

**THE DEPARTMENT OF ENERGY ORAL HISTORY
PRESENTATION PROGRAM**

OAK RIDGE, TENNESSEE

AN INTERVIEW WITH

ALVIN TRIVELPIECE

FOR THE

**OAK RIDGE NATIONAL LABORATORY
ORAL HISTORY PROJECT**

INTERVIEWED BY

STEPHEN H. STOW

AND

**MARILYN Z. MCLAUGHLIN
(ASSISTANT)**

**OAK RIDGE,
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**TRANSCRIPT BY
BRIAN VARNER**

STOW: Today, we're talking with Alvin Trivelpiece. Al came here on January 1, 1989, as director of the Laboratory and served in that capacity for 12 years, having been previously a physics professor at the University of Maryland, director of the Department of Energy's Office of Energy Research, and executive officer of the American Association for the Advancement of Science. He brought a wealth of experience to his position as director of Oak Ridge National Laboratory, and we'll hear about that today.

Let's think back to your very early days when you got interested in science and technology. When was that, and was there any particular individual that got your interest started?

TRIVELPIECE: I grew up in Stockton, California.

STOW: Yes.

TRIVELPIECE: Stockton, California, is an agricultural community. It is not a hotbed of science and technology.

STOW: Okay.

TRIVELPIECE: I was fortunate enough to have, next door to me, an amateur radio operator who was nice enough to – even out in the boonies there in Stockton – let me see what he was doing.

STOW: Yes.

TRIVELPIECE: And, I got interested, in part, through that. And, somebody had given me a book on radio and I'd read that. And, I was always taking things apart. I had a grandfather who had a saw shop, and in the course of taking things apart, I learned a lot. And, I've always been amused since what you learn from taking clocks apart is "Don't try to do that again, because you can't get all the gears and springs back together easily." But I wonder today about a kid who takes apart an electronic clock and finds a battery, a couple of LEDs, and a small computer chip. What do you learn from that? Not nearly as much, so I think that kids today are a little bit deprived. But, in the end, I gave a book report once on E. O. Lawrence and got a chance to visit Berkeley.

STOW: Yes.

TRIVELPIECE: And, somewhere along the line, I just got interested in math. Then a kind of depression hit in California in 1948 when I'd been a construction lineman. And, I got out of work ...

STOW: Yes.

TRIVELPIECE: ... and as I was hitchhiking down to New Orleans, I went through San Luis Obispo. I remembered I had an aunt who lived there whose husband was on the faculty at Cal Poly (California Polytechnic State University).

STOW: Yes.

TRIVELPIECE: I was wet, cold, and hungry. And, they took me in and discouraged me from going to New Orleans. They suggested I go to Cal Poly. It cost me all of five dollars a quarter to go there then. And, that was just the beginning of [my college career] starting at Cal Poly [that ended up taking me] all the way to a Ph.D.. So, I have had the really good fortune of having somebody drag me in – literally – off the street and give me a chance. And, I tried never to look back.

STOW: So, New Orleans lost out and the rest of the world gained?

TRIVELPIECE: Well, I'm very grateful to my aunt and uncle for what they did, and when I had a chance to go out and thank them, I did. They're now getting very old and infirm and I'm quite concerned about their health, but they really were instrumental in getting me started, because nobody else was going to do it.

STOW: Well, we all thank them. Pass that on to them, please.

TRIVELPIECE: Yes.

STOW: When you got your doctorate in electrical engineering, what were your career aspirations at that point? You've done a variety of things over your career —all the way from teaching to administration and politics and everything else in one form or another. So, did you have aspirations at that early point?

TRIVELPIECE: Really, my only aspiration was to continue learning as long as I could.

STOW: Yes.

TRIVELPIECE: And, it's been almost a lifetime goal -- to never stop learning. And so, the opportunity to go to Caltech (California Institute of Technology) came up, and I got an M.S. degree and then stayed and got a Ph.D. there.

STOW: Yes.

TRIVELPIECE: And, I was more interested in physics than I was in electrical engineering. Although the first part of my degree is electrical engineering, the second part is physics. So, I had degrees in both in effect, and then I went off to the Netherlands on a Fulbright Scholarship ...

STOW: That's right ...

TRIVELPIECE: ... And that, I've found, to have been one of the more useful features of my life, as well as having grown up in California and thinking that the East began at Elko, Nevada ...

STOW: (laughs)

TRIVELPIECE: ... It was a shock to go to the Netherlands, where World War II, even in 1958, was still alive. You know ... very much in everybody's conscience.

STOW: Yes.

TRIVELPIECE: What I learned from other people about their experiences in Bergen-Belsen and other Nazi death camps was quite shocking to me. Being able to see the United States through other people or other country's eyes, I think, is an incredibly important aspect of learning and growing up. And, as it turned out, for reasons that are still quite mysterious, I got involved in a lot of international activities over the years, and my early experiences in the Netherlands paid great dividends by [enabling me] to realize that people do things differently in different place. It's not necessarily wrong —it's just they do them differently.

STOW: Just different ...

TRIVELPIECE: Being able to appreciate that fact, I've found, is a really important asset in life and living.

STOW: As we chat over the course of the hour, we'll touch on some of the other aspects of your career

as executive officer with the AAAS and director of DOE's Office of Energy Research (now Science), but I want to spend most of the time on your ORNL experience. You came here in 1989 to head up the Lab. What was it that brought you to ORNL? I mean, that was a career change for you, having come from AAAS, and you'd been there only two years -- or something like that?

TRIVELPIECE: I think it was United Airlines actually that brought me here.

STOW: Okay, well ... (laughter)

TRIVELPIECE: What brought me here actually ... you have to step back one notch. I left the Department of Energy as director of the Office of Energy Research for the most part because I was literally broke. Being an advice and consent appointee for six years had been rather financially devastating.

