American Meteorological Society
University Corporation for Atmospheric Research

TAPE RECORDED INTERVIEW PROJECT

Interview of Robert Serafin
April 22, 2003

Interviewer: Richard Carbone

Rabson: This is Diane Rabson of the NCAR Archives. It's April 22, 2003. Robert Serafin is being interviewed by Rit Carbone.

Carbone: Well, Bob, thank you very much for this opportunity. I've been waiting for this for a long time.

Serafin: I noticed that. I looked at the questions, and there was—

Carbone: (Laugh). It was an act of charity to show you the questions ahead of time.

Serafin: Right, that's true. So, anyway, rest assured, I didn't try to answer any of them prior to this afternoon.

Carbone: All right, well, very good. Why don't we start off by dealing with some ancient history here. I'm not aware of your having been born a weather nut like many of us in the field of meteorology, and so the question is what were your childhood interests, and your schooling choices, say through college?

Serafin: When I was a kid—by the way I was born in Chicago, central city, of parents who were born in the U.S., but grandparents who come from Poland, and spoke almost no English. So I grew up in an ethnic neighborhood part of the city, and when I was young, my real interests were doing well in school, sports, and fishing. I'd learned to start to fish in the park lagoons, which was illegal, and we were often challenged by the police, and the police weren't too gentle with children those days, not like they are today. However, I never really had any ingrained interest in meteorology, science or engineering growing up. I just wanted to do well in school, and went to a parochial high school in Chicago, a Catholic school, and of course they gave us some sorts of tests to determine our aptitudes, and they said they would only accept me in a science or engineering curriculum because that seemed to be where my aptitudes lay.

So I did it, not because I felt it was thing to do, but because they thought it was the right thing for me to do, and that led eventually into an education of electrical engineering. Throughout all of this, the weather meant little to me other than it rained often times when I tried to play golf, or was out fishing somewhere, and we did get lots of snow and cold weather in Chicago. We never thought too much about the weather.

Eventually, after having graduated from college, Notre Dame, and then a Masters degree at Northwestern, my field became radar, radar signal processing for missile detection radars. All of it was classified work while I was working out at Long Island, and then later the Illinois Institute of Technology Research Institute, and the Illinois Institute of Technology (IIT) in Chicago. At about the same time, some of the contracts that we had in the sixties in Chicago were for radar meteorological research with the U.S. Army's Signal Corps in New Jersey, and it was through that that I became associated with radar meteorology, and some of the problems associated with radar meteorology. I remember having been asked to go to a conference I think it was in Washington DC, I think it was a radar meteorology conference at the time. I had a broken leg recently suffered in a skiing accident, broken ankle, and came to that meeting with a big cast on, walking cast, and I met Dave Atlas for the first time, and Dave had been somewhat familiar with what was going on at IIT because he was interest in radiometric tomographic inversions using C-band radars scanning beams. Using horizontal stratification of the atmosphere to create complete profiles of temperature, and there was a guy in Chicago named David Freiburger, brilliant engineer, who later became a high-energy physicist, and went to work at SLAC in California, but it was a guy who Dave really admired, and who became a close colleague of mine in Chicago. So, Dave thought a fair amount about IIT because Freiburger—I met him for the first time in Washington, DC, and we were able to talk, but I didn't know where that might led in the future. Shortly thereafter Dave joined the University of Chicago, and as you know, the University of Chicago has no engineering programs, and at the same time I had begun working my PhD at the Illinois Institute of Technology in electrical engineering. Signal processing theory. Dave of course wanted to build a new, powerful, sophisticated research radar facility in Chicago, and he was very successful in getting funding for that, but he needed an alliance on the engineering side. So he built that alliance with Illinois Institute of Technology, and that alliance was called the Laboratory for Atmospheric Probing—you, Peter Hildebrand, Jerry _____, Andy _____, Ian Harris, Alan Bone…

Carbone: Jim Metcalf.

Serafin: Jim Metcalf, _____ faculty person, were all involved in that, and that was a pretty exciting time. It was exciting from Dave's perspective because he

hadn't done anything like that with students before, he hadn't worked in that kind of environment, and he had just numerous ideas, more than anyone could pursue, and as you know, some of them were good, and a lot of them were not so good, and we had to be pretty firm as graduate students taking the wheat from the chaff, often times at his displeasure, but we did have a lot of good times then, and the fundamental issues in the radar meteorology field that I was dealing with had to do with the signal processing of radar signals, Doppler radar signals, and at that time we had not yet figured out how accurately Doppler velocities could be measured. All of the theory had been worked out for incoherent signals as you know, but the theory for the Doppler signals hadn't been done. So that was really exciting, and some really good work was done at IIT, same time the folks at NSSL _____ and _____ were working those kinds of things, but there was also a man, I'm trying to remember his name, he was at Bell Laboratories, who had essentially created this idea for the auto co-variance, or pulsed _____.

Carbone: Was that ?Reler?

Serafin: Reler? Could have been. It could have been Reler, and Roger and me picked up on that when he was out in Boulder at NOAA. So it was through that work that I got involved with Doppler signal processing and weather signals, and it was a really exciting time, it was a lot of fun, and we answered all of the questions theoretically that were, that needed to be answered in very elegant closed form fashion, which I thought was terrific at the time.

Carbone: So, where are we chronologically here?

Serafin: Late sixties.

Carbone: Okay.

Serafin: In Chicago. You were there as a graduate student.

Carbone: _____ and I worked on that problem in that period, too.

Serafin: Actually, _____ published a paper, which was interesting, but it had no practical significance, as I recall. He was looking at the instantaneous phase of random signals…

Carbone: Yeah, that was…

Serafin: And did the statistics of that, of that, of those, of that phase…

Carbone: Right.

Serafin: An interesting thing is, is that when, taking its time derivative, you get the instantaneous frequency, statistics of the instantaneous frequency were essentially unbiased as I recall, except difficult was that the variance was infinite, and, an estimator that had a very, an infinite variance would not be very practical. _____ had an interesting insight to all of this. He just believed inherently that it would without, he never actually was able to quantify it, quantification was done in Chicago and a couple of other places, and then later _____ did a very comprehensive study of the statistics of the _____ variance estimator, which was a very important estimator, because it allowed us to dramatically reduce the number of calculations necessary to compute mean Doppler velocities. The calculations were the full spectral approach as you know, are highly computationally intensive, and we didn't have available then the integrated circuits, and the high speed solid state devices that were necessary to do that very well. Going back a bit, just a few years before, we had computers that were these missile tracking radar's, pulse compression processing systems. Computers that filled large rooms, which were extremely expensive and not affordable by the meteorological community. Computers like that could have done the job, but we couldn't afford them. The pulsed _____, along with the advent of integrated circuits, made it very cost effective. I would imagine we will get into that a little bit later.

Carbone: Yeah, but sort of, while we're on this topic, it's intimately related to dissertation, I thought we might spend a minute or two on that…

Serafin: (Chuckle)

Carbone: Which was, related to the, the types of turbulence, and I think estimation of turbulent kinetic energy as I recall.

Serafin: Correct.

Carbone: Could you elaborate how, how this was _____ with the developing of understanding of signal theory, practical means of processing?

Serafin: Well by then, I pretty much understood the methodologies, and I had the tools to undertake a study of that nature, and it was motivated of course by Dave Atlas, who saw this as a way to detect turbulence with incoherent radar's on aircraft, commercial aircraft, and as you know Dave had at least one, and maybe several patents for devices that were used on commercial aircraft, and he had a great interest in making these radar's as useful as they could be. He probably also thought that we might be able to patent something, and might someday be able to sell a portion of it. It was patented eventually, but I don't think it was ever sold—well, I'll come

back to that a little bit later because it has to do with enlightened leadership. So I essentially followed Dave's lead, and he said, why don't you look into this problem. The interesting thing was that simulation on digital computers was extremely time consuming at that time, and I did all of this work with analog computers, which can, are very efficient in terms of calculations that can be accomplished, and then essentially digitized the analog outputs of these devices, and from that calculated and estimated the uncertainties associated with the measurements of turbulent kinetic energy utilizing essentially the comparison of the signals in two separated _____.

Serafin: You're forcing me to remember all of this because it's just coming back to be now.

Carbone: (Chuckle).

Serafin: For all practical purposes these two signals were used to beat against one another, and it was a difference frequency that was the velocity frequency.

Carbone: So a structured function.

Serafin: But actually was a structured function approach, precisely except that we didn't actually use multipliers, which I thought later would have been a better way to do it. We simply, I think added them in, and then, detected them. So there was a beat frequency evident in the envelope.

Carbone: Yeah, okay.

Serafin: But it was, it all worked, just as the theory said that it should have worked, and I worked out the estimation, statistics, and it got me a Ph.D.

Carbone: All right.

Serafin: But as yet, I wasn't committed to a field in radar, to a life in radar meteorology, or in meteorology.

Carbone: Yeah, right, and, and that particular subject interests me and before we move into it now in, in the Laboratory for Atmospheric Probing joint lab with Less _____ at IIT, and Atlas at Chicago there are at least two major thrusts. The FBS 18 system, the vertically pointing system physically located at IIT, was the one that probably _____ was staff, or mostly involved with, but there was also the National Hail Research Experiment transportable system, which I guess was sort of more associated with the Illinois State Water Survey, although maybe not originally.

