American Meteorological Society
University Corporation for Atmospheric Research

TAPE RECORDED INTERVIEW PROJECT

Interview of Charles E. Anderson
24 June 1992

Interviewer: Earl Droessler

[Note: This interview was not edited by Dr. Anderson before his death.]

Droessler: This is Wednesday morning, June 24th, 1992, and I am in Raleigh, North Carolina and the North Carolina State University, which is downtown Raleigh, and where I am going to interview Professor Charles E. Anderson.

Charles Anderson is a Professor Emeritus at North Carolina State in the Department of Marine, Earth and Atmospheric Sciences. It is a pleasure to be here this morning, Charlie, and to be with you, nice to see you this morning.

Anderson: Well, thank you very much Earl, it's refreshing to review some of my career, and look back over the years. It's been since 1942 that I have been involved with the field of atmospheric sciences in one form or the other and it's a great opportunity for that.

Droessler: Let's begin by my asking you, how did you get into the field of meteorology?

Anderson: To tell you the truth Earl, it was mainly by process of elimination. I wanted to become a member of the Army Air Corps and I looked over the physical requirements to join the Army Air Corps as a cadet, and it seemed as if the only option open to me was that of meteorology. Flight crews were out of the question because my eyesight was not good enough, so that meant that I had to do something on the ground. I could have gone into engineering but my background in math and chemistry seemed to be exactly the kind of background that they were looking for meteorologists, so I applied.

Droessler: Where did you end up?

Anderson: I wound up at Chicago. One day I got a telegram saying, report to the University of Chicago, a couple days hints and here is your orders and so forth.

Droessler: In hindsight, you certainly had a wonderful opportunity at the University of Chicago. It was probably the premier center of meteorology in the world at that time.

Anderson: I wouldn't doubt it. It was quite prestigious company.

Droessler: Who were some of the principal professors that you met there at Chicago?

Anderson: I think we had almost the cream of the world-renowned meteorologists at that time. We had Horace Byers, we had the two Oliver's, in our synoptic work we had Wolfe, who was an upper atmosphere gentleman, of course, we had the renowned professor Carl-Gustaf Rossby, in dynamic meteorology, Herbert Riehl, in synoptic dynamics, and Victor Starr at that time.

Droessler: And did most of these professors and instructors in meteorology that you mentioned here, did most of them teach you as a cadet?

Anderson: Oh yes. I had classes on all of those, all of those names I mentioned.

Droessler: And you were an Air Force cadet?

Anderson: I was an Air Force cadet. We had a class of about 150 students that started in July 1942, with finishing date in May '43.

Droessler: So you were one of the very early Air Force cadets.

Anderson: I think we were probably the third or fourth class, right.

Droessler: Who were some of the important classmates that later on became meteorologists at some point?

Anderson: Right, who stayed in the field and became quite noted. Roscoe Braham, Chester Newton, Walt Saucier, Joanne Simpson are just a few of the more prominent ones.

Droessler: There was a fellow that I remember that might have been at the University of Chicago at that time, Professor Mike Ference, was he there?

Anderson: Yes. Mike Ference, I think, was the most charismatic professor I had at Chicago. He was a physicist, but he could make atmospheric prophecies just come alive for you, and he was very dramatic in his gesticulations and

his evocation in the classroom. I would say, not by way of any disparagement, but comparing his ability to teach and get ideas across to those, let's say, a person like Victor Starr or even Horace Byers, were just a world of difference. Mike really made it crystal clear to those of us in the classroom and he will always be in my memory then as one of the most dynamic professors I have ever had.

Droessler: As I remember, he went on to have a career. He left Chicago and went to the Army Signal Corps and then went on from there to General Motors to be head of their research activity.

Anderson: I wouldn't be surprised because he had an unusual ability.

Droessler: He really did. I knew him quite well in later years after he was at the Army Signal Corps and he has always been one man that I have admired immensely.

Anderson: Is he still alive?

Droessler: I think he has died.

Anderson: Oh, is that true?

Droessler: Yes, but I'm not certain.

What was life like as a cadet at the University of Chicago?

Anderson: It was rough. It was very rigorous, very demanding and—what should I say—very stressful, because every Monday morning you had an examination on every subject that you were taking, and if you failed to maintain the proper pace with the rest of your classmates, you were washed out and you left the status of being a cadet to become one of just a private in the Air Force or in the Army Air Corps. So you were sent off to someplace for basic training.

Droessler: At that time it was called the Army Air Corps and the Air Force had not split off from the Army. How many credits did you have to carry?

Anderson: We carried anywhere from 18 to 21 credits a quarter, yes.

Droessler: Wow, that was something. In addition you had to have your military training.

Anderson: We had military training, we also had our physical education training and weapons training and Army intelligence, recognizing different kinds of planes and that sort of stuff. Then the whole aspect to how the Army

conducts itself, in terms if you were going to be an officer how you would conduct yourself. Never carry an umbrella, carry all of your packages in your left hand so your right hand would be free to salute, and all of that protocol that we had to master.

Droessler: At the University of Chicago there was a famous athletic field called Stagg Field. Is that where you took your physical exercise?

Anderson: We did our PT training there and I can recall that at one end we had a big cement seating area tier that went up maybe 50-75 feet in the air, and part of our exercise was running up and down those steps, but we were never permitted to go beneath those stands. It was out of bounds. I had a professor, who was my physical chemistry professor at Lincoln University where I had done my undergraduate work, who was working there, and I would run into him now and then, but he could never tell me what he was doing. We later learned that beneath those stands really was where the first atomic pile was put together, and Fermi was there with the other outstanding gentlemen building that device and doing all the other allied work that was needed.

Droessler: Part of the Manhattan Project as I remember.

Anderson: That's right. But that was where they first got _____ going.

To conclude my experience in Chicago, we suddenly found our class size being enlarged from something like 150 cadets to over 300 in January of 1943, at which time, these additional cadets who were either at Caltech or UCLA were shipped to Chicago to complete their training. These poor unfortunate fellows had been trained using the so-called "analog" technique of forecasting where you looked up maps that had similar composition, and then you saw what happened at that time and you would make the same kind of forecast. So, that was an interesting period. It was questionable whether or not we were going to graduate on time because of this slowing down of things. But we finished, I think, about May 8th and we got our diplomas in the Rockefeller Chapel which was a beautiful, beautiful place on the campus, and from that point we all then shipped out to our various destinations.

Droessler: That probably was Caltech, because Caltech closed up its meteorology [department] at about that time and what you say about the analog technique in forecasting is really attributed to Dr. Krick, who was the leading professor at Caltech., and that probably is where they came from.

Anderson: That's right.

Droessler: So, you graduated in May 1943, University of Chicago, I'm sure with honors and great dedication to be the best weather officer in the Army Air Corps. What followed in your—?

Anderson: At the time of my graduation, I was interested in tropical meteorology so I went to Professor Byers, who sort of headed up the program, and I said, "Professor Byers, I would like to be assigned to the advanced training that was going to take place in Puerto Rico, the tropical." He said, "No, the Army Air Force needs you at Tuskegee because we have a black Army Air Corps group there and they need your talents." I said, "OK, we'll see how it works out."

I then asked for a ten-day leave en route because I wanted to marry my sweetheart. I sent a telegram asking for that and it came back, no, you can't have it. So that meant I had to do a real whirlwind engagement and marry. I had been engaged before that for about eight months or so but a real quick marriage in her hometown of Jefferson City, and the very next day I left for Tuskegee. To my chagrin, when I got to Tuskegee I found the urgency wasn't there and somebody had sent me a ten day delay message that never got to me.