STOW: Yes.

TRIVELPIECE: And so, you either have to quit two years before an administration leaves, or you have to stay until after their gone. That's kind of a rule. You don't "bail out" during the election period. And so, I decided to leave and, as you said, went to the AAAS. In my image of the AAAS, my background in engineering, physics, and science in general would have been a major asset to me as chief executive officer of that organization. It turns out AAAS is a regular, ordinary business with 135,000 some odd members. It's a not-for-profit corporation.

STOW: Yes.

TRIVELPIECE: But nevertheless, you have to pay attention to the bottom line. And, the only difference is that the net profit after taxes has to be zero. But, you still have to manage it like a regular business. It's a publishing organization that puts out 135,000 copies of *Science* magazine a week. So, there's a large publication activity associated with it.

STOW: Yes.

TRIVELPIECE: So, AAAS was primarily operating a business. My background in engineering and physics was of no particular value, other than as a social asset, at some of the national meetings. I initially had felt that I really was obliged to stay there for some time, and initial inquiries about my possibly coming down here I did not consider seriously because I felt that it would have been inappropriate for me to leave the AAAS so soon.

STOW: Yes.

TRIVELPIECE: In the end, however, I took my own advice that I had given to many of my students over the years: "It's always better to appear to be foolish than to be foolish." Leaving the AAAS made me appear to be foolish. But, to not go to Oak Ridge as new director of the Laboratory would have been foolish because, in fact, the duties of the job were more consistent with my background and training.

STOW: True.

TRIVELPIECE: And so, I "bit the bullet," as they say, and came here. And, I did not regret it. I think probably the AAAS came out better for it, too.

STOW: It was a win-win situation.

TRIVELPIECE: I hope it was. There's that old joke about somebody who goes from organization A to organization B and improves both simultaneously.

STOW: (laughs) What were your goals and objectives when you came here?

TRIVELPIECE: Well, very simply, to leave the place better off than I found it when I left – whenever that was going to be. And, I started out as soon as I could to try to do things to improve the Lab. [I wished] to bring in some respect for the experience that I had in DOE headquarters as director of Energy Research and also for my knowledge of science, physics, and engineering. ORNL is an institution which specializes in those things ...

STOW: True.

TRIVELPIECE: ... So, I felt that my background should, in some way, assist in trying to advance those interests.

STOW: And, you got here in 1988 ...

TRIVELPIECE: It was January 1 of '89.

STOW: Within a relatively short period of time, you were facing "Tiger Teams," weren't you?

TRIVELPIECE: Yes.

STOW: Was that a frustration?

TRIVELPIECE: I think the Tiger Teams were an unfortunate event. Whatever good they caused, or brought about, was offset by the following sorts of considerations. We had something like eighty people here full time for sixty days.

STOW: Yes.

TRIVELPIECE: They ended up causing a 1400-page report to have been written. We had a few days to write a 1000-page report in response to that. They had identified nearly a billion dollars worth of things that we were in deficiency over. Subsequent analysis revealed that all but \$60 million of that billion dollars had, in fact, been requested long before the Tiger Teams ever even were thought of ...

STOW: Okay.

TRIVELPIECE: ... And, we had not received the money for those things. The idea that we would ignore a major risk to a worker or public health and safety – and not spend the money to repair it --I found kind of insulting. And so, you found that most of the things that were found that were new in that \$60 million were what I've referred to as the "rash of the universe." They really were very small things that were not of any substantial concern to worker public health and safety.

STOW: Yes.

TRIVELPIECE: In the mean time, however, we greatly increased our number of annual ISO audits. Every auditor hour here, by some rough estimate, took eight hours of our overhead time to service one hour of auditor time. What that meant was that our overhead rate was going up. What was annoying was that then the Department would turn around and say, "You're being a bad boy because your overhead rates are going up." Well, now there was a real surprise. Of course, it was going up. It was going up for that very reason. But, what I worry about even more was what I refer to as the "lost opportunity cost."

By that I mean that a lot of people who should have been writing proposals and doing research and other things that would advance the scientific and technical interests of Oak Ridge National Laboratory were, in fact, cleaning out closets, cleaning out junk, and so on.

STOW: I remember it well.

TRIVELPIECE: I also lament the fact that a lot of the junk that was thrown out during that period [was what] I regarded as historically relevant to the Laboratory's past history. So, they threw out good things with the bad things. Now, the place did get cleaned up and that was a benefit, but I think that it was a misguided effort, no matter how well meant it was in its initiation.

STOW: Yet, we fared pretty well as a laboratory in the final analysis, as I recall.

TRIVELPIECE: We didn't get hit as hard ... Well, this is one of those things where, in fact, at the DOE headquarters Admiral [James] Watkins, I understood, had said at a staff meeting, "Please congratulate Oak Ridge National Laboratory on what they did."

STOW: Yes.

TRIVELPIECE: By the time the Tiger Teams got through writing up their report and sending it out to Lockheed Martin, it said that we did a terrible job.

STOW: It didn't sound so good ...

TRIVELPIECE: It didn't sound so good at all. And, I was quite annoyed by what I regarded as an underhanded taking advantage of the bureaucratic system to give the laboratory a black eye, when, in fact, by any objective standard that I understood, we had done quite well.

STOW: Did you have any second thoughts about going back to AAAS at that point?

TRIVELPIECE: No, no. I don't really believe in going backwards.

STOW: Okay. Let's switch and talk about some of the positive aspects of your tenure here ... a couple of things I want to cover. One is the SNS story, and we can talk for hours on that. Let's go back and encapsulate your forethoughts and leadership in SNS and the funding. It would be, I think, a good story to tell.

