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ORAL HISTORY AND COMMUNICATION OF LEWIS RESEARCH CENTER

INTERVIEW: DR. PATRICIA M. O'DONNELL
DEPUTY OF THE ELECTRIC TECHNOLOGY BRANCH

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ZATROCH: Well, I think we better get moving here because Dr. Patricia O'Donnell has another appointment in about a half-an-hour from now. I would like her to do most of the talking. I'll just once in a while, come in with a question, Dr. Gorden, and try to get in the Oral History of Lewis, and her historical experiences that she went through. There are so many that I can remember that she told us about at the Business and Professional Women's presentation, so I would like her to tell you about the first day she came here and from then on her personal historical experiences. And I hope she tells you about her African experiences as a Project Engineer and with the Papago Indians. So, I'll turn this over to her and have her introduce herself, her title and what she does in a typical day, and anything she wants to talk about, mostly her experiences from the beginning to the end.

O'DONNELL: Thanks, Del, I'm Dr. Patricia M. O'Donnell, and I'm the Deputy Chief of the Electric Technology Branch. Our branch is responsible for all types of power systems for future satellite applications and electrical power systems.

ZATROCH: We had a little trouble with the cassette tape malfunctioning, Dr. Gorden, we lost the entire first taping of this interview. This is the second tape of her interview. We will now continue with Pat's oral history of her career, her stay here at Lewis and all the things she has done.

O'DONNELL: Thanks Del. Well, I was mentioning that the project that I decided to do for my Ph.D. involved very highly toxic material, and the school could not accommodate the chemicals from a safety point of view, so they did allow me to do the research here at NASA Lewis. I pursued and finished my research. I had to write my thesis. Then another provocation came along, and when I look back, I'm not sure how I did this. I had been at Lewis for over 20 years when my Division Chief called me in his office and said that there was an opportunity to go to Washington, D.C. for a year's training program and he thought I should seriously consider that. So, this meant I was doing a thesis. I did go to Washington, I didn't know how I was going to do that, but I did it very quickly. I packed up a suitcase for each one of us, took the coffee pot, a fork and spoon, and we drove to Washington.

ZATROCH: You took the whole family with you?

O'DONNELL: Uh-huh. [Laughter] I rented everything, when I got there. I rented the furniture, I rented tables, lamps, rented an apartment, and there we were.

ZATROCH: And your husband went with you too?

O'DONNELL: No, he didn't go with me. Then I stayed in Washington, working, which I enjoyed very much at NASA Headquarters. They gave me an overall perspective of essentially the corporate headquarters of the agency, but at this time I was doing a thesis in Akron and living in Washington, which

meant I was flying back and forth, like I was on a bus to see my professor and advisor all the time because there were always things to discuss. So that was a little difficult.

ZATROCH: This was about 1974 or thereabouts?

O'DONNELL: Yeah, about that. I was in Washington in 1976, so then I stayed a little over a year in Washington. I came back.

ZATROCH: Let me ask a question about communication there. How did you relate, was it easy to communicate with people and get things that you wanted? Did you get the cooperation of management? Did you have any problems at all in the field of communication?

O'DONNELL: No, I didn't have any problems in the office I worked in, I worked in the Department of Energy Programs and I was very fortunate that people that I worked for were dynamic people, they got things done. There was no hesitation when they wanted something done and they told me in no uncertain terms what they wanted, and when they wanted it. It wasn't a soft communication relationship, it was 'get the job done' type.

ZATROCH: Autocratic?

O'DONNELL: Yes, 'You give it to me by 10 o'clock.' It was definitely 'I give the orders, and you implement.' However, it seemed to work very well, we got the job done. I guess the only thing I can say about Washington is that the turnaround time for some of the things they want is very, very short. It's kind of a high-stress job, you wonder if you can get it done when they really need to get it done. However, it is a very satisfying place to work because you're close to the pulse of the activity of course, which is Congress, and all the lawmakers, and all the decisions, the OMB, the money, the legal interfaces, so it's a very exciting place.

ZATROCH: OMB, better explain that.

O'DONNELL: Acronym for Office of Management and Budget, which of course, has the final say how much money any agency gets and what it is they're going to OK that agency to do. So, they play a very important role in the future directions of any government agency.

