

**American Meteorological Society  
University Corporation for Atmospheric Research**

**TAPE RECORDED INTERVIEW PROJECT**

**Interview of Bernard Vonnegut  
9 May 1993**

**Interviewer: Earl Droessler**

Droessler: It's Sunday afternoon of May the 9th, 1993, in Schenectady, New York, and I'm about to interview Dr. Bernard Vonnegut in Vince Schaefer's home in Schenectady, and we'll be talking about Bernie's activities in atmospheric sciences during a lifetime of his work. And I would like to begin by asking you, Bernie, how did you get into this field of meteorology?

Vonnegut: I was scarcely aware of the field of meteorology until my first year in graduate school at MIT. I was studying physical chemistry, and a good friend of mine -- and classmate in physical chemistry -- introduced me to a friend of his who was a meteorologist. I had never met one before! This guy's name was Wallace E. Howell. And so I've known Wally Howell since that time, but our paths didn't cross again until much later.

Droessler: I remember Wally very well. We all do. You know, he was a -- he cut quite a figure in our field of meteorology.

Vonnegut: Indeed! I haven't seen him for, oh, about three years. Is he still going strong?

Droessler: Yes, he's still going strong.

Vonnegut: I would have assumed so...

Droessler: Yeah.

Vonnegut: Well, I graduated in chemistry and then took a PhD in Physical Chemistry, then I went into the glass industry and worked for the Hartford Empire Company, and I worked with Frank Preston, who is a consultant in the glass industry, and I worked on the surface properties of glass, the strength of glass. And when the war was coming on, I decided to go to MIT, where I took a job in the Chemical Engineering Department in the newly formed Chemical Warfare Service laboratories there. And I studied aerosols and filters, and that was when I came to know Langmuir and Schaefer, because they were working on these problems too. And while I was working at the Chemical Warfare Service, a friend of mine -- a

guy named James E. Dodson -- told me about the work he was doing on the deicing of airplanes. He was working, with Air Corps sponsorship, on airplane icing with Henry Houghton -- who at that time, I believe, was chairman of the department --

Droessler: Yeah, Chairman of the Department of Meteorology at MIT.

Vonnegut: And Jim Dodson told me something about the exciting problem of airplane icing, and he told me a bit about meteorology too. I am not sure whether Jim was a student in meteorology or not, but he was an extremely capable guy, and I enjoyed working with him. And I arranged to transfer from the Chemical Engineering Group to the Meteorology Department, and I started working with Jim Dodson there. One of our primary things was the construction of a wind tunnel on the roof of the Aeronautics Building, where the Meteorology Department was then located. And we built a wind tunnel, which was powered with a [Cadillac 16?] engine we managed to acquire. And we built this wind tunnel that could give us speeds up to... I think maybe approaching a couple of hundred miles an hour. And it had a throat -- measuring section -- maybe two or three feet in diameter, and we had spray nozzles at the entrance to this so we could create icing conditions in this tunnel when the weather was cold enough outside. And we worked on various aspects of icing, and --

Droessler: At that time, was the deicing of aircraft by way of having a rubber boot on the leading edge of the wing?

Vonnegut: Indeed it was --

Droessler: And then you blow up the rubber boot and then the ice would crack and blow --

Vonnegut: Yes, there was the B.F. Goodrich system. And at that time, electrically-heated wings, exhaust-heated wings, electrically-heated propellers, and slinger rings on the propeller to put alcohol on. And I had an idea on a scheme for deicing airplane propellers, and then also I worked on instruments to measure icing rate and also to measure liquid water content of clouds, and so I became familiar with some of the concepts in cloud physics. Of course, Henry Houghton had had a lot of experience in this.

Droessler: Did you see much of Henry Houghton at that time? Was he around and available and...?

