American Meteorological Society
University Corporation for Atmospheric Research

TAPE RECORDED INTERVIEW PROJECT

Interview of Warren M. Washington
October 22, 2008

Interviewers: Rajul Pandya and Aaron Andersen

Washington: Weekends at a big hospital washing dishes and pots and pans. And it was a huge hospital, I think at that time about maybe 500 or 600 patients. And I can remember that we had a huge dishwasher, it was bigger than this room, where a colleague of mine who became a doctor also, medical doctor, he'd be at one end. If the dishes came through dirty we would throw them back --

Pandya: Through again?

Washington: So they would go down again. I don't think anybody knew that we were doing this with expensive glasses and plates. But we were quite good at it. We didn't break very many.

Pandya: You mean you would throw them through the air to each other?

Washington: Yeah. Threw them in the air.

Pandya: Oh, wow.

Washington: One of these -- almost like a big conveyor belt. And we would put the dishes in these racks, and then they would go through on the conveyor belt. Anyway, on the dietician, I asked her. I said, "Well, I want to go into physics." And she said, "Well, we have an affiliate hospital in Corvallis, Oregon where Oregon State University --" It was college then. So she called up and got me a job on the spot. And it paid $1 an hour. Up in Portland I was making 72 cents an hour.

Pandya: This was a good deal.

Washington: Yeah. Well, it wasn't a bad life. I saved my money. I had a -- my first car cost $75, a 1936 Ford. And of course being a high school student with a car, that was great. The automobile insurance cost $90 a year. So it was more than the car. And unfortunately, like most teenagers, I got into a wreck. I wasn't hurt or anything. So I couldn't get that car fixed, and so I bought another car. It was a 1940 Ford. And it was a really spiffy car I thought. I have a little excerpt in the book about when I turned 16. I don't know if you remember.

Pandya: You broke your knee.

Washington: Yeah, I broke my knee. And here I am 16 years old. I had bought the car. This was the earlier Ford, before my 16th birthday. And when my birthday came I was still on crutches, so I couldn't drive the car. And I would go out and wash the car every day and shine up things. But I couldn't get in to drive it. That was torture for a young 16-year-old, to have a car and can't drive it.

Pandya: Can I ask what kind of car you have now?
Washington: I have a Prius.
Pandya: How come?
Washington: I get roughly 50 miles a gallon.
Pandya: Wow, it's not bad.
Washington: Yeah, so trying to do my little part for the climate system.
Pandya: I'm guessing mileage wasn't a priority in the 1940 Ford.
Washington: No. No, in fact the gas prices were as I recall around 20 cents or 25 cents a gallon. So it was pretty cheap. I don't know. But salaries weren't very high either.
Pandya: So it sounds like some of your college decision was around where you could get a job, where you could --
Washington: Yes, basically it was, yeah. And I arrived at a school that was good, I think, for me. Because it's in a very small town. Wasn't much to do. I had some advantage over other students because I was an African American, and see, there were only about maybe eight or nine students who were African American at the school. The rest were on the football team. I was a physics major. Now the advantage was that I can go to any athletic event and get in free, because they assumed that I was part of the athletic -- I didn't get challenged, even though I used to joke and say, when they asked me what do you play, when I wanted to get in, I'd say tackle. I weighed about 130 pounds. So they must have known I had to be awfully mean if I were a tackle at that weight.
Pandya: That's funny. I guess I want to go back. You talked a little bit about how far you feel like civil rights has come.
Washington: Yeah. Well, even at a place like Oregon State, I probably didn't suffer a lot of indignities about name-calling and that sort of thing. I think most people treated me reasonably well without -- there were some racial incidents on the campus that I could talk about if you wanted me to talk about them. But I guess I just felt that I needed to stay focused on getting my education and not let people deter me from it. The only discouraging thing was when I registered at the school, the counselor that was assigned to me strongly discouraged me from going into science.
Pandya: Really.
Washington: Yeah. He really thought I should be a business major. And I don't know if that was just stereotyping or what, but I said no, I want to take physics and register into that major. Unfortunately, I never really met up with him again after all those years to probe on why he wanted me not to register in physics. But overall that was a good experience for me, going to that school.
Pandya: You did have these incidents. And if you want to talk about them that's great, if you don't that's fine.
Washington: I don't think -- yeah, I think I've covered some of those things in my book. But they're not probably extremely relevant to how I went through the educational process and came to NCAR and got into atmospheric science.
Pandya: What about advice you'd have for a young person like you who wanted to pursue science and got some of these signals or got some of these things that happened to them? What advice would you give them?

Washington: Well, I think the advice that I give is pretty much similar to what I would give to all students that come and see me. Over the years I see a lot of students and try to help them out going forward. I think that the basic advice is that going into science, going into atmospheric science is a good field to go into. I would think that if we're going to deal with diversity in a serious way we need to especially encourage young minority students to get into it, just because they're such small numbers. And they're small numbers not only in our field but in other areas of science and engineering. But I think what I've learned from my educational process, especially in graduate school, is that I was very fortunate to have mentors who encouraged me all along the way. And so I know that mentoring is an issue that almost all professional scientists and engineers need to do. And the reason I say that is because we benefit from our predecessors mentoring us, and we need to pass that gene and capability on to others who are just coming into the field. And if we don't do it, then we're just not acting in the scientific tradition of passing on knowledge and experiences and educating the next generation.

Pandya: Who were some of your mentors?

Washington: Well, I think I had some at Oregon State, but I would say that the most mentoring that really helped shape my career were a person that -- well, several persons. One person was when I had a summer job at the Stanford Research Institute. And his name was Manfred Hall. He was a young PhD from UCLA who was mentored by some of the premier theoretical meteorologists in the field. And then when I went to Penn State -- and I can just tell a few anecdotes here. Manfred encouraged me to apply at several schools, I think about five or six schools. So I sent out applications to these five schools. Florida State sent back a question for me. They said could you send your photograph. Now I didn't even know that it was a segregated school. In Tallahassee at that time -- and still is to a certain extent -- Florida State University was the white school and Florida A&M, which was just a few miles down the road, was the black school. And growing up in Oregon I didn't know that. And so when I applied there, I can see why that question came back, could you send your photograph.

Pandya: Did you send one?

Washington: I don't think I did, because I think I figured out then what the situation was. But I got accepted at a number of schools. I even applied at MIT, but I didn't realize this until a few years later -- or it wasn't until next April, the following April -- I think I applied in the fall of '59. And I got accepted at Wisconsin and at Penn State. But Penn State had a very interesting offer. It was to work on analyzing the data to put it on grid point and then do simulations of the stratosphere with very simple -- well, they weren't simple models, but they weren't as comprehensive as our present-day climate models.

So I took the Penn State one. That seemed the more exciting to me. But it wasn't until the following April, after I had accepted going to Penn State, that I got a letter from Norm Phillips, the very famous meteorologist at MIT, that they found my application behind his desk. It apparently fell off. He apologized. But I had already made a decision to essentially go on to Penn State.

Now I talk about this a little bit in my book, but the person I worked most closely with was Hans Panofsky, a very famous mathematician, astrophysicist, and meteorologist all rolled into one. He was extraordinary. His father was Eric Panofsky, who was a very famous art historian at Hamburg University. And he had two sons, Wolfgang and Hans Panofsky. And what's interesting about them, he had to leave Hamburg because of the Nazis, and he's world famous for his art historical work. Probably the most famous art historian in Europe. And so he got a job at Princeton Institute for Advanced Study and he was a good friend of Einstein. So they left in the mid '30s and both of the sons came and finished up their education at Princeton.

And there's this thing about the dumb Panofsky and the smart Panofsky of the two sons. One son got straight As and the Panofsky that I worked with, he got one B. So they liked to joke about -- and they apparently both took turns chauffeuring Einstein around, because he didn't like to drive a car at that point in his life. And I ran into Wolfgang just before he died, I guess it was two years ago. And I said, "Well, Hans said that he was chauffeuring." And he said, "No, no, no, I did the chauffeuring." And so I got a Christmas card from Hans's wife, and she said that no, it was Hans who did the driving, because he was the older brother. And can you imagine when you have two brothers, the elder one is going to always take seniority over the younger brother.

But both of them were very active in their fields. Wolfgang went on to develop on the large linear accelerator and was very active in the movement of physicists to lead towards nuclear disarmament. And Hans joined Jule Charney and others in actually doing the first data analysis on the ENIAC computer where you take unequally spaced data on the weather data and then transforming that to a regular grid so you can put it into the computer. And for the mathematicians that might listen to this, the way he did this was he did a double Fourier series and then calculated on the coefficients from unequally spaced data, and then used an interpolation back to a regular grid. So it was a novel way to do the problem.

Pandya: So what do you think Manfred Hall and then Hans Panofsky -- why were they such good mentors? What made them good mentors?