When I came back, there wasn't anything particularly interesting in the group I had left, and I had kind of moved from combustion over into electrical chemical research. So when I left to go to Washington, I was in an Energy Storage Group, that's not like your moving in storage, it's like when you need to save energy for a period of time. I'll give you an example. The Electric Illuminating Company, which you're all familiar with, does not build plants big enough to run everything. If everybody turned on all the lights, all the hair dryers, all the washing machines, and everything at the same time, they couldn't afford to build that plant, so what they do, they build a base load plant and then they have the capability of turning things on if there's a peak load, and they have load leveling applications. So, they do it in the most economical way.

Well, those are the kind of things that I was looking at for solar applications and wind applications, because the wind doesn't blow all the time. If you have the windmill generating the electricity, you need to store it when the wind is blowing, and use it when the wind isn't blowing. In solar cells you collect as much as you can when the sun is out; when it's dark, you have to use what you saved. So, I was kind of in the energy-saving business.

Then when we came back from Washington, there was an opportunity to go into the photovoltaic group which was emphasizing terrestrial photovoltaic as opposed to space photovoltaic. We had, since I came on board, changed from NACA, the National Advisory Committee for Aeronautics, to NASA, National Aeronautics and Space Administration, so space was our goal as an agency. However, there were many technologies that we worked on here which also could benefit people here on Earth, and we call those 'terrestrial applications.' We worked very closely with the Department of Energy in any research which was synergistic with space and terrestrial, meaning that there were mutual advantages made by taking the technology and applying it to some space application.

This group essentially worked through the Department of Energy, through the State Department, and through the World Health Organization. We worked many programs for the benefit of lots of people using the technology that NASA had developed for space. The particular project I was on came through the State Department. I had several programs, the people in Africa, of course, are on the equator. They have lots of sunshine. They have no electrical grids. They need electricity, if nothing else, so they don't have to carry water from a dirty puddle home to cook with. They need a water pump. They need a solar-powered water pump. They don't have kerosene, they don't have gasoline. If they get any water, they dig a little well and pull it up by hand. So, there were a lot of applications for solar energy to be utilized for the betterment of those people. We did many of those.

ZATROCH: What era of time was this, Pat?

O'DONNELL: We're talking about late '70s and early '80s. I got the responsibility of building four solar-powered energy villages in Gabon, Africa. I was the Project Manager and I interfaced with the person in Gabon who was the Head of the Government Department for mining and hydraulics, because we were looking at water supplies for the people out in the jungle. We asked the people, and for the sake of communication, I should point this out, we never did a project without going in and talking to the people first. We had an anthropologist, or a historian go in, look at the life style of the people, ask how many goats go here, how many cups of water do you use here, where do you get the animals, where do you water the animals, and every detail of their life style. Our goal was to not interrupt their life style, just make it a better quality.

After we put the systems in, after a year, and after several years we went back to see if there were any adverse effects of our technology in that particular village. One void in communication was we always asked the people what they wanted as far as electrical things were concerned, and they made a list. Of course, their government had to approve that list, but in general the solar-powered water pump was the first thing they wanted.

So, I didn't think that was any particular problem. I was going to go to Gabon and I was going to put solar-powered pumps on the water wells. I guess it never entered my mind that there would be a country without a single water well. They happened to be a member of the OPEC nations, and the only thing they ever drilled for was oil. So the first thing I had to do when I got to Gabon was to take test samples and hire a drilling company to drill water wells before I put the systems together. [Laughter] So, those are the things that you don't think about and I guess you can consider them a lack of communication. You proceed, because of where you are coming from. And you don't find that out unless you communicate very well.

ZATROCH: But how did you communicate? Did you know the language?

O'DONNELL: No, I hired an interpreter. Actually, it's very difficult to communicate in the jungle because the villages do not speak a normal language. Well, for instance, where I was they speak a language called

Fang. The country, as a whole, is French, so you can talk to the government people in French. The further you get removed from civilization, going out into the jungle; they have their own type of language. But, you get along. You smile and wave your hands a lot. [Laughter] I guess we're running out of time here.