Vonnegut: Oh, indeed, yeah, I saw him quite a bit. And Henry Houghton was a very helpful -- he was a very nice man, and a surprisingly calm man, because we built the wind tunnel on the roof and the engine was installed pretty nearly over his office, and we had put down a bunch of timbers on the roof and made a framework to hold the Cadillac 16, but somehow or other I think maybe we caused a leak in the roof, and the water came down in Houghton's office, and somehow it followed the wiring, and he had a big plate-glass globe hanging over

his desk that gave him illumination, and he noticed (laughter) that this thing had become full of water! (laughter) And I must say, he took it surprisingly calmly. We finally got the thing down without inundating his desk, which was right underneath it. But Henry Houghton, as you may know, was known to us as the "Drop King."

Droessler: Yes, he was a very, very wonderful leader and worker in our field of meteorology.

Vonnegut: He was. And as you know, he was an electrical engineer.

Droessler: Yes, yes, yes, yes. Yeah, it was remarkable that he was able to stay on as Chairman of MIT for so many years, you see, because of the outstanding work that he did with faculty and students.

Vonnegut: Yes, indeed! Yeah.

Droessler: But I've heard many people, you know, remark about that, that MIT just didn't have chairmen that long. But Henry was in --

Vonnegut: Well, he was a remarkable man. And...

Droessler: Do you remember some of the other professors there at MIT at that time?

Vonnegut: Uh, yes... Well, I knew Bernhard Haurwitz. And...

Droessler: OK.

Vonnegut: Well, I was going to say that [Ivan?] was very lucky -- at MIT, when I joined up with Jim Dodson and Henry Houghton, it was a stimulating environment and a very good place to do research. We were free to do what we wanted to do and what we thought should be done. And I think that I've been lucky right along, at MIT in the Meteorology Department and then when I -- the -- well, before MIT, when I worked in the glass industry, I had great freedom to do what I wanted.

Droessler: How long did you stay at MIT? A half a dozen years or so?

Vonnegut: No, no, I don't -- I mean, well, if you count being a student, I was there for a good long time. I entered MIT in 1932 and got my PhD in '39, and then, after a year or so absence, I came back and worked in the Chemical Engineering, and then in the Meteorology Department. From there, I went to the General Electric Company, and I was very fortunate there to have a lot of opportunities for doing what I wanted in research.

Droessler: So you joined the General Electric Research Laboratory, where down the hall -- or in the same building -- was Vin Schaefer and Irving Langmuir...

Vonnegut: No, I joined the General Electric laboratory and I went to work in the chemistry division, and I was told when I came that, if I came to the General Electric Company, I could work on things that were of interest to me, that that was the way they worked. And I thought that was just the ticket. And the first thing I did when I got there was start working on something, because I was afraid, if I didn't, why, somebody would come to me with an idea for something I should be working on! And when I arrived, I knew that Vin Schaefer was -- at MIT I had done some work on supercooling and nucleation, and I knew when I came to GE Vin Schaefer was working on supercooling of water and so on. And since he was doing that, I decided, well, I would work on supercooling of something else, and I chose to work on the supercooling of molten tin. And so I went to work on that and got together with Dave [Harker?] in the -- who is an X-ray expert, X-ray crystallographer, and I used his equipment to measure the nucleation of supercooled tin with his X-ray diffraction apparatus. Then the X-ray tube broke, and it was going to take a while to get that, and so I thought of another method for measuring the nucleation of supercooled tin, which was by the volume change when it froze. And I was working on that when Vin Schaefer made his historic development of the [cold box?] and his discovery of dry-ice seeding. And I used to -- we were in different buildings, but I used to go over and talk with Vince and Dr. [Blodgett?] and Langmuir. And when Vince made his discovery they asked me if I'd like to move over and be part of their group, that there was a whole lot to be done on cloud seeding, and particularly they wanted to know if they could get good quantitative data on the number of ice crystals produced by a dry ice seeding. And so I moved over into that building across the hall, where a little while later I was joined by Duncan Blanchard, and I worked with Vince's coldbox. And in playing around with it, it occurred to me that maybe if I could find a crystal that was very similar to ice, that that would serve as a nucleus, and I found the silver iodide worked. They -- I won't go into the details of that, but it's pretty well-described in the -- are you familiar with *The Early History of Cloud Seeding*, by Barry [Havens?] --

Droessler: Yes, uh-huh. Yeah.