Washington: Well, they would talk to you. In Manfred's case, he was my first real mentor in terms of really sitting down and putting the equations on the blackboard, helping me on the calculations. And what he really wanted me for was to help with the calculations. They didn't have a computer at that time. And so we had to do everything with something called -- on a Marchant calculator. It was a big electronic calculator about this size. And it was like an adding machine. So if you wanted to multiply like ten digits it would actually just keep adding it time after time until it got up to the number. And so it was a horrible thing to have in your office because it sounded like a food processor grinding all the time, and then it would come out with the numbers. I don't think that they had a computer there. Well, if they did, I couldn't have access to it. But I did all my work -- it was a summer job -- so well that they put me on another project doing the calculation of the seismic waves in an underground explosion like a nuclear explosion. So I got a chance to do some geophysics a little bit too. But it was pretty boring work sitting there watching that calculator grind away numbers.

Pandya: So what kept you interested in science then?

Washington: Well, I think Manfred was one of the first pioneers on putting together an analysis and weather service sort of thing. He had a project on the Naval Postgraduate School with the naval forecasting group that's out there in Monterey. And so I got a sense of understanding how to put together models, a little bit about how to do the analysis, get the data ready for them, and that sort of thing. It sounded like an interesting topic. So when Penn State wrote to me about coming there, it was on an Air Force project of a similar nature that Hans Panofsky was the PI for. And he was an extraordinary lecturer. He and his brother just almost frightened me by how they bright they were. He would stand in the doorway of the secretary's office and dictate a book, not write it, but just dictate it. And he would teach virtually every course in the department. And he would come in and just ask the students where he left off, and he would just go to the board and start writing. He didn't have any notes or anything. And he also did something that was odd. Penn State had a program even in the early '60s where you could get a degree by correspondence course. And so he actually wrote many textbooks while he was there where he would do thermodynamics, he would do the dynamics and so forth. And he would just write these books like he's dictating a letter. Just amazing.

And he worked with lots of students there. He was a very popular teacher because he was so easygoing. When you want to work on a PhD there are some advisors who tell you what you want to do and give you something fairly directed. He was entirely the opposite. He said what do you want to work on. Well, I want to work on making weather forecasts, or building computer models. And he would say why don't you go read this and look up how to do these things. And he would just always be encouraging. And he would want you to stop in about every week or so just to chat. But he wanted you to do the thinking and to also do the work of course.

Pandya: Like your chemistry teacher.

Washington: Yeah, very similar style. And I guess I respond well to those styles.

Pandya: Do you find yourself doing the same kinds of things when you interact with people?

Washington: Yeah. In fact I had one of the students in this morning, Jonathan Smith. Have you met him?

Pandya: Yeah.

Washington: Yeah. So he and I were -- that's the first time I actually met him. I was just trying to give him some ideas about how he could do his thesis topic. I kept in a gentle way, what's the scientific problem that you're trying to solve. And trying to give him a little guidance on putting together a workable hypothesis for his thesis that he could use to build his thesis on. So I enjoy passing on the mentoring gene as much as I can.

Pandya: When you finished up your PhD and you were deciding what to do next, you had a couple of job offers, right?

Washington: Yeah, I had two job offers. Yeah. I had a job offer to come to NCAR. And also it paid $9,000 for a year. And I got also a job offer from the Naval Postgraduate School that paid $12,000 a year. Now my wife at that time was

from Palo Alto, because I met her when I was at Stanford. And she obviously wanted to go back to California, because Monterey would be closer to her family. But we ended up coming here. And the thing that influenced me is I went to a conference up in Canada near the border at a place called Stanstead. And there was a little bar that was close to it. In fact if you sat in the table in the bar you could either sit on the Canadian side or on the US side of the table, and you'd be in one or the other country. And there was a very prominent scientist at that table, like Aksel Wiin-Nielsen, who became one of the directors here at NCAR. Julie London, who was over at the University of Colorado, Hans Lattau from University of Wisconsin, Bernard Haurwitz, the very famous scientist who was here for a while. And I asked them where should I go. And they all said I should go to NCAR, because they thought it was new, you'd be getting in on the ground floor, and that sort of thing. So I came here.

Pandya: So you got married while you were in grad school?

Washington: Yeah I did.

Pandya: Was that tough?

Washington: No, it wasn't too tough. At Oregon State where I went to school the tuition was like $47 a quarter, and I was making $1 an hour as -- at that time that I got married I worked on top of a mountain which was close by operating the weather radar. And I think I talked in the book that one night it snowed about four or five feet, and it was right at the freezing level. And so this huge air defense radar, which is much bigger than this room, fell, and just missed the little shed that I was in. And so I could have been squashed. But I think the cost wasn't a big factor. I think I earned somewhere around $150 a month, and the rental was like $13 a month in the place I was staying. So you could live. You couldn't live lavishly of course. In fact when I went to Penn State what was interesting was the tuition was $200 a month and -- no, excuse me. The salary was $200 a month and the rent was $90 a month. And for the first time and the only time in my life I registered as a Republican because the comptroller for Penn State was also the chairman of the Republican Party I think in that county. And if you wanted to get in state tuition you could register as a Republican. And so I registered and I got status as in state student. It really paid off.

Pandya: So if you had registered Democrat you wouldn't have got that status?

Washington: That's what I was told. So I didn't test it. I tested it the other way. Because it was a big difference in the cost of in state versus out of state.

Pandya: It's a little bit of a non sequitur, but thinking back to the beginning of the conversation, you talked about how far civil rights has come, and now we're talking about the cost of education and how affordable it was. And I was thinking about -- I think you quoted John Hope Franklin in the book talking about in response to a Senate resolution saying, "Yeah, that's great, thanks, but if you really cared you'd start working on making college affordable."

Washington: That's right.

Pandya: Where do we still have to go in terms of civil rights and equality?

Washington: Oh, wow. Well, I guess that's a complicated question. I'm not sure I've thought in advance of how to answer that. Let me just start out by saying this, that I think that we've gotten over many of the racial issues in that there's less

prejudice than there was in the past. There's no question about that I don't think. In fact you've heard of this issue called the Bradley effect where Tom Bradley was running for mayor of Los Angeles, and the polls showed him substantially ahead of his other candidate. And Bradley was a black candidate. And he had been mayor. So he had done a good job. But when the election returns came in he had actually lost. And so people tried to reconcile why were the polls different than the actual election, because the polls are usually fairly close in most situations. And I think that they attributed the difference due to racial things, that people when they went into the voting booth voted in a different way than they openly expressed. And that actually happened with another politician in the state of Virginia, Wilder when he ran for governor. The polls showed him well ahead but then he just barely squeaked by by essentially 1%. So I think that the attitudes really have improved. And that's been due to a lot of reasons. One is the civil rights era sensitized people, younger people who have lived in diverse populations, especially in the north and the bigger cities, just understood that race ought not to be the deciding factor. And even in the south a lot of the most blatant racism in terms of lynching and mistreatment of people has pretty much been less. I won't say it's been eliminated but it certainly is a lot less. So I think people have gotten more aware than they used to be.

So I don't know if that's going to change -- well, I think this election will be a good test of have we made any progress, just because the polls indicate for example that presidential candidate Obama is leading by almost ten points or something like that, and we'll just have to see how it turns out. I'm optimistic.

Pandya: Are you?

Washington: Yeah.

Pandya: Why do you think we still do such a bad job in STEM?

Washington: I think a lot of it has to do with the schools, elementary as well as secondary schools. We're just not motivating kids to do well in science and mathematics. And I think inner city schools are still very hard places for students who are more academically oriented to succeed in. They just don't have the right environment. I face this all the time when I talk with students as I go around the country. I at times get a little bit disillusioned because even when I went to high school, I went to high school that was probably 25 or 30% African American students, and I can recall that in some of my classes, like math classes especially, there were some students who were actually doing better than me, and yet they had very little motivation to go on to college, whereas I had parents that encouraged me. And one of the reasons that I mentioned earlier putting that cover on the book is when I went to the church there was lots of role models and encouragement to go on to college. I think a lot of the inner city schools now there's actually less of that positive peer pressure and positive mentoring for kids to go forward.

And maybe there's a little bit of blame in the African American community in the sense -- and I may be guilty of it partly too myself -- in the sense that when I grew up the black doctors and ministers and dentists and educated people often lived in the inner city, and a lot of those people have fled to the suburbs and are not as active role models for the students as they were when I

was growing up. And so I try to make up a little bit for that by being a role model in different kinds of ways.

Pandya: What are some of those ways?

Washington: The role models that we have for the young people now I think overemphasize things like athletics. And if you think about the small number of professional athletes, especially in like basketball, I think I read somewhere it was like 1,500 or something like that.

Pandya: I think you even talked about it in your book actually.

