

Oral History of
Veerabhadran (Ram) Ramanathan

Interview conducted by Laura Harkewicz

12 July 2007

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ABSTRACT:

Veerabhadran (Ram) Ramanathan was born in Madras, India on November 24, 1944. He earned a B.E. in engineering from Annamalai University in 1965 and a M.S. from the Indian Institute in Science in 1970, also in engineering. He received a Ph.D. in planetary atmospheres from the State University of New York at Stony Brook in 1974. Over his many years of work in the climate and atmospheric sciences he has held a number of distinguished national and international positions. He served as principal investigator for the NASA Earth Radiation Budget Experiment in 1974 and was a senior scientist at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado from 1982 – 1986. He was a professor in the Department of Geophysical Sciences at the University of Chicago from 1986 – 1990. Since 1984, he has been a member of the Panel International Satellite Cloud Climate Project. In addition, since 1990, he has been the Victor C. Alderson Professor of Applied Ocean Sciences and Professor of Climate and Atmospheric Sciences at Scripps Institution of Oceanography. He is also the director of the Center for Clouds, Chemistry and Climate (C4) at Scripps. In 1993, he was chief scientist for the Central Equatorial Pacific Experiment (CEPEX) and from 1996 – 2002 he was the co-chief scientist for the Indian Ocean Experiment (INDOEX) as well as the chair of the INDOEX steering committee. In addition, from 2002 to the present he has served as co-chief scientist for the Atmospheric Brown Cloud Project (ABC). In 2002, he was elected to the National Academy of Sciences. The interview focused on Ramanathan's career as an atmospheric and climate scientist, especially his work at Scripps. We discussed the apparent, but inaccurate, conflict between his theories of global dimming (in the context of the atmospheric brown cloud) and the more widely known arguments related to global warming. We also spent a large portion of the interview reviewing his latest project, a controlled and practical experiment, *Project Surya*, in which inexpensive solar cookers (as well as cell phones) will be distributed throughout rural India in the hopes of documenting their role in the reduction of carbon dioxide and soot emissions – major factors in global dimming.

INTERVIEW HISTORY: The interview took place on a summer afternoon in the archival storage office at the Scripps Institution of Oceanography Library in La Jolla, California on July 12, 2007. We talked for approximately one and one-half hours. The interview was briefly interrupted by the ringing of Ramanathan's cell phone but we our conversation continued without pause.

Laura Harkewicz
Oral Historian
August 8, 2007



Portrait of Veerabhadran Ramanathan, no date.
Scripps Institution of Oceanography Archives, UC San Diego.

INTERVIEW WITH VEERABHADRAN (RAM) RAMANATHAN: 12 JULY 2007

- Harkewicz:** This is Laura Harkewicz. It is July 12, 2007. I'm in the office, my office at Scripps Institution of Oceanography library with Dr. V. Ramanathan. And, good afternoon Dr. Ramanathan. If you could please introduce yourself so I can get my correct pronunciation here so we can have it for posterity.
- Ramanathan:** Thank you, Laura. My name is Veerabhadran Ramanathan, and I go by the short name Ram.
- Harkewicz:** Makes it easier on the rest of us, I guess. [Laugh] I appreciate that. So, I guess, the first thing I wanted to have a little bit of introduction here. And, I know that you grew up in Madras, India so I wondered if you could tell us a little bit about your childhood or what made you decide to go into science?
- Ramanathan:** Right. Okay. I was born in Madras, India. Now it's known as Chennai. They changed the name of the city. But, most of my early schooling from grade one on to about middle school was done in a lot of small towns in India, because my father was a traveling salesman, so we traveled quite a bit. I used to spend my summers in a very pleasant village in South India at my grandfather's home. So, I still have fond memories of spending my time in rural areas. I was finishing high school when there was a war between China and India. So, there was a patriotic call for Indians to sign up for engineering and I did that. And, I did engineering for about five years. As I was doing it, finished it, I realized I hated engineering. I worked in the industry for a year and a half. That confirmed my prejudice that engineering was not my call. So, I switched to something in basic science and in India it's very difficult. Once you go on a track you have to stay on that track. So, I went to the Indian Institute of Science. I left a very nice, good engineering position. My salary was about \$14 a month, which was a huge amount in those days, and then I joined graduate school to do research in energy transfer, sort of engineering but a little bit basic physics. And, as part of that I designed the first Mach-Zehnder interferometer in India. This interferometer measures tiny changes in temperature so you can look at turbulence, and my thesis topic was to develop the instrument and study the transition in turbulence. I finished that and that convinced me that science and research was my calling. So, I wanted to switch to more basic research. I went to Stony Brook, State University of New York at Stony Brook. There was a well-known professor but he was in engineering and as luck or fate would have it he switched his field when I joined him, from engineering heat transfer to

study the atmospheres.¹ He was studying planetary atmospheres. So, I switched with him. So, we were both learning at the same time. This is 1970 when I came to this country. January, cold winter, blizzard night, in December landing at New York airport.

Harkewicz: Good way to start your American experience? [Laugh]

Ramanathan: Right. In those days in India they allowed you to carry \$5 with you, and little did I know. Five dollars was a lot of money when you convert to Indian rupees, so I thought I was a very rich man. And, I landed in New York City with all of fifty cents. [Laugh] And, I learned it took close to \$10 to go from the city to Stony Brook, which is fifty miles away. So, I had to stay in the airport for about two days [Laugh] before I found someone going to Long Island. And so, it was just a nice entry into this country. [Laugh]

Harkewicz: I'm surprised you didn't want to just get back on the plane and go. [Laugh]

Ramanathan: Anyway. So, so my thesis was studying the atmospheres of Mars and Venus, particularly the Greenhouse Effect of Mars and Venus. And so, I finished it and went to do a postdoc at NASA Langley Research Center. Within six months, again it's one of those serendipitous things which were to change my career completely, I attended a meeting in Boulder, Colorado where scientists were talking about the ozone impact of CFCs, chlorofluorocarbons, in 1973, 1974, and they were looking at the effects of CFCs on ozone depletion. And that word "chlorofluorocarbons" immediately caught my attention. I was going there to attend some other meeting and I just accidentally happened to walk into this meeting as I was getting out of the men's room. I heard this CFCs, got fascinated because when I was an engineer, my job was to prevent the CFCs from escaping to the air. This was in sealed units and refrigerant units. So, I knew about CFCs and my graduate work was about Greenhouse Effect. So, I said "I'm going to take a look at the CFCs effect on Greenhouse Effect." And then I published a paper in 1975 showing adding one molecule of CFCs to the atmosphere will have the same Greenhouse Effect as adding 10,000 molecules of CO₂.² So, suddenly we have discovered a major potent greenhouse gas in the atmosphere, and that came as a big bombshell to the community. A lot of scientists were skeptical of my findings, because until then, for nearly a hundred years, the world community had decided that the only greenhouse gas they have to worry about in terms of human activities is carbon dioxide. Suddenly this work comes from a totally unknown obscure graduate student. It took five years for the community to accept those findings. And now, of

¹ Who is this? It would be helpful to have your professor's name.

² Footnote the citation to this paper.

course, you know, the recent IPCC [Intergovernmental Panel on Climate Change] report clearly shows there are a lot more greenhouse gases than just CO₂.

Harkewicz: What happened over that five-year period to make people believe the work that you had done?

Ramanathan: You know, some reputable scientists – I don't want to give names – called my work "dangerous," "wrong," "idiotic," and people had to repeat the calculations themselves. But this involved quantum mechanical data. And, I don't blame them because what I was saying is that just in tenth of a parts per billion, which is minute, they were having the same effect as CO₂, which is hundreds of parts of a million. So it took me six months, myself, redoing my theory, and analysis, different ways to convince myself. Anyway, I think that paper ended my obscurity. [Laugh] I got known so now I could start working in legitimate atmospheric science institutions. Until then, I was seen as an engineer not to be trusted. So then I joined the National Center for Atmospheric Research, which is a pioneering institution. I worked there for ten years.

Harkewicz: That's in Boulder, correct?