Vonnegut: -- and Jim [Justeau?] and I put that together, and New Mexico Tech published it. And --

Droessler: Well, I think you're very right, and very wise -- I mean, in this interview, there's no point in going into the detail if it's available in the literature.

Vonnegut: Yeah, I think that a lot of this is available in that, and I should emphasize that Barry Havens, in writing this thing, would write up a -- he'd talk with those of us in Project Cirrus, and then he would write it up, and then he'd bring it back and show it to us and ask us did he have it right, so that we were all free to make corrections or additions. And incidentally, putting together this thing was the idea, I understand, of [Guy Suites?], the head of the lab. And I think that was greatly to his credit and to Barry Havens', who was formerly editor of the *General Electric Review*, that this was put together. But this is an excellent source. I

should say, this early history has also been reprinted in the *Journal of Weather Modification*; it's available there.

Droessler: Through that journal?

Vonnegut: In that journal. However, that reprint of it does not include all the appendix and index of the early history.

Droessler: Well, I'm sure that, you know, looking back -- I don't know all of the activities at the General Electric Research Laboratory, but certainly Nobel Laureate Langmuir and Schaefer and Vonnegut, and the work that they accomplished in the field of nucleation, in just understanding the process within clouds, was one of the prime discoveries at the laboratory, and one I'm sure they're very proud of to this day. Well, after Project Cirrus was finished, the GE Research Laboratory group began to separate and go in different directions, and I'm just curious as to what happened to you.

Vonnegut: Well, as the work in cloud physics began to break up, I was asked -- it was suggested that I might work on solid-state physics. At that time, the solid-state equipment was the big thing, and this was pioneered, I think, by Bell Labs, and everybody else wanted to be in on this marvelous new aspect of electronics. And it was suggested that I might work in that. And I did begin working on silicon diodes, and I found it interesting, and I think I made some contribution. However, I recognized that I had lost the -- I was in danger, I think, of losing the opportunity of selecting what I was going to work on. And I think that, if you have a man who is free to work on the things that he is interested in and that he knows a little something about, that he has a better chance of making progress than a much brighter guy who's told what to do. And so I've treasured the ability -- situations where I've been able to investigate what interested me. And at GE, this was the guiding principle of [Dr. ?] Whitney, the founder of the research lab, and this was strongly established there. And it was my feeling that -- in the period that I'd been there, that this business of -- that I had been given the freedom and it worked out OK. And I figured that, if things were changing -- and it seemed to me that the lab was getting more organized -- that I decided to look around. And at the end of the war, I'd come very [nearly?] going to [Arthur D. Little?] and joining my friend Howard [McMahon?] there. And so I explored the idea of going to Arthur D. Little again and decided to make that change. And when I did so, after I had done so, I -- Guy Suites, the director of the lab, heard about it and asked me to come in and talk to him about it, and he pointed out that this was a very important step that I was undertaking and that he hoped I wouldn't do it lightly, that there were many factors. And he said, "One of the things you must consider is your equity in the pension plan." And when he said that, I knew I had made the right decision. And so I left, and I went to Arthur D. Little having no intention of continuing work in atmospheric science. However, they got a request for -- a proposal from the Signal Corps -- to do something about dissipating warm fog. And that sounded like an interesting opportunity, and so I wrote a proposal and got funded on that. And that was the beginning of my

education in atmospheric electricity.

Droessler: And did this research activity supported by the Army Signal Corps include both laboratory and field work?

Vonnegut: Well, when A.D. Little takes on something, why, they try whatever. And I -- when I was thinking about warm cloud dissipation with electrical means, why, I began thinking of putting out [space charge?] in the air and then I was wondering what'd happen if it got convected, and then I wondered -- thought, "Gee, this is happening in the atmosphere naturally," and then I came up with an idea to explain thundercloud electricity that was very different from the charge-separation idea that had dominated this field since Franklin's time. And I was working on the Signal Corps work, but I wanted to work on thunderstorms to test some of these ideas. And a surprising and remarkable thing happened; my friend Howard McMahan, who was at Little for some time, went out to Enewetak for the H-bomb test, and out there he met Charles B. Moore, a chemical engineer who'd been working for this balloon company in Minneapolis, and --

Droessler: [Windsun?]