Washington: Yeah, it's a very small number of people who are going to be successful in terms of earning a good income. And yet there are hundreds of thousands of students out there thinking that that's what they want to do. And we really need to keep exposing them to other fields. This week in the mail -- I'm helping an organization that's called History Makers. Have you ever heard of that? You probably haven't heard of it. If you google it you would see. And what it is is it's a group that is going around the country interviewing successful African Americans in all fields of science and arts and literature and athletics and so forth and having them tell about their roots and how they got to be where they are. And I did it. But then I've been helping this group get some NSF funding because of the same problem, is that there aren't as many good resources to expose young people to as potential role models of what is possible if they have the capability and interest and doing. And I'm amazed at the number of people that they've got. They have interviewed over thousands and thousands of people and got their life stories, all the way from Colin Powell on down.

Pandya: Did you have some role models as a young scientist?

Washington: Oh, yeah, yeah. In fact I joined a fraternity in Portland. It's called -- well, it's a national one, but they have a local chapter. It's called Alpha Phi Alpha. And it actually spent a lot of time trying to interact with high school kids and so forth trying to get them to go into college and beyond it. And all of the doctors and professional engineers and -- I don't think there were many scientists in Portland, Oregon that I can recall -- and ministers and so forth were a part of this fraternity. And they would meet once a month and they would bring in people like myself and have somebody that would be like a buddy system, encourage you. Now I didn't need a lot of that because my parents had both gone to college, and so I was well stimulated to go to college. All my brothers have also gone on to college. So there was already an ethic to do that.

Pandya: I got the impression reading your book that you're worried about how expensive college is now. Is that right?

Washington: How what?

Pandya: How expensive college is now.

Washington: Oh yes. I think that's going to be a major issue. And if I can be a little bit partisan in things I've said or will say, I think Ronald Reagan did a tremendous amount of harm to this nation, because he preached that we should always keep the taxes low, which means -- at least my interpretation is that you won't be able to have the government help with things like education and so forth. I'm appalled for example when CU now, the state only contributes 15%. The ethic used to be quite different when I started school, which was that you wanted to have the state-

run institutions as cheap as possible so that anybody who's well qualified could go to those schools. And that ethic proved itself beyond great expectations was even on the GI Bill after World War II, where somebody coming out of the service could go to college and get an education and contribute to the nation. So the colleges were all very inexpensive. I don't know what the private schools were at that time, but on the community colleges, on the state colleges, were all driven in an ethic of the state is going to make this investment, and it's going to pay off economically. But when Ronald Reagan came in we switched over to an ethic of keep the taxes as low as possible and cut services. And you can see it. Our infrastructure -- and I consider education part of our infrastructure. It's just fallen apart. It's not only the bridges and the roadways that aren't being taken care of. And John McCain has been advocating this, that this is the way to get out of the economic mess. Well, if you think about the Great Depression as an analogue for what's going on right now, where there's loss of confidence and so forth, Roosevelt set up all kinds of programs, building roads, helping out with the National Forests and so forth, to employ people. And that paid off in that these people had decent jobs and were off of the public dole as much as possible. And the country turned around. I guess in a more minor sort of way Obama is pushing this in terms of moving towards a green economy. And I think we should have been pushing on it the last eight years but we haven't done anything except talk about it. So, sorry for the preaching, but I just think that we're not investing in the future as much as we should be, and education, all the way from preschool through graduate school, should be pushed if we want to compete in future world economies, because other countries are outdoing us.

Pandya: You had an opportunity to say some of these things while you were on the NSB, didn't you?

Washington: Yeah, they probably were tired of me talking about it. But the National Science Board, which I really had the privilege of spending some time on, and I was chair for -- I was on it for 12 years and chair for four years. I think all of us on the board felt that we were seeing tremendous underinvestment in education as well as in science, medicine, and engineering. And we kept pushing for like a doubling of NSF's budget. In fact I went to the White House and I saw George Bush, standing as close as you and I were, sign a document for the doubling of NSF's budget. He didn't give me a pen. I was hoping to get a pen. But I didn't get a pen. You know how the signing ceremonies --

Pandya: They give away the pen.

Washington: He signed it and put the pen back in his pocket, evidently one pen there. But I don't think he was serious about it. It was a piece of legislation that was passed by both the House and the Senate to essentially over four or five years double NSF's budget. Well, it never happened. The Iraq war came on and that was much more important than investing in things like the science programs.

Pandya: So how do you feel about that?

Washington: I think we wasted a tremendous opportunity.

Pandya: Do you think we'll have another one? Will we have another opportunity?

Washington: I don't know. I think whoever the next president is going to be has got a horrible mess to deal with. And clearly we need to change things around. I don't

mean to enormously increase the taxes an already bad situation, but we need to stimulate on the packages. In fact if you looked in the news lately, you'll see that this $700 billion stimulus package really hasn't worked. I think they just need to be more direct, and government needs to invest in the infrastructure, and then I think that's going to offer more jobs and more opportunities. But I don't know. I think the next president is going to have to do something dramatic. It can't be just a Band-Aid.

Pandya: What advice would you give the next president about climate change?

Washington: Well, that's a good question. I would say essentially following on the theme that's already been well established worldwide among people that are knowledgeable about the changing climate, that is to first of all not let this financial crisis deter us from working on the long-term goal of trying to mitigate and in some cases adapt to future climate change. And that means that we need to move away from a fossil-based energy policy that we have now. And I think we can do it. It's going to take investment, but I think that investment is going to pay off in many many good things. I think Al Gore has made the point, along with many others, that our economy is being supported by the Chinese putting money into our economy and that we're turning around and using a lot of that money for buying oil from Arab nations. And that's just not a healthy situation. And if we went to more of a green economy we can cut off that unhealthy financial situation.

Pandya: Sometimes I hear that NCAR has -- that no one is discussing whether or not climate change is anthropogenic anymore, that that discussion is over, there's consensus that it's anthropogenic even at the White House, there's consensus that that's true. Do you agree with that?

Washington: Yeah, I think that's generally true, although I was listening to Rush Limbaugh yesterday driving back from a retreat. I do that to see what the conservative right is saying, not that he speaks for all of them of course. In fact he was spending all of his time yesterday -- most of his time complaining about Colin Powell being a traitor to the Republican Party. But I think he maintains that we don't have the proof. And that small core of skeptics is still out there and may be influencing a lot of people. I don't know. I don't think it's -- I think when you ask even in the African American community is climate change an important issue it's one of the top five. And so even for people who you think would be sensitive to other issues in the national dialogue, I think most people accept it as being an issue that we have to deal with. My problem is that we're not -- even after accepting that, we aren't coming up with solutions that are actionable and that we're setting a new path.

Pandya: You mean as a nation?

Washington: As a nation, right. And I see Europe so much ahead of us on our thinking. They still are grappling about the best way to deal with this situation, but they're actually trying to do things, trying to cut down on their carbon usage and that sort of thing. But it's still not working, but they're actually taking measures. And over time these measures will get more and more strict.

Pandya: So why do you think the US is behind?

Washington: I don't know. You've seen as I have these ads on television. Clean coal. I don't know what they mean by clean coal. That means it maybe doesn't air pollute as much. But I think there's a lot of misinformation. And I think that Congress unfortunately has been too much influenced by lobbyists who want to represent the status quo. I think it's going to take real leadership to really set new government policies that accomplish change.

Pandya: Two questions for you about that. One is as a scientist yourself what do you see as the right role for a scientist in this kind of discussion.

Washington: Well, I think that we should always explain the science to the public or to the policymakers in terms of what we know and what we don't know and be as objective as possible. I don't think it's right for say a scientist to just be like an environmentalist. I think that the objectivity is very important and has to be maintained to have credibility. And so I'm always -- I give a lot of talks and also do some video for various organizations and that sort of thing. I'm always careful not to let them try to use me in a way that goes beyond what's in the science.

Pandya: So do you think things like driving -- like some of your personal choices, are they also driven from the science and what you objectively know?

Washington: Yeah. Although I don't want to get myself on a guilt trip all the time, because I have some colleagues who say to me, "Warren, you shouldn't go to some of these meetings, because you're putting carbon dioxide into the atmosphere." And on the other hand, I think you have to be part of some of these larger group efforts and go to meetings and advocate and give out scientific facts. And so I don't want to let my personal -- what is it -- footprint on the greenhouse -- footprint or carbon footprint prevent me from taking on the role of trying to inform policymakers and the public about science. And I don't want to be so crippled by a guilt trip. I think that we are doing a lot more good than we're doing harm.

Pandya: What do you think NCAR's role is in this changing conversation?