Serafin: No, I think it was associated with NCAR. There was a collaboration as I recall for the construction of two radars.

Carbone: Right.

Serafin: One for _____, and one for the University of Chicago.

Carbone: Right.

Serafin: And, go ahead.

Carbone: Well it, those were both, you know the basis for much research, many dissertations emerging from them, but I, clearly remember your deep involvement with what I would consider to be, at least in retrospect, a rather bold step in the history of meteorological radar, and that was the, the contract with the Control Data Cooperation. I think it was…

Serafin: That's right.

Carbone: The producer of what would be the equivalent these days of super computers. The whole CDC 6000 series, 7000 series in the development of real-time radar signal processors.

Serafin: Right.

Carbone: It seems to be you were pretty heavily into that.

Serafin: I was, yeah of course by then there had been an alliance built between the University of Chicago, and the Illinois State Water Survey, and that is what led to the name CHILL.

Carbone: Right.

Serafin: For that, research radar facility that was being developed. Dave had, I think, gotten the money from National Science Foundation for the construction of that radar, and it would, it was to have been used in _____ experiment, but in a variety of other experiments, as well, and Dave wanted a radar that was transportable with full Doppler capability, radar that would operate in heavy winds. The way that was eventually accomplished was through the use of an inflatable radar, but also one who's acceleration, and I'm remembering all of the, acceleration of the pedestal would be very high, so it had to be very strong pedestal with powerful drive motors so that the antenna could be rapidly scanned back and forth through areas of interest, and I was really involved in almost every aspect of that, and I enjoyed that very much, because I got to, we all did, I think a lot of people in Chicago were involved with that. We were

able to see what it took to put all of these components together to build something that would really provide a very unique capability. Another aspect of that by the way was duel wave length aspect. As you recall at that time dual wave length techniques were being _____as a way to detect hail.

Serafin: They sort of did. I don't think they worked too well. The method, the _____ method was a little too noisy, but never the less, via reflectivity _____ approach to the study of hydrometers, their types water mass, and ice masses and so forth were, very interesting approaches, but a signal processor I think was perhaps the biggest challenge, and Illinois State Water Survey tended to be on a conservative side, and, coming from Chicago with Atlas, we weren't conservative. We went for, the home run, and tried to build our processor that would do everything. Fortunately at CDC, there was a man named Bob Trussell, a very good engineer.

Carbone: Right, right.

Serafin: Very good engineer, and, he came forward with a design, full spectral analysis, clutter cancellation I remember us, I learned a great deal about digital filtering at the time. We learned about Fast Fourier Transforms, how the algorithms worked. We learned about pipeline processors which are essentially parallel mechanisms for speeding up the calculations in the Fast Fourier Transform algorithms. And so eventually we created a highly sophisticated, way ahead of its time, signal processor, which was held together with rubber bands, and chewing gum, and (laugh), and soldering irons and so forth for many, many, many years at the Illinois State Water Survey after that. It was definitely beyond its time, and we hadn't yet figured out how good the pulsed _____ was, yet we understood it better, probably could have gone for a pulsed _____ would cost less, and would have been more reliable, and would have led to more science I think in the short term. Now as you know today, a company like SIGNET builds wonderful signal processors, and they use full spectral processing in nearly all of their processors. Full spectral processing has many advantages, but it was computationally so intense it was very difficult to do at that time.

Carbone: Well as a beginning graduate student, having weighted through many meters of hexadecimal DPS trying to find the hung bits, and the dropped bits the inventors of this device weren't among my best friends at the time…

Serafin: (Laughing)

Carbone: Let me put it that way.

Serafin: Well, you know in fact that was, it's very interesting that you say that because you know we had another controversy between the folks in Chicago and Illinois State Water Survey. The Illinois State Water Survey people always felt that all they wanted was to have the data on tape, and then it could be, the data could be analyzed effectively after the fact, and Dave was a strong believer in displays, real time displays, and also visualization. They didn't feel that way. So I think consequently, we put all of our money, or most of our money into the signal processor tape recording system, and very little into the data processing data manipulation, and display, which are things that we did later at NCAR, and again led the field I would say in that arena.

Carbone: Okay, well that was an interesting period. Dave, of course, as he always does, made it exciting.

Serafin: Yeah.

Carbone: But there was a transition to NCAR not long thereafter…

Serafin: Right.

Carbone: Dave Atlas was successfully recruited to direct the then facilities division of NCAR, which included both observing and computing facilities, and and so he set out to remake this facilities division, which soon was renamed the atmospheric technology division, and you must have been his first recruit.

Serafin: I was.

Carbone: I don't know that for a fact.

Serafin: No, I think that's true. Maybe not, maybe the second, but I was the first that he had intended to bring to NCAR from the moment he left Chicago. He knew that before he told me, but at about the time he was leaving Chicago, he Bob - I'm going to go out there, and about a year I'll have a job for you. I think he hired Stu Patterson before me as a facility manager.

Carbone: Oh he hired Stu.

Serafin: Yep, yeah.

Carbone: I didn't know that.

Serafin: Yeah, there was a director prior to, Stu, who, Dave didn't feel had the credentials that he wanted. In fact, he felt the whole atmospheric

technology division needed revitalization, new directions, to be more scientifically guided, and to be more sophisticated. So he said he'd have a job for me in a year, and I said, well I thanked him very much, but I didn't take it seriously.

And, it was about seven or eight months later that we were out skiing with our family in Colorado, before Christmas. That's something we did every year, and I stopped in to see Dave at NCAR, and I went up to see him, and he was at that time up on the Mesa Lab in an office, a very nice office, and I went to see him, and he said, Bob I think I'll have that job for you next spring, and I wasn't ready to make that move. I hadn't thought about it very much, and I said really. I said well, it's going to take some thought on my part, and he said well, I'm working on it. He said, I'll think on what I want to do. The following spring, he had a very small workshop on radar signal processing. There were only maybe a half a dozen people there. Herb _____ was there, and Dick _____ was there, and I was there, and, I don't remember who else. We might have had one of the engineers from FOF there, Joe _____ possibly, and the whole issue had to do, Gray was probably there, and _____ with signal processing, and what to do, and to build some highly transportable radar's for NCAR. He had the CP2 radar, but it really wasn't under his control. It was under the control of the National Hail Research Experiment.

Carbone: Right.

Serafin: _____. So I gave a seminar, a short talk on work that I have been doing, and principles of theory of Doppler signal processing, and had a great discussion, and afterwards Dave said okay I want to offer you a job.

And it was, manager of the Field Observing Facility, which, until recently had been primarily engaged in logistical support for field expeditions, various places around the world. They weren't really doing anything that was state-of-the-art.

Carbone: Lots of truck drivers as I recall.

Serafin: Truck drivers, and tends, and cooking utensils, all kinds of things.

Carbone: Well.

Serafin: Very much, very much _____ was just a little support kind of operation, and a lot of the previous people in what was the facilities laboratory came out of the military. They were people who had been engaged in those kinds of activities.

Carbone: Yeah.

Serafin: So it took us a while to decide. They made me an offer and he offered what I asked for in salary, which was fair and, in honesty I didn't know too much about NCAR. I didn't know what it did. I didn't know what the atmospheric technology divisions mission was. I didn't understand its mission to support the university research programs with facilities. As far as I was concerned, I was coming to NCAR to develop the Doppler Radar meteorology program, which is what I did.

I learned about the rest along the way.

Carbone: Okay, well. A pretty quick study I guess.

Serafin: Well, the first meeting at NCAR. These days I think if you joined NCAR, I remember it was a rainy day. Betsy had already been here for about a month to get the kids in school and everything, and to join the golf club. I said be sure to join the golf club, because I want to play golf.

Carbone: By the way, Dave told me many times that he suspected, your commitment to the field based on the observation that you play golf.

Serafin: Right, in fact, he said that was his one great reservations about me. That I was too much of a playboy. He also didn't trust me because I wore a tie everyday to work.

Carbone: (Laughing).

Serafin: He felt that you didn't need to wear a tie when you working hard in a laboratory.

However, he had enough faith in me to bring me here anyway. Subsequently he has changed his mind about (laugh) whether I'm a playboy or not.

Carbone: (Laughing).

Serafin: But, the day I came, it was a Monday morning, it was mid-September, and we were having one of those up-slope, heavy rain storms.

Gray, cold, raining hard, and I came to the offices over at 30th Street, and walked in, and there were no orientations they had, Dave said we'll take care of your orientation later. These days you spend about three days in HR before they let you into your office.

Carbone: Right. Not to mention all of the equal opportunity associated with your employment.