TRIVELPIECE: You'd almost have to start with the time I was at DOE in which it was decided that the non-weapons laboratories would have a facility revitalization plan that led to the synchrotron light sources at Argonne and Lawrence Berkeley and an accelerator at Brookhaven. What was supposed to happen was that the next neutron science facility was going to go to Oak Ridge, and that was going to be the Advanced Neutron Source.

STOW: Yes.

TRIVELPIECE: That came along at just about the right time. And, the new administration came in, and through the White House, we got strong support. The ANS was put in the budget, and I thought that things were in very good shape. It looked like we could go forward. Unfortunately, that coincided with the demise of the Superconducting Super Collider. Its budget was voted down.

STOW: True.

TRIVELPIECE: Senator Bennett Johnston was extremely unhappy, because Louisiana was going to be one of the states where some of the components for the Superconducting Super Collider would be constructed. And, he basically said -- and it's not an exact quote, but I know what his idea was -- that, "If DOE isn't going to build a Super Collider, they're not going to get to build anything else." That simple thought alone was sufficient to cause the funding for the ANS to be withheld that year, without prejudice, so at least we could come back next year. I was incredibly pleased that the administration -- and I don't feel even yet that I can comfortably say who in the White House I'd been talking to, but nevertheless, the White House gave it sort of ubiquitous support -- put back the ANS in the budget a second time. By this time, the State Department -- in particular, a fellow named Bob Gallucci -- had begun to be concerned about the fact that the ANS would be designed to use highly enriched uranium. He felt that it was improper for the United States to be building a new reactor using highly enriched uranium, when we were trying to persuade the rest of the world not to use HEU in its research reactors. We were then obliged to do a redesign in which the ANS would use low-enriched uranium.

STOW: Okay.

TRIVELPIECE: From my point of view and from a scientific and technical point of view, switching to low-enriched uranium is really a dumb thing to do. Because, as you know, by the time you put in enough blended down uranium-235 and U-238, you, in fact, have to put a lot more uranium-235 in to make it the reactor go critical.

STOW: True.

TRIVELPIECE: ... You get a much lower flux.

STOW: Yes.

TRIVELPIECE: Plus, because so much uranium-238 is there, you've made the reactor a plutonium breeder, which, I think, is also dumb. So, it wasn't with great joy that we did this, but nevertheless, the ANS wasn't put through the budget again the second time.

STOW: Okay.

TRIVELPIECE: The third time was coming up, and it was in late fall that I received a call from the ubiquitous White House source, who said, "Al, we'll put the ANS in the budget again, but you realize, if this time it goes down -- it's like a drowning person going down for the third time -- the ANS is not going to come up again. Wouldn't you rather consider having a Spallation Neutron Source at ORNL instead of a regular steady-state neutron source?" "Well, it's an interesting idea," I replied. "Give me some time to think about it." The source said, "Could you call us back in about an hour-and-a-half or two hours with your answer?" That didn't leave time to go out and convene a seminar and discuss it.

STOW: No, not quite.

TRIVELPIECE: And so, in fact, the only person with whom I felt I could even discuss it at that point was Bill Appleton, who was the associate director who had been responsible for the ANS. He and I talked for about an hour and reviewed all the considerations. And, to digress a second, there's a story about a guy who was out on the end of a boom for one of these Texas oil rigs in the North Sea and it was exploding behind him. It was clearly going to collapse into the North Sea.

STOW: Yes.

TRIVELPIECE: ... He was a hundred feet off the water. There was debris and burning oil on the water. He didn't have on the survival suit necessary to allow you to survive a few minutes in that cold North Atlantic, and the thing behind him was blowing up. And so, he jumped. It turns out that a rescue boat

was right there. The rescuers picked him up and took him to the hospital. I think he was only one of two or three people that survived this event. But, he was asked, “Why did you jump?” And he said, “Well, I was looking at two possibilities. One was probable death, and the other was certain death. And so, I chose probable death.” That was more or less our thought process at that moment. If we stayed with the ANS, it was “certain death.”

STOW: “Certain death.”

TRIVELPIECE: And, the SNS was likely “probable death” because now we were going to have some stiff competition from Argonne and Los Alamos because they believed that [an accelerator-based neutron source] had been set aside for them.

STOW: Yes.

TRIVELPIECE: But, in fact, the way it had originally been stated in the Science Facilities Revitalization report was that the next neutron science source would go to Oak Ridge. And so, I took that to mean – and had previously stated at meetings in which all the people from various labs were present – that if we don’t do the ANS, we’ll do the SNS. I didn’t think I was going to have to live up to that. And so, Bill Appleton and I kind of, as they say, “pulled up our socks” and went to work. And, we did manage to convert some of the money from the ANS into funding for the SNS project, got it started, and put together a very good team of people that actually overcame a lot of the problems. And, because of my experiences as director of the Office of Energy Research (now Science), I’d come to believe that projects like this are going to be better served if you can do them with more than one national laboratory simultaneously working on it.

STOW: Yes.

TRIVELPIECE: And, since we would have been *the* experts in the nuclear part, we certainly were not the experts in the RF cavity business – Los Alamos was. Well, and then Lawrence Berkeley was pretty good at making front ends [ion source for the linear accelerator] ...

STOW: Yes.

TRIVELPIECE: ... And Brookhaven was pretty good at making magnets that turned beams around corners. So, we put together a plan in which several national laboratories would be working on this project simultaneously. Each lab would take a particular part of the project, obviating the necessity of having a very large collection of new people come here to be trained. In this way, we could take advantage of their skills. So, we put together a plan. And, much to my amazement and that of a lot of other people, it actually worked.

STOW: It helped the politics a little bit too, didn’t it?

TRIVELPIECE: Well, it helped in many dimensions, which are hard to put together. But it was the first time that a major project had major participation by multiple national laboratories – both weapons and non-weapons — and that the labs were brought together in a way to build a facility and participate in it. It has now, I guess, become kind of a standard by which people think things ought to get done in the future.