All in all that was an interesting experience because there we had an all-black training operation to produce fighter pilots and bomber pilots and crews at this one place in the country. The Army Air Corps was segregated at that time so these fellows couldn't get training anywhere else. In fact, there was an attitude that they shouldn't be trained at all because they felt that blacks couldn't make good pilots, they wouldn't be able to operate the machinery, it was too complicated for them and so forth. There was a lot of agitation in the black community about this. I think Eleanor Roosevelt was one who interceded on their behalf. She made a trip to Tuskegee, I'm not sure for what reason, but she had an opportunity to fly with one of the instructors who was teaching in the civilian air patrol program, a gentleman named Anderson, and he took her up for a flight and he performed so superbly that she said, well, I have no doubt that these fellows could make very good pilots.

Droessler: And he was black?

Anderson: He was a black fellow, yes. He was black. "So, I have no doubt that these fellows could make good pilots," and I suppose she relayed this information to her husband and so out of that the Tuskegee idea was born. The Tuskegee experience is quite an experience because if you look back now, after it was all over, they are highlighted in the Smithsonian. If you go up to the Smithsonian Museum, you'll see a whole wall panel of the Tuskegee group, that whole business. Then there have been quite a few TV specials devoted to the Tuskegee airmen. A lot of those fellows, most

of those fellows, who were pilots and in that training came from very good families in the black community, they were well trained and college men and some of them have gone on to make quite great names for themselves. For example, Mayor Coleman Young in Chicago was a pilot in that group, and I could think of other very prominent people around the country who came out of that Tuskegee experience. So, it was a bonding experience because those of us who were involved with it—we had to bond together and really excelled at what we were doing.

The Tuskegee group first went to North Africa as the 99th Pursuit Squadron and they did fairly well, they were using P-40 aircraft. Then when they sent over the three 32nd Fighter Group, which was three squadrons, they finally got P-51's and they had the insignia red tails. In addition to their other duties they would escort bomber flights up over Italy and up into Austria and over into Southern Germany. The great thing that came out of that was that anytime a bomber crew saw the red tail, they felt safe because that group had the outstanding reputation of never losing a single bomber when they were escorting them.

Droessler: Fantastic.

Anderson: For the whole period they were there they never lost a plane. That's been verified over and over again.

Droessler: Did some of these pilots stay in the Air Force and move on up the line?

Anderson: Oh, sure. There was one fellow I know particularly well who was Chappy James, who became a four-star general and he'd come up right through the pilot ranks. He would distinguish himself both in the Korean War and the Vietnam War. Chappy was very outstanding. Of course, the leader of the group had been an Army captain who was brought to Tuskegee to become a pilot and he became the leading colonel and so forth. I still enjoy some opportunity to meet fellows from that era. We have an association of the Tuskegee Airmen Association. They meet periodically. They will have a meeting in Boston this summer in August and it would be an opportunity to get together with a few of the fellows who are still left from that experience.

Droessler: Wonderful. That was a grand experience really.

Anderson: It was. It was.

Droessler: That was really a pioneering experience by any…

Anderson: Stretch of the imagination.

Droessler: Yes, that's right. It really was. After Tuskegee at Alabama and that experience you had there, Charlie, where did you go in your Air Force career?

Anderson: I served as a squadron weather officer at several locations in the U.S. where we were training replacement pilots to supplement those who were lost or who returned from their duty in Italy. We were doing this training in Michigan at Selfridge Field and then later Walterboro, South Carolina, and finally at Gotman Field in Kentucky. My final Air Force location with that whole operation was Lockbourne Air Force base outside of Columbus, Ohio.

At that time in Lockbourne, which was in '46, the war was over and the Air Corps was reducing, and people were being reassigned and I had the opportunity to apply to go into high polymer chemistry. They had an announcement out for those who were interested in these various graduate level courses you could get into. I had my undergrad degree in chemistry and so I applied. To my amazement I was selected to attend the Institute in Brooklyn [Polytechnic University] to study high polymer chemistry. To my knowledge, at least when I was there in '46 to '48, I was the only Air Force fellow there in the program so it must not have been very highly sought for by people in the Air Force.

Droessler: And Brooklyn Poly at that time was a world leader in polymer chemistry.

Anderson: No doubt. Like the rabbit, I fell right into the briar patch. Herman Mark and his group of men were just outstanding. It was just an outstanding experience for me. Had I desired to stay in chemistry, I'm sure that would have been a good jumping off place. But I realized, when I was at Brooklyn Poly, that if I was going anywhere in the field of chemistry I would have to get a PhD. My connection with the Air Force is still…I was on active duty so that even when I completed my degree at Brooklyn—

Droessler: What was that, a Master's Degree?

Anderson: Master's Degree in polymer chemistry. I was assigned to an Air Force research operation, luckily for me at the Watson Labs in New Jersey, which was a research and development operation carried out by the Air Force, which is sort of parallel to what was going on down the road at Fort Monmouth, which is the Signal Corps' research and development. Of course, ours was on a much smaller scale; we were only maybe $1/100^{th}$ of the size of Fort Monmouth, but we did have some interesting things going on there. I was appointed into a group called Atmospheric Analysis and one of my jobs was overseeing the activities, I would say, of a group of German scientists who had been brought over to the states after World

War II, and given the opportunity then to continue their careers but under American sponsorship. In that group we had scientists like Rudolph Penndorf, Max Diem, who was an outstanding cloud physicist, we had Heinz Lettau and we had Eberhardt Wahl. Several of those gentlemen went on to become professors. It was _____ me, Eberhardt Wahl and Heinz Lettau in particular. So, I formed those friendships with those men back in, probably in '49 in the Air Force, I knew them a long long time.

At the same time though, I got in on the ground floor of an activity that was going to grow and that has been my good fortune in a number of cases in my career that I have gotten in on the beginning of something and been able to grow with it. In this case the people who had conceived the Watson Lab operation had a much bigger goal in mind. They wanted a geophysics research operation and we were just the startup group. What happened was that a year or so after that in '48 or early '49 we were shipped to Boston and became the Geophysics Research Laboratory. Everybody knows what's happened to that over the ensuing years.

Droessler: Who was the leader of the Geophysics Research Laboratory at Watson?

Anderson: I think that was Milton Greenberg, I really believe was the guy. He had been a captain in the Air Force and I think he had become a civilian. Then we had another fellow who was very energetic, very charismatic—Al Trokowsky—and he was very dynamic and would argue very hard for what we thought was right.

Now, I think in looking back at that history, the attitude, there is a cooperative attitude between the U.S. government and the universities, really got its impetus through the geophysics operation because really the National Science Foundation didn't come into being until after the geophysics operation had been underway for a while. One could see, as a nation, the advantages of having a cooperative arrangement whereby the government would supply funding for basic research to worthwhile endeavors in the university scene. So, one of my jobs as scientist for the Air Force Geophysics Research Labs was to encourage and sponsor research that the Air Force felt important. Since I had been in high polymer chemistry, I started working at aerosols and I had an opportunity then to work with many outstanding universities around the country making contracts and grants, and monitoring them, putting on international meetings and just wonderful exposure in that sense. So, really it was through that connection that I think the model for the National Science Foundation and later on the Air Force Office of Scientific Research as well as NCAR came out of those early experiences.

Droessler: Who were some of your colleagues that you worked with at the Air Force Geophysics Research Directorate, because it became really the leading activity in supportive research in the USA?