Serafin: Yeah, the whole thing. I didn't get any, I had no explanation of what I was suppose to do except the build this Doppler radar program, and the first thing that we did, at 8:30, I came in at 8:00. By 8:30 Dave had convened a meeting, and he had a bunch of people in the room, Grant Gray, Joe _____, Chuck _____, Jerry Grahams, who was over in chemistry the Air Quality Division then, it was a _____ person I think Fred Brach was there. Fred had not yet joined NCAR, but Fred Brach had this idea for Portable Automated Mesonet, and we were talking about the future of ATD through FOF, and we talked about everything. We talked about automated surface networks, we talked about next generation Doppler radars, we talked about airborne Doppler radars, we talked about _____, and Doppler _____, everything that one could imagine was on the table. That was my introduction to NCAR, and I had a modest budget. I think it was about $500,000 a year at that time, with about 20 people in FOF. It's amazing what you can do with a half a million dollars, and I got some extra money to build a Doppler Radar, and shortly thereafter Dave resigned as ATD director to take on National Hail Research Experiment, and that was because Bill Swinbank, the leader of the program, had died unexpectedly, and he was asked to take on that responsibility, and he did it.

So that left ATD in somewhat of a leadership vacuum, but Dave was of course very, very much interested in what was going on in FOF and at ATD. Within less than a month we had our first advisory panel meeting for FOF. Paul M_____, Roger _____, Hans _____. I'm not sure when _____ joined, but there were really a collection of luminaries in the field. People are now, either, many of them died, but, keen members of the academy, honorary members of the AMS, Presidents of the AMS. Those kinds of people were on the advisory committee at that time. Really great people to work with, and people who had a lot of vision, and the two big projects we undertook initially were the C-band radar's and _____ system. Fred Brach from the University of Oklahoma here to build the _____ system, and he was actually in the RSF I think at that time. My memory may be not accurate on that, but I think he was. He later joined FOF, but the radar's development was all done within FOF, and Grant Gray learned from Roger or me how to build the _____ processor. So what at one time been multi-million dollar processors we built for $5,000.00 in parts the first one, and Dave, as head of _____ wanted some display systems, and I felt that we should try to build a color Doppler Radar Display System, and Grant Gray wanted to do it, except we didn't know how to do it. We didn't know whether the technology would allow us to build this _____ system. Dave was anxious. He wanted us to do something similar to what the people at NNSL had done. Planned sheer indicator you might recall.

Carbone: Ah, yes.

Serafin: And I said, I don't want to do that, I want to build a color display, and Dave said you'll never get it done in time. I said well Dave we're going to try, and Grant came upon some integrated circuits that were perfect for the job, and because they weren't quite fast enough, he used several of them in parallel to match the _____ scan rates of TV tubes, and we built a color display, the first one, and I think that was a really remarkable development. We didn't patent it unfortunately but when Dave saw it, he was absolutely elated. I must admit that most of the scientists at _____ thought it was a gimmick, and most of many scientists in the field thought it was a gimmick, but I did get a standing ovation at the Seattle Radar Meteorology Conference when I presented the results from the colored display. I think that was a joint caper with Harold _____…

Carbone: Yeah.

Serafin: And people began to appreciate what color could do, and how these Doppler signals could be interpreted in terms of bare motion fields.

Carbone: Yeah, I recall clearly the cynicism on the part of some upon their first exposure to a colored display. It's an example of a really exciting, and, important development that led to quantitative real time interpretation of Doppler radar data, being taken far too lightly because it was a little too flashy.

Serafin: Too flashy. I don't think that many scientists give enough importance or to visualization of what's going on. Think about astronomy. The Hubble Telescope. All it does is take beautiful pictures, and from that there inferring the nature of the universe, the origins of the universe, far out galaxies. They've learned that the universe is not expanding, but its rate of expansion is accelerating, and consequently we don't what's causing that. It's led to whole new theories about dark energy, and dark matter. Things that I only read about, but really don't understand. Visualization is so important now. We know that. And every laboratory is now spending a lot of money on visualization. It is simply impossible to analyze the large quantities of data. Your own current research, looking at the _____ of convective storms across the US, and aiming at understanding something about their predictability wouldn't really be possible without the visualization techniques that we have.

Carbone: Yeah that's correct, and I think the whole field of, lets say, geophysical sciences, came on board relatively quickly after that sort of early period of misplaced cynicism about its value, and, it certainly is one of the great accomplishments in the history of radar meteorology, and really led many, many other fields including biomedical technologies, and all of that came on, but that came in more later using essentially similar techniques really

important, and, definitely, a product of that genius that _____ at NCAR back in the early 70s. Well, to what do you owe the _____, maybe the displays have something to with it, but I think it's more than that. The enormous successes of the radar's in the field observing facility deployed, and the Portable Automated Mesonet you know, for really about two decades there was hardly a significant field program anywhere that didn't employ these observing systems, at least as part of the expeditions.

Serafin: I think we took things from the realm of research tools to tools for research. What I mean by that is that it was not longer necessary for the specialist in radar meteorology to make effective use of these systems because we took a user oriented approach to their development. You might recall the early software that we developed for data processing for display. What was it called again, RDSS system, research system?

Carbone: Yes.

Serafin: Wow, all of this is coming back to me.

Carbone: Research Data Support System.

Serafin: Right, and systems like that made it possible for scientists to analyze large quantities of data. People who had not been really associated with the field of radar meteorology at all, people like Peter Hobbs really made some very important, published some very important papers in his study of _____ tropical cyclones with the data from these radar's despite the fact that he really didn't have anyone there who knew much about the guts of the system.

Carbone: Right.

Serafin: And I think that was a major accomplishment, it was a different approach and consequently those systems were widely used by people around the country and around the world.

Carbone: Yeah, and the RDSS became a regular service/physical facility because, the sort of computers, and colored display technologies used to visualize that there were not common place at universities or really anyplace else became a facility, a field observing facility, and led to some considerable advances. In fact the field observing facility led our own scientific computing division in this area and eventually brought them into similar type of activities.

Serafin: By the way, at about that time you were at NCAR. You made a decision to come. I was absolutely delighted when you made that decision, and it was the hiring of people like you, but especially you in the field of radar

meteorology that also contributed to the great success of these systems because your scientific insight and creativity as to how they could be utilized served as a model for others without your training to try to do some more things.

Carbone: Yeah, well thank you. Perhaps, we should break for a minute at this juncture, and we'll move onto ATD at the next level.

Serafin: All right, great.

END OF TAPE 1, SIDE 1

Interview of Robert Serafin

TAPE 1, SIDE 2

Carbone: Bob, in the last segment, we failed to address when you became hooked on a career in atmospheric science, and the chronology of these positions. You indicated certainly at the time of Dave's offer to you, FOF manager, this was far from certainty, so how did it evolve after that?

Serafin: Well, I don't think I even consciously made that decision I'm pretty much an existentialist in the way I live, and, so that means I live in the present, and don't worry too much about the past, and, don't try to plan too much as far as the future is concerned. So I say when I accepted that job from Dave, that I was at least committing for quite a few years to atmospheric science, but I didn't understand fully what it meant at a place like NCAR.

Carbone: Okay. There were a succession of directors starting with Atlas and, I thought it might be useful for you to compare and contrast, your early experiences with Atlas as ATD director, and his successors.

Serafin: Yeah, that's really a great contrast there. Dave Atlas as you know is a visionary scientist, and to this day he still works incredibly hard, and he must be approaching 80 years of age now. He works incredibly hard with his research, and also he was very creative and visionary. So, Dave had a lot of thoughts about how he wanted things to be, how we could use technology to understand the atmosphere. I'd like a, a little, take a little aside there as well because often times people have accused Dave of stealing their ideas, and, I'm reminded of a saying that says that if you take a person's work, and treat it as your own that's plagiarism, but if you look at the work of many people, and, write a paper, that's research. Now see I think in fact that's true. That the one extremely strong characteristic of Dave was that he kept abreast of the literature, what was going on in the field, you know, about his activities at Radar Meteorology Conferences. He was intensely interested in every one of the papers, and every one of the sessions, and he had something to say about it, and I'm convinced that out of every one of those he had an idea, and that some of those he actually pursued, and what happened was later people saw Dave doing something that they had thought about doing, but hadn't done, and attributed that to, his having stolen their ideas, and think that's far from the truth, and in fact it's a distortion of the truth. That's the way science progresses. That's why we publish in the open literature; that's why we have no rights to any window _____ within the domain of our science. It's out there for everyone to look at and to build on, and to build this body of knowledge, and he was exceptionally good at that, exceptionally good at that. He knew what everyone, as you know, he knew what everyone

was doing, and he always had ideas how to do it better, and how, or to do something different based upon what they accomplished.

Carbone: Does the word "opportunistic" fit?

Serafin: Oh sure, but much more than that, yeah, much more than that. So Dave was like that of course, and you and I knew him very well at that time, and I was very comfortable working with Dave. I never had any problems with Dave. Some people did, but I didn't. And, he was a person and pushed. He expected a lot, but he also recognized good work, and, he would do everything possible to reward you for good work. Now when he left, there was a void. Dave was still at NCAR, and he was still intensely interested in what we were doing in ATD and in FOF, particularly FOF, but he didn't, he didn't have control anymore, and he wasn't my boss anymore, and, I'm not sure who made the decision, but Francis Bretherton was then the director of NCAR, and Francis you know is a great scientist, and he was brought here to elevate the scientific stature of the institution following some community review of the whole institution.

