Optical Society of America
Oral History Project
Interview withDr. Richard Powell
Conducted on February 10, 2012by Adrian Kinnane

AK: It's February 10, 2012 and we're in Washington, D.C., at a meeting of the Optical Society of America. I'm talking to Dr. Richard Powell, Dick Powell, who is a past president of the OSA, 2001. Just a minute ago, while we were getting introduced, you mentioned that you're currently retired,and professor emeritus at the University of Arizona.

RP: Right, professor and vice president emeritus at the University of Arizona.

AK: For several years you directed the Optical Sciences Center?

RP: I did, yes.

AK: We'll come on up to that, but let's go way back. Tell me where you were born and when.

RP: I was born in Lincoln, Nebraska in 1939. Then as a young child, moved to Ottumwa, Iowa, and was raised in Iowa until I went off to college.

AK: I came across something and I want to come back to that, too, in a different context, it was a speech that you gave at an OSA meeting out in Long Beach right after 9/11. [9/11/2001 terrorist attacks]

RP: Yes, after 9/11.

AK: You talked about your earliest memory listening to the radio. Could you tell me about that?

RP: I remember in Ottumwa my family gathered around a big Philco floor model radio to listen to the President talk about the attack on Pearl Harbor. My dad, the next day, left and took the train, and was gone in the South Pacific in the war for four years. I didn't see him until he got back home.

AK: You were born in '39, you would have been, I guess –

RP: Three, yes. Very, very young, but it's still a fairly vivid memory. I don't remember much else from that time, but that one made a big impression.

AK: Went off to the Navy, was it?

RP: Yes.

AK: So your dad's off to the Navy, and at home in Ottumwa is your mom and you and –

RP: Brother, older brother.

AK: How much older was he?

RP: Two years.

AK: So when Dad came back, who's this new guy?

RP: Yes, that's right.

AK: You would have been about six or seven.

RP: Yes.

AK: Tell me a little bit about your growing up.

RP: Ottumwa was a typical agriculture center in Iowa where the biggest employer was John Morrell meat packing plant and there's a big John Deere factory there. There was a strong emphasis on education; we had excellent schools, I think, throughout Iowa, but Ottumwa was typical. I ended up having a lot of very good teachers in K through 12 and always had a lot of interest in science and math growing up.

AK: As long as you remember, you just were inclined towards those interests.

RP: Yes, yes, just enjoyed it, and had fun both in school, and also just various science projects that we'd do.

AK: Were either of your parents involved in that kind of work?

RP: No, no, my mother was just a housewife and my dad was a newspaper man. His father was one of the three people who started the Lee Syndicate and so he was in newspapers his whole life.

AK: Your older brother?

RP: He went in to work for Maytag in Newton, Iowa his whole career.

AK: What are some of the earliest things you can remember that might indicate this interest that you had; taking something apart and fixing it, or a science project?

RP: Oh, gosh, I'm not sure I can remember anything that far back of any interest. We certainly did a lot of that sort of thing, but I think it was really when I went off to college that that kind of solidified.

AK: You talked about the schooling being pretty good and thought you had a pretty good education in sciences. How about going to college, for some people this is a "Do I go, do I not go?" Did you always know?

RP: No, there was no question. But as an undergraduate I went to the United States Naval Academy and got very interested in science and technology development for the military. It was obvious that after what happened in World War II and since then, that science and technology play such an important role in the Department of Defense that that really solidified my thinking that that's what I wanted as a career. When I graduated from Annapolis, I took my commission in the Air Force because they offered to send me to graduate school right away to get a PhD in physics. They had a whole career progression for science officers.

I accepted that and went to Arizona State University and got my master's and PhD degree in physics. Then the Air Force assigned me to be a research scientist at the Cambridge Research labs outside of Boston, which I did until my military obligation was up. Then I moved to Sandia National Lab as a research staff member, and then decided I wanted to be a university professor, so I moved to Oklahoma State University for quite a few years.

Then I was offered the opportunity to go to Arizona as head of the Optical Sciences Center, which I was happy to do because it's arguably one of the best optics programs in the world. It was a real privilege to do that. Then later, I moved on into administration, became vice president for research, graduate education and economic development at U of A and then retired. Since then I've been acting as a consultant and working a lot on solar energy projects.

AK: Okay. Let's go back to the Naval Academy. Tell me a little bit about that choice, that decision.

RP: That was influenced strongly by my father's experience in the Navy. He loved it – he didn't love the war, but he loved the Navy experience, and talked a lot about it. That was something that got me interested into it.

AK: So you'd been thinking about the Navy for a while.

RP: Yes.

AK: Did you apply anywhere else?

RP: No, actually I didn't. You know, my family was fairly close with our congressman, and so getting an appointment to the Academy, congressional appointment, was something that was not too difficult. At that time, they had their own entrance requirements, but they decided to use the normal SAT test. They actually made their cutoff about 10 percentage points higher than the Ivy League schools. They were trying to change it academically and become more academically oriented, and I didn't have any problem passing those. I just focused on that.

AK: Were there any teachers or experiences that you had in the schools in Iowa that stick in your mind as especially supportive or influential in terms of your interest?