Ramanathan: Right. I joined in 1976 and there were two interesting pieces of work I was lucky to be involved in. The first was, I was one of four scientists who built this so-called Community Climate Model. This was in 1983, it now has become *the* major climate model. It's gone through several evolutions but the first version of that was developed by us, myself and colleagues Eric Pitcher, and he's now with Cray Research; Bob Malone, he's now at Los Alamos; and then Kamal Puri, he's in Australia.³ So, it was called Community Climate Model Zero. The second was, when I was at Langley I got involved and designed a Satellite Radiation Budget Experiment with some NASA engineers. And, that was launched in 1985, and we worked on it for six or seven years in the background, and then when the data started coming that's when I left NCAR [National Center for Atmospheric Research] to go to the University of Chicago, because I wanted to go into academia. At an academic institution, a little bit more intellectual freedom. You can choose the problems you want to work with. I found NCAR, which is a great institution, but still I was a little bit confined.

³ Eric John Pitcher (1946-) got an M.Sc from McGill University and a Ph.D. in atmospheric Science from the University of Michigan. He was at NCAR 1979-1980 and since 1988 has served as director at Cray Research. Robert Charles Malone (1945-) received a Ph.D. in theoretical physics from Cornell and has been at Los Alamos National Laboratory as a climate modeling scientist since 1972. Kamal Puri is at the Bureau of Meteorology, BMRC in Melbourne.

- Harkewicz:** Uhm-hmm. Who is the funding agency for that?
- Ramanathan:** NCAR is funded by the National Science Foundation. So, unlike Scripps, which is mostly soft money, NCAR has core funding, which is a large amount.
- Harkewicz:** Okay.
- Ramanathan:** I moved to University of Chicago and it was a new experience for me. I learned that until you start teaching, you really don't understand your field at the basic level. I said, to explain to some young people, who have no background in the field. I realized it was a self-discovery, that you have to understand what you're doing at a very basic level and that's when you can explain it. So, that helped me articulate what science is. And really, it was a remarkable experience for me. To be sure, the first year I was a bad teacher. [Laugh] It took me about four or five years to learn how to teach, you know, information, to filter it.
- Harkewicz:** Was that a painful experience for you, or was it just a learning experience?
- Ramanathan:** To me, you know, my whole life, I'm learning every day. I'm sixty-two [Laugh] and happy to report I'm still learning.
- Harkewicz:** That's good.
- Ramanathan:** So, and you learn a lot from young people, students.
- Harkewicz:** So, that pretty much brings us up, I guess, to coming to Scripps, yeah. So, how did you end up here?
- Ramanathan:** I left Chicago in 1990. In 1988-1989 it became clear to me the climate change problem is going to become one of the biggest issues for humans. In fact, I had written a paper in 1980 when I was at NCAR, teaming with a meteorologist, showing that -- I think this was probably one of the first papers to make a prediction that there would be unprecedented warming by the Year 2000.⁴ We had given a specific date. And, by the time I was in Chicago I started realizing the complexity of the problem. We were initially seeing the atmosphere as a physical system, you know, regulating the Greenhouse Effect. So, as I realized, the complexity of the problem I realized that, "I need to get into some big science where I can look at the whole planet." And so, we proposed the Science & Technology Center. The National Science Foundation had then just announced these centers, a new concept in research funding in the United States. They wanted to give a larger sum of funds than an individual investigator so that long-term

⁴ Insert citation to the paper.

big science problems can be addressed by academic scientists as opposed to those class of problems were at the government scientists. The Science Foundation had the wisdom that, "We want to do some of the big science in universities, because then you can train students, and then they're prepared." So, we proposed and we didn't get it the first year, but Chicago was remarkable. There was a just a pioneering African-American scientist, he was also provost, Walter Massey, who became National Science Foundation director.⁵ I still remember I went with this idea to Walter. I came back the next week, I had a check for \$250,000. He said, "Go do it."

Harkewicz: My. [Laugh]

Ramanathan: And I was also fortunate, my colleague there was Paul Crutzen, you know, who subsequently became a Nobel Laureate.⁶ So, I talked to Paul and he got excited so we both proposed the Center and we didn't get it the first round, and then we applied for the second time. But in the meantime, my family was getting dissatisfied with Chicago, particularly my wife. We were living in Chicago.

Harkewicz: In Hyde Park there?

Ramanathan: In Hyde Park, and we could have moved to the suburbs, and we tried. My wife didn't realize what a bad driver I was. She thought I would get killed within a year. [Laugh] So, our option was to leave. And, I remember, '89 January was a wild snowstorm and we were about thirty miles away from home. Normally when I start driving is when I start thinking about my science.

Harkewicz: Not a good thing in the snow, yeah. [Laugh]

Ramanathan: And after ten o'clock I was about sixty miles away from home not thirty miles. [Laugh]

Harkewicz: Oh no.

Ramanathan: So, that settled it in her mind, "We have to move."

Harkewicz: I'm from Chicago. I know what Chicago winters are like. [Laugh] Yeah.

⁵ Walter Eugene Massey (1938-) received a Ph.D. in physics from Washington University in 1966. He was a at the University of Chicago from 1979-1991 first as professor and then Vice President for Research. He was Director of the National Science Foundation from 1991-1993. He served as provost at the University of California for two years before becoming President of Morehouse College in 1995.

⁶ Paul J. Crutzen (1933-) is a Dutch chemist who received a Ph.D. in meteorology from the University of Stockholm in 1973 and was long associated with the Max Planck Institute for Chemistry in Mainz, Germany. He was a professor at the University of Chicago 1987-1991 and worked part time as a Professor at Scripps Institution of Oceanography beginning in 1992. He received a Nobel Prize in 1995 for his work on the hole in the ozone layer.

Ramanathan: You can relate to that? [Laugh] But, it was a great university. So, having decided to move, I realized the key issues in climate are all involving coupling between oceans and atmosphere. Until then I thought the ocean was just as a pond of water, best to ignore. And, it became clear to me, "I can't ignore them." So, what other place to go? Until I left Langley I was still an engineer. I came to NCAR to learn atmospheric science and I left Chicago to learn oceanography. So, I came to Scripps.

Harkewicz: Nice progression here. [Laugh]

Ramanathan: Yes. But I think I want to mention also what it takes to attract new people to an institution. So, if that's any guidance. I wouldn't have come but for the remarkable leadership at that time. There were three people who recruited me, Freeman Gilbert, Sally Ride, and Ed Frieman.⁷ You can't think of a better three persons. So, I got hooked because of them. I had offers from Yale. I had offers from Columbia, Irvine, but I decided to come to Scripps. Not only because of Scripps' reputation, I personally am not enamored of reputations. I don't go to a place because it's well known. So, that's not the reason I came to Scripps. I came here because I thought I could learn oceanography here, but at the same time I knew my heart was in big science. I needed to go to a place where they would provide that facility for me, and these three leaders I was persuaded.

Harkewicz: They convinced you to get here? Okay. You described a lot of the other places that you've worked. How would you compare your experiences from other places that you've worked to your experience here at Scripps?

Ramanathan: Yeah. That's a good question. Before I answer, I want to mention, I don't think my experience would be typical of others. I'm in a different situation because the day I announced that I'm coming to Scripps was when NSF announced they were funding the Center. So, I brought the Center with me.

Harkewicz: Okay. I was going to ask you that. [Laugh]

Ramanathan: And, that Center transformed my life. Because, it was about close to \$20 million over a period of eleven years. So, it allowed us remarkable flexibility to do some work on problems of importance to the environment.

⁷James Freeman Gilbert (1931-) received a Ph.D. in geophysics from MIT in 1956. He came to the Institute for Geophysics and Planetary Physics (IGPP) at Scripps Institution of Oceanography in 1961 as has served in many university administrative posts. Sally Kristen Ride (1951-) received a Ph.D. in physics from Stanford University in 1978. She was a NASA astronaut from 1979-1987, and came to IGPP at Scripps in 1989 as Professor of Physics and Director of California Space Institute. Edward Alan Frieman (1926-) joined the faculty of UCSD as Adjunct Professor in the Department of Physics in 1981. He served as the eighth director of the Scripps Institution of Oceanography and Vice Chancellor-Marine Research from 1986 to 1996.