Washington: Well, here again I think it's mostly in doing good science, improving our understanding of how the atmosphere and the ocean and other parts of the climate system work, and then to explain that as best we can. I think it's obligatory that we do this as a national center, because this is probably our number one immediate -- say immediate, over decades -- issue to deal with, is to do this sort of thing. But I just came back from a retreat of all the laboratories here at NCAR -- I mean of all of the divisions. And you heard a lot of scientists still talking about that we shouldn't let all of our other work be driven by societal importance, but that we should keep on also in parallel so to speak working on interesting scientific problems. And I think it's healthy for an institution like NCAR to essentially do both.

Pandya: So does that mean having some that are interestingly scientific, some that are societally driven? Or does it mean identifying a subset that's both?

Pandya: I don't know. I don't even think it has to be -- every scientist has to work in this mode. I'm reminded. In my book I mentioned that when I talked with Walt Roberts, who is the founder of NCAR, he encouraged me, and I think others who had just come to NCAR, that we should work on something that's an appropriate activity for NCAR, like building models or taking observations or

building databases, whatever. And then he said you should spend half your time on that, other half of the time on what you think is important. And in my case those two things coincided. I didn't have a problem about that. But there should be some freedom for scientists to pursue on their own interest what they think is important as well as what the center ought to be doing as a whole.

Pandya: Thanks. I was going to ask you about that 50-50 balance and if you thought that was still about the right balance.

Washington: Yeah.

Pandya: So I was at something last week. It was Roger Pielke, Jr., who said that our field needs to choose. And this is related. He said we have to choose between being a small scientifically driven field like astronomy, and if we do that we have to reconcile ourselves to ever declining budgets. Or we can be a societally relevant field like NIH or like public health, and that we need to make that choice, we can't do both.

Washington: Yeah. In fact I was just talking with one of the program managers yesterday from the National Science Foundation. And he and I were talking about this issue. And this was something that's been debated a great deal on the National Science Board. And my take on it is this. The policymakers, when they come to giving out the budget for all of the science agencies, faces this issue. If you look at the foundations of the National Science Foundation and NCAR as part, the foundation was based upon the promise that we would explore scientific and engineering discoveries. However, part of the promise was that was going to lead to economic benefit. So I think it was wrong to say setting up the National Science Foundation was supposed to be only dealing with pure science without any application purposes. Well, I don't think the basic charge has changed much. And NSF has carried out its mandate to fund all of the areas of science and to look for innovative creative science, and then every once in a while you would find something that would have some practical application. Well, I think in atmospheric sciences, we're a little bit closer to the application side of things. I know a lot of scientists that won't like to be put into that mode, but in order to fund a place like NCAR or to fund the National Science Foundation, the policymakers will say -- this is for all presidents, not only Bush or whoever's coming after him -- are expecting that you will also help with some of the major societal issues that the country and the world are facing. So I'm essentially saying we need to do both, that we can't just do one or the other.

Now when it comes to the other agencies, their definitions are a little bit more narrow. If you're doing work for the Department of Energy, energy has got to come somehow into the mix of the research program. If you're at EPA then environmental issues. If you're with NOAA it's dealing with the oceans and the atmosphere. So there's always this rich menu of things that go all the way from just fundamental discovery to helping out deal with some horrendous issues that the world and the nation are facing. And the Congress expects that. But I was always -- when I testified -- I testified many times as the chair of the National Science Board -- I was impressed with most congressmen and senators. They understood that we needed to have a healthy science program. But then they were also saying can you help us out a little bit with some of these other problems that

we're facing, because you have the expertise in science and engineering, and we need your help.

Pandya: Is there a role for a place like NCAR or a scientist in doing that help but also ensuring that that kind of help is available equitably to everybody who needs it or to all the communities that might benefit from it?

Washington: Can you give me an example?

Pandya: This maybe is as little controversial. So I'm sorry if it is. But Katrina maybe showed that we didn't do an equally good job of helping every community prepare. Is there a scientific responsibility in that you think?

Washington: Well, the answer is probably yes. But on the other hand I thought that there were many scientists and engineers speaking out that that was an accident that was waiting to happen and that they had said that we weren't building the dikes right. And there were social scientists saying for example that we were allowing people to live where they shouldn't be living. And that's a tough one because everyone wants to go back home after the latest disaster and put their life back to order. But you remember even with the hurricane that recently hit Galveston, those people shouldn't have been living there. It was clear that that was going to eventually get hit by a strong storm. And the same is with parts of New Orleans. And you've heard about flood insurance, and we encourage people to get flood insurance. Well, for years along the Mississippi River Basin, there were places that were getting flooded every year and people would sign up for flood insurance in February and pay their $200 or $300 premium, and it would flood, and we would pay to build their house over again. Well, finally Congress woke up and said, "We'll only pay next time, but you can't move back to where you want to move." And we fixed that problem. Well, not completely. Some people are still getting flooded on a somewhat regular basis. But we're not doing as bad as we were in the past.

And that's what we need to do with parts of Florida and New Orleans and along the Texas coast, is we have to tell people that you can't build here, even though you would love to build there. And the way that that's even working in Florida now, hurricane insurance now exceeds the payments of most house payments.

Pandya: Wow.

Washington: So people are starting to change their behavior. In fact you can't get private insurance, and so the state took over, setting up a state fund. But you can imagine over time that that's not going to work, because it's going to mean that people in other parts of the state are going to be paying for people who are trying to build in the wrong parts of the state. And I don't think that's stable. I think that over time people are going to say why should I be paying for so-and-so to build their fancy house on the beach or on the sandbar and I have to pay for it. It's not stable.

In Texas, for example, they had some kind of state-run program. And the claims to use that are ten times or even more, I think it was like 100 times the amount of money that was in that fund. So all of the taxpayers of that state are going to have to help pay for the rebuilding. And I think at some point

somebody's going to say you can't build there anymore. I think Roger Pielke, Jr. would understand this very well, because he's looked into this kind of issue.

Pandya: Right. He's shown that hurricane damages have gone up and up and up and up.

Washington: That's right. And it's going to keep going up as long as the population goes up.

Pandya: And as long as they want to live on coasts.

Washington: And hurricanes I think are going to get stronger in the future.

Pandya: It's like 2:30. Do you need a break or anything?

Washington: No, I'm fine. You want to keep on going?

Pandya: So I was just thinking probably -- maybe I'm guessing, but maybe you weren't this outspoken when you first arrived at NCAR.

Washington: Probably not. I'm an old guy. All they can do is shoot me and ship me off somewhere.

Pandya: You did get increasingly involved. You got involved with AAAS, the youth, you got involved with AMS. How did that happen? Did you ever feel like -- well, some of the proteges in stories sometimes describe how they feel like they shouldn't or can't say certain things because they're young and their careers are at risk. Did you ever feel that?

Washington: I don't know. I look back on my career here at NCAR, which goes back -- 44 years ago when I first came. I never felt that I was restricted from saying anything. There were a lot of early scientists who came who were very broad-minded I thought and just wanted young scientists to be in the mix so to speak and not be feeling that their careers are in jeopardy if they say the wrong thing or if they -- in fact there was a lot of freedom I thought, even more so than what we have now. I'm not being critical of what we have now because there's a lot more accountability built into our system. I always like to tell this story. Akira Kasahara, who was my colleague in the early days here at NCAR, we went to see Phil Thompson at a place called the Lamppost Bar. You get lunch. And it was right across -- it's where McGuckin's is right now. It turned out that that wasn't part of the city. That bar was an island, because it had been there early on. And so when the city grew it couldn't take over the bar because it served liquor. So they had these little islands. Over on 28th Street they had another little island for a liquor store where it wasn't in the city. It was in the county. And yet it was a place where you could get drinks and stuff. Because it was a dry city at that time. Yeah. And Phil, I think he had somewhat of a drinking problem. So he would come in after lunch after having a few stiff ones. And Akira and I went over and talked to him and said, "We would like to start building a computer model here at NCAR that could be used for our research as well as be made available to the university researchers." He said that sounds good, do it. There wasn't any document that we were going to do this or a plan. It was just talking to him and him saying yes. And we would start doing it. Whereas I think nowadays you have to at least have a proposal and go through a lot of review and all that sort of thing. So it was a little bit more fun in those days. You didn't have the torture of having to write extensive documents before you could do anything. But I don't know if it's fair to compare what we did those days versus now. Now you have a

lot more accountability. Before you can do something you have to propose it and get it reviewed, and somebody has to approve it, and then you get marching orders.

END OF AUDIO FILE

Pandya: Do you remember the first time as a professional you brought up the issue of diversity?

Washington: Well, I'm trying to think of where it really came up. It almost came up externally in my case, because I talk about there in the book about Walt Roberts invited me to observe the AAAS in 1969. He was the president of AAAS at the time, and he wanted us to review what the board was doing. So he invited each board member to bring a young colleague, and he asked me to come. I think that sensitized me almost back to the 1950s when I was involved in the civil rights struggle in Oregon.

Pandya: In the junior NAACP.