ZATROCH: No, I just have a 10:30 interview appointment with someone else. I was just thinking of your time.

O'DONNELL: I also had the opportunity to put in a solar-powered village at the Papago Indian Reservation which is out in Arizona, and it might be news or not news that, after doing a survey where solar energy could benefit people in the United States, we found that the only place where there was not a grid, an electrical utility power lines, within a reasonable distance of people, were unfortunately on the Indian reservations. The only other application we found were remote hunting and fishing lodges, but everybody else in the United States, no matter where they happened to live is within a reasonable access to an electrical grid. So, unfortunately, the Indians were identified as somebody who could use solar energy. We went and talked to them. Yes, they could not afford the fuel, but he was in charge of getting the fuel; the Chief of the village had to use his own personal money to put the fuel into the diesel generator. It was an economic hardship on him, but they lived as a tribe, as a village, and the Chief gets all the responsibility. So, we put in the system. They were very happy with the system and the system worked very well.

ZATROCH: Give a little description of what kind of a system. I thought that was kind of interesting.

O'DONNELL: Well, there are solar panels in various size systems. The one we put in, oh, about 2 kw or 4 kw, depending on how people are going to use this. The people decide what it is they want the solar cell electricity to go to. The Indians chose refrigerators, because Indians live on dried food because they have no refrigeration, so they eat dried beans, smoked meat, dried this and dried that. So it's not a very broad selection of a diet for them only because they can't keep anything in a refrigerator because they do not have any refrigerators. They don't have any electricity, except the diesel generator.

So we gave them refrigerators, and another communication thing I'll bring out here, they wanted a sewing machine to sew their tribal outfits, and they wanted lights, one light in each: in the feast house, and one in the church. These Indians had no electricity except the diesel generator which ran out of fuel and which didn't work all the time. The problem was, even though they were attempting to get their children educated, the children could not study at night, except by a candle or kerosene lamp, which wasn't too good. So they wanted lights so the kids could at least read something when it got dark. We gave them all these things.

It was interesting that you don't think about everything. We gave them refrigerators, individual refrigerators. At first they wanted a big refrigerator for the village. The village is very small, maybe 15 or 20 people. But then they decided that maybe the Bureau of Indian Affairs were the ones we met with regularly to discuss problems and that they should have individual refrigerators because Indians share everything. You cannot tell a member in your tribe that he cannot share what you have. That's just the way of life. If I happen to be working and I had some money and bought something in the communal refrigerator, I would not be the first one to eat it. And that was acceptable. However, to avoid any problems like that, we gave each household an individual refrigerator, not in a house, but in a little building that we built, so that they could close the door and nobody else would go into that refrigerator. However, closing the door was a problem, because they never had refrigerators and, therefore, they didn't realize that you had to close the door. [Laughter] So, after we put in the refrigerator, the first pictures that we took had all this ice and frost all over the door, because they kind of pushed it, but they didn't really shut it.

ZATROCH: How often did you go out to check all this to see how it was working?

O'DONNELL: We went out quite often. So we did a lot of those programs. Then it was decided there was so much work coming in the field of aeronautics and space, that we would not do any terrestrial programs any more. That was an agency decision, one of the changes in our organization [note Dr. Gorden], so we went back totally to space research.

ZATROCH: Now what year was this, would you say?

O'DONNELL: It was in the '80s to 1982 time frame. There was an opening for a management position in the, I don't know what they called us then, they've changed our name a few times, we're the Electro-technology Branch now. I thought since my program is phasing out, I will apply for a job because it was a mutual match for my background. I did apply for the job and I did get the job. So I became the Section Head, we had Sections at that time, Electrical Chemical Fundamental Section.

ZATROCH: Let me interrupt at this point in order to have you appreciate the fact that, mind you, that all the years that Pat worked here how slowly a woman was able to advance herself. She's now a Section Head all right. And now she's a Branch Chief. The 'wheels of the mill' grind slowly as far as the women are concerned at Lewis Research Center and other NASA installations. I just want you to appreciate the fact that a woman has to really work hard to get to where she is today. Continue, Pat.