- Harkewicz:** Now, this is the Center for Clouds, Chemistry, and Climate?
- Ramanathan:** Right.
- Harkewicz:** Before you go on about that, was the funding given to you to start this Center? It came with you, is that correct?
- Ramanathan:** It was given to the University of Chicago, and they wanted to run it there with me at Scripps, but then after six months it became clear that's not working out. So then, the Center was transferred here, from Chicago to here.
- Harkewicz:** Did that cause any kind of bad feelings with the people back in, at Chicago? [Laugh] You don't have to go into it if you don't want to.
- Ramanathan:** Yes. I think there were several members of the department who didn't speak to me for nearly ten years. I can sort of empathize with that because they had spent a quarter million dollars on getting the Center there, and a lot of effort. And, Chicago had been nothing but generous towards me. This is one of those unfortunate things that I had to leave. So yeah, there were ill feelings, but I think I deserved everything I got from Chicago. [Laugh]
- Harkewicz:** It was quite a coup for Scripps, though, I guess, to have this Center here, and you? So, we started with our question about how this compared to . .
- Ramanathan:** With the experience at Scripps? So, I think with the Center we were focusing on clouds, and chemistry, and climate change. So, the Center itself was sort of an interdisciplinary center. It was an international center. There are a lot of U.S. and European institutions involved. And, as luck would have it all my interests shifted to understanding how the ocean was regulating the atmosphere, sort of an emerging area at that time. This is 1990s. So, we were able to take all the Center money and leverage it to get more funds, and we did two major field experiments. The Central Equatorial Pacific Experiment. It was done with two aircraft and two ships. Until then, I was sort of a paper and pencil scientist, although I had used satellite instruments. I still distinctly remember when I proposed this experiment one of the reviewers said to NSF, "Why are you funding Ramanathan? He wouldn't know an aircraft if it hit him on the head." [Laugh] And to me, going from that state, and that reviewer was correct. I think I would have known an aircraft if it hit me, but nevertheless metaphorically he was right, he or she. But, I think a woman scientist would have been kinder [Laugh] in the comment. It was a typical male, alpha-male commentary. So, we grew from this. Each time we did the Experiment we discovered something new but that's not what we

anticipated. The Central Equatorial Pacific Experiment was done to understand a major controversy, "How does the Pacific Ocean regulate the climate?" And, I was proposing that the western Pacific Ocean, which is the warmest ocean on the planet, controls itself from overheating. When it gets warmer it produces deeper clouds which reflect sunlight. I sort of proposed a thermostat idea. It was a totally different way of looking at the system to what people had done, and although the Scripps oceanographers didn't have a problem with it a lot of the meteorologists were thinking of complex things and had a huge problem with that. They wrote pretty, I would say, vicious papers criticizing it.

Harkewicz: The Scripps meteorologists?

Ramanathan: No.

Harkewicz: Any, other meteorologists?

Ramanathan: Outside. I think Scripps scientists were able to understand what was going on. They realized it's time to look at the system in a new way. And I then jokingly called it a "unified hypothesis" because it unified the meteorologists against it. [Laugh] But, what helped is that the agencies said, "My god. If Ramanathan can get so many distinguished tropical meteorologists angry there must be something in his idea." [Laugh] Remember what Einstein said, "Objection to a theory is directly proportionate to its probability of being correct." So, we did an experiment to understand how the ocean was regulating and what we discovered was that the sunlight reaching the ocean was a lot less than what was predicted by models. It was because the atmosphere was absorbing more sunlight than what was predicted. That finding was published in *Science*.⁸ That finding took me in a whole different direction. I realized I had to find out, "What is this dark substance in the atmosphere?" So, that took me to thinking, "Maybe it's pollution particles." Now we call them "black carbon." So we followed it up by proposing another major experiment in the Indian Ocean. It's now recognized as one of *the* major experiments in aerosol research. It was also acknowledged by the National Academy of Science. They published a report last year citing INDOEX as a major step forward. You know, Paul Crutzen and I were the chief scientists and I chaired the science team. We did this experiment in the Arabian Sea. We were looking at pollution transported from South Asia. And, I think it was one of the first experiments where we threw everything we had at it. We took six aircraft. There were 200 scientists. We had chemistry. We had physics. We had meteorology. All instruments. And we also persuaded the Europeans to move a satellite from Atlantic Ocean into the Pacific, into Indian Ocean, and then we took two ships. Now INDOEX has been published in over

⁸ Add footnote for this paper.

two or three hundred papers, several journals. There were several articles in *Science*, several articles in *Nature*. It was covered widely, but there were two remarkably simple messages from the Indian Ocean Experiment. What it showed was that the entire northern Indian Ocean was covered by brownish haze, a pollution cloud. We call them "atmospheric brown clouds," and that opened our eyes. When we say "brown cloud" like the Los Angeles, LA smog, or the Denver brown cloud, it's an urban phenomenon. But, what we found is because of transport, what starts off as urban pollution is really a massive scale. That made me rethink, you know, what's happening in Los Angeles. We say, "Oh, our pollution is not much. It's when days we have inversion," right? But we are still running the same number of cars everyday. So, what happens on the days Los Angeles doesn't have its brown smog? It's going downwind to the rest of the U.S. So, it's a simple thing but it took me this \$23 million experiment [Laugh] to realize what's going on. So, then we looked at new satellite, which was launched, and it showed that. Our whole plume from U.S. goes over the Atlantic while the Asian plume comes across the Pacific into us, and the European plume goes into Central Asia. So, each one of us is in the backyard of somebody else's pollution. Okay? So, that's widespread. And, second, we found these brown clouds were absorbing an enormous amount of sunlight and cut down the sunlight going into the ocean by as much as ten percent. Now it's called "global dimming." So, we found the dark substance would just, but, you know, gave us that difference between model absorption and observed absorption in the Central Equatorial Pacific Experiment.

So, after coming to Scripps most of my work has been over the oceans. And, I got familiar with ships as a platform, so we're exploiting the ships. And, the other major thing is that I find when I work with students they're fully educated on the oceans part. So, the students are interdisciplinary. So in all these ways Scripps has benefited my research.

Harkewicz: So, you think that this transfer from paper and pencil, theoretical experimentation to these big-scale experiments was directly related to your coming to Scripps?

Ramanathan: I would say, well, the main reason that happened was because of the Science & Technology Center. I think, in the platform, using ships as a major source of observation, I think being at Scripps helped that.

Harkewicz: Okay. Would you consider the kind of field work you do with the ships more like traditional research cruises or is it different from the past?

Ramanathan: Ours is targeted. In other words, we have specific, we have aircraft measurements and then we have ships seeing what's at the surface. We fly the aircraft over the ships.

- Harkewicz:** They're looking at the same area?
- Ramanathan:** Right.
- Harkewicz:** Okay.
- Ramanathan:** And, the aircraft just goes by, but the ships can stay there and make some longer-term observation, "longer-term" meaning a few weeks to days.
- Harkewicz:** I want to take one step back here for a minute to when you first came and you started setting up the Center. How did you go about doing that? I mean, did you bring people with you or how did you get people together and get this going? I mean, were you starting at ground zero and you started from there? Or, were there people here that you worked with?
- Ramanathan:** You're talking about Scripps?
- Harkewicz:** Yeah. Right. When you started the Climate Center, the Clouds and Climate Center.
- Ramanathan:** Yeah, you know, there were several Scripps scientists who were a part of the Center. Richard Somerville⁹ is one; and then Kim Prather¹⁰ from UCSD Chemistry Department; Paul Crutzen, who was at Scripps. And, so we didn't have to start at ground, ground zero. These are all experts. There's one thing you mentioned, "How did being at Scripps help this big science?" I think it helped in a big way because Scripps, by definition, is a mixture of scientists, individual paper and pencil scientists, and scientists who do big programs, you know, big field science, like Walter Munk, and John Orcutt and others. So, that atmosphere was there to launch. Nobody was scared of this and so I could draw on that experience, number one, and I had tremendous support at the director's office.
- Harkewicz:** From Ed Frieman?
- Ramanathan:** And then Charlie Kennel, after that.¹¹ Because on the one hand Scripps is a graduate department, but on the other hand it is a research institution, like a large government organization, except it's a lot more efficient because it's soft-money funded. Nobody is on permanent payroll. So, you have to be innovative. So, that kind of atmosphere definitely helped, and if

⁹ Richard Chapin James Somerville (1941-) has served as Professor of Meteorology and Head, Climate Research Group, Scripps Institution of Oceanography since 1979.