Washington: Yeah. Now just to give you some perspective, in 1969 the AAAS meetings were exciting. The reason I say they were exciting, we had bomb scares, we had the media chasing people around, because there was violent protests over the Vietnam War. And scientists were considered culprits in things like napalm and building the instruments for killing people and all kinds of anger was expressed by young people from the campuses. And even in the science community, because scientists were considered culprits. And so I think the AAAS felt under some pressure to change the way that they were dealing with it. So as I explained in the book we were given $28,000 by the trustees, and they appointed me as the chairman of the youth council. Well --

Pandya: You were 33, right?

Washington: Yeah. I was 33 years old. The youth council. Now most of these people on the board were like Nobel Prize winners, like Walt Roberts, the head of big organizations both in the private and the public sector. And we came back just a few months later with very sharp criticisms of how they were operating. And I was pleased that they did set up at least one program there. A program to deal with women and underrepresented minorities. And I like to joke to Shirley Malcolm. I said, "Shirley, I was involved in hiring you." And she jokes about it too back with me. And I was. I was involved. And I think on that there was a lot of emphasis from the AAAS trickling down to other scientific organizations, because AAAS actually represents 150 science and engineering societies and organizations, and so by it taking some leadership in pushing for dealing with not only women and the minority issues but science education and all kinds of broader issues outside of their just normal science advocacy type programs, I think it's really helped to advocate for science and for the funding of science.

Pandya: Can you describe some of these youth council meetings where you came up with some of these recommendations, and maybe even what some of the criticisms or recommendations were?

Washington: The meetings were boring. They didn't have good -- they didn't have speakers who were teaching unorthodox views. That they didn't have any programs that featured women and minorities. And often the organizers of the sessions didn't take them into account. That they didn't stress enough science

education in their agendas. That they needed to use some of their own resources to fund some of these activities. That they weren't taking on the role of encouraging other organizations that are affiliated to be more active in these areas. We also recommended that they set up a separate program committee that really advocated certain themes at the meetings, like on the environment or on pollution or things like that. I'm not sure that we were the only ones that probably recommended that. And that they have on their committees young scientists and engineers as part of their meeting agenda. So it was just trying to change them from being an old stodgy organization into something that was modern and more contemporary and more exciting.

Pandya: So did you have to present this to the board of AAAS?

Washington: Yeah. In fact we did. And they gave us even more money to come up with more ideas. And we wrote a report.

Pandya: So you were really well received, it sounds like.

Washington: Yeah, I think so. And I think that they were anxious to get some fresh ideas about how to do these things. And I think the committee was set up -- it was called the youth council, but it was a committee basically. Instead of just being a temporary thing making recommendations we were ongoing, and we could even offer a monitoring to see how they're coming on making the changes. We did that several years. But I think that was -- I think you asked a good question. I think that was the first time that I was really thrown back into the diversity thing. When I came to NCAR in the early days I wasn't asked to deal with the diversity issue. It was always in the back of my mind. It was a few years later that Peter Gillman and I wrote a letter to the AMS recommending that they do something in the area of diversity. And I think they followed up by establishing a board on women and minorities. And I served on that board on the first group that was on that.

Pandya: That board still exists.

Washington: Yeah, it still exists. And it's been very active. It's had to go a little cautiously at times because the membership wasn't used to having women especially active. And it's just interesting to see the change. Over half the graduate students now in the atmospheric sciences are women. So in the mid '70s where we had just a few women who were involved in the atmospheric sciences to the one now where it's no longer a problem of them getting into the field, we still have the issue of some of them still perceive of a glass ceiling issues. But I think those are disappearing.

Pandya: Do you? After that initial success what happened next? How did you stay involved in diversity?

Washington: Well, there were a relatively small number of us who spent time dealing with this issue. For a few years I think in the mid '70s I would spend a couple weeks or something like that traveling to HBCUs. I went to Howard and then I would go to Atlanta schools, Southern, Prairie View. I even went to my father's old school, Talladega, which was an interesting one. I talk about this in the book a little bit. It was humorous. I gave a lecture there and I had some extra time. So I went over to a library and I said, "I'd like to look up something on my father." His name was Edwin Washington. He graduated in 1928. So the librarian goes

off and comes back. She says, "There was no Edwin Washington here in 1928." I said, "Oh my gosh! How come? Can I look at the yearbook?" So I look at it, and there's my father. His name was George Washington. So I asked the librarian to xerox that page. And so when I got back to NCAR I made copies of that copy and sent it to my brothers and my dad. And I said, "Dad, you've lied to me all of my life, and your name was George." And of course he called me up and joked. He said, "Yeah, as soon as I left the south I changed it to Edwin. I hated that name George Washington." So he took it in good spirits. But can you imagine having a name like George Washington? That would be -- and going through school like that? You can imagine the kidding that he must have put up with.

Pandya: So those visits to the historically black colleges, campuses that you went on, how did those --

Washington: Well, it didn't pay off very well. I think that we got a few students to come and spend some time. And ironically I gave a talk at Spelman College, and there was a young lady in the calculus class that I spoke at. And that was Denise Stephenson Hawk. She eventually came here to NCAR. But she was stimulated a little bit by my talk to think about going into atmospheric science. But I didn't think it was very effective. We were bringing students here for the summer, but it didn't have any of the rigor that was in the SOARS program. And very few of those went on. I had two students from -- let's see, one student from Spelman and one student from Morehouse who were in physics come. And they had already married each other. And they're both working in the Weather Service. You may have met her. Margaret McCullough. Yeah, she was like the assistant deputy secretary of the Weather Service and worked herself up very high in the organization. And so there were a few that came through the system. But we didn't have the follow-through, the recruitment that is reflected in the SOARS program.

So I think the SOARS program -- and you certainly know more about it than I do, Raj -- really benefited from some prior knowledge of what worked and what didn't work in earlier times, and therefore you could shape the program in a way that was going to increase its effectiveness. And the other thing that's probably changed too is that now we have some atmospheric science programs at several of the HBCUs. I think you're probably a better judge of how successful those programs are. But I think that for some of the bigger schools that they are generating students who are going to eventually go on to getting their masters' and PhDs and eventually be leaders in the field.

Pandya: You talk about a lot of good programs just that you've seen in your book.

Washington: Like what?

Pandya: Well, Do It maybe was one of them or a proposal for one. Would you be willing to talk a little bit about that?

Washington: About which one? You mean Do It?

Pandya: Yeah.

Washington: That was an interesting one. Two of the founders of -- I forget their names. One of them was Newton Minnow. Founders of using television for educational purposes. Came to the National Science Foundation and asked if we

could have some sort of program set up where we would be collecting revenue from licensing of television stations that would go into a fund, and then the fund could be used to finance educational programs. And it was much closer to the original land grant program that Abe Lincoln set up. All of these colleges all across the west and Midwest actually came out of something that Lincoln set up where they would give a certain amount of land to a state to then set up a college. And at that time it was mostly around agriculture to educate farmers and so forth. But it actually grew into more like technical colleges. Oregon State, Iowa State, Ohio State, Michigan State, all of these were land grant things. So it was essentially using that same concept to use the selling of the licenses, to instead of just going back into the Treasury, it would essentially go back into setting up educational institutions, because it would be getting money from the royalties of the licensing of parts of the airwaves.

Well, they came to the foundation and said we need a home for this activity. How about making the National Science Foundation a place for it? Well, the board thought about that, and said, "Well, it just doesn't quite fit. We might get overwhelmed by this addition. Or the addition could swallow up the National Science Foundation." But we did make recommendations about how it could be done. And in fact I chaired that committee for the foundation. And so this thing languished for years in the House and Senate and I noticed I got an email I think a week or two ago that the House and Senate had passed it and the President had signed it to set up this thing. So it's taking like ten or 15 years, and I had some small part in that, because I pushed the board to be a part of it and make recommendations as to how it should be set up.

And we actually wrote up a report. And so over the years they would invite me to come to these meetings, and I would offer my support. I don't consider myself a founder or anything like that, but at least I testified up on the Hill about it and contributed to it. So it's one of those things that you never know how it's going to turn out. But it's like the lottery. You have to invest in it a little bit and sometimes you can win.

Pandya: You sound really proud of your role in it. There must be a lot of things that you can look back on and feel pretty good about.

Washington: Yeah. Well, I do. I think I had a long good career. I've had some failures too. I tried to set up a foundation to deal with trying to get the minorities into science and that didn't work out.

Pandya: The Best Foundation, right?

Washington: Yeah, the Best.

Pandya: Would that be something you'd be willing to talk about a little bit?