Anderson: It did. I had a chance to meet Joe Kaplan, who at that time was one of the leading scientific advisors to the federal government in that he is a member of the National Academy of Scientists and of course, he was a professor at UCLA, but he was on our board of directors and advisors and I had an opportunity to interact with him. It was through him that I met Will Kellogg, who is the second person to receive a doctorate in meteorology from UCLA following Jule Charney. People who were actually working at Air Force Research Lab—of course, we have to remember Helmut Landsberg; he came in as one of our early civilian directors. Helmut was instrumental in coaxing Chris Junge to come over from Germany to do some aerosol work, which was at that time, seminal work on the composition of aerosols and atmosphere. What Chris Junge did was to conduct almost a worldwide survey of the background aerosol and to everybody's surprise he found that the background aerosol was a sulfur type compound and these were present, he found, from near the surface of the Earth all the way up into the highest stratosphere. Of course, he found all kinds of nitrogen compounds and things like that but really Chris Junge's tenacity, his careful scientific approach to problems that produce that lasting work. Of course, he was rewarded for all that by being appointed the director of the Institute at _____ in Germany where he returned.

Some of my colleagues out of my own generation were people like Dave Atlas, Ralph Donaldson, who were in radar meteorology, Bob Cunningham, in cloud physics along with myself. We had Philip Thompson, who was doing numerical modeling work along with Chan Touart, who was there at the time; it's just a whole host of fellows who went on then to seed other places and do other things. That was really, I'd say, a wonderful place for the first five or six years because it was just bursting with these young guys with all this energy and know-how.

Then we were able to bring some Japanese in. We had Tanaka and Kanagowa come in and they were doing vacuum ultraviolet spectroscopy, which opened up the way then for us to understand how chemical reactions take place in the high atmosphere because you are in near vacuum conditions. That work was very outstanding. Not only did the geophysics group do in-house research and not only did they sponsor allied research in the various universities but they also put on some very important international gatherings. They would invite scientists from around the world and discuss some of the more outstanding problems and then see to it that these discussions were written up. Many of them then ended up in the form of books. In fact, I was an editor of one called

Cumulus Dynamics, which is still being mentioned in the literature, where we looked at the physics of how cumulus clouds developed and we had some outstanding authors, including Joanne Simpson in that group, that looked at that problem. We had similar publications in many aspects like electricity, upper atmosphere, the handbook for geophysics was put out by that group and it really served as a bible in the very early age of missiles and space launchings in the early 50's because it provided comprehensive data on the structure composition of the atmosphere from the surface that's high as, say 100 km. So, I look at that era as one of just blossoming for geophysics. As I was saying a little earlier, I think it was out of that group of people, Bob White was there on the staff and that really got our leadership for both NOAA and NCAR.

Droessler: And many of the universities.

Anderson: And many of the universities. It was just a really blossoming experience.

Droessler: And among the monumental effort that the Air Force supported was the publication of the **Compendium,** and that book is still very useful today.

Anderson: Oh yes. Tom Malone was the editor but it was the bible. It was really; what we knew at that time was reflected that in the **Compendium.**

Droessler: Do I recall correctly that two other fellows were there at the Geophysical Research Directory and one was the name of Al Query who went on to a great career in the NSF in Antarctica activities, he was a leader in that program. The other was Vin Lally, an upper atmosphere fellow who went on to a great career at NCAR. What was your interaction with those two people?

Anderson: Well, Al Query was over in geophysics so really he and I didn't do too much together. He was more of an expert in studying the reflection of sound by subterranean structures so that he could tell what was down there. But one of his colleagues, a woman named Betty Iliff, was very helpful to me in studying gravity wave type pulsations in the atmosphere using pressure transducers, which was one of the instruments that Al Query and his group had developed. And I did some very nice work in Arizona and in and around Cambridge…or Bedford on these kinds of waves that come out of a roaring cumulus clouds and thunderstorms. But I would say the other gentleman you mentioned, who was that?

Droessler: Vin Lally.

Anderson: Oh, Vin Lally was more of a meteorologist because what he was doing was developing these very high capacity balloons that could carry large payloads.

Droessler: Big plastic ones.

Anderson: Big plastic balloons that might be 100 feet tall when they were finally released and they carried payloads to extreme heights. It was really the only opportunity we had for gathering data high into the stratosphere beside from acute rocket shoots. We had rockets on program but they were just up and down kind of things but these balloons could stay aloft for hours and hours. In fact, Lally and his group, when finally at NCAR, had balloons circling the Southern Hemisphere for weeks just making repeat trips. They were able to map out the wind structure very nicely. I see Vin Lally just recently retired from NCAR after many, many years of service there as director of their Balloon Facility down in Palestine, Texas. That group of men we had at Cambridge was just outstanding.

Well, during the 13 years that I spent with the Air Force Cambridge Research Labs there were several things that I am proud of being associated with. One very early thing I did was to write a publication on the scientific basis for cloud seeding and this received…it was early in the whole cloud seeding game and I had come in as a trained chemist but I was also a meteorologist and so this whole era of cloud physics seemed to be a natural for me. I undertook then to dissect the principles that were involved in cloud seeding. I got a very nice letter back from my commanding general saying this is the most lucid account that he has ever seen.

Today even my friend, Roscoe Braham, who is now a colleague here at N.C. State, says he has a copy of my early report and he is keeping that as part of his history that he is putting together along with this whole business of cloud physics and cloud seeding. That experience in working with the cloud seeding brought me into contact with Langmuir and Schaefer and Vonnegut over at General Electric. So, I was able to participate in a lot of little discussions along with Ross Gund from the Weather Bureau who had some very vehement arguments with Langmuir about the efficacy of cloud seeding. And that also then allowed me to meet Paul McCready because I really got him started in his business. We had reported to hire Paul to be our representative to the ANC project at the University of Chicago, but Paul had been critical with some cloud seeding work that was done in New Mexico, I think it was. So, the Chicago people felt that well he might be biased so then Paul—we couldn't hire him. So, Paul decided well he would go out and start his own company, which became MRI and the Lowry Research Institute and I gave him his very first contract. I can look back and say well I worked with Paul McCready, and of course you know, everybody knows what Paul has done.

Droessler: Marvelous entrepreneur.

Anderson: At any rate, that was one nice thing I did. Another nice thing I did; I was asked to serve as the cloud physics project officer in Project [Operation] Greenhouse, which was forerunner of the H-bomb experiment out in the Marshall Islands. We went out there and we would explode these warheads from towers. We would build these tall towers and then we would set the blast off. One of the experiments was to see whether or not the debris that was sucked up by the explosion and debris that came out of the cloud, being radioactive, could act as seed for nucleation of ice crystals, which could then precipitate them in their regular precipitation process and somehow contaminate things on the ground.

To do this we had a fleet of a dozen drone aircraft, drone B-17's, and each drone was monitored by a live crew that flew along side and directed it. It was my job to set the whole thing up and of course then to reduce all of the observations. We staggered these aircrafts so that they would fly through the plume of the cloud at different heights and take measurements and we had wind and aerosol collections etc. I worked on that writing…I stayed out of it and we talked for about two months. It was an interesting experience along with Pete Wycough, my boss, and we had a very interesting time up there. It took me about six months to analyze all the data and I came up with the conclusion that the material that was left in the wake of this rising doughnut was not nucleating material, so that scare was over with.

Droessler: How high into the atmosphere did this cloud rise, 100,000 feet?

Anderson: It would go probably…well it's close to that, yes. It was a giant vortex ring. That's what it was. [A] vortex ring preserves themselves. They just went up just like a giant vortex; of course you had a tremendous after-wind as they left the surface because you had all this air that was pulled in as the ring got underway. But yes, the after-winds were probably 500 mph or more right at the surface. We were probably about 4-5 miles away from the blast itself. We were all assembled on the beach that morning with special glasses so we could see the whole thing.

Will Kellogg was one of my colleagues out there and he and I installed equipment in the very top of the tower to do some aircraft flybys and make some measurements and calibrations. I will never forget Will Kellogg loved heights. I was scared to death; up a 300-foot tower and I had to climb up on that thing and it was not complete: it was just an open cab with just a few boards. Will was dancing around on these boards and whatnot, and I was clinging on with dear life, but that was a good experience because it gave me an opportunity to learn a lot about Will Kellogg and we became great friends from that point on.