RP: No, not really. I had excellent teachers all the way through, but I don't think any of them specifically pushed me in one direction or another.

AK: How about at the Naval Academy?

RP: We had outstanding instructors there and they were very focused on education. You had the ability to take extra courses outside the required ones, so I took all the extra physics and math courses I could. But again, I really enjoyed the professors I had, but there wasn't any one particular one that especially influenced me.

AK: Can I just back up a little bit?

RP: Sure.

AK: Your dad hears FDR talking about the attack on Pearl Harbor. He's got a job, he's got a wife, he's got two boys. It seems like there's no hesitation, he's joining.

RP: That's correct.

AK: To me, that sounds unusual, was it?

RP: No, not at that time. I think things have changed since then, but at that time, I think everybody stepped up to the plate, and did their part, so I don't think he was unusual at all in that.

AK: It's fair to say,maybe,that this kind of commitment to service goes pretty far back and deep in your life.

RP: Yes.

AK: By the way, how did you find the Naval Academy?

RP: I loved it. Loved every minute of it; had a lot of fun there.

AK: Do you remain in touch with any of your classmates?

RP: Yes, we still have an email that goes back and forth between all my classmates. Unfortunately, at the time we got out in '62, the Vietnam War was going full strength, and so we lost a lot of our class in Vietnam. We also have a fairly active alumni group that I'm in touch with.

AK: Your interest in science must have been pretty strong because the Air Force then offered you a way to continue your pursuit of physics.

RP: Yes, at that time, the Air Force Academy hadn't started graduating a full complement of people yet, so automatically 20 percent of Annapolis and West Point graduates went in the Air Force. That's how they got their officers before the Air Force Academy started providing what they needed.

AK: That's interesting, I didn't know that.

RP: Yes, that was a long time ago.

AK: And this was voluntary.

RP: Well, it depended on where you stood in the class because you got a choice of what you wanted to go into as long as it was available. There was a slot available for this when I was able to pick it.

AK: It was at Arizona State?

RP: Yes.

AK: You got your PhD in physics. What was your area of interest?

RP: When I went to graduate school, I really wanted to get into solid-state physics. Because if you look at what had gone in recently in physics, the invention of the transistor had just

started to drive microelectronics and it was all materials-based. The reason the Air Force sent me to Arizona State is they had a very well-known, solid-state physicist, Ben Gossick who had been at Purdue working with a group that was instrumental in inventing the transistor, so I wanted to work with him and get involved with that.

But once I got there, it was clear that the invention of the laser, which had occurred a couple of years earlier, but still was a very new thing in physics, was such a hot topic because people wanted to develop more lasers and know what to do with them. I kind of combined my interest in solid-state physics with this new hot topic of the laser, so I got involved with optical properties of solids. And that has been my career focus ever since, optical materials.

This spans everything from growing your own crystals to putting different doping ions in to change their properties to studying how light interacts with matter. Doing different kinds of spectroscopies to study how the energy from light is dissipated as heat or gives different kinds of transitions inside a solid. Using the laser spectroscopy techniques, especially later on, the very fast time resolve techniques and coherent techniques like four-wave mixing to study material properties.

As I got older and my career matured, it moved more from fundamental physics into more device-oriented things, but still optical materials. Then, near the end of my career, we were actually building laser systems for various kinds of applications. It evolved

from fundamental science to applied science and that's fairly common for somebody in a research area like this.

AK: It's an interesting subject actually, that whole relationship between – you almost have to put it in quotes, "pure science" with quote, "applied science." Charles Townes was one of the many who noticed how the laser confounded any easy distinction. You had devices actually opening doors to theoretical insights, as opposed to just the other way around. I guess that's what you were observing.

RP: Yes, that's exactly true. Anyway, the optical materials became the focus of what I did throughout my career.

AK: You went to the Cambridge Research Labs in Massachusetts. You were there as a commissioned Air Force officer.

RP: I was a second lieutenant and then first lieutenant in the Air Force, but was actually just given a laboratory, and said you're a research scientist, do something.

AK: And what you did was in the field you just described?

RP: Yes.

AK: Tell me a little bit about that because many people don't quite understand how these labs operated.

RP: The labs that are run by the Department of Defense are generally somewhat more focused on topics on things of interest to the military. Certainly, when you think about lasers, they were very much of interest to the military, the laser. You know they always dreamed of a laser weapon which didn't necessarily come to fruition like they thought. But lasers were used for range finders and target acquisition and guidance and all the other things and have been highly successful. They were quite happy to have me working in that area.

We had the facilities there, we built up the facilities to grow our own materials, so we were studying different kinds of ruby with different dopings, that had been the first laser material, and other kinds of materials that we thought might make good lasers. We were doing a lot of studies that were really good fundamental science, but at the same time, could have had a very big application.

AK: Funding sounds like it was not too much of a problem.

RP: Not at that time, no. Later on, funding starts to tighten up, but at that time there was still fairly easy to get funding for your research.

AK: Colleagues? They were obviously not all commissioned officers.

RP: No, there were maybe a handful of commissioned officers; everyone else was civilian.

AK: And you worked in civilian clothing, I assume.

RP: Yes, most of the time.