Washington: (break in tape) Contribute to it. So it helps students. And they don't know exactly what the legal aspects that they'll have to deal with are going to be as a result of that. But it's the same sort of issue that you must deal with in terms of the SOARS program. The board has talked about -- when I was on the board, we talked about this as lot. Because we felt that even though when the law sounds like you're trying to be fair to everybody by eliminating these things it really hurts diversity programs. We've talked about here on the diversity committee here. And just like the foundation, I think what CU is going to have -- if it does pass --

is going to try to find other ways to accomplish it. Just like you've had to find ways in the SOARS program to get around these things. But I think it's people like Ward Connerly who's pushing for the thing here, wanting to set up something like what's in California. And it's been a disaster there in California. It's actually lowered the number of students going on to those institutions. It shouldn't work that way.

Pandya: What kind of argument would you use for people who say we shouldn't have affirmative action, it's not right?

Washington: I say that we needed to have a balanced community in each of the professions, and that if we don't deal with encouragement programs, and that's what these diversity programs are, that we're going to have an unbalanced society. I think when you get numbers up to the right levels then it's no longer a problem.

Pandya: So they're a step. They're getting us to where we need to go.

Washington: Yeah. But we're a long ways away from that. We certainly don't need affirmative action in most cases for the women, although there may still be isolated cases of discrimination against women. But I think those have largely disappeared in our academic environment. I don't think there's necessarily discrimination. Maybe that's the wrong way to put it. Even with minorities. It's not that we have so much discrimination. We don't have enough who are just applying in these various fields to help us out in STEM education. And I think you have to go out and be affirmative until you get the numbers up to some reasonable level. Don't you think so?

Pandya: Yeah, I absolutely agree, I think.

Andersen: So the question is this. Mathematics is the language of science. And what was your early relationship with mathematics as far back as even elementary school?

Pandya: That's a great question. Should I repeat it? I'm just going to repeat it for the tape. The question was mathematics is the language of science. And Aaron was wondering what your early relationship was with mathematics even as far back as elementary school.

Washington: Wow. I think I liked mathematics right from the start. And I'm not sure I had any special ability in it. I think I just did my homework and my parents didn't have to push me to try to get good grades. But later on when I got into the field of going to Oregon State -- well, let me just mention a little bit about high school. I think that you took algebra the first year of high school. And then you took trigonometry in the second year. Trigonometry and geometry. And then you could take some advanced courses in these areas. And I just really got into them just about the same time I was getting interested in science. And one of the really fortunate things I didn't really plan on but turned out to help me is when I went to Oregon State I didn't realize until I got there that they had an extraordinarily strong program in advanced mathematics, applied mathematics. In fact it really specialized in their mathematics department in numerical methods. And in 1955 they got a computer that was called the Maniac. And it was built by the same makers of the ENIAC that was at Princeton, the first electronic computer. And I took a course when it first came in in how to use this computer. And it was

extraordinary what you had to do. Everything was on paper tape. You had to program in hexadecimal, in other words to the power of eight. And you had to run it on these -- it was a big computer, about the size of this room, but it was probably very weak by comparison to what we have now of course. And I learned how to solve small algebraic equations and so forth. And I think that turned me on to use of computers, that course.

And then I took some courses in applied mathematics. And I had enough credits at the end I could have graduated either in physics or applied mathematics. And so I think I set the course for what I was going to be in that undergraduate, so that when I applied to graduate school I had more than enough requirements to get into graduate school. I was especially strong in mathematics and physics. And when I started studying even in my graduate school at Oregon State for my master's, got reading the meteorological books on the theory of waves in the atmosphere and things like that. They were relatively easy compared to my physics courses, because I knew where the equations came from. And in fact that went over, if I can jump to like 40 years later or 35 years later, when I started writing textbooks on climate modeling. All of that came back. I could go into where these equations came from, go through them step by step. And when I came here to NCAR working with Dr. Kasahara, he and I were always on the same page. Because he has a great physics background and mathematics background. And we had independently spent time at the Courant Institute at NYU, which was the famous place of applied mathematicians. And so we didn't have to think about how we were going to put together a computer model. It was just going ahead and doing what we already knew how to do. Did I answer your question? I'm not sure I answered your question.

Pandya: Yeah. Do you want to jump back to that?

Washington: Yeah.

Pandya: Do you remember what it was?

Washington: No.

Pandya: Do you remember what it was?

Andersen: What my question was?

Pandya: No, what the question we started with was.

Andersen: We were at affirmative action.

Pandya: Yeah. And just what you would say to someone who said -- and you talked a little bit about that and a little bit about some of the challenges it's faced.

Washington: Yeah. I think that we talked about some of that already. I'm not sure I have anything more to add unless you have a specific question.

Pandya: I have a couple other questions that came up just listening to you talk. But Aaron has a --

Andersen: That's OK.

Pandya: Are you sure? This one is a little out there, so if you don't want to answer it, just say you don't. Your book has a picture in front of a church. And I guess I just wondered what you thought about how religion and science go together. It's something we don't talk about much in the scientific community.

Washington: Yeah. Well, I don't have any special things about it. I don't think I mentioned I'm a deeply religious person, although there's been times in my life

where religion has been more important than other times. For example, when my wife was dying from breast cancer that was a tough time and I think I had to rely upon religion to help me get through that and help her to get through it. But I think in the context of my career the church was very important, because it was a place where you got a great deal of encouragement to do what you wanted. I don't think I was -- I was always encouraged rather than inhibited from doing anything. And it was a place where there were many successful role models. And in fact one of my children asked me just a few weeks ago where do you look upon the church and the black experience. And the history really goes back to slavery where the church was always a place where the slaves could go and have some independence. In fact we always hear about this Reverend Wright people talk about with Obama. But that tradition goes way back to the slavery times when the frustrations of the slaves could be expressed in the church and people didn't seem to object to it, because it was put into the Christian talking about frustrations of life and so forth and so on.

And so ministers played a big role in keeping the community together and keep them focused on there's a better day coming sort of message. And that I think even percolated up into the 1930s when you see that picture in the time that I was growing up. It's the place where you went to get direction. It wasn't necessarily direction about your faith in God and that sort of thing, but just a sense of community. It was one of the places where you'd get some structure along with the family structure that you could get too. So it was the sort of thing where you were expected to go to church. You didn't have that option of saying well, I don't want to go to church. But I don't think I'm personally involved with religion and church as much as I was growing up in that environment. And things change. I changed somewhat. I'm certainly not antichurch. I just think that it was a very important phase of my life at that point.

Pandya: Thanks. Aaron, you had a question.

Andersen: It has to do with the tools of science and the technological evolution that you've seen. I heard you talking about the computer. But you probably were working with a slide rule before you actually had a computer. We've gone from slide rules to supercomputers and satellites and so forth. As you peer out over the horizon, other than faster and bigger computers and more satellites, are there any other technologies that you see out there that might lend to the advancement of science?

Washington: Wow. That's an interesting question. Let me put it into the context of NCAR. When the I think it was 12 or 13 universities were proposing just right after Sputnik that they needed to think larger than themselves, the idea of setting up a center came up. And the center was really built around -- at least my view of it -- look in the blue book, but it was to build the facilities and the scientific staff that would be used for doing things that were beyond the scope of an individual academic department. For example, airplanes and supercomputers and computing facilities. And people who could put together core projects, like building computer models or building observing capabilities in various ways. And I think that ethic was very sound. And the reason it could have happened was NSF's -- remember, NSF got a big boost right after Sputnik. NSF had been already in

operation, but it was pretty small. It was catering to very small proposals. It got a little bit more active in the IGY, but then after Sputnik they said we need to step up and do some bigger things. And so the time was ripe for atmospheric science to step up to the next level. And it did so successfully I think. Not that it's always been a smooth road, because we're always somewhat in competition with the universities. But as long as we stay focused on the things that are more appropriate for a center, then I think that we're OK.

Now I'm hopeful for the future that we'll come back to that ethic to try to do bigger things. I serve on the Space Studies Board, which gives advice from the national academies to NASA about where should we go in the future. Should we deal with the moon? Should we go to Mars? And it's the same thing with atmospheric sciences. I think it would be a mistake for us to say well, the budgets are tight, we shouldn't do anything. We still need to invest in the future. And if we don't invest in the future that this country is going to fall behind other countries of the world. And we should be among the leaders.

Now what's changed also is that we can't be the only leaders. China and the European Union and maybe eventually countries in Africa and other places in the world will get together and come up with very aggressive programs to deal with future scientific efforts. But US should still be either doing these things itself or in collaboration with other countries. And if we step back from just saying well, we need to worry about that, 20 years later or 30 years later, we're going to fall behind.

I'll give you another example of that. It's in China. As you've heard often, they're now the largest producers of carbon emissions in the world now. And they're still building like one coal-fired power plant a week. But a few weeks back when the leadership had heard from its people that the air pollution and water pollution and the environmental -- it's just already trashing the country to an unacceptable level. And within a short period of time the leadership said we're going to start to build a green economy. Only in China can you do that. Whereas this country goes on year after year debating what should be done, how should we finance it, and so forth, China can just say this is a new course that they're going to go on. That's one advantage of a dictatorship, is that they can start down another path almost immediately, whereas under the democratic process it's painful to see all the talk but essentially no action. Hopefully with new presidential leadership we'll get on the path of dealing with this problem in a constructive way.