Vonnegut: No, it wasn't Windsun. This was... I think Windsun would have been an offshoot of that. No, it wasn't for Windsun, but... (pause) General Mills, I think.

Droessler: General Mills, yes. General Mills.

Vonnegut: And Charlie Moore was out there to make a polyethylene tube about a mile long, filled with helium, so that they could examine radiation from the bomb when it was set off. And he was in charge of this big project, and Howard McMahan invited him to come and work at Arthur D. Little, and Charlie turned up there, and Howard introduced me to him, and we got talking, and I found out that Charlie knew something about meteorology, and I told him about my idea on electrification, and he said that, "Well, that suggests an experiment, so let's do them." And you know Charlie Moore --

Droessler: Oh, yes.

Vonnegut: He's an extraordinary fellow. He is very bright, and he has enormous energy. At any rate, I met Charlie Moore, and had I not met him I think that this idea of thunderstorm electrification -- I would have forgotten about it, but he suggested, "Let's work on it!" And so we went down to Washington, and we saw [James Hughes?] and told him about this idea, and he seemed to think it was interesting, and we told him about our ideas on thunderstorm electricity and also that it might be playing a role in tornadoes. And I remember, he took us in to [Benny Peori?], to talk to him, and we had a little Van der Graaf with us, and we put some dust on Manny's desk and turned on the Van der Graaf, and gee, it made a wonderful wind and the stuff blew all over the place, all over the desk. And I guess we were alarmed, or maybe Jim was, that Peori would get mad about this, but he thought it was great. He enjoyed it. At any rate we got funded, and that

was the beginning of my involvement in thunderstorm electricity.

Droessler: Let's just explain for the record that both Benny Peori, who was the chief scientist in the Office of Naval Research, and Jim Hughes was a meteorologist in the Office of Naval Research -- so you were talking at the ONR, and you got some support, then, from the Office of Naval Research for your work.

Vonnegut: Well, if it hadn't been for Howard McMahon and for Charlie Moore and Jim Hughes and ONR and Manny Peori, why, I'd never have gotten involved in this stuff. And a big surprise I had, a little over a year ago, was when my friend Howard McMahon died. He subsequently became president of Arthur D. Little for a while, and he became ill and died. At about the time of his death, I was talking with Charlie Moore; I had assumed -- I had thought, "What a wonderful thing it was I happened to meet Charlie and that we got involved in this stuff," and Charlie told me something I had not known, and that was that (inaudible) Howard McMahon had said he'd like to have him come to Arthur D. Little and work with me! He never told me about -- I thought this was a happy accident; I didn't know that this was a...

Droessler: The marriage had been brokered.

Vonnegut: (laughter) No, I had no idea, and...

Droessler: Well, that was wonderful, I mean, that he had so much insight into your personality and your character and what you wanted to do --

Vonnegut: And Charlie, yeah.

Droessler: And Charlie! And he saw the two coming together as this...

Vonnegut: I told Jim Hughes about it, and his comment was that probably Howard was just as surprised as anybody that it worked. (laughter) I will say that Charlie is not the easiest person I've ever worked with. (laughter) But he sure as hell is the best. (laughter)

Droessler: Well, he's really a bundle of energy and ideas, and he just loves to get moving and get things organized and --

Vonnegut: Yes, and he is --

Droessler: "Let's do it!"

Vonnegut: -- a person of the highest integrity. I think he's marvelous, and as I've told you, I think that it was very sad that he didn't get elected to fellowship in the AGU, and I'm remiss that I haven't started this over again. But Charlie was the first one to carry out the introduction of material into the ionosphere, to see how it affected the radiation and so on. He -- people thought about doing this for some time; nobody knew how to do it, and then the Air Force [Cambridge?] came to

Arthur D. Little and wanted to know whether we could do it, and we took on the job. And I was involved in it a little bit, and so were others, and we came up with some ideas that didn't amount to anything, but Charlie Moore had some ideas which were valid, which he carried out. He made the equipment, he went down and fired this thing, and the Air Force made this first glowing cloud in the upper atmosphere. And...