In fact, Dave was part of that revitalization of NCAR. Well, Bretherton appointed a man named Wes _____, who was really a systems engineer from the RAND cooperation, I believe. A very smart man, intelligent, good engineer, but didn't know anything about meteorology. I think he had been brought to NCAR by Walt Roberts, as I recall, as a visitor or something. This was sort of an interim position for Wes, and in truth, Wes didn't know much about what we were doing, but he didn't pretend to either. He was, he was smart enough to realize that he didn't, and consequently he gave me a lot of free rein, and, I really enjoyed that. I enjoyed not having someone trying to second-guess everything I did. There was a lot of confidence in what we were doing. Bretherton himself had a lot of confidence in what we were doing, and I had many interactions with Bretherton. Probably more than a facility manager today would have with the director of NCAR. Francis was the director of NCAR and president of UCAR, but I was talking to Bretherton regularly and these days it's pretty hard to get at them. I know that from personal experience, but, Wes _____ was good. He was there for a while, but he really appreciated what we did, and, I was surprised that he gave me some of the biggest raises of my career because of the accomplishments.

Shortly thereafter Cliff Murino joined, and Cliff was a very, very clever man, an intelligent man, but, not really a scientific researcher. He had, had a lot of experience at NSF monitoring contracts. He knew how to work behind the scenes in Washington. He was a very good, kind of, well trained bureaucrat. Knowledgeable scientist, but not really interested in doing any science, but Cliff also let me have pretty much free rein. He liked what he saw, and he didn't bother me. He didn't, never tried to. I

don't ever remember him giving me anything other than excellence, excellent, excellent, excellent in all of my reviews. I don't think that was justified, but I never was, there was no problem with Cliff. Cliff was appreciative in what was going on. I don't think that was true with his interactions with the other facility managers. He had to do some things and take some actions, but he always had a lot of confidence in us, and he gave us a lot of our resources. So all of those things that I'm allowed, allowed us a lot of freedom, and allowed us to do the right things, and, and I think that the group delivered very well.

And then Cliff left to become president of the Desert Research Institute.

Carbone: To what extent did this, if I may call it laissez-faire management style, influence your own thinking on management, because, I can say as a recipient of your supervision for many years that certainly was inline with your philosophy to certainly lend lots of rope, and let good people do good work.

Serafin: I always believed in that. I believed in that back in Chicago before I came to NCAR. It was something that was sort of inherent in my personality, but I remember a lot of people I worked with there saying, the same sorts of things. Hire good people. Tell them, give them a general idea of what you want, and let them go and do it and don't try to stand in the way, and don't try to manipulate their activities excessively, and I tried to do that. It was, it's been my style from forever. I think...the difference with the contrast between _____ and Cliff was that I knew a lot more about what was actually going on. Not only what we were doing, but what we were trying to do, and as you know, and I took a lot of interest in what was happening and but I don't think, I don't think that I was an obstacle. One thing I tried to do, I think I did accomplish to some extent was to get the facilities to work together a little bit more. You might recall that I took the two advisory panels and made them one, called it the ATD Panel because we needed aircraft and radar's and field facilities to study the weather. There are some other things that I wanted to do, maybe perhaps still hasn't been accomplished, but, we may be moving slowly in those directions. We were able, I think to get the airborne Doppler radar developed and underway, and we also got the polarization diversity radar developments underway while I was ATD director. We also, I think made some major headway with _____ systems using things like satellite communications, and hired some good people. Got Research Applications Program started in a very small way in ATD. John McCarthy did a great job with that, and as you know the work we did on wind sheer research with Roger and me, excuse me, not Roger and me with Ted _____. Ted _____, his graduate students at that time Greg Forbes, Roger Wakimoto. Greg is now a star on the Weather Channel, and Roger is a professor highly respected at UCLA. Those were really exciting times, and that

work of course led to Doppler radars being installed at airports around the country. Saved many, many, many, many lives and now our Research Applications Program has about a 130 people I think, and continues to flourish in the environment that we established back in the late 70s and early 80s when that happened.

Carbone: Yep. Yeah, that actually evolved from the joint airport weather studies project in the field observing facility.

Serafin: Correct.

Carbone: , and , later, later…

Serafin: Actually that program was undertaken in 1982.

Carbone: Right.

Serafin: But you, and Jim Wilson, and Ted Fujita and I several years before, shortly after the NIMROD experiment in Chicago, but it was a Radar Meteorology Conference meeting in Miami Florida sat around with a beer or scotch late in the evening designing that experiment.

Carbone: That's right, I do, I do recall that.

Serafin: And a big risk, what was the big risk we took in that design?

Carbone: That the climatology would support finding a microburst…

Serafin: In such a small network.

Carbone: Right.

Serafin: Because we realized at that time that the phenomenon was only, you know, a couple kilometers…

Carbone: Right, right.

Serafin: In horizontal dimensions.

Carbone: You had to be.

Serafin: You needed to be close.

Carbone: Close to see it, and we wanted to do it with three radars, and in fact I remember the expectation was, well gee, I hope we get one or two or three.

Serafin: Right. Do you remember how many we got?

Carbone: Oh it was in the tens, I remember that.

Serafin: Oh no. 170 microbursts within 15 km of the airport…

Carbone: Wow.

Serafin: And I think it was a 90 experiment. 170.

Carbone: Yeah, yeah.

Serafin: And at least half were judged to be hazardous to aircraft.

Carbone: Yeah, that was, one of, I would say larger meteorological surprises in my lifetime, just how _____ those were basically turned out to be almost every patch of virga. There was dying cumulus congestus had something at least resembling a microburst.

Serafin: Right.

Carbone: So but let's, let's back up a little bit here you, you, at the time of Cliff Murino's departure to the presidency of Desert Research Institute in Reno you were, at least in the eyes of scientists like myself, and other staff in the division, you were the obvious successor, and during that transition NCAR management, I____ that was Bretherton, but I don't, I don't really know, decided to split off the computing facility. In fact taking the old ATD, and creating a new scientific computing division, and basically making ATD no more than, I mean budgeterily I mean anyway, half the size that it was. Did that trouble you at all at the time?

Serafin: A little bit. I was a bit miffed but I think in retrospect I think that it was the right thing to do. Actually the person who really pushed for that was - let me see, by the way it wasn't Bretherton then, Bill Hess was the director of NCAR at that time.

Carbone: Oh, Hess was already…

Serafin: Was the director.

Carbone: Okay.

Serafin: And, there were really good reasons to do that because, the ATD budget was over half that of all of NCAR, and a lot of people thought it was the tail wagging the dog. Cliff was a very effective leader, and he was

effective at getting money, and Cliff instituted the concept, and a practice of tax exempt financing. So he found ways to get money for these big computing systems and so forth. NSF liked Cliff, and as you know they always like facilities, so, facilities got, they were very well funded, and there was concern about, ATD just becoming too big. A second thing was that Walter McIntyre, who was then director of the scientific computing division took this as an opportunity to elevate the computing division because he didn't really want to report to me. He really didn't want to report to a director. He wanted to be the director. So, I was a bit miffed, but in retrospect I think it was absolutely the right decision. I never lost any sleep over it.

I didn't know a lot about computing technology. I didn't know much about operating the systems, and, my real love and interests lay with the observational facilities.

Carbone: It was just a general-purpose signal processing after all.

Serafin: Oh yeah, right. I learned a lot about sensors, and remote sensors, and all sorts of signal processing, and balloons, and by the way, ATD was growing. You might remember that it grew quite a bit so ATD became an enterprise in its own right of 10 or 12 million dollars, and well over a 100 people.

Carbone: So going into the position, what were your principal aspirations for ATD?

Serafin: Oh well I had, you probably know this and remember this, I never, I never liked the idea of having a separate R & D group research support facility. I was opposed to it because I had experienced firsthand that they often times did what they wanted to do, and not necessarily what the scientific community thought needed to be done, and that bothered me. So I had, we had a retreat, you might remember that. It was like an all-staff retreat for ATD to consider re-organization of the division shortly after I became director, and everyone within RSF was very gloomy about it because they thought, and rightly so, that I was going to distribute their functions to the other facilities, which is what we did, but I think the retreat worked really well because people, in having participated in that, we had lots of breakout groups, reporting back, and planning, and they understood why although some might not have agreed, they understood why I was doing this. I did that, and I think it was the right thing to have done and, and certainly everything worked well through those years following, my, having become director at ATD. I'm trying to think about, it was one of the major things. The other important things I did was to hire the right facility managers, in particular you. I persuaded you to head the FOF and I sort of stayed out of it. I let you all do your thing, and as you know, I was, not as

introspective as some managers or directors might have been. I spent a lot of time with the outside world.

Serafin: Spreading the message, and interacting with people outside. I was always interested in what ATD did. I have always wanted to be present at major field experiments. People would joke about that, but I know that the staff appreciated that.

Carbone: Absolutely.

