

STOW: Anything else that comes to mind that needs to go onto the record here, John?

BIGELOW: Well, no -- except that I would like to say that working here at ORNL has been basically a joy the whole time.

STOW: Well, you and many other people feel that way. I mean, most people that we've talked to have been very pleased with their careers here.

BIGELOW: Well, I certainly second that.

STOW: The Laboratory's a better place for your contributions, and we thank you very much.

BIGELOW: I hope so.

STOW: Thank you for your time today, John.

BIGELOW: You're welcome.

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