O'DONNELL: Whenever anybody [laughing] asks me about women and how they are doing, the advancement is positive. I've got to say that. Through the years, I've seen at least recognition that women have not been recognized, however, the rate of advancement is so slow, you wonder [laughing] if it will ever happen. Anyway, that's just an aside.

I am now a Deputy Branch Chief for the Electric Chemical Technology Branch. A Branch is approximately 20 people, so I have 20 scientists and engineers that I am responsible for overseeing their research making sure that we meet our milestones in different programs.

I wear several hats, I'm a Deputy Branch Chief and I do battery work and fuel cell work, and any electrochemical device we look at, because we have to develop the lighter power systems, longer-lived power systems, and more efficient power systems for space application because the cost of getting it into space is just horrendous.

I also am the manager of the total NASA, as an agency, battery program. That's a very large program. Every Center is represented, every Center has projects, and I have to interface with people at all the different Centers, Goddard, Johnson, Kennedy, Ames, on all types of battery problems; so I also have that responsibility.

ZATROCH: You act as an expert and consultant, is that right?

O'DONNELL: No, I run a multi-multi-dollar program involving all of them.

ZATROCH: Do they have to clear it; the communication has to be between you and them on what they are working on?

O'DONNELL: Yes, I get the money from Headquarters and it's a mutual agreement what problems we decide we're going to solve with that money. They have to answer to me for the progress for those particular things.

ZATROCH: Communication-wise, how do you interface with them? Do you use our conference room for that? There's a teleconference system we have here. How do you communicate with them, mostly?

O'DONNELL: On a lot of our programs, we have used the teleconference room.

ZATROCH: Explain that a tiny bit for them.

ZATROCH: All right. The teleconference room is very nice facility that allows you to make contact with the other agencies or with corporations. The last one I was at was with the Space Station. I work very closely with the Space Station Office out here on power systems. They'll have their prime contractor, their subcontractor, their space station people, and the power people in a room. Well, the NASA people who are the space station people and the power people are also here in the teleconference room. There are TV screens and you see the conference room that you're having a meeting with, which are the prime contractors and the subcontractors.

ZATROCH: In other cities and states?

O'DONNELL: In other cities and states, and you talk just like you're in the same room but you're not. They answer, they put their graphs and charts and data on the screen and you can see the data points, you can see the curves.

ZATROCH: Saves a lot of time, travel, and money.

O'DONNELL: Yes, it's very convenient. We use those kind of facilities. We use conference calls an awful lot. That's where you call the operator and you tell her that you would like Johnson, Ames, Goddard and myself, and maybe one or two of my people on a conference call and we have speaker phones, so we just turn on our speaker phones, and I have people here in my office. The operator calls when everybody else is on the line, and you just start talking and everybody hears you and everybody else talks back.

ZATROCH: And the operator coordinates all these phone calls for you?

O'DONNELL: Right! That's a wonderful means of communication, because Johnson Space Flight Center can talk to Goddard Space Flight Center, Goddard hears them, and Goddard can say, 'Well, Johnson, I don't think that's so, maybe we should look at this,' and I say, 'Well, maybe we don't have enough money to look at both of these in the program, may we look at something next year?' So, we can coordinate the whole program that way, which is very good.

We also meet physically several times a year where the representatives and the people working on all the programs get together and we have a 'Progress Report,' where people actually get up and give their presentations and we collect all the inputs and put them out as a document.

ZATROCH: They come here to Lewis?

O'DONNELL: We rotate the meetings from Center to Center. The next one happens to be at Lewis. So, that's the kind of things we do now.

ZATROCH: I took a picture of you by that Mars picture. Could you tell me what that could be?

O'DONNELL: The future of our programs is (1) Power systems for the exploration activity. Exploration activity is NASA will go back to the moon and will go to Mars. Mars is a little different in that when

you're designing power systems, you have to design them, specifically, for each application. The Lunar application takes one set of criteria, the Mars application another set of criteria, so we design specifically for each application. We also do satellites like I said, and our first success is 'Flang' for which we designed from scratch our own types of power system. We've designed a nickel hydrogen battery for space application. Everything flying up to this time has been nickel cadmium batteries and they are too heavy, they don't live long enough, we had a lot of problems with them, so we have designed a special space battery which is a nickel hydrogen battery and our first flight of that battery is on the Hubble Space Telescope, and I must say, it is working very well.