Pandya: What do you think of geoengineering?

Washington: It's a tough one. And I think a lot of thoughtful work has been done on that by people like Paul Crutzen and others. And they always preface their article very carefully by saying, "You should only consider this sort of thing if mankind doesn't take the steps that it should be taking." In other words it's not a first option. Now I do know that like the Department of Energy, which I'm an advisor for in various ways over the years, and still am, really doesn't want to touch this thing of geoengineering. Because you can see if they come up with a program to mitigate the effects of the use of fossil fuels that they can be accused of not dealing with the core issue of cutting back on emissions and find a cheap way to

get around it. And the fundamental problem still with geoengineering, all of these schemes, like putting aerosols in the stratosphere or heat shields -- not heat shields but shields in space at the G1 point so that the sun's radiation gets blocked and therefore cools off the planet. The trouble with all of these is that they don't deal with the problem of the carbon dioxide going into the oceans and making the oceans more acidic. And that is a very fundamental issue, because we're already seeing from the work of Joanie Kleypas here at NCAR and others that we're going to essentially ruin the oceans as a food source and ecological source for our whole world. And I don't see any good solution out there. I just sent off a paper to Science magazine last Wednesday with my colleagues, Jerry Meehl and others here at NCAR, pointing out how much global warming you can avoid by use of conservation, renewables, and other measures. And so I'm more on the side of trying to still hold out hope that we can come to our senses so to speak, and minimize global warming and other climate change effects. I think it can be done. But it's going to take work and changes of a lot of the world's politics about use of fossil fuels.

Andersen: It seems as if even the most recent IPCC information and recommendations may have been overly conservative in terms of the seriousness of the global environmental situation. Are you concerned about that at all? And do you see yourself speaking in the future about that?

Washington: Yeah. And in fact I do speak out that I think it is too conservative. I among many of my colleagues here, Jerry Meehl and Kevin Trenberth, feel it was too conservative. Now the one part of the conservatism is understandable. And that has to do with sea level rise. Under the rules of the IPCC an article has to be published before it can be made reference to in the report. And so there's a time lag. And they had to freeze the publications that they used at some point, like a year in advance, before the report actually came out. And I think the sea level rise, we see a lot of papers that are very quantitative about what's to be expected, because we have good measurements from satellites and in situ measurements around Greenland, other places, so that we can now get better estimates of sea level rise in terms of its impact.

Another weakness of the IPCC process -- and it's not a criticism, it's just that it's the way that they did it. Is that when you had to come down to the final wording, you're sitting in a big room with people who come from oil producing countries. And even thought they may not contribute much in the way of scientists, they still sit in the room, and they have some say. And there's a strong tendency for the people who are selling oil and gas, representing those people, to try to minimize the impacts and to make the statement less alarmist. And I think the statements that came out of the IPCC erred on the side of being conservative. It's unfortunate because just like with smoking we had ample scientific evidence before we had the strong definitive statements that said that smoking is not good for you and it causes cancer. So there's a built-in lag.

Andersen: Another question if I may. I heard a term used last week that I'd never heard used before. And it was climate change refugees. And it seems to be clear that if climate change occurs in the future as it is predicted that we'll see more of

that as well as the whole issue of national security for nations who are affected by climate change. Have you had any thoughts about the future of that?

Washington: In my article that I submitted to Science last week, my last paragraph in my article states that the US chief of I guess you would call them spy agencies, there are 16 spy agencies in the US -- I didn't even know there were 16 -- wrote a consensus report, which is classified, stating that climate change is a major national security danger. And part of it is due to the food disruptions, about the forced migration of people from one country into another, causing enormous tensions. Now I couldn't get the report obviously, because you have to be -- but he testified to Congress in open testimony. And I consider that like a publication, because it's a printed document. And I quoted that document as compelling reason to push for more mitigation, because this ought to be something of great concern, even to the conservatives of this country and others that they need to do something. Because you can just imagine the wars that might sprout up, and will likely sprout up, I should say, from the migration of people from places that they're living to other places.

And it's not only for sea level rise for example, but for example in Venezuela and Peru for example, all of their fresh water comes from glaciers that are rapidly melting. Where are these people going to go? There's going to be pressure for them to migrate, and some of them will want to do it aggressively.

Andersen: One last follow-up question in all of this. Obviously these are huge global challenges, and climate change points to the interconnectedness of all of humanity. Do you see an opportunity to speak towards the possibility of uniting human beings around these issues as well as just fighting over resources?

Washington: Well, clearly the ideals incorporated into the United Nations and its affiliates is basically to have us work in concert over many of these very difficult problems like climate change. I think there's a tendency in our country especially to look down upon international organizations. And yet for anybody that spends a little time thinking about it, in order to deal with all of these things, all the way from health to food to disease propagation to trade, we've got to deal with these things in a more international effort than just a nationalistic point of view. And although I'm not sure the American public understands this as much as the other people in the world do. The reason is our country is still fairly isolated from the rest of the world. Most Americans have not traveled abroad, other than to maybe Mexico or Canada. And they look upon foreigners with a bit of -- I shouldn't say hostility, but suspicion. In fact I can remember when Obama went to the Berlin Wall and -- what was it? A couple hundred thousand people came to hear?

Pandya: It was huge.

Washington: And he was criticized by some conservatives as being liked too much by Europeans. Well, I think if you had the two alternatives, being hated by foreign countries or liked, I would like our national leaders to be liked by them, so they can solve some of the problems of the world, and help deal with these very tough problems that we have to deal with. And I think that our country has acted in recent years too much in a unilateral way and not working with other countries to solve problems. Sorry for the soapbox.

Pandya: You've gotten to meet a lot of heads of state. You talked about meeting Margaret Thatcher. You've met presidents. What qualities impress you in a leader?

Washington: Well, I think I met all of the -- I never met Ronald Reagan. I think I've met all the other presidents.

Pandya: Maybe that's better for him.

Washington: Yeah. Well, there's a little quote in my book I mentioned about when I did -- Margaret Thatcher came. You want me to talk about this a little bit?

Pandya: Yeah, please.

Washington: When Margaret Thatcher came, I don't know if you were around then, Aaron.

Andersen: I think it was right before I came.

Washington: OK. Well, obviously it's a big thing to have a head of a state here. And so she flew in and we had the SWAT teams around NCAR on the roofs and everywhere. The visitors who usually wandered down from the hills wanted to stop in, and they couldn't come in the building. But so I think that they arrived here on time. There were some other places they had to go. And she was on her way up to Aspen to have a meeting with Ronald Reagan up there. And so she stopped in. And her science advisor, I forgot what he was called, but he sat up on the meeting. And I was asked, since I was the director of the climate division at the time, I was asked to give the presentation. So Governor Romer wanted to come, and also the mayor of Boulder. So I guess somebody must have dealt with them. But they were invited to come, but they couldn't ask a word. They couldn't comment. Because this was supposed to be a private briefing for her for learning about what was the latest on the science.

So we did put together a briefing. And now this was in the days when we didn't have the overhead. We had the viewgraphs. And so I'm going through. Now it turns out that she graduated -- Thatcher had graduated from Oxford in organic chemistry. So I knew that in advance, so I worked with the chemists here to make sure they could inform me of the things I should prepare in that area. And it turned out that Guy Brasseur and Steve Schneider were also in the room too. So I could call upon them to answer questions. But nobody was supposed to say anything except for Margaret Thatcher unless called upon.

So I was going through my viewgraphs, and she kept asking more and more questions and so forth. And so when the time came for them to go to the next place -- they had to go down to someplace in I think it was Martin Marietta or something like that -- the science advisor stood up and said, "Well, it's time for us to go." Margaret Thatcher pointed over at the stack of viewgraphs and said, "We're not going anywhere until I see every one of those." Everybody else sat down. And we worked through them.

Pandya: That must have felt great.

Washington: Yeah. So we worked through all of them and got most of her questions answered. And she ended up by saying to me, she said, "I've learned a lot, and I'm going to see Ronnie --" that was Ronald Reagan -- "up in Aspen. I'm going to talk to him about this. He's not as concerned as I am about this issue." I don't think that she made any headway on that. But it was a wonderful experience.

One of these things you never would think that you would have that opportunity. And I've got some nice placards at home. She sent me a letter thanking me and so forth and so on. And so pictures and stuff. I should put those in the archive. I have to talk to Diane.

Pandya: In your book you said you thought that was important that leaders have the opportunity to do things like that.