One other thing that I did with the help of Rudy Pendar was to develop a technique that would allow jet aircraft to suppress their ability to form contrails behind them when they were flying at altitude. At some point in the Air Force's development they decided, well, these airplanes could fly so high they could go undetected if there weren't radars around but they would always be given away because you leave this long bright trail. So, they asked us if we could somehow get rid of the trail. I worked with Pendar and we got over into the atmospheric optics problem and to make a long story short, I invented a way of making the particles that came out of the trail so small that they scattered blue just like the background skies so you had blue against blue which made the trail invisible. Paul [McCray] helped us because they did the ground photography and whatnot, and they helped build some of the instrumentation that we put into the aircraft. It was dramatic because we could have a B-17 fly over; two engines putting out contrails and two engines putting out nothing. Of course, naturally that was put under secret or confidential. I don't know if the Air Force ever used it or not but they issued me a patent, I will say that, I got a patent for that. That was a nice piece of work on my part.

It was after a short time that the Watson Labs endeavor was shipped to Boston to become part of the electronics setup there. Then, we had our own identity and it was put up at the Watertown Arsenal at first and then finally down at the Summer Street Labs near the Naval harbors there, U.S. Navy, and then finally we got our own new structures out at Hanscom Air Force Base in Bedford, Mass. It was in that era…we were all most of us still fellows in their late 20's, early 30's, and we saw the advantages that educational institutions in and around Boston had to offer. Of course, most of us who were meteorologists immediately associated with the local chapter of the American Meteorological Society, which met at MIT, and that gave me the opportunity to meet some very notable people, particularly Charlie Brooks, and to learn a lot about the Blue Hill Society and the Blue Hill Observatory, and in fact we had our first radar site out at the Blue Hill Observatory and Dave Atlas and his group were sited there.

Charlie Brooks is quite a character and he makes an indelible impression on my memory because he was the founder in the year 1919, the year of my birth, so I always say, well, the AMS and I are the same age because we started off together.

Droessler: The AMS and a couple of Charlie's.

Anderson: Right. Beyond that, well, I didn't really take courses at MIT until Dave Atlas decided he was going to go to school. I would go down and I would do some lecturing for them but Dave Atlas said I am going to get a degree and darn if he didn't go down there and get a degree. So, that really

energized quite a few of us. We would say, well, if Dave can do it, we can do it. So, I enrolled in '55 and took classes and did very well and I got my degree and quite a few other fellows got their degree. Now at the time I was going to school at MIT, I had an opportunity to meet some of their own grad students who later became employees out at Hanscom Field when it was part of the Geophysics [Lab—AFCRL]. People like Bob Cunningham, Bob White are a couple of names that jump right out at me. Then I had a chance to be re-associated with my old professor from Chicago, which was Victor Starr, who became my advisor, he and Houghton at MIT. I finally got my degree in 1960 from MIT.

Droessler: This was a PhD degree?

Anderson: PhD degree in meteorology.

Droessler: Pretty good when we got it from MIT.

Anderson: Yes, from MIT, so I am always proud of that association. I did not get an opportunity to be taught by Charney because he came after I finished my courses. But I did have exposure to Tom Malone and to _____ and Victor Starr and Houghton and Polly Austin and people of that caliber—which I felt MIT was then probably the leading institution at that time.

Droessler: Was your thesis problem in the area of cloud physics?

Anderson: It was. It was on the pulsating roof of cumulus clouds where we made the studies out in Arizona at Flagstaff in the summer—

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SIDE TWO

Anderson: —northern Arizona where we would take out the C-130 aircraft and we had mesoscale meteorology. We had Fujita out from Chicago, I got an opportunity to meet him and work with him. Paul Macready would come over from Pasadena with his crew. Dave Atlas would come out with his radars and whatnot, so it was quite an expedition.

We had an opportunity to try some ideas that I had developed in the labs back in Hanscom Field, not on seeding clouds to produce ice crystals, but to suppress the ice crystals so that we wouldn't get any ice at all. Now, this would not be possible today because we were releasing things called _____ in the air. We did this, I and another fellow named Seymour Bernstein, and we had some spectacular results. We had some really tremendous rain clouds that developed. Vince Schaefer had always said that most of the cloud material was dissipated into cirrus that just trailed off in the tops of these things and went on downstream. But if one could turn that around so that instead of making ice crystals instead you grew these large raindrops, then you would benefit from the cumulus type development. Unfortunately today I don't think the EPA and the environmental people would allow us to do that sort of stuff but it has always stayed in the back of my mind as a possibility because we had such great success out in Arizona on that project.

Droessler: What did you do then, in the sense that you create a lot of very small water droplets?

Anderson: No, what we did was to really poison ice nuclei, potential ice nuclei. We just poisoned them. Whatever was there we would put down, these means would form a surface that would make it very repulsive to crystallization of ice on these surfaces. So, even putting silver iodide, we could poison that.

Droessler: So actually you caused a rainfall without going through the crystal stage.

Anderson: Right.

Droessler: Such as we have in the tropics.

Anderson: Right, you get large droplets.

Droessler: Lets continue on with your career as a meteorologist, a professional meteorologist. After the Boston, MIT, and Air Force Geophysics Research Laboratory experience what happened to you?

Anderson: I had an offer to join Douglas Aircraft Missiles and Space Systems Division to head up their atmospheric analysis group. I thought this was a great challenge because it would put me into the space age and all the hoopla and glamour surrounding that new era.

So, I moved to Los Angeles and formed a group that was going to do this sort of work. Our task was several-fold. One was to provide the launch people with information about the structure of the atmosphere through which these vehicles were traveling so that we could tell them what the density and temperatures and whatnot would be on a launch date and that we did very well. But the other thing that we did was really our own creation.

We decided at that time, which was 1961—there we staged an interplanetary exploration with the notion that there might be canals on Mars with water in them. We didn't used to know much about the planets at all. We said, well, let's put together a series of monographs that would tell what we knew about these other planets in the solar system as best we can at this juncture in time. So, we prepared a series of monographs on Mars and on Venus, etc. They got wide publicity. Douglas was very proud of this because their name was on it and so forth. We had quite a demand for these monographs. Of course, I and my staff did the writing and I had to do all the editing of it to make sure they came out as best we could.

In that connection, I met some gentlemen over at Channel Lake that the Navy had a facility there and they were telling me about an upcoming eclipse that was going to take place in May or June of 1963. They said wouldn't it be wonderful if we could learn more about the sun if we get above most of the Earth's atmosphere. I said, you're at Douglas so if we get one of their DC-8's as a platform, that would be a great opportunity. I said, yeah, I will look into it. Well, I went…at that time in previous attempts there had been some single-seated aircrafts that had flown up and just made an up-and-down kind of thing without much in the way of any science at all. I went back and I talked to Dr. Klemperer, who was a chief scientist at Douglas, and a gentleman named Deutsch, who was an astronomer associated with Caltech and Mount Wilson. I said, what about this and they said it could be done if we get a DC-8 we could do it. So, it was out of that conversation that Douglas said yes, we will get behind it. What we'll do is to take a brand new DC-8 off the flight line that was being _____ to some customer, take out all the seats on one side and install special windows for those who needed them and put the instrumentation in the windows, and we'll fly a course that will parallel that of the sun moving across the Earth.

Now this particular eclipse that we aimed for was the one that took place in May or June of 1963. It started over northwest Canada and swooped down southeastward to merge over Maine and out over the Atlantic Ocean. We estimated by flying along with the sun we could extend the length of observation time for the eclipse from something like 3 minutes to 5 minutes. But, more important, we could almost guarantee that one could get observations because we would be above the clouds. So that was the idea behind it.