Droessler: So he used a rocket to carry the material up?

Vonnegut: He did, yeah.

Droessler: But he had to use the right materials, too...

Vonnegut: Well, he had to know how to disperse them. People had been saying, "Let's do this," but nobody had ever done it, and Charlie did it. And the Air Force people announced this new thing, the experiment that they'd carried out, and in the acknowledgement Charlie was mentioned. And when they fired the one and they got this lovely sodium cloud, why, Charlie said, "You know, from the pictures here we can figure out what the winds are up there." And these guys had just been interested in the radiation and the various levels in the sodium anodized (inaudible) excitation, and Charlie said, "Well, we can get the winds in the ionosphere from this -- look how this cloud's changing." And he figured it up and showed it to the Air Force, and they said, "Gee whiz," and they published a paper which they were kind enough -- a second paper -- to make Charlie a co-author. But yeah, he made an extremely important contribution to ionospheric physics.

Droessler: Well, let's continue now with your work at Arthur D. Little, and where did you go next, and what sort of a problem did you take on?

Vonnegut: Well, I was working with Charlie at Arthur D. Little, and he got an offer from Sterling Colgate to go to New Mexico Tech, to become a professor of physics there, which he did. And so I continued alone at Arthur D. Little, working on various aspects of thunderstorm electrification. And Charlie and I, although we were with different outfits, continued our association, and I went out there -- and have gone out there many summers -- to work with Charlie, and we've also written papers together. And Vin Schaefer invited me to come to Albany, which I did in 1967, and I've been working on various things here, including thunderstorm electrification, and have been doing some teaching. And then I was faced with the problem of retirement, and I got an extension and continued as a member -- as an employee of the University -- until... I guess it must be three years or more now, when I was told that this couldn't be extended any more -- my working there -- but if I would retire, why, I would get an extra pension or something, and I decided that this would free up a slot for somebody else, and I decided to do that but to stay on and work. And for a little while I got funding, but my funding stopped about three years ago. I'm unclear whether it was because of -- that I was pursuing an idea on thunderstorm electricity that was quite different from what most workers were following, so I guess my -- I didn't



get very good reviews, and certainly a part of the decision not to fund me resulted from that, and also from the fact that I'm getting old.

Droessler: Now, why don't you recall for us some of the specific work that you did at ASRC and, you know, one or more of the students that were associated with you over these many years here at the State University of New York at Albany.

Vonnegut: This is a dangerous thing to do off the cuff, because I'm liable to forget some of the more important ones, but I'll give it a try. I think a piece of work that I thought turned out remarkably well was done with an undergraduate, a senior, a guy named [Rich Pacerelli?]. And Pacerelli worked with me, and with Professor Henry [Chesson?] in the Physics Department, on altering the structure of silver iodide. We could make a crystal -- we could modify silver iodide; we could get it so -- silver iodide's about a percent and a half bigger than ice; we were able to shrink silver iodide crystals so that they were smaller than ice, and we found out when we --

Droessler: It sounds, to me, impossible.

Vonnegut: And when we -- the X-rays showed that we had got these crystals to the same size as ice -- it turned out they were best at nucleating. That -- smaller than that? Why, then they weren't so good anymore. And we found an optimum. And this, I thought, was a very nice piece of work that confirmed that the size of the crystal is of great importance in the nucleation phenomenon. And...

Droessler: Yeah, that really was a remarkable discovery. And the fact that you could shrink the size of the silver iodide crystal to approximate the size of the ice crystal -- the water ice crystal -- was just a marvelous, innovative idea, I think.

Vonnegut: And incidentally, I should mention that I couldn't get that funded. I had a proposal to do this, and they -- the thing got turned down, because they could think of all kinds of reasons why this wouldn't work. And so I just...

Droessler: You went ahead and did it anyway.

Vonnegut: Went ahead and did it anyway, yeah.

Droessler: And it did work.