Washington: That's right. In fact I think one of the restrictions -- I've done this with Clinton a couple of times and with Al Gore many times. Is that they need to be able to talk to scientists without the media in the room, because you can imagine what happens every time a leader like that asks a question, and it's not right, they don't phrase it right or -- you can see the media the next day saying the president asks a stupid question about climate change, and getting beat up just because the media is looking for something sensational to say rather than helping to get informed. And so the president really needs -- and other people -- even this works in Congress too -- is that they need other mechanisms where they can find out and learn and feel free to ask questions and not appear to be stupid. I think that's very important. I've done a lot of that when I was -- yeah, especially under the -- on Bush Senior. Yeah, where I really worked behind the scenes a lot to inform the cabinet officers about what was going on. That was at the time that I had to build the climate model for John Sununu when he was chief of staff at the time of the -- and just I had a great time with him, but he was hated by everybody on the cabinet. The people in the cabinet would call me back to Washington. I would be with their chief advisors in a single office, and I had to promise that I wouldn't leak anything to the press or to anyone else. And they said, "What's going on in the White House?" These are cabinet officers.

But I think that that's part of the responsibility of us scientists though. When you get those opportunities to help out in spreading scientific facts and what we know and what we don't know.

Pandya: You're really good at it. I've seen you give talks to nontechnical audiences. And you're good at it. How come? Why are you good at it?

Washington: Well, I think it's practice in some ways. But it's also that you need to give a little thought to how you're going to present stuff to a particular audience, all the way from technical to a layperson audience. And also you have to know that you only have their attention for 45 minutes or a half-hour or whatever and you need to get your story or your main points across. So I don't know. I guess I've just done it a lot over the years. In fact you've helped me through a lot of these things, prepare and get the presentations all set up. So I'm going to keep doing it.

Pandya: Do you like it?

Washington: Oh, yeah, I like it, sure, I like it. It doesn't take that much time out of what I do otherwise. I just think it's a part of my job. Especially here at a national center. I hear some of my colleagues always complain that they have to do these things or do some things. And usually the system works such that if you don't want to do them people aren't going to force you to do them, because you're going to do a lousy job if you don't really want to do it. But on the other hand we have some scientists who feel that it takes too much time away from their normal activities. So there's enough people around here that can help out on these sorts

of chores and not get overwhelmed. We don't all do it. In fact I always -- someone calls me to do something, if I can't do it, it's not convenient, I just call one of my other colleagues, and usually one of them is quite willing to do it.

Andersen: What do you think are the biggest one or two unknown or unanswered science questions in the atmospheric sciences?

Washington: Well, I still think that we don't quantitatively know how much global warming is going to take place, OK? That's a biggie. But on the other hand, I don't think that should stop us in the policy area. Whether the globe warms up by three degrees rather than two degrees. Because there used to be this thing that even with the Bush administration, the elder Bush and this administration, they like to use words like what is the safe level. I don't know what that means. There's no level where CO2 goes up that it's going to be OK and then if you go past that by one part per million it's going to be all catastrophes going to happen. I just think it just gets worse. And it happens quicker. In other words even right now with our present level of carbon dioxide concentration of near 380 parts per million we're melting glaciers around the world in a very significant way. But on the other hand I don't think we can ever go back to like 350 or 280 or whatever. It would be so hard to go back to preindustrial times. So it's just a matter of -- well, at least one thing I show in this paper is that if we go to 450 -- because we're on a steep slope right now both global warming and increasing carbon dioxide and other greenhouse gases -- that if we go to 450 and stabilize it at 450 that we can stabilize on the glaciers, especially like the major ones, like Greenland. But some people tell me that that's way too conservative, that we're going to really go much higher.

For the cynic in me, and there is some cynic in me, that this country and the world governing organizations don't really do anything until real catastrophe happens, and then to a certain extent it's too late, because you can't suddenly reverse this. It's not like air pollution where you can over a decade, you can take some steps and clean up the air and things are a lot better. This is not that kind of problem. It's got built into it a lot of inertia. And the climate changes that we're seeing now are going to really transform this planet, and we can't easily reverse that, even if we bring down the CO2 or we stabilize it. So it's not something I'll see, but my grandchildren will.

Pandya: You brought up your grandkids. One of the questions proteges always ask me is how do you balance life, work and science. How have you done that?

Washington: Wow. Well, that's a good question. I guess I balance the best I can, OK? And I say that in the sense that when I had active children around, and we had three girls and we adopted a boy, I did all those things. I was little league coach, I went to the ballet classes, I did all those things that parents do, they go to all the athletic events and school plays and all the things. And I worked it in. I just worked it in. And the nice thing about NCAR was that you could do it in a relatively easy way, because NCAR is a fairly family-friendly place. You can put in the hours, you don't necessarily have to do them all in sequence. If you want to take off for an hour to do this or that or take part in this or that, you could easily make it up in the evenings or the weekends or whatever. And so I worked hard and did a lot of things, but I also felt that family was very important. I was

raised in a family that was very supportive of the children being active and trying different things and doing things. And I wanted that to happen to my children. So somehow you did it. And it worked out. All my kids are doing fine.

Andersen: If the new president came to you and said, "Warren, I recognize that climate change is a tremendous challenge facing our country and the world," in terms of policy, what is the first most important step that we have to take to deal with this problem?

Washington: Oh. Well, I would say that the most important step is that we start to be aggressive in dealing with the emphasis on a green economy. We need to move away from increasing the putting of carbon into the atmosphere which ends up warming up the planet and causing major climate change. And I think that if the leadership really came from above it would already start to happen in a much larger scale. If you've noticed, many cities and some states have already started taking substantial steps. And I think that we can do that. Now this tape won't be available for a while, right?

Pandya: That's right. I think you've got at least a month before it comes out.

Washington: OK. I've been approached to -- at least one person is actively pushing me for being science advisor. I don't think I can -- there's a letter circulating in the community. But there's other people that are more qualified than me I'm sure to be a science advisor for Obama if he gets elected. I always keep in my PDA the fact that he invited me to -- Obama invited me to be on a panel with him on a panel dealing with climate change. And I was extraordinarily impressed because -- not that he invited me, but impressed with him in the sense that he came out -- and I was expecting a crowd of several hundred people, and it was like 5,000 people out there in the audience, and he came out without any notes in front of him, and he talked like he had just digested the summary report of the IPCC. He gave numbers. He talked about what needs to be done. He talked about the impacts of climate change. And I was just impressed that he could absorb that sort of information and do it. Now this summer -- now this was September of last year, of 2007. This last summer I was invited to be on a new commission on climate change that was made up of some of the people on that same panel that I was on with Obama from the Joint Center for Political and Economic Studies. And the Joint Center is a historically black think tank that's in Washington, DC. It's been there for like 20 or 30 years. Commenting on policies in the economic and political domain that deal with African Americans. And so I've been active in that, and we've been giving advice. And we have to give advice to both campaigns, the McCain and the Obama campaign, about climate change. So we've had press conferences at the National Press Club and have had meetings at the Congressional Black Caucus and places like that.

So the downside is people want me to come and give talks. And so I've been very selective about doing that, because I just can't be on the road all the time. But I don't know. I'm hoping that if Obama does get elected that I can serve in some sort of way, not necessarily an official way, because I'm feeling this is the twilight of my career. I'm 72, so I don't think I want to work as hard as I've been working over the years. But maybe some sort of advisory way in one of the committees or something like that would be the ideal situation for me.

Andersen: Have you heard talk about a cabinet level climate czar slash advisor?

Washington: I've heard. I've heard about that. Now I can only give you my impressions of these sorts of things. Up until George Bush the second became President, the coordination of climate research had always been done in the White House under the Office of Science and Technology. And that, at least I feel, is the best place to do it. Setting up another -- now NOAA has just come out with the concept of a climate services initiative out of NOAA that would essentially take over research and so forth. I think that's a mistake, because when you're dealing with NASA, NOAA, NSF, EPA, Department of Energy, and Department of the Interior, my experience is that one agency telling another agency what it should be doing never works. And that's what we have right now. George Bush lowered the profile of the science advisor so he is not any longer in the Executive Office Building right next to the White House, and his profile. And both Obama and -- I think Obama in his campaign statements and his literature is elevating it back to where it should be. And I think it would be better if the climate coordination is done at the White House level. And then it percolates right directly to the cabinet officers. And I have a little scene in my book where I talk about speaking to the cabinet. And it was interesting to see right after my talk and Dan Albritton who's down at NOAA -- he's the other of the two of us who were talking -- the science advisor had all of the cabinet heads involved in science in the room, and he turned to them and he said, "We're going to need to do these things." And he's telling them as the representative of the President that we needed to do these things to coordinate the activities. And I think that works, because the head of OMB was in the room also. And so our structure of government works top down. If the President says this, it works itself down through the system. But if you're having one cabinet officer tell another cabinet officer what to do, I don't think it works. And you can understand that.

Pandya: Human nature.

Washington: Human nature.

END OF AUDIO FILE