¹⁰ Kimberly A. Prather got her Ph.D. from the University of California, Davis in physical chemistry in 1990. She holds a joint appointment as a Professor in the Chemistry and Biochemistry Department at UCSD and the Center for Atmospheric Sciences at the Scripps Institution of Oceanography.

¹¹ Charles Frederick Kennel (1939-) a physicist, served as Director of the Scripps Institution of Oceanography and Vice Chancellor of Marine Sciences from 1998 to 2006.

it had been a typical graduate department, academic department, I think it would have been very difficult. They would have got worried. The role models were there. So in that sense, yeah, it helped tremendously.

Harkewicz: Okay. So, was the Center all soft money then? There isn't any hard structured funding?

Ramanathan: No.

Harkewicz: No?

Ramanathan: I think, no but Scripps gave some seed foundation funds. Okay? And, it's about five percent of what we get. But the thing is NSF funding was eleven years, one and half to two million a year, and no one ever gets that kind of fund even in the government. You get your paycheck but you don't get research dollars. So, in that sense it was huge, and my salary was covered by the state. In fact, two weeks ago the National Science Foundation asked me to talk to the new class of Center directors and apparently they picked C4 because they consider it one of the most successful centers. You have to understand, the Science & Technology Centers are their own fields. There are fourteen centers. One was in math, one was in materials science, one was in biology. So, it covers the entire gambit of fields. We were the only atmospheric science, one of two in earth sciences. So they invited me to talk about what they called "Legacy of C4." Why did we succeed? It made me think. I think one of the reasons for our success was that we ran the whole thing. We did not have any permanent staff. I had one manager. The rest of the money was used to do experiments, students, and postdocs. The advantage of that is when a new opportunity came I could shift rapidly. We proposed to study clouds and chemistry using models. Within a year I realized this field experiment. We took that money and put it in the field experiment. That led to Indian Ocean Experiment, which is a totally different field.

Harkewicz: So, you had that flexibility?

Ramanathan: Yes. I see comparing my experience in the microcosm with the macro experience Scripps is facing with its budget problems. Scripps is a \$90 million institution. The budget shortfall is just \$1 million, but that's causing such a huge trauma. The reason is there's no flexibility. That's what I see happens to most, if not all, older bigger institutions. Everything is tied up. There's no flexibility in the system.

Harkewicz: So, do you think you could have something to offer to Scripps management of how they could avoid that kind of issue?

Ramanathan: I've tried, but the management thinks I have nothing to offer them. They think – they may be right– that it's much larger and I'm talking too small a scale. I've tried to offer my five cents worth there but not gotten my message across. But, I don't think they're ignoring me. They don't see that connection. But to me, it's not a question of \$100 million, or a billion, or ten dollars, it's the flexibility you have. You could be abject poor with a multi-million property, capital. If all of it is tied in your house and you don't have money to pay for your car, you're poor.

Harkewicz: Right.

Ramanathan: So, if I were to head a research institution I would make sure I had fifteen percent. That's what I did. Every year I made sure I had fifteen percent left over. Even now, you know, C4 left. I have a bigger project now, Atmospheric Brown Cloud Project, and we used that to test a new technology, unmanned aircraft vehicles, UAVs. It's going to be featured on the front page of *Nature*, that's at the end of this month, and apparently five museums are going to feature that, because it's now seen as a new way to do science. But, how did we do that? I -- at the C4 Center I was rich. When that Center went I became like normal poor faculty, but we hustled and then because of what we did we got this Atmospheric Brown Cloud Project. We were setting up surface observatories over Asia, but I never forgot my fifteen percent lesson. The ABC Program is about two and a half million, and fortunately until Kennel was there I was still getting my five percent. So, I used that five percent, a hundred thousand, to hire some postdocs to double up the UAVs. I didn't have to ask anybody. And now, it's become a huge thing.

Harkewicz: So, you don't use everything you have? You always make sure you have something left?

Ramanathan: I have that flexibility. You see, science is not something you can plan. The unexpected comes up, you should be able to exploit it. And, if you don't have flexibility you just have to let the opportunities pass by. You know the cliché, "Opportunity knocks but once." You need to be ready.

Harkewicz: Okay. I want to ask you something about the politics of the Atmospheric Brown Cloud if we could?

Ramanathan: Sure.

Harkewicz: I would ask you more about your fifteen percent but I want to make sure we get this question. I know that some people tend to see global dimming as sort of like the opposite of global warming. There was even an article where the author wrote, and this is a quotation, "Discovery of the strong connection between the brown cloud and global warming vindicates the

U.S. government's insistence that more scientific data is necessary before extreme policy prescriptions, such as those contained in the Kyoto Protocol, are adopted."

Ramanathan: Wow.

Harkewicz: So, what . . .

Ramanathan: Where is that quote from? Are you . . .

Harkewicz: It's from this article, *Heartland* article. It's a website.¹²

Ramanathan: I see.

Harkewicz: And, I wondered what you feel about people that maybe use your work as a excuse for us, in the United States to not sign the Kyoto Protocol?

Ramanathan: I think that is totally incorrect. If anything what the brown cloud research shows is it substantiates the global warming because the warming predicted by models is twice as much as what we have seen. So, for example, for the same greenhouse gas buildup from the pre-industrial to now, the planet should have warmed by about a degree and a half Celsius. What we are seeing is only half of that. So, the question is, "Where is the missing thing?" One obvious answer is, "Our models are wrong." But, what we are finding the brown cloud has work. Other aerosol research has shown as much as fifteen percent of that greenhouse forcing has been masked by the increase in the particulates. Okay? So, the implication is when we clean up the atmosphere, and we should because this pollution is damaging other things, we're going to see a major acceleration in the warming. So, what it tells me is that as we reduce air pollution the urgency to decrease the CO₂ becomes more urgent not less. So, that's a completely erroneous argument.

Harkewicz: Okay. I understand that "The 9/11 Study" showed that the three days that they prohibited jets, when there was no jet stream, actually showed an increase in surface temperature of the Earth? So, what do you think would happen if we were able to clean up all this particulate pollution?

Ramanathan: Oh, if we clean up the particulate pollution and don't reduce CO₂ the warming would accelerate tremendously. That's why I used the word "mask." I feel because of this mask we still don't know the beast behind the mask. We still don't know, really, the true intensity of the greenhouse forcing.

¹² James M. Taylor, "Asian Brown Cloud Contradicts, Confounds Global Warming Theories". Available at: <http://www.heartland.org/>. Accessed: 5/23/2005.