AK: What were your reporting requirements? What was your obligation?

RP: Well, they would have a meeting of the officers who were stationed there once every few months to touch base, and see what you were doing, and how things were going. Mostly, I just reported to the laboratory director, who was a civilian, about the research I was doing, so there was very little military requirement.

AK: As a practical matter, you pretty much operated and lived as a civilian.

RP: Yes.

AK: Then your time with the Air Force was up, you went to Sandia.

RP: Yes. At Sandia, I did the same sort of research work.

AK: Tell me where Sandia is.

RP: There are actually two locations; one in Albuquerque and one in Livermore, California. I was at Sandia in Albuquerque.

AK: And you moved there because?

RP: Well, they offered me a job. (Laughter.) But, no, Sandia is one of the really good national laboratories involved in research. At that time, it was run by the Bell Lab system and it had a lot of good research going on and we loved the southwest having been in Arizona before. It seemed like a good place to go.

AK: And it turned out to be.

RP: Oh, yes, I loved it.

AK: Then comes an interesting decision. Sounds like you were thinking of teaching; so you went to Oklahoma State in 1971.

RP: We were talking about people influencing your career. While I was at Sandia, I met a friend and colleague, Bill Sibley, who was at Oak Ridge National Labs doing research. He moved to Oklahoma State as head of the physics department. One thing that I learned from Bill that affected my career, was the importance of not just focusing on your own personal research, like we all were doing in our national lab positions--we had our own

research projects -- but rather spending a lot of your time teaching and mentoring other people: students, post docs, junior faculty. Bill was very good at that. That appealed to me a lot. He had a position in the physics department at Oklahoma State and asked me if I would join him.

I went there to help build the research program up, which we did. There was very little research when either of us got there, but in the end, every faculty member was funded for very active research projects. But it changed my career from just being isolated in a laboratory to having a group of students and post docs, and focusing on helping other people, helping mentor their careers.

AK: That appealed to you and it sounds like it continued to appeal?

RP: Yes, that was one reason why I later on moved into full administration like the vice president for research position. The whole focus of the position is helping other faculty members develop their careers and move forward.

AK: Sometimes a university can be a great base from which you can do a variety of things. Did you do other things while you were at Oklahoma State in terms of consulting?

RP: Some. One of the things that I really am proud of in my career that we did at Oklahoma State was to develop a statewide center of excellence in lasers. We convinced the state that we could use our expertise in lasers to help companies throughout the state in

economic development projects and things that would benefit the entire state. We got money to hire several other professors in a similar area, so we had ten of us and they built a big center. Actually Boone Pickens was building this new geology building and there wasn't any basement so we took over the basement and built this laser center where we each had our own research projects doing grants and contracts research with students and post docs.

We also used our expertise to go out throughout the state of Oklahoma, and use what we could, both with our equipment and facilities and our knowledge of lasers, to do things to help companies. So we had projects with everyone from Eagle Picher, a big materials company in northeast Oklahoma, to 3M, which had a big facility in southwest Oklahoma; and all the research labs for the oil companies – Conoco Philips, Kerr-McGee –and a bunch of medical projects at medical centers. It was a really successful, statewide economic development project that we built there that I was very proud of. It worked very well, gave us a lot of visibility for the university and the state.

AK: How did it work in practice? What did you do?

RP: Well, it depended on the company and the field. Some of our professors were more in a chemistry type area, and fit best with the oil labs. My materials background was more suitable for working with Eagle Picher. We had an engineer that had a lot of great ideas on how to do things. Just as an example, 3M in Weatherford made all the films for photographic capabilities. They had what's called a web manufacturing facility where

they have these films that are just going by from spool to spool. They spray polymer spray on top of the films to manufacture them for whatever they're going to be used for.

But if there's some kind of a defect in that process, they wouldn't know about it until the end and then they'd have the problem of throwing away either a whole spool or splicing out things. So this optical engineer that was working with us devised a way to have a laser scanner, while they were actually doing the process, which could detect any kind of a flaw in the layer they were laying down, and immediately stop the process, correct what was going on and then start it again. So 3M actually patented that, we had a technology transfer agreement and their lawyers came down from Minneapolis. We worked a whole deal on transferring the technology. That's the sort of thing we would do.

AK: It sounds like, am I correct, it wasn't just the physics department, this was university-wide?

RP: Yes, we had people from physics, engineering, chemistry and actually some from veterinary medicine because a lot of the applications in medical areas, they're easier to try out and do in vet schools than they are in human medical schools. So the vet med people were really helpful, too. So it was a pretty broad-based facility.

AK: Tell me again what your role was in this. What was your position in the university that you were doing this?

RP: I had been the head of the physics department. Then I decided I wanted to just give up administration for a while and focus on research. I talked to the vice president for research about this concept and we, at that time, had a group that the legislature was funding to develop science and technology in the state of Oklahoma. We wrote a proposal to them saying look, the university's willing to use this new building to build this laser center, hire some new positions in this if you'll give us money for this economic development outreach part of it. It was a joint development that was my idea and I started, but certainly when it was up and running, I wasn't the only one doing it. We had ten really good people working on this.

AK: Sounds like your brainchild.