Serafin: Being there, interacting with them. The boss was interested in what they were doing really liked that, I, loved, working with the people, and with the PI, and sometimes, you go out there and you get some flak because, systems not working quite right. Someone like Peter Hobbs can be, somewhat outspoken if things aren't going quite right, but I can honestly say that I never had a real falling out with any PI generally speaking. ATDs record speaks for itself. It was always judged to be, excellent. You know that. The spec reviews, and others could find little fault with us. We were good. Jim Wilson was another hire, Peter Hildebrandt was brought into ATD, John McCarthy was brought into ATD, Paul H_____, and you could probably think of some others that , Walt _____ was already…

Carbone: Walt _____, right.

Serafin: Was in 85.

Carbone: Right, yeah.

Serafin: .

Carbone: We certainly, well, and then there was Al Cooper.

Serafin: Al Cooper joined.

Carbone: And Ron _____.

Serafin: Yeah.

Carbone: As I recall in the similar era.

Serafin: _____ was here for a while with John McCarthy.

Carbone: Right.

Serafin: _____

Carbone: So during that era, we sort of built on the existing strengths of the field observing facilities, and then as I recall populated the research aviation facility with a critical mass of science.

Serafin: That's true. Tried to make them more like FOF.

Carbone: Right.

Serafin: It was a hard sell, and I don't think to this day it quite got there, but they moved in, they moved in that direction, I think maybe they had fallen off a little bit in the last few years; partly due to circumstances, and partly due to emphasis within the ATD. I probably should have done more to create more funding for ATD when I was NCAR's director, or NSF I mean, but on the other hand, I don't think the problems were critical while you were ATD director.

Carbone: No, no, far from it.

Serafin: But after you left there were a lot of budget cuts I guess we'll get around to talking about that, you know in a moment.

Carbone: Yeah, well.

Serafin: But these were factors well beyond, the boundaries of NCAR or even the NSF that caused these things to happen.

Carbone: Right. So if, if you had to pick out two or three highlights of your tenure as ATD director which ones gave you the greatest satisfaction?

Serafin: I like the people I hired. You know that is tremendously satisfying. But continued technical excellence that had been there when I went in, and I'll tell you in fact it was a pretty easy job when I was there. Pretty easy because FOF had done so many good things, and there were so many good people in place. We had such an excellent reputation. There was a time, several, this is an anecdote several years after I was ATD director; Bill Banes said to me, "Bob", he said, "Everything is running so well, you don't have anything to do." I said that should be my goal, I said any leader who can't accomplish his job in 40 hours a week, and…

Carbone: Meanwhile, Harold was going into cardiac arrest.

Serafin: Well, he did have a heart attack, but I don't think it was because of what I was doing to him (laugh).

Carbone: Well, he survived it.

Serafin: He survived it quite well. He's still alive today. He is overeating. He is suffering from cancer and other things, but, he, I, you know I said, if you hire the right people, and you have the right vision, things ought to run well, and several years later I was NCAR director then. Jim Wilson and I were on a chair lift, skiing. I said to Jim, I don't have enough time. I put every minute of my day is spent doing something, and working seven days a week, 60 hours a week and he said well, you must be incompetent, and I said why? He said well several years ago you said that any competent leader ought to be able to do his job in 40 hours a week. (laugh). So he was right. I think that maybe for a while there I was just waiting for the next level of challenges. I didn't have too much that needed to be done, and ATD was functioning exceptionally well because of the leadership that was in the division. I remember the, the directors committees, or management advisory counsel meetings that we had. Do you remember those?

Carbone: Yeah.

Serafin: I really liked those.

Carbone: Oh, good meetings.

Serafin: They were good meetings. There was a lot of substance discussed, and, we tried to build consensus. It was good.

Carbone: Yep, definitely. Well let's move on to the era of NCAR director. In light of the sort of background and _____ of your predecessors you were a different strike. So in the search for a new NCAR director how did you sell them on a guy like Bob Serafin being a director of the institution?

Serafin: Well I didn't try anything different. I answered all of their questions. They like the written responses that I had given to their questions. I remember Dick Hallgren was on that committee, and, at that time the Global Change Research Program was coming along, and Dick you know is a weather guy. Not a climate guy. Right, and he was greatly concerned that GCRP was going to grab all of the money. In fact he was right, but it was, it wasn't possible to derail that train, and I talked about the US Global Change Research Program as being an opportunity for the full range of scales, and it being impossible to understand climate without understanding _____ scale and weather. While he accepted that as being true, he didn't like the answer, because he wanted to see a much bigger emphasis on _____ meteorology. I told him that we of course would work to accomplish that, but at the same time we had to take advantage of our opportunities, and I was told afterwards that in the interview, the interview

went exceptionally well in comparison to the other candidates that I had clearly gotten the job.

Carbone: Very good.

Serafin: And, I was very happy because, that was quite a step for NCAR to take to make an engineer head of the Nation Center for Atmospheric Research, quite a step.

Carbone: Yeah.

Serafin: It says that I learned quite a bit about atmospheric science and, and meteorology in particular during my earlier years. I always tried to do that. I always tried to understand what it was we were trying to do with the radar's, not just the radar's themselves.

Carbone: So, my recollection of that period is that you entered the directorship, and I don't want to make too much of this, but in a period that, that I recall now as being a somewhat troubled time at NCAR. There is, there was significant internal tension. Part of it was related to the pull of the shift toward global change, and some other things, and the usual budgetary squabble, and there was more of an undercurrent of dissatisfaction for maybe not any one reason, but a ____, and then superimposed on top of this was this, somewhat skeptical attitude, particularly in places like, CGD for example about how, about your qualifications and capacity to lead an institution like this scientifically. So out of all those three of four different negative sorts of undercurrents going on, how did you steer the mindset of this institution away from this sort of negative attitude?

Serafin: Well the first thing that I did was to confront them and not in a, not in a really confrontational style, but to get them to think seriously about global change research, and what was happening on the funding scene, funding in Washington. As you know, virtually every area of research was being cut at the time that Bob _____, Shelby _____, and Mike Hall, and then later Eric _____ DOE were building US Global Change Research Program. In fact their bosses of their respective agencies weren't too happy with them because in a sense they were going around straight to OMB, and getting money for this interagency program. Well, our scientists judged it to be, applied, directed, kinds of things that they didn't like, and they didn't want to be part of. They really wanted to have complete freedom to, use every penny in our budget as we, the institution felt was prudent and best, and that just wasn't in the cards, and I told them all right, we can of course do that, but if we do, we'll turn down all of these opportunities in climate research. Just beginning to talk about interdisciplinary research, ocean atmosphere interactions, and, the roles of _____, and _____ system, those

were just kind of an usher that we had any colleges at NCAR yet, but they might have been starting to come in through ASP program.

Carbone: Yeah.

Serafin: Anyway, they had a, they had to acknowledge that yes in fact this was an opportunity, and yes in fact we probably had to write a proposal.

Carbone: The chemistry program was really sort of strongly embracing this shift weren't they at the, at the time.

Serafin: I think that they were because there was one program, the only program within NSF, and this gets at the bureaucratic side of things. The only program at NSF that was labeled Global Change, was the Global Tropospheric Chemistry Program as you recall.

And Bill Hess had actually manipulated that somehow and made the community really unhappy by taking some GTCP money and spreading out with all of the divisions, and the chemistry community decided it would become invisible, and the program wasn't getting what it needed, and you, you were probably aware of that. You were there during that period. You were on the NCAR's directors committee debating those kinds of issues. Another thing I did was to say that we had to be more business-like with every proposal we get, we've got to deliver on that proposal. What ever it is we're going to do it. We're going to account for the money, and we're going to deliver in accordance with the objectives of the proposal, and, this was all done within a new framework of thinking that I brought to NCAR, and that was to change our planning process, and we developed a truly strategic plan. It wasn't very big, it was maybe 50 pages, 40 pages, all nice color cover and glitzy smooth paper, but it was really an important undertaking because it changed the way we thought about ourselves and the way we function. It said that here we were an institution. We needed to do certain things. We needed to conduct great research. We needed to involve the universities, and we needed to have great facilities. So we were an extension of the research education programs in the universities. We had a role to play. It didn't matter from where the money came, as long as we could be faithful to our mission, it would be okay for us to take money from other agencies. The outside community got uneasy about that of course. Even in that first _____ plan had a list of principles for making strategic decisions. Among them was opportunism. Not expecting to be able to do everything, but taking advantage of opportunities, and doing those things that were possible because, we thought we knew how to do them, and also because, we could have the resources to do them. Those were a couple of things that I did early on, and pretty soon people realized that I wasn't going to turn all of NCAR into a massive ATD, which was one of their fears, and I introduced

annual retreats, which I must say are difficult with a staff. Always difficult but were really important because we had to have an opportunity to provide opportunities for them to, to speak up. The scientists generally are, as you know, very creative capable people, but they can't really synthesize, they don't tend to synthesize. Their science along with other findings and accomplishments in the institution to make sense out of a bigger picture. They're not really building that mural. They're working on a portion of it. And, I think that I tried to do a little bit more of that mural construction while I was there working with the directors committee. The directors committee became I thought very effective during those years, and I followed the same principles that I always did. Tried to hire good people and let them do their jobs.

Carbone: Okay.