STOW: Let’s cover some other things that have a positive spin to them while you were here. You anticipated computational sciences coming online, I think, as kind of a major actor, and you were very instrumental in getting ORNL involved in computational sciences early on. What gave you the foresight?

TRIVELPIECE: Actually, it's more hindsight than foresight. I worked with the AEC in 1973 and '74.

STOW: Yes.

TRIVELPIECE: At that point, I was responsible for the research program for fusion. Fusion did not have a very strong theory program, and it certainly didn't have a very strong computational base.

STOW: Okay.

TRIVELPIECE: And, as I looked at things, it struck me that the total computing capacity for all of the labs that were involved in fusion in 1973 amounted collectively to what was then, one 6600 – a CDC 6600.

STOW: Okay.

TRIVELPIECE: Not very much ... And, the problem was that people at one lab would develop transport theory that could not communicate with transport theory from another laboratory, because they used different parameters. So, the idea that it would be nice to have one computer in which you could do transport theory and everybody could compare all the experimental results in some database made sense. I'd asked Bennett Miller, who worked for me, to start a study on the role of computing in controlled thermonuclear fusion, as it was called then. And, he did. It lasted about six months. In the course of that study, we decided that the absolute minimum that was needed would be 7600 capability, which was a couple of hundred times faster than 6600.

The problem was that we couldn't afford to put a 7600 at every lab. So, we came up with this idea: we'll put a 7600 at one lab, and then we'll connect it by wide bandwidth lengths with the DEC-10s that we will put at each of the laboratories. I was assured by most of the fusion computing community that that wouldn't work. But, fortunately I'd read a book or two at this point, so I knew it would work, and not only that, it was probably a five-year-old state of the art.

STOW: Okay.

TRIVELPIECE: And so, we put that together. And, it was up and running in a year. It was the Magnetic Fusion Computation Center out at Lawrence Livermore National Laboratory. Now, at the time, I would have liked to have picked Oak Ridge, but Oak Ridge had, at that time, what I thought was a rather crummy computing capability. And, in fact, they had more of an administrative computing capability, not one that was dedicated toward meeting the needs of the scientific community at either here or the other plants. With that in mind, when I came back to DOE in 1981, I felt that the fusion community had really taken advantage of this, and to some extent it was almost the beginning of the Internet. I mean, people were using computers for communications as much as for scientific computing ...

STOW: Yes.

TRIVELPIECE: ... And the first time that an APS (American Physical Society) program was ever put up on what might be referred to as a website [occurred when] the old text editors were available on this 7600. And so, everybody in the fusion community could send e-mail messages to each other. So, it was quite an advance from that point of view. But, that was the background. That was what was in my mind when I got here. And, I'd been trying to get people in DOE's biology and high-energy physics offices to start using the computer center, as well. So, we ended up expanding it, making it available to the others. In some cases, we almost had to force them into using it, because they really didn't want to. And so, this was kind of in my mind. I had seen other examples where Oak Ridge had been behind the power curve as computational sciences began to advance. There's experimental science and there's theoretical science, and gradually there would be computer science

STOW: ... computational science.

TRIVELPIECE: ... And, computational scientists did some truly outstanding things, like build a ten solar mass star and demonstrate that, as it collapsed, it produced this neutrino wind ...

STOW: Yes.

TRIVELPIECE: ... And the neutrino wind blew the mantle of the star off, creating a supernova. It was the first decent explanation of a supernova. And, it was not done by using the mathematical methods of theoretical physics. It was done using computational science. Knowing that, and seeing what Livermore and Los Alamos had done, it struck me as odd that Oak Ridge almost made the computational sciences second-class citizens in the Laboratory. And, it worried me. I firmly believed that Oak Ridge was not going to prosper and advance unless it got up in the front end of that game. I know that in some quarters my views did not make me particularly popular. But, I managed to recruit Ed Oliver.

STOW: Yes, I remember Ed.

TRIVELPIECE: When Ed came to the Laboratory, our plan was to do as well as we could. Through some combination of miracles, we got an Intel Paragon 150 and, for a brief fleeting moment, that was the fastest computer in the world. We teamed with Sandia National Laboratories on some projects to make long-distance supercomputing work for massively parallel processor projects. Since then, it seems like scientific computing has been running very well here on its own, and the advances that have taken place have put computational science on an equal footing with the other branches of [experimental and theoretical] activity here. I can't imagine how Oak Ridge could have advanced into the modern era, so to speak, without having that kind of capability. So, while I wasn't prejudiced about it coming here, I did believe that it was going to be essential that scientific computing, rather than being the second-class citizen, somehow needed to become on an equal footing with the other science activities under way here.

STOW: Well, it certainly has. I mean, it's a major component of virtually every program here nowadays, as you well know. Now, another initiative that you got started, or at least were involved with, was science education for high school students. Did you bring that interest with you from your previous days at DOE, or did you pick it up somewhere else?

TRIVELPIECE: That's a funny ... I almost have to go back again to the time I was at DOE. The first time I met Secretary of Energy-to-be John Herrington ...

STOW: Okay.

TRIVELPIECE: ... I was to brief him on the information he needed in order to go through a confirmation hearing. It was part of my job.

STOW: Okay.

TRIVELPIECE: So, after getting to know him a little bit, the first thing he said was, "Al, what can we do with our national laboratories, to help inspire young people to consider careers in science and engineering?" I replied, "Gee, that's a great question, John, but let me tell you that right now, I'm supposed to get you through this briefing book in order for you to get confirmed. Okay?" So, a month or so passed. He's been confirmed. We're having a Secretary staff meeting, and sort of cold turkey again, he repeated exactly the same phrase verbatim and looked down the table at me, and I felt a little uncomfortable and my face probably flushed just a little bit.

STOW: Yes.