RP: It was my brainchild, but like most brainchilds, you have to have a lot of people to make it work.

AK: Well, congratulations, it sounds like it was a huge and useful –

RP: It was, it was very useful.

AK: People talk about public/private partnerships, sounds like that kind of thing.

RP: Yes, that's exactly what it was, yes.

AK: You were at Oklahoma State then for about twenty years.

RP: Close to it, nineteen, I think.

AK: Tell me what happened next, then; you go to the University of Arizona.

RP: I did. We had this laser center that was going strong and I was really pleased with it, but at the same time, the Optical Sciences Center in Arizona, the director retired and they had a search committee and they identified people that they thought might be good as colleagues to come in and take over the reins. Peter Franken, who was head of the search committee at the time, talked me into coming to Arizona, which I was happy to do. The optical sciences center there is such a famous place, really good place, and seemed like a good move. I loved every minute of it.

AK: So you went there in '92 as a professor of optical sciences.

RP: And the director of, what was then called, the Center for Optical Sciences. But essentially, it was a dean's position, you reported directly to the provost like a dean and we gave our own degrees, like colleges do. And eventually, after I moved over to the vice president's office and Jim Wyant took my place, we actually changed the name as a college with the director being called the dean then. When I was head of it, it was still called director of the center, but it's exactly the same position that became dean of the college.

AK: Starting in ’99, I guess it was, you were vice president for research and graduate studies.

RP: And economic development, all three.

AK: That sounds a little bit like what you were doing in Oklahoma.

RP: Somewhat, except this was for the entire university; it wasn’t just the laser center like I was in Oklahoma.

AK: Working on public/private.

RP: Did a lot of that, yes. I was on the governor’s advisory board for science and technology when Janet Napolitano was governor. Among other things, we got the legislature to fund an organization called Science Foundation Arizona, which is a public/private partnership where the legislature puts in a certain amount of money and then industry has to put in money and we fund research projects of interest to economic development.

AK: Your general area of scientific interest was in this broad field of materials, optics, optical qualities in materials –

RP: Yes, that was my personal area. By the time I got to the vice president’s position, that didn’t matter anymore, we were dealing with everything.

AK: It sounds as though you pretty successfully fulfilled one vision that you had of university life which was the opportunity to work with other people to do things, help other people along.

RP: There were a couple of other things that gave me a lot of satisfaction. During the years I was in Oklahoma, I spent some time going around the state giving in-service teacher training talks to the physics teachers in the K through 12 system. I found that, as far as I could tell, there were two physics teachers in the entire state who had taken a college physics course. The rest of them were coaches or something else that got assigned to teach physics.

So a group of us, six of us, got together and found a couple of friendly legislators, which isn't easy to do in a populous state like Oklahoma. We convinced them to give us money to start a state-funded boarding school for gifted and talented science and math students in high school. We got this through the system; a very wealthy donor gave us a building, and we started the Oklahoma School for Science and Math. For example, in physics, we hired three physics teachers who had PhDs in physics and research experience. They did the same thing in chemistry and biology. We did all this around the state Department of Education which has all sorts of rules about teachers' unions and getting teacher certification out of colleges of education.

We did it as an economic development project and got our money through the economic development group. I was on the founding board of directors for this Oklahoma School of Science and Math, which became and is extremely successful. The students come from all over the state and live there for the last three years. They'll come from towns that had no opportunity to take advanced courses in science or math, and this school gives them really what they need. All of them go on to college. We had a bunch of them go to MIT and Cal Tech and all the major science colleges. That's been a very successful project that I was happy about.

AK: It's not that usual for a career professor who's working daily with graduate students at pretty high levels to take an interest like this in K through 12. It does happen, but it's pretty unusual. How did you get into it?

RP: Well, as I say, I was asked to go around and give talks to high school physics teachers throughout the state. When I found how poor our physics education was, and I had colleagues who were doing the same thing in chemistry and biology, and they felt the same way. It was just something that grew from this frustration. We all had kids in school, so we had a high stake in this.

AK: It's commendable. The whole country has a high stake in it.

RP: We use North Carolina as a model. It has an outstanding school for science and math students. I went there to visit and we used that as our model, so we weren't the first ones

to do it. I think in a state like Oklahoma where it's very difficult to get people to value higher education or gifted and talented students, it was a miracle that we got it through. But we weren't the first; we used these other examples.

AK: I commend you for doing something about it because an awful lot of folks would look at the problem, recognize the problem and say, "Wow, isn't that awful, I'm not going to go there again," and then go back to the university. But you did something about it.

RP: We did something about it and it's still in existence, it's still going strong. They're looking for a new principal or director right now, so it's worked really well.

AK: Talk to me about the OSA.

RP: Let me do one more thing first; just talking about things that I was happy with and pleased with in my career. The third thing I was going to mention really occurred after I moved to Arizona, and after I left optical sciences, and was the vice president for research. One of the things the U of A is very famous for is optics for telescopes. We have a genius there, Roger Angel, who developed the technology for spin-casting gigantic mirrors which revolutionized the whole ground-based telescope business, and also developing ways to do stress lab polishing and adaptive optics mirrors.