Vonnegut: And it did work, yeah. And Pacerelli did a swell job, and...

Droessler: Now, in the weather modification experiments and the cloud seeding experiments that are still ongoing, you know, nationally and internationally, do the workers know about this crystal size phenomenon? Do they have that available to them?

Vonnegut: Not that I know of, and I am surprised, because to make this optimum crystal size, instead of using pure silver, you use copper, too. So you can make

the stuff cheaper, because it doesn't contain quite so much silver. And I -- so far as I know, none of the operators are using it, but it's a strange world.

Droessler: Even though it would provide a more optimal seeding material for them, and a cheaper one, they still go on their old paths.

Vonnegut: That's right, yeah.

Droessler: (laughter) Human nature.

Vonnegut: Yeah.

Droessler: Yeah. Any other student you would like to talk about, and his work, and the work with you?

Vonnegut: Oh, I'm sure there are many. I had... (break in tape?) One of my first graduate students was excellent, and he worked with me on the -- on experiments or activities related to the idea that electricity may be important in tornados. And Bob carried out -- well, he constructed a laboratory apparatus to investigate the effect of a vortex on high-voltage discharge, and he constructed an apparatus in which we were able to make miniature vortices with high-voltage discharges. And he built the apparatus, carried out beautiful experiments. In addition, he went into the field -- in some cases, he looked at tornados, but he did a lot of work calling up people who had seen tornados and getting information from the real tornado experts, the people who've been up close to them. And he published some very nice papers on this, and his skill at talking to people -- which is evident when he is doing his weather programs -- worked beautifully over the telephone, and he would call up people and talk to them and make tape recordings of what they had to say and would find out other --

**END OF TAPE 1, SIDE 1**

## Interview of Bernard Vonnegut

### TAPE 1, SIDE 2

Vonnegut: I had hoped that Bob would continue to do research -- laboratory -- theoretical, anyway -- in atmospheric science, because he was very good at it. And I suggested -- he said he wanted to get a job, and I suggested that he might look at Arthur D. Little, where I had formerly worked. And he went to Arthur D. Little, and I gave an excellent recommendation, and he became an employee there, and he had some ideas on how surface-active chemicals might affect the growth of liquid particles in warm clouds. And he wrote a proposal on this at Arthur D. Little and got funded and built a beautiful vertical wind tunnel, a novel design in which he could hold small water droplets at equilibrium in an updraft and examine their behavior, how they coalesced. And while he was there, working at Arthur D. Little in Cambridge or Belmont, he had somehow had an offer to do the weather on a tiny little TV station, a very low-powered affair. And he would do that, I don't know, I guess maybe once a day or something, and then somehow he received an invitation to go to a much larger TV station in Providence, Rhode Island, about 50 miles away. And I guess he was commuting and was a TV weatherman in Providence. And he wasn't there too long, and he received an offer from one of the major TV stations in the Boston area, and so he began doing the weather there. And a little while after that, he was invited to be the weatherman on the *Today Show*, and so he, I believe, moved to New York and was on the *Today Show*. And he was on it for a year or so, I guess, and I know that -- he told me that when he accepted this job with NBC, that he looked upon it as an opportunity to educate the public about science, about meteorology, because Bob is basically a scientist, and a very good one. And he was disappointed, I know, that he didn't get more opportunity to talk about [the?] science. And then -- I don't know the details of it, but I think maybe Bob was on vacation, and they had a substitute come in and do the weather on the *Today Show*, which was -- I'll think of the man's name; he's still doing the weather; he's not a meteorologist...

Droessler: His name is Willard.

Vonnegut: Yeah, Willard Scott. Yeah. Willard Scott took over. And Willard, I guess, made a -- became very popular --

Droessler: Extremely popular.

Vonnegut: -- and somehow it was suggested that he and Bob Ryan exchange jobs. And so Bob went to Washington, and I know -- well, I've heard that -- well, I've occasionally seen him when I'm out there. He's doing a first-rate job.

Droessler: Yes, he's first-rate in his work there, and he's known nationally. And he's now the national president of the American Meteorological Society.