TRIVELPIECE: And, I'd hoped he'd forgotten it, but he hadn't. The third time he said it, which was maybe four or five weeks later, I said, "Well, maybe what we ought to do is invite the smartest kid in each state in computer science and let them go out to Livermore and work on the Cray computer there for two weeks sometime." And, I could tell by the way my fellow assistant secretaries were behaving that they thought I had really said something truly stupid. And then, like a lot of people in Washington, I had a phone on my desk, which rang when the Secretary picked up his phone, and the call came directly to me. It did not ring very often, but it rang that morning, and Secretary Herrington said, "You know, that's a great idea." He said, "I'd like to be able to do that. What would it take?" And I said, "Well, I could put in a budget request for next year." "No," he says. "I want to do it this fall. I want to do it in August or September." Well, it was already June, I think.

STOW: (laughs) Created a monster for yourself, didn't you?

TRIVELPIECE: Well, at this point, you know, my palms are sweating a little bit. And he said, "Oh, by the way, I talked to the President about this, and the President thinks this is a really great idea, and he would like to visit with the kids while they're out there at Livermore." Well, within a very short period of time, we had literally contacted the governors of all the states, made a suggestion to them that they develop a mechanism by which they could identify supposedly the smartest kid in computer science ... a senior or rising junior in high school ... and that we would pay their way to Livermore. And, much to my amazement, it was arranged that President Reagan would arrive on August 6 at Travis Air Force Base and that the Marine One helicopter would bring him over to Livermore to meet the smart kids. And, then I woke up in a cold sweat one night, and I called somebody at the White House the next day and I asked, "Do you really want to have the President inside Livermore on the anniversary of the dropping of the atomic bomb on Hiroshima?" And, the answer was "Well, probably not." As it turned out, he wouldn't have gone there anyway, because he had to have an operation. He had some medical problems at that point. So, it wouldn't have happened anyway, but the fifty kids came. And, they were pretty smart, and it really worked. Well, this idea of an honors program for students to go to a DOE facility took hold. And then the next year, I think we expanded it to Argonne and then Fermi Lab. And then Oak Ridge had Environmental Sciences here. And, I had talked to a number of governors about this, and I thought that this program was a bullet proof as any program you've had for kids. Now, some people complained it was elitist. But I watched them. These kids benefited greatly.

STOW: Oh, yes.

TRIVELPIECE: And, some of them are going to be the scientific leaders of tomorrow. It was a great recruiting tool, because Livermore hired sixteen of the kids that were there the next summer to work at Livermore. And, ultimately, three of them became full-time employees. Now, you tell me a recruiting program where you can go out and get six percent of the smartest kids in the United States, have them become identified with your institution, and go to work there on a full-time basis. I don't think there's a headhunter in the world that can even come close to a record like that. So, it worked very well. And, I think Oak Ridge probably benefited the same way as the other labs. Not all the kids joined the labs where they worked, but a lot of them, after they got their Ph.D.s., ended up in the DOE complex somewhere.

STOW: In the 1980s we thought we had a real crisis in science education in this country.

TRIVELPIECE: Well, we still do.

STOW: Do you think that that was an overreaction in the 1980s compared to where we are now?

TRIVELPIECE: No, I think it was the right thing to do. I mean, there were other things that should have been done in addition to that

STOW: Sure.

TRIVELPIECE: But not something instead of that. And, the problem was that somewhere along the line, the funding for it was held up one year. And, I thought that governors would scream, saying, "We want this one continued." Nobody complained. And, a lot of people are amazed that nobody complained. I think it would still be a great program to resurrect and start up again. The labs benefited from it, and I saw that here personally, because I think that having young people around the Lab actually inspires the senior scientists to do things that they might not otherwise have done. There's nothing like a kid being around to ask a question that your colleagues are too embarrassed to ask you.

STOW: I remember that very clearly. I was in line management at the time, and I know that our staff benefited tremendously from that, over in the Environmental Sciences Division.

TRIVELPIECE: Well, if I could wave a wand and cause one program to get started again, I would do it. I wrote Secretary Herrington a letter as I left the department, in which I said that it may not have been the most dramatic thing that we did, but in terms of the overall benefit to the United States, I think the high school honors program may have been one of the more important things we did together while we were in office.

STOW: And, his response ... ?

TRIVELPIECE: He agreed with that, yes.

STOW: Well, you know, if history repeats itself, and it generally does, we'll see it again here.

TRIVELPIECE: I sure hope so.

STOW: Yes. Another event that happened during your tenure here was the restart of HFIR (High Flux Isotope Reactor). Any particular recollections that you want to pass on regarding that?

TRIVELPIECE: A lot of them are very painful, but when [the Soviet nuclear power plant] Chernobyl exploded [in 1986], I ended up being essentially the DOE duty officer that dealt with the Chernobyl disaster, inside the department. I spent quite a few hours looking at overhead imagery and things like that. I put together the committees, one of which was the Meserve Committee, and the other was a committee that consisted of people with appropriate intelligence qualifications to be able to look at all the things and talk about it with the Secretary.

What had happened that I thought was unfortunate was an overreaction in looking at all the Class A reactors in the United States. And, the overreaction prompted DOE's Oak Ridge Operations to shut down HFIR, but shutting it down without a plan for restarting it was a mistake, I think. Under Secretary Salgado and I approved what Joe La Grone, manager of ORO, had recommended. And, the mistake that we made was that there should have been a restart memorandum put in place at the time, because what happened was, as the restart process got started, one committee after another would come in and somebody would say, "Well, we need a committee of people superior to the one that we just had." Well, pretty soon, you get this process going in sequence that takes a tremendous amount of time and costs a great deal, but not very much productive output came from it. Everybody was so "tip-toe cautious" that they didn't do what should have been done in getting HFIR started sooner. There was a tremendous loss of value, as far as I was concerned.

STOW: But, we did get it restarted.