We had all this facility and we started a joint international project with Germany, Italy and the U.S., the U.S. being University of Arizona, Research Corporation and Ohio State

University, to design and build the large binocular telescope. We had the responsibility for building the optics, and Italy was building the structure, and Germany was building instrumentation to go on it. As VP for research, I was the University of Arizona representative on the board of directors for the LBT and this whole design, building and commissioning phase. It was an outstanding international project.

That telescope is now up and working on Mount Graham. It's the most technologically advanced astronomy instrument with two gigantic binocular arms and the interferometric way of operating and the adaptive optics secondaries; it has better seeing power than the Hubble telescope. It's something that was a major international accomplishment for science. I got a lot of pleasure being involved with that, a great project. I got so interested in it that after I retired, I bought my own little eight inch Celestron telescope and took the secondary mirror out and put a CCD array at the prime focus. My hobby these days is taking photographs of deep space objects, taking pictures of galaxies and nebulae, just in my front yard. It affected me a lot in terms of my interest in that area.

AK: You used the term LBT.

RP: Large binocular telescope.

AK: And Mount Graham is where?

RP: Southern Arizona.

AK: How far from you?

RP: It's about 120 miles.

AK: How often do you get out there?

RP: Not very often anymore now that I'm retired; I used to get out there every couple of months. There are three telescopes on; the Vatican has a telescope there and then there's a sub millimeter telescope and there's the large binocular telescope. It's a nice observatory site.

AK: Congratulations, not only did you accomplish something for the telescope, but you picked up a side interest.

RP: Right, it's been fun. (Laughter.)

AK: How well can you see with the telescope that you made yourself?

RP: Oh, well I didn't make it, you know, I bought an off the shelf telescope, I just modified it. But I've got about a hundred or so pictures of galaxies and nebulae that certainly aren't like professional astronomers get with their big telescopes, but the ones I can see, I can get very good pictures of.

AK: That's terrific. In your yard?

RP: Just out in my front yard. I've given a lot of talks at camera clubs in how to do this and public lectures on astronomy.

AK: The OSA; I don't know when you joined the OSA. You were a fellow as of '88.

RP: I don't know when I joined either. (Laughter.) When I first got out of school, back in the early sixties, I immediately joined the American Physical Society because my degree was physics, and was active there. I'm an elected fellow of the American Physical Society. What really happened was, in my area of solid-state physics, their major meeting is called the March Meeting because it's held in March. It just grew and grew and grew. It became so big and diverse that it was hard to meet anyone and do any networking, the things you do at science meetings.

I switched over and started going to OSA meetings that were much more focused on things that I was interested in. You could give talks and meet people afterwards and network a lot easier. So OSA became my professional society of choice. I got involved with it that way and publishing papers in OSA journals. I honestly don't remember when I first became a member.

AK: Before we leave the American Physical Society, I should mention you were a founding member of the APS division of laser science.

RP: Yes, that's one of the things we did. We actually had a freestanding meeting on lasers that a group of us were involved with each year and we went to the American Physical Society and suggested that they take it over as a laser conference. It grew enough that we said, well how about becoming a division, and it just evolved that way.

AK: You already mentioned that you didn't agree much with an idea with some folks may have had that lasers were just another form of instrumentation.

RP: Well, I guess you can look at it any way you want (laughter), but I found it very – you know a laser is a very complex instrument. The physics involved in making a laser, especially you're dealing with a solid-state laser, and how energy is absorbed on the atomic scale, and how it moves from atom to atom and how it's finally dissipated. There's a tremendous amount of physics involved and that's what interested me. I certainly consider it to be a lot more, it's more of a scientific study.

AK: I think that that's history now, anybody that was thinking that. Especially if you think about using lasers to cool and trap atoms, I mean if that's not shedding light on pure science, I don't know what is. You were president of the OSA in 2001, which meant that you were president-elect in 2000 and vice president in '99. That was an interesting time in the OSA, in the history of the organization. Let me back up a little bit. Tell me a little

bit about your involvement because they don't ask folks to be president of the OSA without a lot of involvement with it.

RP: I was an active member in terms of going to meetings and serving on committees and publishing papers. Then I got elected to the board of directors and served on that for a while and then later elected to the presidential chain. I guess looking back at that time, there's several things that I was involved with. Of course, that was the time there was a lot of discussion about merging with SPIE, so we wasted a tremendous amount of time and effort with that discussion and I think, fortunately, didn't move ahead with that.

There were two things that, during my time on leadership, I really tried to push. One was getting the OSA to be more active in terms of advocacy things for our members: lobbying Congress, lobbying different funding agencies here in Washington. That was fairly controversial. A lot of my colleagues did not agree with me on that for a number of reasons but that's something that I was pushing for. As an example of something that I did, we had a year there when the Air Force submitted a budget where they were going to take all of their basic research money, 6.1 money, and move it into funding a major weapons system.

This would have been disastrous for any of our members that were funded by AFOSR [Air Force Office of Scientific Research]. So I testified before Congress, the House Committee on Defense Appropriations, about what was going on and how important it was for the scientific community that we keep the basic research money doing basic

research. In fact the Air Force, under pressure, withdrew that and reinstituted the money in the 6.1 line. From that, Congress asked the National Research Council to form a committee to help the Department of Defense define basic research and produce guidelines for how they were going to spend their money, and I was asked to serve on that committee, which I did.