ZATROCH: There we go, so we have a success story. When you communicate with your own people, how often do you meet with them and talk over the tasks you have to do, or the projects that you have to work on, with your own direct people here?

O'DONNELL: We work in two ways, the Branch as a Branch meets oh, once a month. Anyway, more often if there are crisis situations that have to be communicated. Like, if we have budget items to talk about, then we call a special Branch meeting, but, as just a regular get together and update everybody, we meet once every three weeks or so. Within the Branch we have a microstructure, and that is we have task teams. We have an engineering team for one type of nickel hydrogen battery, another engineering team for another type of nickel hydrogen battery, an engineering team that addresses fuel cells, and I head up an engineering team that develops advanced components for a light-weight nickel hydrogen battery.

ZATROCH: Like for the space station, for instance.

O'DONNELL: Right. We have the Space Station as one of our future missions, and there's the Earth Observing Satellite, which will look back at Planet Earth and see the problems and the rate of change of problems, good or bad. There's the advanced TEDRIS Satellite which we're working on power systems for, which is a data relay and tracking satellite, which communicates the data back and forth to Earth. So, we get together in our task teams on a more regular basis which addresses one particular engineering aspect of the whole Branch and, essentially, it's a scientist and scientist kind of thing at a very fundamental level.

ZATROCH: Is it very informal?

O'DONNELL: It's informal, it directs where we want to put our emphasis, what new data points we've got, how they fit with our theories, what mathematical solutions we should look at.

ZATROCH: Do you share suggestions, do you talk things over and are you communicative?

O'DONNELL: It's a group decision process and consensus. And it's a scientist analyst process, because the person might get data and it may not fit a preconceived equation, for instance. So we have people who are mathematically inclined, and the mathematics-background person would have the capability of looking statistically at that data, then we do things like the TAGOOCHI analysis of data where you don't have to do 99,000 experiments. You can do certain matrix of experiments and then analyze them mathematically to get your answer. So we have a mix-and-match of expertise that look at the data and tries to tell us how do we translate data into good engineering designs.

ZATROCH: And everyone offers their own suggestions, depending on their own expertise?

O'DONNELL: Right!

ZATROCH: People will accept these suggestions?

O'DONNELL: Oh yes! People will accept suggestions. We talk about them. The task groups are small, about five people generally. Maybe somebody says, 'Well, maybe we should use the two-parameter method.' And somebody else says, 'Well, we would feel better if we used three.' And maybe we can't use three because the budget or time constraints say we don't have time to do that, in depth, let's take a look first and then we'll refine later. Yeah, there's never a problem with the decision. Everybody signs up to whatever they decide to do, so everybody feels comfortable with it.

ZATROCH: So each person signs up for part of that task, and you all get together and talk about it, and maybe kind of interface and improve on it, or get some ideas and give suggestions to each other. Is that the idea?

O'DONNELL: Yes, that's the idea. And we've built our advanced battery by this method. We had teams competing each other for an advanced design. They worked out their heat transfer equations, their thermal management, and their concentrations, and everything. Each team made drawings, they designed parts and everything. Then we had a runoff between the two designs.

ZATROCH: A little competition?.

O'DONNELL: Uh-huh.

ZATROCH: The reward system, we were talking about that in class, that sometimes has incentives.

O'DONNELL: So we're anxious for the future and what it beholds. I guess, when Del said 'Communications,' I thought, 'I don't do communications, I do science,' but, I guess, as I've been thinking about it since she came and asked me if I would do this interview, I've been thinking, 'there's not even an hour in a day that I'm not doing communications very seriously. And sometimes you have to be very careful because miscommunication, one person goes off with one analysis of a situation, and somebody else goes off with another analysis of the situation, so I don't think you could ever have too much communication. I think the problem is that you can have too little communication.

ZATROCH: Pat, thank you so much for your time and I know your time is valuable and I appreciate it very much. I hope, Dr. Gorden, that this will help all of our students and wherever this information will end up, because Pat has given us some very valuable information about communication, and also about her own career and history of Lewis. Thank you very much.

O'DONNELL: Your welcome, Del.