TRIVELPIECE: We did get it restarted and there have been problems. It's an old reactor and getting it rebuilt as it is now, I think, probably cured some of the problems it had. But, I felt that at times, caution

piled up on caution was not warranted, given the technical characteristics of the situation.

STOW: Another significant activity that occurred while you were here was to split from Lockheed Martin Energy Systems, and that was not an easy undertaking. Can you reiterate what the thought process was that led to that, and what some of the challenges were?

TRIVELPIECE: I honestly don't know some of it – but you have to realize – right at this particular point in time – Lockheed had been Martin Marietta ...

STOW: Yes.

TRIVELPIECE: ... Martin Marietta Energy Systems and the Lab were part of that. Norm Augustine and I were trying to remember the name of the president of Lockheed at that time. At any rate, they got together and decided that, in effect, it would be more fun to run one \$12-billion company between the two of them than have each of them running a \$6-billion company. And, then they brought up some other companies, such as GE.

STOW: Yes.

TRIVELPIECE: But, Lockheed Martin was formed. Eventually, Lockheed Martin recognized it had a fairly large collection of business activities that were related to DOE. So it asked Al Narath, who'd been the director of Sandia, to become the group president for these activities, including those of Idaho and Oak Ridge. At about that time, Secretary of Energy Hazel O'Leary sent down a notice on the extension for the contract, in which there was a provision that Oak Ridge could have a separate contract, if so desired. Well, it turns out that Al Narath had decided that he thought it would be desirable for Oak Ridge as a laboratory to be on an equal-footing basis, even within the company with Sandia ...

STOW: All right.

TRIVELPIECE: ... In the same reporting level, as well as on an equal-footing basis with the other national laboratories, and not be a secondary part of another activity. That was his attitude, but he did not have the overall responsibility for causing it to occur. And, I really don't know exactly what did happen, but Secretary O'Leary wrote this permissive statement.

STOW: Yes.

TRIVELPIECE: And, Martha Krebs was director of DOE's Office of Energy Research, and literally, the day after that went into effect, Narath and I, together with Krebs, Decker, and others in the Office of Energy Research, were meeting in Washington in her office. And, she laid out a set of conditions which said, not only did she want that done, she wanted it done in a timely fashion. And, this was in October. And, she wanted it done before the first of the year.

STOW: My gosh. (laughs)

TRIVELPIECE: A lot of people around here had to roll up their sleeves and go to work to create a new corporation, give the new corporation a name, and get it chartered in Delaware. They did all the things associated with getting a business – financial staff and legal staff took care of lots of details, and we had a very long checklist. We kept working down the checklist and on January 1, New Year's Day – it had been signed before that – it became effective, so having been to New Year's Eve parties, Bob Van Hook and I – Bob was the deputy at that time ...

STOW: Yes.

TRIVELPIECE: ... Were probably not fully alert, but we decided it was time to come out and greet all the new employees of the new company, Lockheed Martin Energy Research Corporation. So, we did. On a New Year's Day, about thirty people work out here.

STOW: (laughs)

TRIVELPIECE: ... We found most of them and welcomed them. And, we thought that was kind of an interesting way to start the whole thing off. I think it was a good move. I know that some people think not, but it was time that Oak Ridge sort of be in a position to try to help define its own destiny, and not be a subsidiary part of the Y-12 complex. And, other than I think it's a long overdue step, and perhaps some will disagree with that, but I think that the long-term health of the institution has a much better chance being in the current circumstance than it did in the previous one.

STOW: Oh yes. No question. But we're still trying to wrestle our way loose from Energy Systems in some areas – benefits, for instance, retirement, and so on.

TRIVELPIECE: I was thinking more of the problems that had to do with Y-12 having some difficulties. They had to focus all their interests on their circumstances. That meant that the ORNL divisions at Y-12 ended up not being able to get janitorial services and other services they needed ...

STOW: Yes.

TRIVELPIECE: ... And, it caused us problems. So, I think that the correct long-term move was a separation [of ORNL from Y-12]. It didn't have to be hostile and fast, but it did need to be thoughtful and complete.

STOW: Good. Thanks for that background. We've heard for years that the Department of Energy is on thin ice and ought to go away. And, then we've heard also that there are too many DOE national laboratories. There's too much duplication of effort. Having served both within DOE and now as the director of the Laboratory, what are your perspectives on those two "rumors," if you will.

TRIVELPIECE: Well, let me start and ask you a question. Do you think that because Harvard has a physics program, Caltech should not have a physics program? What do you call duplication in this case? Scientists and engineers, by their very nature, loathe the idea that they will duplicate what somebody else is doing. Nobody ever wants to get up at a scientific meeting and give a talk in which they say, "Well, I am pleased to report that what the previous speaker just said he had discovered, I too have discovered that."

STOW: True.

TRIVELPIECE: You go to great lengths to avoid that. So, just because there happens to be two national laboratories does not necessarily mean that the work product is duplicative in any way shape or form.

STOW: True.

TRIVELPIECE: And, there are very large collections of dedicated federal employees who are upstream of the money and who received the proposals that have to be written by each laboratory in each program each year, and they don't want to be accused of using government money to pay two different people to do precisely the same thing at the same time. So, having said that, no, I don't think there is duplication. I think there may be, in some cases, work that is not at the forefront – or maybe work that is not of high quality. That ought to be identified and weeded out. And, I think the laboratories have not done as good a job themselves at policing their own institutions for work that is not of the highest scientific quality.

STOW: So, I gather from that answer that you don't feel that there's much duplication, if any, within the DOE system. Just because there appears to be duplication, there's no reason to consider doing away with one of the labs.