I think that's been very helpful to OSA members and other scientists in the community who receive funding from the AFOSR and Office of Navy Research and Army Research Office, any of the DOD research offices which funds a great deal of research in our community. Another thing that we did, a group of us OSA members made an appointment at the National Science Foundation, and they got all of their division directors together. We'd brief them on the current status of optics and where we saw it going in the future and what the different possible opportunities were. From that, NSF set up an optics funding initiative. I really pushed in those areas of using OSA as an advocacy group in Washington. Some people liked that, some didn't.

The other area that I pushed for at the time I was on leadership was involvement of our international members, not just as being kind of passive members, but more involvement on committees and in leadership and even becoming president. The OSA actually responded very aggressively in that area, and we've had international people as president, and certainly serving on the board and a lot of interactions between OSA and optical society of different countries. That was something that meant a lot to me and I really pushed for.

The other thing I can think of in terms of OSA involvement, in 1981, George Keyworth was the presidential science advisor at the time. He got a group of us together at Keystone, Colorado for a meeting to talk about how to do a better job in developing solid-state lasers. We had people who were doing crystal growth and doping of materials to change their properties; a group that were doing fundamental science studies, optical spectroscopy of the materials to figure out all of their underlying properties of how they produce vibronic transitions so you can get tunable lasers and this sort of thing; and then a bunch of laser engineers. There were no existing scientific meetings at the time that brought this kind of diverse group together.

It was a very productive meeting. The next year, the Army Research Office had hosted a similar meeting at the Night Vision Lab, and the year after that they hosted a meeting at Scripps Institute in La Jolla. It became such a popular kind of meeting that the Optical Society took it over as a topical conference and it became the Advanced Solid-State Laser Conference for OSA which was one of the most successful topical conferences for OSA for many, many years. I think that's a good example of how a member-driven, bottom-up sort of project can percolate into a mainstream OSA event. That's one of the things OSA, I think, does a good job at is picking up on these sorts of things.

AK: What would have been the discomfort that some people might have had about actively getting involved with governmental bodies, decision-making bodies, Congress?

RP: We've got enough diversity of our membership that we have a lot of international members. Well, us lobbying Congress in the U.S., to provide more money for our scientists, in some ways the perception was it would hurt our international members because we would have more money for our research and they wouldn't, sort of thing. Within our own community, we have a lot of people who work in industrial laboratories and to have the government fund science research at universities doesn't help them. So there's just a lot of different opinions on this.

Now when we did some of these things, it turns out that colleagues of ours, both in Australia and Germany, for example, used the example of what we did here to do the same thing in their countries. So in fact, I think it actually helped them, but that's not a universally held opinion; there still are people who don't think we should be involved in lobbying.

AK: I was wondering whether or not it was a holdover from the old days where lobbying was something that businesses did and not scientific pursuits.

RP: I didn't detect any of that.

AK: Again, it's still arguable these days whether or not the government ought to be involved in various research projects, but some are so big and so complex, it's hard to imagine that. In a way you sort of think maybe we had won this one back in the forties, but I guess not.

RP: No, it's still hard to get government money and things are getting tighter and tighter.

AK: You chaired the public policy committee of the OSA in 1998. So you were involved in this kind of activity then, and continued as president.

RP: Yes.

AK: The way the OSA does it, you kind of warm up to the presidency. You get a year as president elect. So by the time you get to the presidency, there shouldn't be too many surprises. Were there any? Did it seem like a natural kind of –

RP: Yes, it was a pretty natural progression. I can't think of any surprises, anything that happened that I wasn't aware of ahead of time. You know, we had the normal personnel issues and typical things going on but nothing major.

AK: I remember some talk about a bit of self-consciousness about the name, Optical Society.

RP: Oh, yeah. (Laughter.) There was a move to change the name to include photonics and a lot of people didn't like that. So all those things were going, the SPIE merger, there always is something like that going on, but not a major issue.

AK: There was more recent talk about the name, the Optical Society of America, when you have so much of an international body.

RP: Yes, that was discussed a lot, too.

AK: These things seem to be sort of symptoms of growing pains and symptoms of adjusting. Engineering perspectives, physics perspectives, they come together. Laser confounds all of those sort of social distinctions.

RP: Right, that's true.

AK: But people try to work out a way for themselves to organize. And the OSA's been through those, as you mentioned.

RP: It has been and I think that that diversity is one of the strengths of OSA. I saw this in a more of a microcosm at the Optical Sciences Center at the University of Arizona. We had a group of people who were optical engineers who designed and built things in the optic shop, or telescope optics, this sort of thing. Then we had the fundamental scientists, the physicists who were doing laser spectroscopy, trapping of atoms and things like this, very fundamental physics. Then in the middle, the more photonics device people, they're building devices, but they're doing it with very fundamental physics sort of orientation; nanoscience technology sort of thing. We had all three technologies mixed together.