- Harkewicz:** So, have you been able to explain that in the media? I interviewed Richard Somerville, and we got to talk a lot about his media interactions. And I wondered if you've had that opportunity as well?
- Ramanathan:** Yeah. I point this out all the time. I think so far my interaction with the media has been, I would say, positive. Now first of all I disagree with most of my colleagues on this in that, well those who claim, you know, "You shouldn't talk to the media," it's, you know, "Leave it to the experts." Maybe because of my immigrant mentality I feel we're all on welfare, you know. We have nothing productive to give to the society except knowledge, and what right do we have to hold it? Of course, we shouldn't distort it. We shouldn't seek the media. I'm against that. But, if they come to you you have to. I prepare. I just don't go pick up the phone and answer it, [Laugh] because I know I'm talking to thousands of people behind this one person who is calling me. And, I know in the medical research, every week they say one day a tomato is good for you and then they say a tomato can kill you. So, I know there's a problem in talking to the media, but I think we can educate them.
- Harkewicz:** Well, there is a problem. A lot of people talk about the public's lack of scientific knowledge. So, do you see it as your responsibility to educate people? Or, do you get frustrated with that kind of . . .
- Ramanathan:** No. I don't get frustrated. I think it's a responsibility. But I have to understand, I have a filter with people like some others don't have. It's only the most courageous who can spell my first and last name, [Laugh] pronounce my name, and quote me.
- Harkewicz:** Yeah, I see. [Laugh]
- Ramanathan:** That is a big value there, so that protects me.
- Harkewicz:** I see. Yeah.
- Ramanathan:** My first name, I'm forever grateful for that purpose.
- Harkewicz:** Okay. Well, climate science has become very political in recent years, and I wonder, do you think that climate scientists can remain apolitical?
- Ramanathan:** I think so.
- Harkewicz:** Okay.
- Ramanathan:** I don't see any reason why we can't remain apolitical. I think that there is an issue. We all, I struggle with it. First of all, I think if we just stick to facts, okay, then I don't see why we have to get political about it. For

example, if we interpret my research some think I'm supporting President Bush's policy because I'm pointing the finger at something else. In fact, the Indian government and the Indian scientists have accused me of this, that I am funded by oil industry. I was in the big meeting in India, there was a lot of people, I said, "Please," I said, "Lord, I hope the oil industry will fund me. I need funds to do my research." [Laugh] So, yeah. I think in that sense, but I don't worry about it. I mean, if you're honest with yourself then you have nothing to worry. I gave a talk to over a thousand students at the U.N. General Assembly, but the last two years I've been slightly different in the sense when you become potentially political is that when you start telling people what to do. Okay? And I'm still searching myself, but I feel I have to start. I can't say, "I don't care what you do to the planet. All I see is my scientific results." I think in that sense this problem has moved from the domain of science into public interest. Because it's getting to a stage it could kill; floods, storms. Okay? So, what has it done to me? I am now focusing on, "What can we do about it, global warming?" And now, I proposed a project – I'm going to India ten days from now – a mitigation effort to reduce the brown clouds.

Harkewicz: Specifically in India?

Ramanathan: I'm starting with India and China, and now it's in India. The reason is the following, that – we talked about this brown clouds masking?

Harkewicz: Right.

Ramanathan: But, the brown cloud is just two kinds of particles. One is the cooling particle, which is sulfates that mask, but also a particle which heats, which is black carbon that's amplifying the warming. I'm going after the dark particles because they are the ones which are contributing to the melting of the glaciers, slowing down the monsoon circulation, also accelerating the global warming. And most of the emission now, as much as sixty or seventy percent of the emission comes from cooking, okay, with the wood fires and cow dung. And, that's also a source for over half a million deaths. Just like when I heard this NCAR scientist in 1974 talking about CFCs and it took my mind and my time as an engineer, you know. The childhood I spent in my grandfather's village I still have vivid memory of how my mother or grandma used to cook with wood and cow dung, and she would need a two hour rest after each cooking. Fortunately, there are bigger houses and better ventilation, but there are over half a million deaths in India still happening from this. So, we are proposing a project to take a large enough region, about a hundred villages with a population of 20,000, we're going to give solar cookers and biogas plants to completely eliminate it¹³. The beauty of the brown cloud is, its lifetime is only two

¹³ The project is titled, "Project Surya." "Surya" in Sanskrit stands for "solar" or "sun." For a copy of the white paper that Ramanathan submitted see his website at: <http://www-ramanathan.ucsd.edu>.

weeks, as opposed to CO₂ which is a hundred years, hundreds of years. It'll take a long time. Whereas, you cut down brown cloud you will see the effect immediately, because it's gone in two weeks.

Harkewicz: Now then, are you going to see the effects of global warming more then, do you think?

Ramanathan: Yeah. We don't know yet but what we know is that – I'm trying to create a black carbon hole, eliminate the emission of black carbon all together. And then, I want to make measurements to see how much is it helping in the greenhouse forcing? And we just got some funding from UNEP and Qualcomm is funding this project. So . . .

Harkewicz: Qualcomm? [Laugh]

Ramanathan: Yeah. Because, we are collecting data in each of the homes and that data is going to be transferred using a cell phone.

Harkewicz: Okay. [Laugh] That makes sense. Whatever works, I guess.

Ramanathan: That's it. Yeah. But the thing is if it can be scaled to all of India then it buys the planet – see, that's the beauty of climate. It doesn't matter where you do it, it helps the whole planet. I'm hoping that we can buy the planet about ten or fifteen years time to figure out how to reduce CO₂ with alternate technology.

Harkewicz: Well, that sounds very exciting. I'm glad to hear you're doing something really practical then.

Ramanathan: Uhm-hmm. Yeah.

Harkewicz: I'd be interested to find out what the results are. But, I want to ask you, you said that the Indian government was upset with you for your work?

Ramanathan: Because they think it's pointing fingers at them.

Harkewicz: Right. Exactly. I know, and originally it was called the "Asian Brown Cloud"?

Ramanathan: Brown Cloud. Right. That was a stupid mistake on our part. [Laugh] We shouldn't have done that one anyway.

Harkewicz: But when we started talking you mentioned how Los Angeles' pollution goes to Asia and Asia's pollution goes to –

Ramanathan: No, I said Los Angeles' pollution goes to, down into . . .

- Harkewicz:** The rest of the United States? Right. Exactly. So, when you proposed this particular experiment did you have difficulty convincing people to let you do that, this?
- Ramanathan:** I will tell you a month from now. [Laugh] We're having our first meeting in New Delhi. But, a lot of Indian NGOs have signed up with me, some of the major ones. They are excited by it. But, we are having this meeting on August 3rd and we are inviting the Ministry of Environment to come to that meeting. We will see. I don't know why they'll oppose that, because it's killing women and children. I mean, for India it's an embarrassing problem. If we can show that, "Hey, there's a way to solve this," my feeling is – I'm not expecting major opposition but I've been naïve about these things, how governments think. So, I don't know.
- Harkewicz:** Okay. Well, good luck with that. [Laugh] If this has been a constant – is it just because the population has continued to grow that it's gotten worse and worse, or has something changed that has made this become more of a problem?
- Ramanathan:** I think, you see, generally what's happening is that it's the same problem that you have in the U.S. If you look at our black carbon emission, our pollution emission in 1950s was about five to ten times large. Because, what happens is that when a technology is released you use that technology to improve your well being, right? So, in the '50s and '60s nobody worried about all these problems, pollution, it was helping people. But then, by early '60s the air pollution became an oppressive issue in this country. They started reducing it. India and China are going through that phase. They're advancing their well being, so-called well being, by using outdated technology, old coal-fired power plants, cooking with biomass burning. So, you remember why are fireplaces banned in many of the regions in the U.S.? Because of the pollution.
- Harkewicz:** So, it's like anti-tech, sort of? Okay.
- Ramanathan:** Yes. So . . .
- Harkewicz:** Going "natural" or something to that effect? Okay.
- Ramanathan:** So, it's going to take them – but, what's happening is that we are now realizing the pollution is just not local effects, although they are big, they're also having regional and global effects. So, I'm hoping that by reducing this something simple -- we know how to do it. It doesn't take a rocket scientist, even a climate scientist can do this -- people realize, "If somebody as ignorant as Ramanathan can do this [Laugh] we can do it." Honestly, I'm very ignorant. I don't know anything about these things, but

I feel somebody should do it. So, I'm doing it. But, my interest is global scale. I'm thinking it will help global warming. So, that's where I think this is one of those situations, a win-win situation. It improves the local scale, but the social scientists are wondering, "Why would the women want to adapt?" So, that's where I think the cell phone would be an incentive.

Harkewicz: So, they're getting a cell phone as . . .

Ramanathan: It's just not the cell phone. You see, a cell phone is a big source of income. They loan that, they can loan the minutes. In a lot of the villages they can't call anyone. So, people who have it can buy time, and then we can educate them. By the time the village women get to know how to use the cell phone I'm hoping we can educate them that by not cooking with wood and cow dung they save one or two hours each day, they can use that to earn money. I mean, ultimately it's a question of "How do you get out of poverty?" Okay? So, we are hoping that this will show them a way out of it.

Harkewicz: But, are you selling it as a local improvement as opposed to the climate, a global improvement?