TRIVELPIECE: I wouldn't be so foolish to say that I'm sure there's no duplication. But, I think duplication is more in the eye of the beholder, by virtue of titles and things like that, than it is in the content of the work. If you would show me five or six papers that had been written, in which the duplication of work was obvious –I mean, almost to the point of plagiarism –I'd come to the opinion that perhaps there is duplication. But, that would be quite anomalous, and I doubt that it really happens.

STOW: Good answer. We've got a lot of things to cover here. You've held a variety of jobs over your career, all the way from teaching to administration, to lab director to consultant, and so on. What's been your favorite job? What work gave you the most satisfaction?

TRIVELPIECE: Well, somebody once joked that I'm the poster boy for the idea that the human heart can't long stand happiness, that I've had some really superb jobs. Being a professor at the University of California is a superb job. And, the other part of that is I couldn't hold down tenured positions at several universities. Well, obviously, I gave this up voluntarily and each one of them has been different. To have been a professor at the University of California was exciting. The work there was interesting. I consulted at Varian Associates and worked at Livermore at the same time, and it was wonderful. I mean, I had a great opportunity. Why did I go to the University of Maryland? Well, at that particular time, I had said publicly at scientific meetings that somewhere in the United States, there needed to be a major university that would regard plasma physics as a science that it was willing to have as a major element in a major physics department. The University of Maryland said, "Well, if you'll come and do that, we'd be glad to have you do that."

STOW: Yes.

TRIVELPIECE: And so, I had to put my feet where my mouth was, so to speak. I went there and filled with a very large empty room with plasma physics experiments. Today, Maryland is still one of the leading institutions that has a wonderful program in plasma physics. Why I did leave the university system? Well, somebody at the university wanted to make me dean, provost or whatever. They put me on a search committee. I finally tired of this. I wanted to be a professor. And, I enjoyed being a professor. But I got an opportunity to go to the AEC for a couple of years and help get the fusion program running in 1973. So, I thought if I just go out there for a couple of years, they'll forget me. I went away for a couple of years, and I came back, and I was right back on the list for dean, provost, whatever. So, I said, "Well, I'm not going to do administrative work in a university. If I have to do something that even looks like administration, I'd rather do that in industry. A friend of mine had a small company in San Diego called Maxwell Labs, so I got a job out there. It was a small company, and I felt that I could learn as much about management in such a small company as I could by getting an MBA. And, it turns out that's pretty close to being true, because, in a small company of \$10 million, everything goes wrong everyday. And, no matter what your title is, or what your background is, you're helping put out fires everyday.

STOW: You're always learning, right?

TRIVELPIECE: I learned a lot in the few years that I was there. And, briefly, I went up and ran the laser isotope separation program for Exxon, but it turned out that there were several personal and family reasons why that job wasn't going to work out. I went back to SAI (Scientific Applications, Inc.). I enjoyed SAI a great deal. I mean, I had a wonderful job there and was peacefully minding my own business when the Secretary of Energy asked me to come meet him. I was somewhat innocent. I just thought he wanted to meet me.

STOW: Yes.

TRIVELPIECE: Well, it turns out that he wanted to recruit me. So, the next thing I knew, I'm standing before a committee of the Congress saying "I do solemnly swear, etc. ..." And, that's how I got into the Office of Energy Research. These things are not planned. Some people, I've noticed, have a really carefully laid out life plan.

STOW: I understand.

TRIVELPIECE: My [career has been characterized] by almost accidental events taken in sequence.

STOW: While you were here at ORNL as director, what would you look back on as your most satisfying accomplishment?

TRIVELPIECE: Well, what I said at the very outset is that I think I left the Lab better off than I found it. That's what I would like to think that I did. And, whether it's SNS or computing, or just generally making the place organized and able to run better, or keeping the overhead rate down and making the Lab more streamlined and business-like – all of those things put together. It's not any one single identifiable feature –it's the whole collection.

STOW: Here we are in 2003 with the 60th Anniversary of the Laboratory. We are doing some history interviews, and in forty more years on the 100th Anniversary, someone's going to be sitting here looking back over the history of the Laboratory. Al Trivelpiece's name is going to come up. What do you think the words are going to be that will describe your tenure while you were here? What would you like them to be?

TRIVELPIECE: Still it's simple. I left it better off than I found it.

STOW: Okay. Well, you're consistent in your answers.

TRIVELPIECE: I don't know how better to put it. These jobs are not one-dimensional positions. What do you say? It was to get the SNS or get computing. Those things can be transient. Forty years from now, a Synchrotron Light Source might not be in the United States. What would be here instead? Well, I don't know. I have trouble predicting the past, so I'm certainly not going to try to predict the future.

STOW: We're sitting here now, having only recently heard that Bill Madia, our current Laboratory director, is going to be moving on to other opportunities. What qualities should the new Laboratory director bring to the job, and have they changed since you were Laboratory director?

TRIVELPIECE: Well, from my perhaps snobbish point of view, I've always thought that the Lab director ought to have been somebody who was a bench scientist or engineer in some activity ...

STOW: Yes.

TRIVELPIECE: ... And has an independently established scientific reputation, but has acquired along the way, a sufficient level of management skills in order to take care of the necessary financial and personnel activities associated with an institution like this. But, first and foremost, you ought to be a good scientist, and second, you ought to be pretty good at the management business. I've always had the feeling that if you're a superb manager and a lousy scientist, you probably are not going to do as much for this kind of institution as you should be able to do. It certainly seems to be the pattern at most of the labs.

STOW: What personality traits does it take to be a good Laboratory director?

TRIVELPIECE: A surprising degree of patience, a willingness to listen. Taking a certain amount of hostility in stride and with good humor. Being willing to also make tough decisions. I don't particularly like people who enjoy firing people. Therefore, I believe that it should be very painful anytime that you have to let anybody go for cause, but that you should not be afraid to do that when it becomes necessary and do it quickly and efficiently and with some degree of concern. And, try to minimize the hurt to the party involved.