I was appointed to be then the expedition meteorologist and we had something like 70 scientists aboard this aircraft. We took off in Long Beach and flew up to Edmonton, Alberta, Canada, and the next day we were to go up and fly the eclipse. As the expedition meteorologist, of course, I went right off to the weather station to see what the weather was going to be like for the flight for the next day. Things didn't look too good. There was a front coming in from the Pacific and we didn't know how extensive the undercast would be. At that time, it was around 1963, there were no Omni range or LORAN or anything like that available up in that part of the world so the pilots had to use dead reckoning to find out their positions. There was just no other radio support, which meant then that they had to have some visible objects on the ground to really establish where they were and since this is a pinpoint operation we had to be right in the center of the _____ to do what we wanted to do and fly right down that _____ with the sun. I said my goodness, what are we going to do. Well, we took off and we flew up over the Great Slave Lake, which is North of Edmonton, and flew Northwest and our rendezvous point where the sun was going to be at Fort McKenzie, which was at the juncture of the McKenzie River and the Yukon River…or some other river, I forgot now but they came together right at that juncture. That's where we were then to turn around 360 and fly down the line of the sun. Dr. Klemperer had rigged up a little imaging thing right to the _____ to keep the image of the sun on the centerline so that he would be flying right with the sun.

Well, we got up over the Great Slave Lake and the clouds started to gather beneath us. We got higher and higher and still more clouds. We finally broke out of the clouds at 41,000 ft., in a DC-8 at 41,000, we had this extensive cirrus stratus beneath us and we couldn't see a ground feature of any kind, nothing, so they dead reckoned and flew on up to where they thought that Fort McKenzie might be. I don't know _____ but it seems like I have been blessed with good luck. When we got to where we thought Fort McKenzie would be the only hole in that whole deck was there and we see the juncture of the two rivers. We said, ha, we're at the right spot. We turned around and broke out the champagne and flew right down with the sun and the fellows got marvelous observations. Of course, we toasted everybody on it and movies were made. I've got a movie over there now that shows the whole thing. It was good enough for National

Geographic. We had celebrities aboard. We had a lot of the astronauts and this guy that used to do the science report, Jules somebody [Bergman-*ed.*], from NBC [ABC-*ed.*] was aboard. We had, what do you call them, a first day's stamp—that means things were stamped right aboard the aircraft so they would become collector's items. We landed at Edmonton and refueled and then took off for Long Beach.

On the flight back I do remember that I and Scott Carpenter who partnered us in a bridge game. I drew a hand that had seven diamonds, had all the honors except the queen and of course the cards that were distributed with other people were making strong bids, too. I can remember going to seven diamonds hoping I could get by without the queen but we went down.

Droessler: Down one.

Anderson: I will remember that.

Droessler: That was worthwhile.

Anderson: That was worthwhile, yes.

Droessler: You couldn't finesse it?

Anderson: Couldn't finesse for the queen. We were written up in the National Geographic with a very nice article. My name was mentioned as the…

Droessler: How high could you fly in that DC-8 then with the seats up?

Anderson: We could probably get, with a light load, to 45,000. It was a Delta aircraft. We just used it before we delivered it to Delta. It had all the insignias and all the organization.

Droessler: You just broke it in for Delta.

Anderson: Yes, we broke it in for Delta. So that was very nice.

Droessler: That's quite a story, Charlie. Thank you very much.

Anderson: The other thing we did at Douglas, we did a lot of things there because another thing I did at Douglas, that I am proud of, was that Douglas at that time, had a whole bank of IBM computers because they needed them to determine the aerodynamic characteristics of these air frames they were building for either aircraft or missiles and we had assess to them for free. One of the first things that I did, I said well let me use this electronic computer to run some models of cloud growth. Before that, Joanne Simpson had run a dry convection model. It would run for maybe 2-3

minutes and it was the very first model that had been prepared and she had published this model in my book called, **Cumulus Dynamics**.

I conceived of how to put the moisture in to make it a moist cloud model and so we produced the first cloud on a computer at Douglas. We gave a paper on this at one of the West Coast meetings and I gave lectures on it over at UCLA. In the audience was Christian Murda. Christian Murda was so impressed with it that he got a copy of my report and ran a reprint and do you know even today Christian Murda tells me that he uses it in his class because it was nicely done and we showed all the profiles and whatnot. It was a simple model and he said, "Yes, I used it in my class, in fact I have it on my final exam this spring." I said, wow this is something we did in 1961 or '63.

Droessler: That will help those Florida State students to learn something.

Anderson: Right. So I got a big kick out of that. Frank Murray and I really refined it and took it to a very high level.

Droessler: Where did you publish that?

Anderson: That was published in the "Monthly Weather Review" and the "Journal of Atmospheric Sciences" as well as New York. So that, I think, pretty well ended my, I mean it was a cap, to my career at Douglas. But I left Douglas because I could see that although my work at Douglas was quite interesting, I was more or less a specialist. I was not part of their mainstream activity because their mainstream activity was building airframes.

Droessler: You were [a] hired hand.

Anderson: Yes. As long as I was doing things interesting for them, fine but I wasn't indispensable to their main product at all. Plus the fact that I was working in an environment that was mainly engineers and whatnot and I just thought I should get back to my chosen profession. So, I got in touch with Bob White who had just been appointed director of the Weather Bureau. I said, "Bob, I would like to come back to meteorology." He said, "OK, Charlie, I am forming this new organization—ESSA—out of the Weather Bureau and we're going to have an office of the federal coordinator for research. We are going to coordinate all meteorological research in the federal government. So I would like you to come to become the manager of our supporting research division." I said, "Bob, that sounds like a good idea." So, I moved from Los Angeles back to Washington D.C. in 1965 to do that.

Droessler: And you became the first coordinator.

Anderson: Yes, I was the first coordinator, first manager rather. Bob was the coordinator; I was the first manager for the _____ supporting research. We had an organization called I-camera and we were the coordinating committee for, I guess, meteorological research. It was Frances Wheaton; I don't know if you knew her, she was a representative from the Signal Corps. I got to meet a lot of those folks from the different agencies because we had all federal agencies when we had meteorological research; the Defense Department, the Signal Corps, Air Force people, you name it, we had it. We had all of them.

Droessler: How long did you stay with ESSA?

Anderson: I stayed with ESSA until '66.

Droessler: So about a year and a half.

Anderson: A year and a half. But that year and a half was notable because I worked with Bob on setting up the first World Weather Watch program. It was really during that time when Johnson, I guess it was, made his Rose Garden speech about getting the World Weather Watch underway. We had prepared all of the background material for that.

It was really during my stay at ESSA with Bob White that I got an opportunity to get reacquainted with _____. [Sphernig] had gone to Washington to become the chief scientist for the Weather Bureau. When we first arrived we were still down at the old "M" street offices there in the stables and whatnot. My office was up on Connecticut Avenue, very nice. Bob White soon moved the whole operation on out to Rockville, Maryland, and made it a first class operation, something _____ had never done. [Vern] Suomi and I served on a lot of committees together. Apparently Suomi was impressed with my, whatever, he thought I had a lot of get-up-and-go and was not afraid to speak up and so forth and I could get things done.