Serafin: There was one, if you want to hear it, there's one really important accomplishment that I can think of, there are many, but one that particularly stands out, and that was resolving the conflicts in the climate modeling community for coupled-climate models. This involved several agencies particular DOE and NSF, within NCAR various groups at least three groups. One was a climate modeling section at CGD, the other was the oceanography section. The third one was Warren Washington's activities, and, I worked really hard on that, working with the agencies, and with scientists in the division, and finally as you know, the directors, were on the directors committee then?

Carbone: Yes.

Serafin: Yeah. The directors committee was also talking about it, but finally got the CSM, Climate System Modeling project underway, and that is absolutely the leading program in the country today with climate modeling. No doubt, and without it, I think NCAR's climate research would have fallen off of the table so, I'm very proud of that because I had to work with lots of people. We also had, a very cooperative person at NSF, Jay Fine. Jay resonated with the concept and came to the table, and he said we really, this is really important to me, he, him, at NSF, and, he wanted to see it happen, and he helped along with Bill _____ and myself, to get a large chunk of Global Change money into the NCAR budget for a new climate modeling computing facility that was available to the whole community now, not just primarily to NSF researchers, which is something I always felt should be the case for NCAR. It's a national facility, not just an NSF facility.

Carbone: There's, something related to this, in talking about NSF support and encouragement. It seems to me that during this period that, a foundation of the relationship with, NSF shifted from one that was sort of rooted in,

shall we say an adversarial posture, to one which was more of a collaborative and cooperative posture.

Serafin: I think that's true. I think that's true. I generally had good relationships with the people at NSF. Probably time to take a break.

Carbone: Okay.

Serafin: All right let's do it.

END OF TAPE 1, SIDE 2

Interview of Robert Serafin

TAPE 2, SIDE 1

Carbone: Bob, at what point relatively early in your tenure as director, there was the great Mesa Lab expansion activity/crisis.

Serafin: Right.

Carbone: Care to comment on those days?

Serafin: Oh sure a little bit. We felt strongly that NCAR should be co-located, and we were spread all over Boulder, and you might recall there was a famous directors committee meeting during one of our summer retreats that okay now is the time, it doesn't matter, it's going to cost us some money, we might not have all of the money, but we must get ourselves a building. We were in 11 different sites in Boulder, and that just didn't make sense, and so we started looking around for sites, and we found some buildings. NSF also arranged to get us a site on the Department of Commerce Labs below the Mesa Laboratory on Broadway, where presumably we could have built a building there, but we also thought it was worth while looking at the possibility of building on a mesa. Now we had every right to build on a mesa, and in fact when NCAR had been established, it was understood that the 500 acres up there was to allow not only for the NCAR of that era, but also the NCAR of the future, to expand, and we did a lot of work on trying to make that happen. We received unwarranted, what we found later to be unwarranted encouragement from the mayor, then mayor of the City of Boulder, who turned coat the minute the pressure started to rise, but there was a huge outcry from many members of the community that this was sacred ground up there, and we shouldn't tamper with it, there would be more traffic coming up and down Table Mesa Drive, and it would be unsafe for the children in the neighborhood, and so forth and so on. We had a plan; I think it was a pretty good plan. It would have been expensive, but it was a pretty good plan because we would have been un-intrusive, we would have been down mostly subterranean with most of the light coming in from above through the roofs up there. We would not be visible from down below, so, but you could still see the building, but there were a lot of people who thought it was an architectural mistake because of the _____ it shouldn't be tampered with, and there were just too many obstacles, and so we gave—. By the way, a lot of staff didn't like it, and any staff who worked up on the mesa didn't like it in particular because they viewed it as somewhat of a shrine not to be tampered with as well. It's interesting _____ that with time more and more of the NCAR program is moving away from the mesa, and after these recent or impending moves, I think there will only be two divisions on the mesa,

CGD and computing, and the remainder of NCAR will be off in other buildings here down in the Foothills Laboratory or at Center Green.

Carbone: As was said many years ago, the Mesa Lab is turning into "Musée de NCAR."

Serafin: Musée, Musée de NCAR, yeah right, and one could ask whether we'll be up there forever, but obviously the building is a symbol of atmospheric research. There is no doubt about that. It's a marvel, and has been a great place for us to have, and a great place for us to work. I had the pleasure of doing that for 11 years, and I really enjoyed it, but it's not the most efficient place in which to work. We found a building instead, and the real estate market was pretty weak at that time, down here at Foothills Laboratory. I believe that the cost was about 11 million dollars for 250,000 gross square feet. Pretty inexpensive, very inexpensive, and this has turned out to be an excellent site for us, and subsequently UCAR has purchased other buildings, which allowed us space for expansion, and soon they'll be building a new building just for the atmospheric chemistry division. All new laboratories, latest state of the art equipment for safety and so forth, but it was quite an experience to be rated by so many members of the community. I felt treated discourteously and disrespectfully for no good reason. We were picketed on the streets.

That was the least of our concerns. However, it was an interesting experience, but I said I would never as NCAR director try it again. Once was enough, and I don't think NCAR will ever try that again.

Carbone: I think the die is cast in the _____

Serafin: Right, absolutely.

Carbone: So…

Serafin: A great building, and in terms of attraction, I think that today it's attracting some 60 or 70,000 visitors a year. Many children and people come up to see the Self Guided Science Tours, or to be part of a guided tour during the summertime, and it's quite a symbol. The City of Boulder identifies with it, and atmospheric science identifies with it.

Carbone: Well, in that era there were quite a few all-stars on your directors committee. Maybe, I'll speak for myself, I wasn't as aware of the quality of the overall timber on the committee at the time, perhaps to be immersed in it, Ralph Cicerone for a short time, _____, and I could go on here, but the point is this is one heck of a lot of scientific _____, management team imagine already that you thought they worked together pretty well.

Serafin: Yeah, pretty well.

Carbone: And .

Serafin: As well as you could expect a group like that.

Carbone: Yeah.

Serafin: Of course Ralph didn't stay long after I became a director.

Carbone: Right.

Serafin: I think that obviously he became chancellor eventually at Cal-Irvine, a very important job. He became a member of the Academy in Washington, _____ became head of _____ Institute for Meteorology in _____. Warren, Guy. I'm very close friends with both Warren and Guy to this day, and also with Ralph, we occasionally see one another and chat, but Ralph has done a great job out there in California. There were really good people, obviously, and I think the directors committee has always been populated by good people, including yourself. You're a terrific contributor to the director's committee, always being willing to think outside of the box so to speak. NSF term came along. NSF always said they wanted to think outside of the box, but whenever there was any thinking undertaken outside the box, they immediately jumped back into the box.

Carbone: Right.

Serafin: And closed the lid, because there were always obstacles, and things that we didn't understand. Why we couldn't do things one way or another.

Carbone: Yeah.

Serafin: But, yeah it was a very good directors committee, and I always enjoyed working with people. I think that one of the greatest joys of any career is the people you get to meet, and always learn new things. Throughout my life I've always learned new things, and I'm still learning new things with work, with the academy. I love academy committees because we get a bunch of very good capable people together who think about problems, and from different perspectives, and you learn about things that you never would have learned if you were just in your office working away on your own.

Carbone: Right. You know we have already talked about the evolving relationship with the NSF from a somewhat, or sometimes-adversarial one to more collaborative. There is also the evolving relationship with the universities,

and with UCAR that emerged from being, you know, a small corporate office for president and a few other officers, to an independent organization that conducted some, some technical and other service activities, and the evolution of UOP.

Carbone: UCAR Office Of Programs.

Serafin: Right.

Carbone: In my opinion that later development has evolved in somewhat an untidy way, and not very clear relationship with respect to NCAR as an institution, but what are your views on how the relationship with UCAR universities, UCAR and UOP itself evolve in that time.

Serafin: I think you have to understand first how the concept of UCAR programs developed and evolved. I think it began with Bob White. Bob was a very visionary person. He was president of UCAR. He spent half of his time in Washington while he was president of UCAR, I think in the wintertime. In the summertime he spent out in Boulder, and winters in Washington. Bob felt that UCAR should be kind of an umbrella organization. Be more than one _____ center. There were things that could be done, and his first try at that was to take the National Scientific Balloon Facility out of NCAR, and place it within UCAR, and to negotiate some sort of a contract agreement with NASA. Because it was NASA investigators who were using the balloon facility mostly. Then there was another thing, UNIDATA was another one of the early ones, and I was on a small committee with John Dutton and Don Johnson at the University of Wisconsin _____, to look into the concept of the UNIDATA, and the motivation for UNIDATA was that there was concern that the National Weather Service was going to cut off its data to the universities, and universities had to have some way to distribute weather service data to their departments and so forth. UNIDATA became a separate freestanding activity, primarily because the board at that time didn't want NCAR to grow.