STOW: As you look back over your career, Al, has there been any particular individual – scientist or engineer – who has really influenced your career?

TRIVELPIECE: Well, it would be hard to pick anybody other than my thesis advisor, Roy Gould.

STOW: Yes.

TRIVELPIECE: Roy Gould is a professor at Caltech. In fact, I think Roy had been on the advisory committee at ORNL, not while I was director but earlier. Roy is one of those unusual people who seems to do things with students and get things out of students that others can't. I certainly, having started at Cal Poly and shown up at Caltech, would not have been regarded as a strong candidate for getting a Ph.D. Roy helped me a great deal at times, and, at other times, was sufficiently stiff and demanding to get me through to earning a Ph.D. Then he and I together discovered waves that are ubiquitously referred to as the Trivelpiece-Gould Modes in plasma physics journals. Much to my amazement, there are still publications that refer to these waves even today. He had his 75th birthday last year in December. They had a celebration for him at Caltech. I was his first Ph.D. student.

STOW: All right.

TRIVELPIECE: And then in 1995, his last and 40th Ph.D. student graduated. I gave the first talk, and this young man gave the last talk. About fifteen of us were still around in between. All gave talks on various aspects of things they had done. Roy's been my personal hero and friend. He and I are friends and colleagues. We were actually graduate students together, which made it hard on ...

STOW: Not much age difference there ...

TRIVELPIECE: Not much age difference. He joined the faculty of Caltech in about a year and, as he said, he took over some students from a guy named Lester Field. He said he inherited a contract with ORNL and a few graduate students of, as he put it, "indifferent quality."

STOW: (laughs) You've gotten an awful lot of awards and honors over the years. Is there any particular award or honor that stands out as being head and shoulders above the others?

TRIVELPIECE: Being elected to the National Academy of Engineering is a nice honor, but a lot of people get honorary degrees. Most people don't realize that Caltech does not give out honorary degrees. But, what it does do is identify somebody from its own institution who graduated there and give them the distinguished alumni of the year. And, that is the equivalent of their honorary degrees. And so, I've regarded the fact that Caltech was nice enough to give me award recognition by naming me Distinguished Alumnus of the Year. That was more than the law demanded certainly. I was very proud of that.

STOW: As you look back over your career, is there any major thing that you would change, if you could go back and make big changes?

TRIVELPIECE: Well, given the kind of random walk character of the career I've had, you could wonder why I did some of the things I did.

STOW: Well, you've explained the transitions very well.

TRIVELPIECE: But, no, I don't. It's, you know, like most of your experiences. You wouldn't take a million dollars to do them again.

STOW: Yes.

TRIVELPIECE: You wouldn't take a million dollars to not have done them. So, I'm very pleased with what has happened. I've never been bored.

STOW: Well, there are a lot of people that can't make that statement, that's for sure. What's the future hold for you?

TRIVELPIECE: Well, since I retired from the Lab, I've been consulting at Sandia, and that's been quite rewarding -- in various areas of energy -- trying to get nuclear power considered as an essential element in the energy mix in the United States and elsewhere in the world. That has provided opportunities for me to work with some of the Russians and help get the protocol between the United States and the Soviet Union started on the peaceful uses of atomic energy. Those contacts have allowed us to have a rather beneficial arrangement with the Russians. And, I'd gotten my colleague Velikhov, whom I've known since 1963, to come out to Sandia. Well, he came here and gave a talk, as well. But, he came out there and we've established a video link and that video link is then going through a lot of aspects of how we might collaborate between the two nations in terms of trying to take advantage of the fact that one of the elements of the future, to me, is going to be nuclear power. And, if that's going to happen, then it ought to be done well.

STOW: True.

TRIVELPIECE: And, if it's going to be done at all, it also ought to be to the economic benefit of the United States and Russia, who helped invent these businesses, and not necessarily China, Japan, and France. So, I believe that the United States needs to be a player in that, as well as global nuclear energy and the issues of water, energy, and terrorism -- these are very interesting subjects. And Sandia is involved in them as is Oak Ridge, and I've had the opportunity to participate in several Sandia programs through my consulting activities there. So, for the time being, that's what I'm going to do. I don't really anticipate taking on another major full-time job.

STOW: Are you unicycling at all now?

TRIVELPIECE: (laughs) Well, we're packing to move to Nevada one of these days ...

STOW: I understand.

TRIVELPIECE: ... And the unicycle is sitting there in the basement. I'm trying to decide whether to pack it or leave it -- I think I'll take it.

STOW: I was going to say, you should pack it by all means.

TRIVELPIECE: Yes, but I think my wife Shirley would insist that I get a helmet this time -- because I used to ride it without a helmet. Riding a unicycle is interesting, and if you have a mathematical bent, you realize finally that the way to learn how to ride one is to recognize that you're solving the Mathieu-Hill equation in three simultaneous coordinates. The Mathieu-Hill equation can be described this way: If you put a ping pong ball in a long open tube and turn it this way, the ball falls out. But, if you turn it rapidly, the ball only goes a little way in the tube.

STOW: That's right.

TRIVELPIECE: And, if you turn it again rapidly, the ball doesn't fall out. So, if you turn the tube at a certain speed, the ball just oscillates back and forth. Well, that's what you do on a unicycle. You fall forward, you pedal hard, catch yourself, fall forward, pedal hard, catch yourself. That's actually a solution to the Mathieu-Hill equation. And, then you do it in the wiggle mode and then the twist mode. And, you wiggle and twist simultaneously. Your brain can do all this. And, small children can do it without even knowing they're solving the Mathieu-Hill equations. (laughs)

STOW: And, they don't know they're doing it. We're about out of time. Thank you, Al.

TRIVELPIECE: Steve, I appreciate it.

STOW: Appreciate talking with you.

TRIVELPIECE: Enjoyed it.

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