Ramanathan: Yeah. That's why I'm teaming up with UNEP and a few NGOs to produce some videos. At the villager level we're going to push this as a local issue. I mean, I'm not foolish enough to persuade them on global warming. We couldn't persuade President Bush. What chance do we have to persuade a villager? No. It's going to be on the local issue. But, on the regional level and the national level I'm going to point out to them that if we can document – and it's also a scientific experiment – we are putting some of the most sophisticated instruments in each home and outside to document how much have they cut down. It's not been done before. People have tried to reduce this cooking this and cooking that, but they're not documenting what impact it has. That's where the scientist tries to do something practical. She or he still brings a scientific prejudice. "I want to document it." So, I'm hoping that India can take this at the international level, "Hey, we're contributing this to global warming mitigation. So, give us our share of the mitigation funds." So, that's our hope. Everything works on paper but we have to see in practice.

Harkewicz: So, okay, I want to make sure I'm understanding this is real interesting. You're giving the villagers cell phones, so that they can communicate the data that they collect from using the solar ovens as opposed to– my interests are more in the medical field. I know that a lot of times when you do clinical trials you have to deal with the fact that people may not always take their pills, and things like that, how are you trying to respond to . . .

Ramanathan: Those are the things we're going to discuss at the Delhi meeting. For example, the cell phone, of course the data is going to be transferred wirelessly, you know, without the kind of towers. But, the cell phone is, not only... We're going to put the instruments at ponds and there'll be filters and they take a picture of that filter every day and send it to us. And then, we're going to have eight or ten simple questions, such as, "How many wood pieces you used? How many cow dung pieces used? How long did you cook, morning, evening?" And then their health information. "Did you cough today?" Epidemiologists are going to come. They're going to use that. And, the social scientists are interested in the behavioral changes, and I don't know how much we can collect that data. We're interested in that and working with Jessica Wallack, who is a professor at IRPS.¹⁴ So, we're thinking, "If they don't send the cell phone pictures, how do you know?" Okay? Remember, when you don't pay for your cell phone bill, what happens? It gets disconnected. We are thinking of putting in software, when I don't get my picture their cell phone will start scrambling. [Laugh] They told me, "Cut it off." I said, "What I find more frustrating, my cell phone not working I can throw it. But, it sort of works, half the time it doesn't work." [Laugh] I said, "We should scramble it."

Harkewicz: So, you never know? [Laugh]

Ramanathan: So, she or he hears only every other sentence. Just imagine. Your curiosity will kill you. "What is the person trying to say?"

Harkewicz: Okay. I understand.

Ramanathan: We have other ways. In this cluster of villages there's a major woman's college. We're going to have the principal and the students involved in this, because they know how to talk to the women in the local language. And, they will also do some sanity checks about the data. They themselves will go look at it and see if they're maintaining it properly, etcetera.

Harkewicz: Okay. So when is this going to begin then?

Ramanathan: Well, you know, I don't know. I'm thinking by September or October. I never have a long-term thing. I need things to happen now. So, we're hoping to start because their pollution season, the dry season starts in September or October. We're not going to be able to do all the 6,500 homes. We're going to start a pilot project with fifty to a hundred homes and collect data for the first six months to learn what not to do and what to do, and then hopefully by next fall start it in full swing.

¹⁴ Jessica Wallack received a Ph.d. in political economy from Stanford University in 2004, and joined UCSD as Assistant Professor of Political Economy in the School of International Relations and Pacific Studies (IRPS).

Harkewicz: But, will it continue throughout the whole year?

Ramanathan: Oh yeah. See, the first year we won't change anything. We just collect data. The second year, over a period of four months, you know, we replace all these cookers and the biogas plants and, you know, change it for a year. And the question is, a lot of people ask me, "How are you going to sustain it?" We need about four and a half million for this 20,000, including the science and the solar cookers. And, I'm passing the begging bowl around. My, undergraduate daughter she's a big activist at UCSD and she led the campaign on Darfur at UCSD, and she gave me an idea.¹⁵ Maybe I can develop, you know, this wristband or pen and sell it for a dollar each. So, we're going to try every way to do this.

Harkewicz: That's good. Yeah.

Ramanathan: And, that's why the NGOs are there. They're, "Do it." But, we have now, I think Qualcomm, we're negotiating to fund a million and UNEP has agreed to fund a million. So, I have about half the money I need. The other half you may get a ripple. [Laugh]

Harkewicz: Well, you can make it a healthcare issue, so I'm sure you're going to have people, that can use it as a tax write-off or something like that, I suppose.

Ramanathan: That's interesting. So anyway, the question is "How are we going to sustain it?" That's the key issue. Because, if you can't sustain it I haven't done anything meaningful. And, I talked to the Chicago Climate Exchange Commission. You know, you can sell carbon credits. Basically, for every ton of carbon you put out in the U.S. you give them, I don't how much it is, about \$5 or \$10 and then they save carbon emission elsewhere. Okay, it's cheaper to save carbon emission in developing nations because our technology is already advanced. It's difficult to make it more efficient. So, they said they're going to list *Surya* in the Chicago Climate, in the Stock Exchange. And, they felt we could get about \$200,000 a year, and that's what I need to sustain it, to maintain the cookers, and so we have a . . .

Harkewicz: It sounds like you've got things lined up, if . . .

Ramanathan: It's amazing. It's falling into place. And, what I'm discovering is that it's possible, you know. Two or three years now I'll completely switch from science into doing this and that's what I'm thinking. If we succeed. You meet interesting people, people who care. I love that. Who care about the world.

¹⁵ Tara Ramanathan is President of UCSD Students Take Action, a group that organized several campus protests of genocide in Darfur.

- Harkewicz:** Will you have to set up some sort of foundation or something like that in order to do that?
- Ramanathan:** I don't know. Because my interests are to scale it up to all of China and India. I can't do it. I can only show the way. I'm talking to U.N. Foundation. I visited them. This is the one Ted Turner gave a billion dollars, and I know the person who's heading up the climate thing. I went and met with him a couple of weeks ago in Washington D.C. That's really what I find frustrating, people do a lot of talking. Even Gore, he has no solution. If you listen to his movie . . .
- Harkewicz:** I was going to ask you about that. So, you brought it up. Yeah?
- Ramanathan:** Of course, I'm disappointed with that movie.¹⁶ I mean, I like what he's doing, otherwise nobody would know about it. It's just fantastic. But, I just think he's such a clever guy and I'm sure he's surrounded by all the top guns he can think of. Why aren't these guys coming with a solution? So I'm feeling if I show this, others will just jump in. We'll see.
- Harkewicz:** Have you gotten any negative feedback from colleagues or anything about the idea of offering solutions or getting involved as opposed to just doing science?
- Ramanathan:** They don't know it. [Laugh] That's my strength. That's what I did when I did the UAV, no one knew I was doing UAVs. I show it as a fait accompli. It succeeds then I talk to them. Right now I just talk to people who can help me. I don't talk about this in scientific circles. Or, through you, this may propagate. [Laugh] I don't know.
- Harkewicz:** So, how did this whole . . .
- Ramanathan:** But, Tony Haymet knows about it, and Larry Smarr,¹⁷ our chancellor Fox.¹⁸ I mean, when she invited me to give a public talk I talked about this.
- Harkewicz:** But, is Scripps involved with it then? I mean, are they going to process the data or anything like that?

¹⁶ *An Inconvenient Truth* was directed by Davis Guggenheim and presented by former Vice President Al Gore. The film premiered in 2006. Gore wrote a companion book, *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It*, the same year.

¹⁷ Larry Smarr received a Ph.d. in physics from the University of Texas at Austin in 1975. He is founding director of the California Institute for Telecommunications and Information Technology and Harry E. Gruber professor in the Jacobs School's Department of Computer Science and Engineering at UCSD.

¹⁸ Marye Ann Fox (1947 -) received a Ph.D. in chemistry from Dartmouth College and became Chancellor of UCSD and Professor of chemistry in 2004.