Carbone: Right, I was about to say that it seemed to me to move in that direction based on a mistrust of NCAR and its…

Serafin: It was a rather substantial mistrust of NCAR. Some didn't, some felt that NCAR shouldn't be any bigger. Some felt that NCAR was too independent. I think the later may have been as important as the former. In short, there was a velocity at NCAR from the very beginning up until about the time that I became director. It was through Walt Roberts, and Francis Bretherton, John Firor, Bill Hess that we should get the money, and we should decide how to use it, and consequently agencies were

concerned about NCAR receiving money for a particular purpose, and then doing something else with it, and I changed that. That whole thing changed. NCAR would never be accused of that today. I'm convinced of that. We're very faithful to what we say we will do. Our sponsors recognize that, our sponsors I think are generally pleased with the research that NCAR does for them, but at that time the trust wasn't there. So, UNIDATA developed, and then COMET developed. John McCarthy was a big proponent of COMET, and wanted COMET within RAP, but the Board absolutely wouldn't permit it. COMET was a separate freestanding…

So if you look at a number of the activities in the UOP today. They are good programs. They have been very successful. Great at serving the community, but they don't have much in common with one another. In fact, each of them has in my opinion greater affinity with some part of NCAR than they do with one another. So it is, it's sort of a portfolio of activities, but without cross program coherence or interaction.

And that's the reality.

Carbone: Yeah, and quite difficult to articulate a reason why they are not part of NCAR.

Serafin: Well I think today would be a worthwhile to re-examine that. I've actually suggested that to Rick Anthes, and Rick himself has considered it, and has thought about it. I would say somewhat favorably, but also is aware of a lot of the political realities. You might have remembered that at one time there was a committee of the C, the UCAR Management Committee established to examine an adjustment of the organization, and as might be predicted the response was, yes there's a lot that we can do together, we should do that, we should interact, but let's not change the organization, and that's an absolutely predictable response.

Carbone: Yep, exactly the word I was going to use.

Serafin: Must take the action, and decide to do it, or don't ask the question.

Carbone: Right.

Serafin: If you ask the question and then wait for the answer you know what the answer is going to be. It's good to ask the question, but then you have to explain that you're going to do it. You have to explain why you're doing it.

Carbone: So far no regrets have been expressed. What's your biggest disappointment during your tenure in NCAR directorship, or any other capacity for that matter?

Serafin: You know, I don't dwell on disappointments. In any job, you'll have some tough times. I don't have to tell you that, and there will be difficult, sticky issues. They might have to do with the budget; they might have to do with cutting staff, or cutting program. They might have to do with misunderstandings. A lot of them are personal kinds of issues. Sometimes you place trust in an individual, and expect there to be a solid condition of mutual trust that will evolve and develop and it doesn't, and that has happened on a few occasions, but I don't think too much about the negative. There are tough times. There are times when you just have to stand up, bite the bullet, move forward, and go through those times. Go through the difficulties; experience the pain. There are times when you have difficulty sleeping at night when problems occur, but I don't have any great regrets. I don't have a single real regret.

If there is one thing I might, and I said I don't like to dwell on the past, but if there's one thing I might have done differently, is I think NCAR got a really bad rap about this business of highly parallel computing. We did the right thing; we made the right decisions with regard to the Japanese supercomputer. I'm absolutely convinced of that. Every government agency that looked at our benchmarks and so forth could find nothing wrong including some of the intelligence agencies, who were very interested in this issue. Yet politically we were required to not purchase the Japanese supercomputer. That was okay. I could understand the politics of that, but then later, we were maligned within committees back in Washington including the NSF saying that we were in the dark ages, didn't understand the new technologies, weren't with it, needed to get on board with these massively parallel computers, and then they sent out a committee, and if there was ever a lynching group put together, it was that one, to criticize NCAR for not having done it right with regards to supercomputing. We weren't putting enough money into computer scientists and all the rest. Well, now it's about three or four years later. Not only we, but virtually every atmospheric science group in the country, is learning how to use these massively parallel computers, yet I recently talked to Maurice Blackmon, and the Japanese vector supercomputer is much more efficient than the massively parallel machines for our kinds of problems. We still haven't made those software breakthroughs very necessary, and I think we were a bit to conciliatory with that committee, and it didn't really help us.

Carbone: Maybe the committee had a vision that's applicable a decade or so down stream, but in the meantime, to make the switch prematurely, and in fact, diminishes the productivity in the institution in the interim.

Serafin: Absolutely, and their interests were totally different than ours. It goes back to what you and I were talking about earlier. What was it that made the early ATD so successful? It's because we didn't dwell on radar technology, we dwelled on the innovative utilization of new technologies for atmospheric research. So I think climate research for a while, in the US suffered quite a bit. I don't think there's any doubt about that.

Carbone: No doubt about it.

Serafin: Despite if it had not been for our leadership on the CSN, climate research in the US would be in the dark ages compared to what have in _____. Now I think there's no problem. We're okay, and massively parallel machines are being purchased in Europe _____, but it was a little early to move in that direction, and we were accused of not looking at the technology, and none of that was true. We were looking at the technologies, keeping abreast of the technologies; we just didn't think they were ready for us yet.

Carbone: And they weren't. Well, if you don't mind, I'd like to move outside the walls of NCAR, UCAR a bit, because you have been extraordinarily active in a wide range of endeavors. You started a journal with the American Meteorological Society. You advised just about every relevant agency in the US government, and maybe some that aren't so relevant, and untold governments worldwide. A few people, if any, have been more active in affairs of National Academy, at least among people I know. So I have to ask you what, what's motivated you to be so engaged, and how do you get aware with it in view of the other responsibilities that you had, and could you name two or three of these community service or leadership accomplishments that you prize most?

Serafin: Well that's a whole bunch of questions.

Carbone: Yeah.

Serafin: Let's see, getting away with it was relatively easy, although for a while it seemed like every time I left town for a week, I came back there was a huge problem facing me for a while, but that changed. I think it was having really good people, and letting them do their thing. I've always believed in that, I still believe in that, kind of explain to them what we want to do, what our goals are, and then let them do it. There are people who know how to do it. There wasn't any problem with that from my perspective. That's quite in contrast to a man like Francis Bretherton, who felt that he could actually almost direct the activities of every scientist in the institution, and in some cases he could, and in others he couldn't, but never the less he thought he could. So I always had a broad perspective on

things. I was very interested in what people were doing, but I didn't try to do their work for them. In fact, I thought it would be detrimental, counter productive to try to do that. So, you know being willing to work hard. I spent a lot of time, and was able to do those things. As I mentioned, with regard to the academy work, I think that is particularly fun. Lot's of fun because you get to meet all kinds of people, and these committees sometimes hang together for a while. One extreme was the Weather Service Modernization Committee that was in existence for about 10 years. Those people came to become very good friends. Worked effectively together. We could debate issues. Fight with one another, but write good reports, and the Weather Service was waiting with bated breath for virtually every one of those reports. One I remember had to do with the siting of radars, whether the _____ had been put in the right places because certain Congresspeople felt that they weren't close enough, or they didn't have one in their district, and that study was the first time that we had ever looked at the effectiveness of the NEXRAD design from the perspective of the weather it was trying to observe. The previous criteria had been coverage at 10,000 feet above ground level, and then drew a bunch of circles around the country and said there it is we covered it.

Carbone: Right, right, yeah.

Serafin: Well I must admit that surprisingly that was not too bad a network, and we were able to prove that, but we did find some holes, and the Weather Service immediately went out to fill those holes. We didn't tell them they had to do it, but they went right out and filled those holes. Those who were really waiting for that report, they wanted it. The staff of the Weather Service wanted to read our reports because what was happening in the modernization was affecting them in their jobs, where they were going to be working and so forth. The unions were interested in our report because their employees, the employees of the Weather Service belonged to the unions. I really loved the academy work because it's, you learn a lot. _____ I'm learning about space science and telescopes that were built to look into the far reaches of the universe, satellite systems, and the problems with the shuttle, which aren't serious, but. I really like that, I like interacting with people, and with different people, and with learning, and I think I've also been able to contribute, and maybe the main thing I do contribute is that of synthesis, being able to listen to lots of people talk about things, and not necessarily have my own agenda, but put it together in simple terms that everyone can understand and agree upon. With regard to the AMS Journal, I did that because I felt that technologists in our community weren't being afforded ample opportunities to publish their work.

Dick Hallgren was the president of the AMS at that time, and he agreed with that, and even though there were many in the community, as you

might have predicted who felt that we didn't need another journal, just use the existing journals. I always wanted to go that way, but _____ said we need another journal. Now it's a monthly journal, it's highly respected, and I think it's doing a good job.

Carbone: You may recall, I was an editor of the Journal of Applied Meteorology at the time, and I took the view that _____ was an adequate vehicle for those sorts of publications, and the real problem was to stimulate the technology community to write papers, but you know this has worked out. The journal is successful. It's, people feel at home in it, and it just its existence has stimulated more publication from _____.

Serafin: I think it grew about 20% last year too.

Carbone: Oh is that right?

Serafin: Yeah.

Carbone: I have to admit I haven't kept up on it. Now I have what may be the most important question of the interview, okay, in that these external activities have required a great deal of travel on your part, and so I want to know the answer to this question. I hope you're prepared to say how many actual miles you have flown on United Airlines.

Serafin: Over a million. I think it's 1.34, I haven't looked recently, but it's well over a million miles.

Carbone: I have a, I have a confession to make. You have too. We're in the same ballpark.

Serafin: I know, I know that. He's the one who use to criticize me so much for traveling, and…he's worse than I am.