Vern had one promise out of the administration at the University of Wisconsin to set up a Space Science and Engineering Center on campus with himself as the director. He wanted to do some things in space that he had in mind. He approached me about coming out to Wisconsin to become his associate director where I would have the day-to-day management of this operation and he would be the chief scientist and come up with all of the brainstorming ideas. I said, "Vern, that is very flattering." He knew I was going to leave Washington because my wife didn't like living in Washington. We had some young kids and she said, this is not a good environment. I was planning on going back to California or I had an offer to go and join Bitemon, who had just been

signed to the labs out in Boulder, to go join his labs. I also had an offer from the Bureau of Reclamation to join their operation in Denver. So, I said, "Boy, this is very nice and very tempting." So Vern said, "Why don't you come to Wisconsin?" I said, "Vern, it gets mighty cold in Wisconsin and that's…although Missouri was a lot colder than Wisconsin. The other disadvantage to going to Wisconsin is that I would be going to a college campus. I know as well as you know that the name of the game on a college campus is that you've got to be a professor if you're going to be there." "We'll make you a professor." I said, "Well, Vern, I wouldn't go there unless I were a full professor, tenured. I'm too far along on my career to start with a lot of nonsense." "Well, we'll make you that." So, I said, "Wow." So, they had me out to Wisconsin and everybody treated me real well and so forth. Vern came back and said, "Yes, we'll make you a full professor, tenured, if you'll join us." So I said to my wife, "Now what should I do?"

Droessler: That's hard to turn down.

Anderson: I said, "Hon, how many opportunities will I ever get to become a full professor at a Big Ten university?" She said, "Probably none other."

Droessler: Yes, with a wonderful department of meteorology.

Anderson: I said, "Probably none so I better take it." I did, and I'm not sorry. I have spent 20 years there and really did some nice things.

Droessler: So, now you're a full professor of meteorology at the University of Wisconsin, one of the finest universities in the country, and had a career there of 20 years. Now what was your main research activity at the University of Wisconsin?

Anderson: When I first went I set up there cloud physics activity but for the first few years my main activity was getting the Space Science and Engineering Center off the ground. When I arrived it consisted of a big room that Vern Suomi occupied and he had this huge stack of papers and books in the middle of the floor. My first task was to hire a secretary to help get things organized. Vern Suomi had trip reports, travel reimbursements that were 3-4 years old that he hadn't been reimbursed because he hadn't submitted the materials. So I had to get things organized. So I hired a good secretary and I went about hiring a staff for this center, which means I had to buy equipment, machinery, secure a building to do the whole thing. It was really a monster job. I was teaching as well. By 1970 I told Vern, "This is just too much. I'm really going to have to be a professor or become a full-time administrator and I don't want to become a full-time administrator. What we should do is to set up a position called a Executive Director; somebody who could run the day-to-day operation of

the center to free us and make some decisions but not get involved with just the minutia of the operation." So, he agreed and we did hire a full time director. There was a gentleman there at the moment named Bob Fox who has been there, I guess, ten years or more.

Droessler: And doing a wonderful job.

Anderson: A wonderful job. He left Vern and I free to do whatever we wanted to do. So, then I was able to turn my attention to the cloud physics work. One of the first things we did in cloud physics at Wisconsin was to join the _____ program. So, we went out to Colorado every summer looking at the hail.

Droessler: National Hail Research Project.

Anderson: Yes, Northeast Hail Research Experiment. We went out there for 3 or 4 summers in a row and I turned out some nice student theses from that. We studied the electrical properties, we studied the use of _____ at the ground, we found out that hail-bearing clouds had different kinds of signals then ordinary thunderstorms, we looked at the seeding and the results of the seeding by using time-lapse photography, we did some cloud penetration work there and so it was quite a nice operation. Out of that I had several students who did very well. Steve Colt who is at NASA now at their mesoscale program. I had a fellow named Al Mida who heads up the whole, I'd say, Geophysical Research Program in Brazil who took his doctorate with me. I had him out in the field in those days. Louis Uccellini, who took his Masters with me at Wisconsin, and we worked on some of these problems. I can look back at that era as being a very productive era. One thing we did was to build a vertical wind tunnel, much as they had down at Oklahoma, but it was much scaled-down in terms of money. We built it for $100.00 and we assembled it out of wood and old discarded pieces of motors and things like that but it operated on the same principle and we didn't have a finely geared turntable that would be on very smooth roller bearings but you wouldn't allow it. So, instead of having roller bearings for our turntable we put roller skate wheels on it. Of course, you could imagine what this sounded like when we got it going. But it was interesting enough so that all the nearby high schools and small colleges would come and bring their students in because we could actually make _____ farm in this thing.

Droessler: And you could seed them.

Anderson: Oh, yes. We could make them visual and by speeding it up we could go from one vortex to the multiple vortexes, 2,3,4,5. So, that was a good centerpiece just for the advertising of the department.

It was during that time, around 1970, when we started to get the satellite data. It was very crude but I started to work with it. One of my earliest Master students in 1972 used the ATS-3 satellite data to study some tornadic storms that were created over Mississippi, the state of Mississippi. We could measure divergence and whatnot out of these single pictures. It was at that time then I started to notice some peculiar aspects of storms that produce tornados vs. storms that didn't in the satellite view. I said we should look at this. About the mid 70's we started to look at it a little more carefully. By the late 70's, about '79 is when I published a little paper on characteristics of the plume that was associated with a tornadic storm vs. non-tornadic storms. Then the whole technology of the satellite improves in navigation, improved in the frequency in which pictures were taken improved and so coming into the early 80's my whole research interest switched from cloud physics to severe storms.

In that switch I was able to convince the department to hire Pao Wang who had been a student of _____ at UCLA. So, Pao Wang came in to do the cloud physics work. Pao has been recently granted the German medal for outstanding research, the German-American Foundation; I think it was the Gutenberg Medal. Anyway, he is the recipient of that medal this year so he will be spending a year in Germany. But any rate, my work has gone off into the severe storms and tornado so that when I wound up my career at Wisconsin I was very heavily involved in using the satellite. I learned all about using the satellites and I was an opportunist because I saw this new range of possibilities being made available from the satellite using the cinematic properties of the satellite and things that they wanted to do with it as a new tool for investigating atmospheric phenomenon particularly on the mesoscale, or on the storm scale.

Droessler: Again you were fortunate to be at the right place at the right time because under Vern Suomi the satellite technology really exploded.

Anderson: It did. It did.

Droessler: He had nice research grants from NASA and from NOAA that kept that engineering center going at full tilt. It even had some personnel that came there. I think this fellow Bill Smith.

Anderson: Oh, Bill Smith. Oh yes, he brought…

Droessler: First-rate fellow. Yes.

Anderson: Then they would get him on the _____. They have a NOAA _____ group there under Kit Hayden and Paul Menzel. Al was in the…

Droessler: At the beginning, yes.

Anderson: At the beginning of some of the game.

Droessler: And helped it grow.

Anderson: Helped it grow.

Droessler: And benefited from it.

Anderson: I think in this kind of discussion, Earl, I think I must have had the foresight to recognize the potential of something and move with it. You could have been around there and said well that is something else I'm not going to get…I don't want to learn about that. I just saw that this thing was going to be a marvelous tool. So, I got into the computer age in a hurry. I learned about computers and all that real fast.

Droessler: Well, I think too it also shows the element of courage you had and to launch off into a new field of endeavor and also your openness in being willing to explore opportunities. You didn't close your mind when you were at Douglas and say this is where I'm going to stay the rest of my life; you let yourself open to an opportunity at ESSA and when you were at ESSA you left yourself open to other opportunities. I think that's a mark of high quality in my book.

Anderson: Well, thank you. I look back on my career as being very productive and very enjoyable because I've had the opportunity to work with outstanding people and accomplish some nice things. I really appreciate it.

Droessler: After you left Wisconsin and came to North Carolina State University you were just in time to take on a study of very severe tornado activities here in the Raleigh area.