- Ramanathan:** Oh no. Probably, one of my postdocs will do that. But the data is, of course, public. I think the way we're going to do that is do all of the data analysis by scientists and students there.
- Harkewicz:** In India? Okay.
- Ramanathan:** Because it brings the cost down of the whole thing. But, there's UCLA, they're very interested in networking, linking 6,000 cell phones, data. On the technology side there's quite a bit of interest. They want to see how this evolves.
- Harkewicz:** Okay. So, you really think that you may actually go into something like this full-time?
- Ramanathan:** It's not a question. I think I want to and I think there's a good chance, because I don't see there's any other way I can help what's going on in a better way than this.
- Harkewicz:** Well, I can appreciate that. There's always a lot of pointing out what's wrong, but what can you do about?
- Ramanathan:** See, that's what I'm thinking. I mean, after a certain point if you don't give solutions you're causing more damage. You're making people depressed. What's the use of telling people, "You can't drive your cars." They've got to drive their cars to work. You know, I take the bus since the last six, nine months, but every other day something comes up. Today I have to go to the clinic. Yesterday I had to go here, where the bus doesn't go.
- Harkewicz:** Right. It makes it very difficult.
- Ramanathan:** Public transportation is pretty awful in the U.S. And, there are cold winters, I mean, you've got everybody locked up in a 3,000 square foot home, what can they do? You're frustrating them. We've got to think about solutions. See, this ethanol we're discovering is a disaster.
- Harkewicz:** I'll put this on pause for a minute.
- Ramanathan:** Sorry. [Cell phone rings]
- Harkewicz:** Do you want to pause?
- Ramanathan:** No. That's fine. I'll just turn it off.
- Harkewicz:** Okay. So, what were we talking about here?

Ramanathan: I guess maybe we should conclude this. I just want to say, I feel strongly scientists working in the climate area have something to offer in terms of solutions, because at the minimum they can give guidance on what's a bad way to do it. We don't want to create another disaster. So, we have to start working. I'm not claiming everyone, at least the old guys and the old women scientists who can afford to do this. I'm a tenured professor, in principal.

Harkewicz: Well, I suppose your life has been fairly progressive, so maybe it's this time in your life to do that kind of thing. So. I did want to ask you, and I'm sorry to take us totally off your solutions for problems, but I did wonder, you were in Boulder for most of the winter, or winter I guess wasn't it? Let's see. You came back in . . .

Ramanathan: Spring.

Harkewicz: Okay, in the spring?

Ramanathan: Right.

Harkewicz: And, I know you've been out to the Pacific a number of times to do a lot of research and I wondered how your field work impacts your personal life? Is your, did your family usually stay here in La Jolla then?

Ramanathan: Right. This time my wife joined me, you know, about for a month, or two months. And, it has, you know, a huge impact on the family life. But for me, as my wife says, "He's gone half the time. It doesn't matter which field experiment." Or, "At least if he's doing a field experiment I know he's in one place where I can find him."

Harkewicz: I see. Okay.

Ramanathan: So, but yes, it . . .

Harkewicz: So, even if you were here you'd be gone half the time anyway?

Ramanathan: I call her quite a bit. Yeah. And, I think that Scripps accommodated me very well. For example, this is during my teaching year so Scripps permitted me to do this video. So, I was there teaching the course through video, and as a result students in Boulder also took my class. So, my student population tripled and it was nice.

Harkewicz: Okay. So, that was another thing I wanted to ask you too. Have you continued your teaching then here at Scripps as well?

Ramanathan: Oh, absolutely. I love teaching but my frustration is I'm not able to give it as much time as I want to. I enjoy teaching.

Harkewicz: You think that might be something you would spend more time doing if you were to get involved in this other kind of more social activism type work?

Ramanathan: I don't know. I don't know if I consider what I'm doing a social activism as opposed to a practical experiment, you know, on the thing. But, you're right. I'm thinking that if this experiment succeeds then I may teach a joint course within the social sciences and the physical sciences. I may propose a course to our Division of Social Sciences. And, probably it has to be undergraduate. Yeah, I would be very interested in doing that and bringing in another social scientist to think about the implications of this. You know, why would people change their behavior? We have talked in this country for the last fifty years and now we have put warning on smoking, it causes cancer, but people still smoke in large numbers. So, why would a villager avoid cooking because of global warming? [Laugh] It's not clear.

Harkewicz: Right. It doesn't make much sense does it? Yeah. Well, I hope it works because I would be interested too – it is hard to make people see the connections, I guess.

Ramanathan: Right.

Harkewicz: So, you have someplace to be soon and you've really covered a lot of my questions. We talked about your personal life here. I did want to ask you though, one of the things that I'm trying to ask people about is the Scripps community. So I wanted to ask you if you have found yourself, over the years, socializing with different people at Scripps, or if that's something that you don't really do?

Ramanathan: I wish I could do more of it than, just because of my travel and my field experiments, and then the time I need to spend with my family has not given much time. But I do socialize to a limited extent. We have dinners together with some colleagues. And, I'm just too shy a guy to go to TGIF. [Laugh] I've not done that. One day I'll get the courage to go there.

Harkewicz: Before you leave the Institution, yeah? [Laugh]

Ramanathan: I think I'll do that.

Harkewicz: And, when you do these field experiments do you usually take graduate students with you, along?

Ramanathan: Yes. Graduate students, and postdocs, and scientists. And, it's just a remarkable huge, a small-scale social experiment by itself when you go with a bunch of students, and staff, and scientists. And particularly, I think, all of my field experiments are done on small islands, and it creates its own dynamic, and pluses and negatives. For example, Maldives. It's a Muslim nation where they have different dress codes for men and women. I have female graduate students and we are on a small island with spectacular ocean so we had to put some restrictions on women swimming versus – all kinds of interesting challenges. And, I remember we did this major field campaign, it resulted in a paper in *Nature*, but those six weeks were during the Ramadan period where the Muslims they don't eat from sunrise to sunset. So, I had to tell my students to hide their food in their backpack and take a bite at it when nobody is watching. But, we were all to eat like them, early morning, and in the night, and it was very interesting. But, I also feel hopefully it has had a very good impact on my graduate students, because you hear right now about the Muslims being radicals from the Iraq War, but in Maldives you see a different picture. They're just like the rest of us. They want a peaceful life. So you know what you're seeing is a small fraction of the population, you don't stereotype them. So . . .

Harkewicz: So is it out of respect for their particular culture that you try to do this or is it almost like against the law to eat from sunrise to sunset?

Ramanathan: Right. I would say, you know, some of both. And, first of all we know we are in a foreign country, so you respect their practices. But at the same time, you know, it's also the law. So you make sure you abide by that. A little bit of both I would say.

Harkewicz: Are there any particular locations? It sounds like you've done a lot of work all over the world? Is there any particular place that you particularly like or particularly don't like, for whatever reason?

Ramanathan: No. Right now we are thinking of branching off into Africa. I just returned from a trip in Kenya. No, I love anyplace in the planet. But it has to make scientific sense. So, we did an experiment from Fiji Islands, and Maldives, and then Northern California, and this time, you know, this experiment you talked about which we did from Boulder. We did it from Alaska and, you know, Hawaii. So, I think I've not gone to cold places. Maybe I should start. [Laugh] Greenland and Antarctica.

Harkewicz: No. You spent enough time in Chicago in order to do that.

Ramanathan: That's right.