Carbone: I thought the answer to this would be over 2. I thought you were over 2.

Serafin: You put on more miles than I do.

Carbone: No, no, no. I'm right somewhere, I haven't looked lately, but somewhere around 1.2.

Serafin: I've dropped off a lot now to about 40,000 a year.

Carbone: Gee, I haven't met my first 2 million miler yet. Okay it'll just have to wait, but keep it up. So, few people have the honor to serve as the president of their professional society, and I know for a fact that you really enjoyed that year, or couple of years in which it was most active. Do you

have anything to say about it, and anything you did to sort of nudge the direction of the society as a whole?

Serafin: Yeah, I really enjoyed that, and it is a great honor as you say. It's a competitive election. The candidates are usually strong, and now you have to write a campaign statement, I think in my election year it's the first the candidates had to write their campaign statement published in the bulletin, and I had tough competition. John Snow was dean of the College of Geosciences at Oklahoma, and he has done a lot for AMS. In fact, he had done more for AMS than I had in recent years. I had been on the executive committee back in the early 90s, and started the journal and that sort of thing, but in the interim I hadn't done too much for AMS. So, I was very _____, and it was a lot of fun. The AMS had written what amounted to its second strategic plan. When I was on the executive committee back in the early 90s or late 80s. Dick Hallgren was the president then, and he did a strategic study in preparation for the 75th anniversary of AMS. Well when Ron McPherson came in, he wanted to look at a vision study associated with the next millennium, and so the strategy had been laid out. There wasn't a lot to do. It was a good plan. AMS that is more inclusive, but without throwing away its roots, its principal roots are in its publications and its needs, but over the decades, you yourself have seen how the annual meeting has grown, and how much broader and more diverse the participants are with regards to their areas of interest. Education has really grown in AMS. AMS is probably spending close to 3 million dollars a year in education with undergraduate right through graduate education.

Carbone: _____ presence and policy has expanded.

Serafin: Policy arena has expanded. All of those things cost money. Most of that is funded through agencies, government agencies, and private sector contributions because AMS doesn't have the resources itself to fund anything of that nature. The one thing that I really did, I think maybe with AMS, during my one year as president, was to take a really close look at financial management and planning, and trying to tie together the societies investment policies with its budgets, and to ensure that in the long-term, it will remain string financially. In recent years we spent a lot of money on a few things. Spent a lot of money on a building in Boston, which of course we owned, was given to the society, but was all said and done, we will have spent close to 3 million dollars on complete renovation of the carriage house for working space, and then the renovation of the main building, which needed doing or it would have fallen down. That building was built in 1804. Very famous building. An architect, I think it was the same architect who designed the nations capital in Washington, DC. So it's a famous building, originally a residence.

Carbone: So the 200th anniversary is upon us.

Serafin: Yeah, it is. 200th anniversary is upon us. So we really, it's amazing, but I got, I think I got the staff to understand, might sound silly, but the difference between revenues and expenditures from a broad perspective.

Carbone: Yeah, yeah.

Serafin: And we also had meetings with the development committee and investment committee, and management so that everybody could understand what the ground rules were. How much money we might expect to earn on our investments. How much of that would be prudent to spend. What size reserve was necessary for our organization like EMS, and what our development fund raising goals should be, and I'm really happy about that. It took a lot of hard work because, I must admit, in my opinion, folks weren't thinking about this in a business like way, and maybe this occurred or happened because of our years back in 1993, NCAR went to a full cost-accounting system, so we had to deal with that kind of a system. We understand today the difference between overhead and direct costs, but I've also been associated with some private sector companies. I know how to read balance sheets, and I know how to read _____ expense statements, profit and loss statements. The last couple of years, AMS has been losing money because we committed to certain initiatives, and AMS like any other organization has suffered because of the drop in stock market, and weakness in the economy, but at least now we have tools that can show clearly what's happening, and there are ways to stop this, so I felt that it was really important. Another thing, I think my annual meeting was the first on in which we had the "New Format" in place, and you served as AMS program committee chair for three years or so, right?

Carbone: Right.

Serafin: And that was kind of fun, and the concept you and I came up with, this weather fest thing has now been in place for two years at annual meetings and seems to be quite successful.

Carbone: Yeah, yeah it does.

Serafin: I don't know whether they'll be able to continue it because it does cost some money, and the annual meetings for many reasons haven't been profitable. Now, taking steps to correct that.

Carbone: I think that, you know, you speak of this new format, and your year was the kind of the beginning of the transition.

Serafin: Yeah.

Carbone: I do think that the coming meeting in Seattle, will represent maturation of the process, and it'll be interesting to see, of course January in Seattle isn't maybe the greatest draw, but it'll be interesting to see how the complete evolution of the format works out, at least with the members that chose to attend.

Serafin: There are obviously some concerns about the venue in January. Seattle is a great city. As you know, January, the days are short, and we've had many experiments up there, in January.

Carbone: The drizzle gets to you after a few…

Serafin: I remember once when it was quite cold. It snowed, and the streets were icy.

Carbone: Well let's not talk about that.

Serafin: Let's hope that doesn't happen, but Seattle is a very cosmopolitan city, and it should attract lots of people we hope.

Carbone: Okay, I've kind of been wrapping this up here. I thought we'd talk about the extraordinary demands placed on you in all of these capacities that we've discussed, and the fact that such demands can put pressure on family life, and in your case family with four children. I know that Betsy has been enormously supportive of you, and your professional endeavors, and so the question is did the demands of your family ever get to be an issue during this ride you've taken.

Serafin: Well I don't think so really, although I must say that toward the end of my tenure as NCAR director, Betsy began to ask me why I couldn't place a higher priority on family things. Although I think I always tried to balance my life. We always took vacations. We always did things with the kids, and I had never heard any of our children gripe about any of this, and we remained very close friends with all of our kids, who are now married and with their children. So I'd say it is demanding. Back in Chicago I was working on my PhD when we had four kids. We were living out in the suburbs, working hard, and getting a PhD all together, and I managed to do it all. I remember studying on the trains in the morning for exams, French exams, and in those days you had to have a language exam, not today.

Carbone: I took the German exam five times before I passed it.

Serafin: I passed it the first time.

Carbone: Chicago did its own thing. It wouldn't settle for the standard exam. It had to make it harder. So now jumping as sort of a final point in this interview, jumping completely outside the box, you've engaged in a number of activities, and eluded to them throughout this interview that are outside the atmospheric sciences, and at times you spoken like an aspiring commercial _____. I don't know where that's going to head, but yeah, that could involve yours truly. Are there any other ambitions still lurking in the afterglow of your professional career.

Serafin: Yeah there is, well I'm not sure it's professional. There is, I'd like to buy a ranch with a river that runs through it, quite a bit of river for fly-fishing. These days I fly fish more than I use to. I love to fly fish, but I've always liked the idea of a ranch, and a place to go when the quiet and private fishing, not crowded. These days I fish almost always on private rivers on ranches because public waters are too full of people, and I'd like to do that. I'm not sure I will do it, but I keep looking around for a good opportunity. I have many other specific aspirations that I don't… I kind of joke, but a few times people have asked me to run for public office. I won't do that. I mean, serious requests.

Carbone: Yeah, well.

Serafin: But that would have been fun at an earlier time in my life but not now.

Carbone: Not now.

Serafin: One thing I have to do is convince myself that I should have tried something, too, will be too demanding of my time and try to back off, and I've been able to do that. I have a lot more time to myself now than I had. Betsy doesn't necessarily agree with that all of the time, but the numbers bare it out.

Carbone: Well, I'll look forward to our winemaking session tomorrow evening. Getting dangerously close to the bottling phase.

Serafin: Right.

Carbone: Is there anything else that you would like to express.

Serafin: Well there is, and you didn't mention it. I don't know if it was in the list here or not, but that was election to the Academy, which was another totally unexpected honor. I, you might have been involved in that to some extent.

Carbone: I was.

Serafin: In fact, writing materials. I'm sure it was Dave Atlas who nominated me, although I don't know that either for a fact, because it is a pretty secret process, but it's, it was really a total surprise, and a great honor to have been elected, and Betsy told me about it when we were getting on one of those trips. We were going to Australia to a, do you remember _____, the International Climate Group that sponsored a computer at NCAR for climate modeling, we got an airplane in Los Angeles, it was about 10 o'clock, overnight flight to Sydney. We sat down in our seats, and Betsy said now I can tell you that you've been elected to the Academy, and I almost fell off of the seat. I didn't know anything about it. I didn't know it was underway, and I think that's true in most of these, and subsequently I've helped to get other people elected to the academy, and that is really important for NCAR, the institution, because it's, you have to be lucky, but you also have to have accounted for something, and there after many numbers, so it's nice. It was really nice to have been so recognized. I never expected that when I started my career, and you never know what will happen. You just try to do a good job and things take care of themselves.

Carbone: Well, thank you very much for this opportunity. It's been most enjoyable, and I sincerely hope that you enjoyed it as much, and…

Serafin: Yeah.

Carbone: It's been a great pleasure being your friend and colleague for 35 years.

Serafin: Mine also; you bring tears to my eyes.

END OF INTERVIEW