Anderson: This is true. Of course, I came with the intent of providing severe storm capability to the department and the deans were very generous in helping me acquire remote workstations; workstations we have tied to the mainframe computer at the Space Science and Engineering Center at Wisconsin so that we were sort of like an outpost. They acquire the images from the satellite and we simply bring them down over the Internet system. But it so happened that I came here in '87 and we had the big Raleigh tornado in '88 so I would get a lot of ribbing about that. They said never have they ever had a tornado in November that go right through Raleigh. Well, that tornado provided me with an opportunity to turn out about 4 or 5 masters theses again of just coincidence maybe or sometimes I say I'd rather be lucky than good because there it was.

Droessler: Also you became an instant local hero.

Anderson: Not a hero but at least a source person. I got a lot of attention on that one.

Droessler: That's very charming.

Anderson: I'd say my work here at N.C. State has really, I think, been revolutionary in the sense that we brought a new and different dimension to satellite meteorology. The things that we have done that were not being done by others probably take on two different dimensions. One is that we have moved from an orlarian scheme of analyzing things to a logrongian scheme, which is very important when one is looking at mesoscale phenomenon, particularly things on the storm scale like big thunderstorms and tornado producing thunderstorms. That can really do a wonderful job if you do that in a logrongian scheme.

The second thing that I think we've done had been to introduce some really high-powered statistics in analyzing our data. This has been through the wonderful tremendous assistance that we have gotten from Professor John Monahan in the Statistics Department, who has worked with us. He has shown us some procedures and techniques that allow us to interpret our data much much better than we have been able to do otherwise.

Droessler: Yes, N.C. State is very powerful in statistics.

Anderson: Probably the leading institution in the country in applied statistics.

Droessler: Yes, that goes back to its early days of agricultural statistics.

Anderson: Right.

Droessler: It has an outstanding reputation here.

Anderson: Just really great, really great. Those two features, I think, have brought us to where we are today where we make the claim that we have a breakthrough in being able to detect a tornadic thunderstorm from a non-tornadic thunderstorm simply by looking at the satellite images.

Droessler: Can you detect these in a reasonable amount of time so that a forecast can be made?

Anderson: We learned lead-time. We just had an experiment that we carried out this spring and lead-times range anywhere from –5 minutes, which means that if the funnel is already on the ground we were able to make the declaration to as much as an hour and 30 minutes lead-time. On average, I would say,

our lead-times were between 20-30 minutes. We hoped that we could improve on that if we would automate our whole procedure.

Droessler: So the development of the tornado cloud gives us a signature that can be picked up by the satellite imager.

Anderson: By the satellite imaging.

Droessler: This signature may precede the actual tornado or it might accompany the tornado activity itself.

Anderson: Yes. In other words the circulation that produces a tornado has a certain spin to it and that air that has that spin emerges from the top of the cloud with the same spin and we can detect it. We can tell if it is spinning in a cloud or if it is not spinning. If the cloud has no spin in it we say it's going to be non-tornadic. If it has a spin in it we say it's going to be tornadic and then we can say how severe the tornado would be depending on how strong the spin. It's as simple as that. It was simple in that sense, but to really reduce that concept to something that's workable is a lot more complicated but that's the essence of what we are doing. Why we can do that with tornadoes where you couldn't do that with a mid-latitude cyclone is a whole secret but mid-latitude cyclones, they spin too, of course they know they spin counterclockwise. These tornadic storms in their centers spin counterclockwise but on their edges they spin clockwise. It's the clockwise part of the spin that we are seeing, that we measure, the clockwise part.

Droessler: That's the difference.

Anderson: That's the difference. That's an attribute that we say is only true of these tornadic thunderstorms because they are confined in space by the fact that they are very slow moving. The winds at the plume level, where the plume was formed, move faster than the storm itself and therefore we get a artificial boundary being established as to how far out the counterclockwise spin is allowed to go, which means then that we're working on the principle of conservation of momentum. In that case because if you've got this kind of spin, the counterclockwise spin taking place in the center, the principle angle of momentum says that then you've got to have a clockwise spin close by or nearby to compensate because if it was there to begin with its got to stay zero. Now in the case of the atmosphere and these large extra-tropical cyclone of course, you have the hole of the atmosphere. If you've got a big spinning cyclone you're going to have a big spinning anticyclone high somewhere else so it's all balanced out. But if you take something as small as a thunderstorm then you don't get it balanced out. At least in these big tall thunderstorms that maintain their erectness even in the face of very strong ambient winds.

Droessler: Now the last week or ten days we have had severe outbreaks of tornados in the Midwest and even in the Madison, Wisconsin area. Are some of your students and yourself looking at these satellite pictures?

Anderson: We're compiling all of those pictures and they are going to go into our base data center. There we have a very interesting question to ask. We had days when they reported something like 60 tornadoes. The question we want to ask then is under those circumstances in order to get that high a number of tornadoes it almost says that every storm that developed was tornadic, whereas our studies have shown most of the time even in tornado belt region that maybe it's only 1/3 of the thunderstorms that grow become tornadic. So we want to see what's unique about those days when you have these gigantic outbreaks. Remember the jumbo outbreak of 1974, April 3rd, when we had something like 150 or so tornadoes. Almost every storm that developed that day became a tornado.

Droessler: Why? That's the question.

Anderson: And then why on other days, maybe only 1 and 10 will become a tornado. There is still a lot we don't understand about tornadoes. That's the challenge that's still not known.

Droessler: So, you're working here at North Carolina. State mainly with graduate students?

Anderson: Grad students, right. It's fun because we are now part of the Southeast Severe Storms Consortium and we hope to get that underway this coming year, in July really.

Droessler: Who is supporting that? Is that NOAA?

Anderson: That's NOAA. That's a NOAA initiative. We had support from NOAA and we have had support from NASA. We are now trying to get support from the Air Force.

Droessler: Well isn't it in the future that NOAA will be moving its weather station onto the campus and you'll have access then to even more data and analyses through the NOAA network?

Anderson: Yes. We are looking forward to that. I am expecting that NOAA will have an experimental weather center where some of these ideas can be tested on an experimental basis separate from the regular forecast office.

Droessler: So that might lead to a cooperative agreement.

Anderson: Oh, absolutely.

Droessler: Between NOAA and N.C. State.

Anderson: Right.

Droessler: Such as they have at Wisconsin and many of the other places.

Anderson: There are some great things down the road.

Droessler: Well, there is still a lot to accomplish isn't there?

Anderson: Oh, yes. I am enthusiastic about the future.

Droessler: Well, Charlie, you have just had a marvelous career and I am delighted that you a still so enthusiastic and excited and useful in the field of meteorology. I would like to, for posterity sake to ask you, who is Charlie Anderson?

Anderson: Well, I'm the son of parents who had fairly high aspirations in life. My mother and father had seven children, six of whom lived to become adults. Out of those seven, I think, all went to post-high school.

Droessler: Went to college.

Anderson: Either college or professional training of one kind or the other. My mother had post-high school training herself. She was from Fulton, Missouri. My father came from Northern Mississippi and his father was quite a prominent landowner in Northern Mississippi. He owned large farms and he had a lot of tenant farmers. My father was a very proud man. At the time when he was a youth, the so-called Jim Crow laws had become very suppressive. So, he decided to leave Mississippi and forsake his share of the farm to seek another life. He came to St. Louis where he met my mother and they were married in St. Louis in the early 1900's and he started a family. He always wanted to be an independent businessman.

Droessler: Did he accomplish that?

Anderson: More or less. At one time in his life, he was a railroad porter, but he felt that that was demeaning work, really beneath his stage because he had been raised as a son of a wealthy man.

Droessler: An aristocrat.

Anderson: They had servants and whatnot. So he didn't like the idea of working for, bowing and scraping for tips and stuff like that. He decided that he was going to…(tape #1 end).