This is hard for a university because they are different cultures so they value different things. When it comes up for promotion and tenure or other things where you're evaluating faculty, you're comparing apples and oranges. It becomes a difficult issue within a university environment. Well, you expand that a thousand-fold into (laughter) the optical society and you have the same thing.

You have groups that don't really care whether you publish a paper or not, it's more a system that you build or a patent that you get. You have others that are very interested in how many papers can I publish this year and peer review versus non-peer review. So it's an issue, but I think it's really a good issue. It's good to have this diversity of cultures mixed together.

AK: It's been a pretty adaptable organization.

RP: It has, yes, very agile.

AK: Given the very greatly accelerated forces of change in the last twenty, thirty years, it's really remarkable. If you look at what's happened with the publications in the OSA, from *Applied Optics* on, every one of those changes has been an adaptation to keep up with what's happening out there.

RP: Yes, online journals and library subscriptions, it's a major change in the field.

AK: Did you get abroad much when you were president?

RP: Continually. Well, actually throughout my whole career. One of the other things we had talked about earlier, people who influenced me, one of the people that influenced me a lot is a man by the name of Baldassare "Rino" Di Bartolo, who is a professor of physics at Boston College. I learned a lot from Rino, but one of the things that he did and does still is run NATO summer schools in Erice, Sicily, very close to his hometown of Trapani. Early on in my career I was privileged to go there and give some lectures several different years in a row. People attend these from all over Europe. I got to know and develop close collaborative relationships with people throughout Europe.

We had a very close collaboration with people at the General Physics Institute in Moscow. I got elected to their Russian Academy of Engineering Science through this collaboration we had. We had long-term collaborations with the CNRS labs in France and with the labs in Spain and colleagues in the Netherlands and Ireland. So there was just a continual travel back and forth to all of these places.

They would send students and post docs over to work with me, and I'd go over there. I've always had a lot of international travel like that. Then when you become president of OSA, of course, you go for different reasons to represent OSA in different places. I went to China and Taiwan and Australia and places in South America. International travel has been a big deal.

One thing that I learned early on and then especially through these NATO conferences is how important a scientific community is in terms of international diplomacy. Even when countries are having a lot of tensions with each other like the Cold War, the U.S. and Russia, the science community isn't. The science community, scientists to scientists work together very well. I think we unfortunately don't use that kind of collaboration in diplomatic areas as much as we should. But the international collaboration is one of the cultures of optics and science in general that's very important.

AK: You remind me very much of what Charles Townes used to say, that the Russian colleagues would come over, of course they were all being tracked and traced, but he made remarks just like what you were saying, that scientist to scientist was a great way of building bridges, at the height of the Cold War.

RP: That's true.

AK: We'll note that you believe that it's underutilized. I'm sure you could make a very good case for it today as a way of establishing better relations.

RP: Yes, absolutely.

AK: There's another argument for not avoiding lobbying. (Laughter.) You mentioned also what people are interested in overseas. Have you been to China?

RP: Oh, yes.

AK: People talk about science as a kind of a unifier in a sense because everybody's talking about similar phenomena. That goes against the notion that there are cultural differences in how you do science, but maybe there are cultural differences in what you want to do with the science that you're developing. Any observations on that score? Could you take people anywhere in the world and transplant them into each other's labs and they would be equally comfortable?

RP: To a great extent, especially, say, European labs and U.S. labs, I think are pretty easy to go back and forth. In Taiwan and in China what I saw was a much greater government involvement. They would have this technology park that would have the university and a bunch of companies and a government lab all kind of mixed together that were focused on very specific problems that they thought would be important to impacting society.

I saw that both on Taiwan and in mainland China. That mechanism of setting up and doing research and who's controlling the focus of the research is a little different culture than what we do in the U.S. where each professor or each research staff person at a national lab kind of defines their own curiosity-driven program. So it would be a little different to try to transplant from those labs.

AK: The Optical Society of America Foundation, tell me a little bit about what your involvement with that was and where you think it should go.

RP: Actually, I haven't had any direct involvement with it. That started after I had phased out of leadership, so I wasn't involved in any of the discussions or anything about starting it. I followed with interest what they're doing and how they're doing. I think they're doing a great job, especially in funding things and education and special projects like this new Tony Siegman endowment for a laser summer school. So I don't have much I can comment on, on the Foundation, except I really think it's a great idea.

AK: I asked in part because you had such a successful involvement in K through 12 and encouraging interest and talented young people in science and engineering.

RP: Sure.

AK: Sum up for me now, you're retired from the university.

RP: Right.

AK: You are doing some enjoyable astronomy in your front yard.

RP: (Laughter.) Uh-huh.

AK: What else are you involved with right now?

RP: Like every retired professor I became a consultant. It turned out that what most people wanted to consult about is solar energy. I worked first for Science Foundation Arizona to help them start a solar energy group of projects that they had money to fund. Now I'm working with the Research Corporation for Science Advancement helping them with their solar energy program. Research Corp. is the second oldest science-funding group in the country after Carnegie Foundation. They happen to be located in Tucson, so it makes it convenient. We're funding over thirty projects.