- Harkewicz:** But, how long would it take you to get this plan you have for the Indian experiment? How long would it take you with all the planning to get something like this up and going?
- Ramanathan:** I think, for example the UAV Project from time of concept to execution, you know, developing of the instruments and launching three UAVs and publishing a paper in *Nature*, it's about four years. Those are remarkably fast time periods compared to the Indian Ocean Experiment, also from conception to execution was about four years. I'm a four-year guy. [Laugh] You know, what it takes you to finish a graduate school, or an undergraduate school. So, SURYA, most of these things I get just comes, I don't plan any of it. Just a random thought comes and then I think, "Oh, that seems to be a good idea." And then I look into it, and I get fascinated and then I start doing it. So, the idea for SURYA came to me and I think just in early last year or middle of last year. Then I wrote a white paper which was distributed this January. So, let me make a prediction. This was what, 2006? Hopefully by 2010, July, we'll have finished the first phase of SURYA and maybe we can have this interview again and see what happened.
- Harkewicz:** All right. I know you needed to get out of here, so there are a few questions that I ask everybody at the end of our interview. I'm going to ask them to you also just to see how people respond to these same questions. And, in some ways you may have actually answered them to a certain degree but I'll ask them anyway. What do you think has made Scripps successful?
- Ramanathan:** Yeah. Thank you. I think it's a good question. I think individuals. Undoubtedly. It's not making plans. It's not any administrators. It's an individual and Scripps. I look at Scripps as an individualistic place. And I feel that's why I am happy and thriving here. I'm an individual and I think it's a place where you get an idea and no one can stop you from doing it. There are always jealousies, colleagues being suspicious. You know, when you have a big science agenda your academic colleagues are normally nervous about you, that you're, "This is a train wreck coming to take over." [Laugh] I've had that experience at Scripps. But, I don't think that it's unusual in a university. That's the nature of academic institutions. They protect. But, I can't put my finger on it. There's something in Scripps which allows you to do that.
- Harkewicz:** Okay. I did want to ask you, too, and sort of related to that response. You know, you said when you were a graduate student and you wrote this, this paper about . . .
- Ramanathan:** A postdoc. I had just finished graduate school.

Harkewicz: And people didn't believe you? Now, do you think that your reputation sort of precedes you, that some of these suggestions that you make are more easily funded or something because of your reputation from past experiments?

Ramanathan: I think in terms of science, yes. Science goes by reputation, track record. Yes. On the other hand SURYA is not going to be by reputation because I have no reputation in that field. So, it's going to – of course, it's because of my networking, for example the Qualcomm connection was made by Ed Frieman. He happened to talk to the chairman of Qualcomm and he liked that idea. So, that's how SURYA is going to happen. In a certain sense reputation, but not reputation in this field. Irwin Jacobs could have asked, "He's a climate scientist. What is he doing with cooking?"¹⁹ [Laugh] He didn't ask that question. I'm thinking somebody's going to get smart and ask that question. [Laugh] "What is Ramanathan doing about cooking?" But you see, it goes by reputation but that alone is not going to do anything for you. That's the beauty of the American system. See, I ask myself, "Why is America so successful?" I find in many parts of the world the "old boy" network works. That hurts. That's a killer. That is a person who is on the top is able to get the money. So, that's so-called reputation. But, in the U.S. you have to prove yourself every time. You know, that's the peer-review system. All my funding has gone by National Science Foundation and, you see that's why I'm always surprised when I get a big grants because all my proposals are sent to at least twelve reviewers because they are bigger sized. Sometimes I feel I can get the same money by writing hundred thousand dollar proposals and write fifteen of them. But, what's interesting is that somehow Americans are able to put their prejudice – I feel I'm not liked by half of my colleagues because, you know, I go charging. I don't look behind my shoulder. You can leave a lot of hurt people behind when you do that, but I just don't have the time. I'm not doing it maliciously. I don't have time to see what people are feeling about me. I feel if I do that I'll grow quickly old, [Laugh] and not do anything.

Harkewicz: Yeah. You're probably right.

Ramanathan: So, that's why I admire the American. When I get criticisms on my proposals, they're always objective, and I always got funded because they see the value of the science. They'll throw snide remarks, but at the same time somehow, this is what my feeling is, saving America. You know, the political system I see is just as bad as the rest of the planet, but some of the Americans have that thing. I'm not claiming Americans are not prejudiced as others. We are all human beings. But somehow when it comes to the

¹⁹ Irwin Mark Jacobs (1933-) received a Ph.D. in electrical engineering from MIT in 1959. Jacobs founded QUALCOMM, Inc. in 1985 a company with interests in mobile satellite communications and digital wireless telephony. He serves as Chairman and CEO of the company.

professional things they're able to put it aside. In the countries I know, they're not, they bring their personal baggage into the office. Anyway. Yeah.

Harkewicz: Okay. All right. So then the under, the other side of the "What made Scripps successful?" is what do you think may have threatened its success?

Ramanathan: I think yeah, it's a good question too. You know, when I said "Scripps" I think of individuals. When I think of why Scripps is good I think of Walter Munk. I think of Revelle, Dave Keeling.²⁰ I don't think of an institution. I would say, "Well, that's how they know Scripps," about people. I think I've seen in the last ten or fifteen years, the fact that we still talk about Roger Revelle shows we are looking into the past, we are looking inwards and I can't put my finger on it. Yeah, I feel, I don't see the stars and, you know, those individuals. There are a few. I'm not going to say there's none. There are a few but I feel Scripps is losing its preeminence.

Harkewicz: So, a threat to its success is that there aren't the individual stars, at present, or in the future?

Ramanathan: I don't know if I want to use the word. Maybe, it's wrong to use the word "stars," the visionaries. The people who are willing to jump off a cliff. See, you need some crazies who are willing to take risks. The problem with the risk is you could fail, become obscure, but there are certain individuals who don't care, and I don't see those crazies and visionaries who are willing to jump off a cliff.

Harkewicz: Well, if you forgive the terminology, do you think the climate has changed since – [Laugh] I'm sorry I couldn't resist –from the past with Revelle and Walter Munk, and things like that? I mean, do you think the world is just different? I mean, or is Scripps different?

Ramanathan: I don't think so. I don't think the world is. The world is still the same. Nobody can stop a winner. We have a Craig Venter, who is pushing the envelope.²¹ No, I don't think so. That's an excuse we can give, but the world is still there to be, you know . . .

Harkewicz: Do you want to propose why you think that might be the case?

²⁰ Walter Heinrich Munk (1917 -), physical oceanographer and professor of geophysics at Scripps; Charles David Keeling (1928 – 2005), Scripps geochemist and prominent climate scientist; Roger Randall Dougan Revelle (1909 – 2000), Scripps director 1951 – 1964 and founder of UCSD.

²¹ Jon Craig Venter (1946-) got a Ph.D. in physiology and pharmacology from UCSD in 1975 after serving in navy in Vietnam and developed a method of sequencing DNA fragments while working at NIH. He was the founder and president of Celera Genomics and currently president of the J. Craig Venter Institute.

- Ramanathan:** Honestly, I don't know. This is what I said, you know, I've been running in one direction so I've not looked at my side or back. I don't know. But, suddenly I look back at Scripps I'm saying, "What's going on? Where are these people?" I feel a lot of the problems I hear are about budget, I've not participated in them. I think we need a balance of scientists, excellent scientists doing paper and pencil and we need these visionaries who are going to go save the world, meaning save the scientific world, push new technology, push new science, go in different directions.
- Harkewicz:** Well, a lot of the other people I've talked to have said that a lot of the problems are with funding and that, you know, people like Roger Revelle and stuff had ONR funding and it was . . .
- Ramanathan:** I don't believe it, Laura.
- Harkewicz:** No? You don't believe that? Okay. [Laugh]
- Ramanathan:** Not at all. You create the opportunity. You know, the same thing I said at the ABC when we proposed we were going to set up stations, the U.S. government said, "There's no money." But, somehow, you know, we found funds from UNEP on this. I find that shocking what you say is that billions of dollars are put into climate. Now, what do we mean by saying, "No money." I don't believe that at all.
- Harkewicz:** Okay. Then my final question is, what has Scripps meant to you?
- Ramanathan:** Quite a bit. A tremendous amount. I don't think any of the things I did here would have been – I think the kind of things I was able to do here would have been possible only in a very few institutions in the U.S., and Scripps is one of them. And, the second is, just the name Scripps adds stature, makes a big impact. But, you can't rate on that alone, but that helps. And to me having colleagues like Munk, and Dave Keeling, and others, I mean– it's a big inspiration. You know, I'm sixty years old. I'm still inspired by Walter. The role models are not just for teenagers. It's for everyone. [Laugh]
- Harkewicz:** Okay. Is there something that you wish I would have asked you that I didn't, or something that you wanted to say that you didn't have the opportunity to?
- Ramanathan:** No. No. You let me ramble on too long. [Laugh] That's my only complaint. But, I thought it was good questions.
- Harkewicz:** Okay. Well, thank you very much.