END OF TAPE 1

Interview of Charles Anderson

Tape 2, Side 1

Anderson: My mother came from a modest but very Christian household. Her stepfather became a minister but he was a hardworking man, he was a very outstanding man himself, but her father, her real father, was in the labor movement. He moved from Fulton, Missouri, to Kansas City, Missouri, after he and my grandmother separated. He became the business manager for the _____ and mason tenders local in Kansas City so he was fairly well off.

Droessler: That's right.

Anderson: He had his own car and own home, a very nice setup. So, my dad started this truck farm in Clayton, Missouri. I was born there in Clayton, Missouri, 1919. He enjoyed a fairly modest living. He would raise crops and then take them to market and sell them, or he would peddle them to people. So, he had a regular route that he peddled on. He had a green thumb; the man was good at growing things. But we were raised on this farm. We had cows and horses and chickens and just all of the things that a young boy would love to be able to run around and play and feed them, so that was great. Then I had to help my dad. So, I grew up on the farm and when I was about 11 the Depression really hit, it was in 1929 or thereabouts. We moved back into the city of St. Louis because he just wasn't able to make a go with the farm.

My mother was determined that we would always be exposed to the colorful things. So, even when we lived on the farm in the county, she would see to it that we would get to visit the art museums, the _____ gardens, the botanical gardens and the theatres. St. Louis has a wonderful outdoor opera in the summer in Forest Park. In fact, Forest Park was a huge park in the center of the city that was the site of the 1904 World's Fair, so a lot of the buildings and what not that had been put there for the World's Fair had remained and a lot of the things that put in…of course, St. Louis also has a world famous zoo and so we got to see all of that.

My mother read to us a lot. She was a great reader and she read to us. So, I got a very strong interest in reading when I was even a preschooler. In fact, they thought I could read because she had read the stories to me so many times I just memorized them right away and I could…they would say, oh this kid can read, well I couldn't read but I had a good memory. But, at any rate, I was a pretty bright youngster, no doubt about it. A lady in the neighborhood had a son who was a bit older than I, his name was Henry ?Wieman, he was probably five or six years older than I. He had

this tremendous collection of books that his mother had bought him…his parent's had bought them, books for boys. So, she asked my mother if I might be interested in this collection of this library because her son had outgrown it and mother said yes. So, I inherited a library of about 100 books, the Tom Swift series and all of those. I had them right at home and of course I devoured them. I mean, being on a farm in the afternoons I just read a book a day almost. I got through all of that stuff, ?Tin Rod and all that just at home. So, I acquired a taste for reading very early.

Even after we moved back into the city, it was my regular beat to go the public library and take books out and do my reading. So, I acquired a taste for learning, an interest in learning of a more catholic nature, so I was interested in everything.

But then I really got interested in science. When I got into high school, I took physics and I took chemistry and I took the math and I did well in all of those and I said, gee, I would like to be a scientist. I just stayed with that track. Through my chemistry work in college I was under the tutelage of a man who worked on the atomic project so he must have been taking physical chemistry because he was chosen to work on that. So, he was a hard taskmaster but I appreciated him because when I got to Chicago I knew what hard work was all about when I was in the meteorology program there, I didn't suffer at all from my background.

As I said, I had three sisters older than I, and they had all gone ahead of me through high school and they had done well so the name Anderson was known to all the teachers and they were; here comes another Anderson. So, the expectation that I was under was high. In other words they expected me to do well so I didn't want to disappoint them. I was the valedictorian of my high school class and I got a scholarship to Lincoln which wasn't much, but it enabled me to get to college and I think I finished third in my class, I could have done better but I finished third. I have all that experience. I was elected to my high school hall of fame when they first started it and that's a very elite group of people.

So, I think I have had just an intense curiosity about things and things scientific particularly. I think that was encouraged by my early reading adventures. I would say my enthusiasm has been kept alive by my decision to come into the university system because you never then grow tired of your colleague, your associate, because your associates are always new students who you spark ideas from and argue with you about and then they move on.

Droessler: Always looking ahead.

Anderson: Always new challenges whereas if you stay within say an institutionalized organization, such as a government lab or a private industry lab, you and your colleagues pretty well talk each other out after a few years. They don't have anything new to offer you, nothing new to the spark, whereas if you stay in the university environment, there is always going to be something new because you'll always have some new people to train and then you see something from a different angle, you see, or they may come up with something from a different angle. That keeps you young and I think I've been blessed to stay in the university environment for this long because that's really, I think, the key if you want to keep young ideas you've got to stay around young people.

Droessler: Now did you meet your wife at Lincoln?

Anderson: I met my wife while I was an undergrad. She picked me out, I didn't pick her out, she picked me out. The first day I hit the campus she saw me and said, "I'm going to marry that fellow." I wound up doing it.

Droessler: How many children do you have?

Anderson: We have two living; we lost our son but we have two living, two grandsons and two great-grandchildren who we are enjoying very much right now. In fact, I was up this morning at 4:30 with the youngest one.

Droessler: Do you have the two grandchildren living with you now for the summer?

Anderson: They come for the summer.

Droessler: For the summer, yes.

Anderson: Yes. It's our tradition in our family; we keep the grandkids for the summer.

Droessler: That will keep you young.

Anderson: Oh yes. Oh yes. Through my getting my degree at MIT, I became the first black person in the world to earn a PhD in meteorology. So, that is not anything of any great in part but it does give me that set-apart distinction. So, when I meet people like the head of the weather service at Nigeria and the Secretary General…

Droessler: Patrick Obassi.

Anderson: Yes. I can say, well, I'm still your dean because when you got your PhD at MIT I preceded you. That's a nice distinction to have. I was head of _____ and all those fellows.

Droessler: We still don't have very many black PhD's in meteorology do we?

Anderson: No, but it's not surprising. If you find a fellow that is good in physics and math he is going to be _____ from somebody of different _____. Engineering, they say come with me right now we'll give you $40,000 a year. You've got to have a love for the nature and atmosphere if you really want to get a good meteorology…

Droessler: And the medical field is very persuasive too.

Anderson: Oh, yes.

Droessler: And the law field.

Anderson: Oh yes. The challenge of young fellows is there are so many other directions they can follow.

Droessler: Well, you've had this wonderful career behind you now and you are at N.C. State and looking forward. Where do you go next?

Anderson: N.C. State has been very good to me because my contract with them was for a five year contract which meant that I was retired at the age of 72 last December and I am continuing along with them at one-quarter time because I am associated with this new Southeast consortium. I foresee that I will be associated with N.C. State for sometime into the future as long as I am interested and we are able to bring in new monies and keep things going. I may be a professor emeritus but really I'm going to keep the shop in here a few times every week. I just don't see myself just drying up and blowing away. Now, maybe my health may impede that but as long as my health stays up and being able to work with students and whatnot I think my enthusiasm will stay high.

Droessler: Well, lets hope you have good fortune with your health. I think part of your health and your well being is your ability to maintain a usefulness of your life, you see; a usefulness and a vigor and a sort of a look ahead. All of that helps, I think, to maintain a reasonable youthful appearance and a youthful outlook on life, which you certainly have, Charlie.

Anderson: Well, thank you. Thank you. I agree, I think, your whole tone of beliefs is predicated on how you view yourself, your own prospective with your peers and whatnot. I just don't view myself as a senior citizen committed to sitting on the front porch in a rocking chair. That's not my view.

Droessler: So many of your colleagues today, not only here at N.C. State but throughout the U.S.A., expect you to continue with your research work

and continue to publish and continue to turn out masters and PhD students. That's their expectation.

Anderson: Great. Well, I'll try my best.

Droessler: This is Earl Droessler concluding the interview with Charles Anderson in Raleigh, North Carolina, on June 24th, 1992.

END OF INTERVIEW