There's a lot of optics involved in solar energy. Certainly a lot of solid-state physics, but optics for a lot of our projects involve concentrator optics, Fresnel lenses or holographic diffraction gratings, things that you could use to concentrate the sun's light. Then in a solar device you have a lot of optical materials, transparent conducting oxides and the photovoltaic material itself. We're just currently using things like silicon that have a upper limit of efficiency that you can't get by physically, you're not going to beat it.

You're looking for different ways to structure these materials so quantum dots and nanotechnology is playing a big role in developing new kinds of materials for solar energy. My focus still is on optical materials. The application is specifically for solar energy instead of for lasers, but it's similar. Of course, I'm not doing my own research with this; I'm helping the funding agency define what should be funded and then monitoring those programs.

AK: Is this connected with the university or is it independent?

RP: Research Corporation is an independent organization that funds projects at universities. I have to be careful of conflict of interest, so I make sure I don't get involved in anything at the U of A. Science Foundation Arizona was similar except they specifically fund Arizona universities, so there wasn't a real problem with me getting involved with some of those. The work is being done at universities. I'm just doing the decision-making on what to fund and how to develop the field.

AK: Towards the end of your term as OSA president in 2001, we experienced this attack on the World Trade Centers, and the Pentagon, and the plane that was downed in Shanksville, Pennsylvania. The OSA, the next month in October, held a meeting out in Long Beach, California. There was some discussion about whether to have the meeting or not. Tell me a little bit about that and the decision to go ahead.

RP: I think a lot of people at that time were concerned about traveling because of the airplane hijacks. A lot of people were in mourning because they had friends or family that were involved in this. So we discussed whether or not it was a good thing to go ahead with the meeting. We decided to do it and we knew that we'd have a lower attendance.

But we felt if we cancelled it then the terrorists had really won, at least in our case because they stopped us from going on with life as usual, and that it was important that we make the statement that no matter what they did, they weren't going to destroy our way of life and so we did go ahead with it. It was a fairly successful meeting and we had

a lower attendance, but we had a lot of good scientific talks and the people who did attend it I think liked it like they do any of our meetings.

AK: It was in a speech that you gave at that meeting where you mentioned your early memory of being around the radio set and having your dad go off to war. I guess this brought back memories.

RP: Oh, yes, that was probably the other time in our history when we had an attack like that. It did bring back a lot of memories.

AK: An attack on our shores. You also mentioned, apart from the decision to proceed as an act of determination, even patriotism, Vannevar Bush back in the 1940s making the case for a very strong science and engineering involvement with defense, that science and engineering were going to be crucial to any successful defense of the United States. You remade that case in light of the 9/11 attacks. Tell me a little bit, if you could, about how optical science has fared in that regard; the kinds of things that have been done in the interest of this new crisis of making America safer with increasing our security.

RP: Well, there are a lot of different areas, optical imaging technology has developed to very sophisticated levels. Both, say, imaging from satellites where you can look at who's developing atomic weapons, or who's doing what. You can really get a tremendous amount of intelligence with very high resolution from that kind of optical imaging which is very important.

There's a lot of development of sensor technology; remote sensing where you send a laser beam out and it comes back and tells you what kind of gas may be present or other kinds of things that you're interested in. Imaging technology, sensor technology, and just normal homeland security, what's going on with these high-resolution x-ray scanners at airports now. I think there are quite a few things that the field of optics has been developing in response to this.

AK: Just the couple of examples that you gave to support the idea there's a strong case to be made for continued funding of R&D, science R&D.

RP: Yes, oh, yes, very much.

AK: What did you find most satisfying, looking back on your career?

RP: I think any professor will say that what's most satisfying is seeing the success of their students and post docs. I ran into a former student yesterday here at the meeting that just gave me his new business card. He's been promoted to the CEO of the laser company he works for. I've got students in various labs and universities. It makes me very proud to see what they've done.

That's probably the biggest thing. I think also things we talked about a few minutes ago of the projects like the Oklahoma School of Science and Math, large binocular telescope.

These ongoing things that you start sometime during your career but they take off and are successful without you later on. I think those are the sorts of things that give me a great satisfaction.

AK: Your career certainly has exemplified the idea that there is a rich variety of ways that science can get involved with society in useful and productive ways. They counter the stereotype of the isolated scientist. Of course, you wanted to go there, you wanted to get involved with a network of people who are doing science in useful ways, and you did. Congratulations.

RP: Thank you.

AK: And you're not done yet.

RP: Uh-oh. (Laughs.)

AK: You're done with me, you're not done with what you do.

RP: Yes, we're still working on solar energy.

AK: Terrific, thanks for joining us.

RP: Oh, you're welcome. It's been fun to do.

AK: You mentioned Tony Siegman. He recently passed away.

RP: Yes, he was a good friend, hated to lose Tony.

AK: He was so well known.

RP: Yes, when I was ready to teach my first laser course, I ran into Tony and he said, "Oh, I've got a new textbook coming out."I said, "But it won't be ready when I need it for the students." He said, "I'll send you the proof pages of it." He sent me the proof pages of his book which I used for my class notes for the first laser course I taught then. Great book.

AK: That's collegiality.

RP: Yes, it is, and that was Tony.

AK: All right. Thanks again.

[End of Interview]