Vonnegut: Now he can tell the public about science and meteorology, make them

understand it, without cutting corners.

Droessler: Yeah. And he does that.

Vonnegut: He does that.

Droessler: Yeah, and he goes out to --

Vonnegut: And he's, I think, a... (pause) We're extremely fortunate to have him heading up the AMS.

Droessler: Well, I think he was very fortunate, too -- and I don't mean to pat you on the back -- but I think he was extremely fortunate to have you as his college professor, helping him understand how to do good science, you see?

Vonnegut: Yeah, well --

Droessler: So it works both ways.

Vonnegut: -- it works both ways. I was sure very lucky to have him for a student.

Droessler: Now, Bernie, you've received funding from several of the government agencies that support research...

Vonnegut: Yeah.

Droessler: Did you ever get involved in the space program?

Vonnegut: Yes, I became involved in the space program in connection with the space shuttle. A friend of mine, [Otto Vaughn?] at the Marshall Space Flight Center, told me that -- in a few years -- that the shuttle was going to be flying; was there anything that I thought we could do about lightning from the space shuttle? And I said yes, and he said, "Why don't we put together a proposal?" Which we did; it was -- I guess we -- I found out about it, and it was a rather short time to do it, but I put together a proposal to take motion pictures of lightning from the space shuttle, and also to have a photocell that picked up the optical signature of the lightning. And we were pleased because, out of about 200 proposals that were submitted to go on the second space shuttle flight, we got funded, and so for several years Vaughn and I had funding from NASA. And we had three -- we had an experiment on the second, the fourth, and the sixth space shuttle flight -- something of that sort. And at that time I was the [PI?] on it, and now Vaughn is continuing that work and is getting some elegant pictures with -- now taken, I think, almost exclusively with video cameras -- of lightning.

Droessler: Are these cameras that are handheld by the astronauts, or are they part of the space shuttle itself?

Vonnegut: Our experiment, they were handheld; in recent work, I think some of them

are handheld and they may also be making use of some fixed ones.

Droessler: Well, that's very exciting, to look down on thunderstorm phenomena from above...

Vonnegut: You've never seen those?

Droessler: No, I never have.

Vonnegut: Oh, they are magnificent. And we're now getting to the point -- I think we've got a few flights now, where we have lightning over the US, where the lightning is being recorded by the lightning network, and we now have a few cases where we can see the lightning from the space shuttle and also are picking it up on the network.

Droessler: Were there some unexpected lightning phenomena that you observed?

Vonnegut: Well, I would hesitate to say that *I* observed... In recent flights, they've gotten cases where they (inaudible) apparently seeing these very rare discharges that go from the top of the cloud up into the upper atmosphere.

Droessler: Which was not expected?

Vonnegut: Well, we knew such things occurred, and we finally got to see them. And in the past, some astronauts have given stories about seeing lightning going horizontally in cloud systems for hundreds of miles, and we've now confirmed that. We have lightning discharges that go for many hundreds of miles horizontally.

Droessler: Well, that reminds me, you know, of the immense amount of information that we received from the very early satellites about the cloud patterns and how one storm system affected the other and how cloud patterns flowed from one to the other to the other, which we had really not been able to confirm by looking up, but it was relatively easy to do this by using the satellite photos.

Vonnegut: We are seeing what appears to be relationships between lightning occurring at two spots quite a distance apart, and we don't understand that. (break in tape?) When you see a cumulus buildup -- a thunderstorm that's presumably penetrating into the stratosphere, and you see these cumulus buildups -- that's where you see the lightning, where this is happening -- convection and the lightning. Which is something you would expect for several reasons. Tomorrow, if it -- (inaudible) you're going to be coming over to the University; you might like to look at the lightning network, and you might like to talk to [Anton Simon?], the guy who noticed this association between the strange electrification of the Plainfield Tornado and what went on. And he is excited about what he's finding out, finding an association between the polarity of storms and the occurrence of hail, and he is an enthusiastic, bright guy and has -- I don't know whether you know him; you've probably met him or maybe heard his talk at San

Francisco?

Droessler: Yes.

Vonnegut: Well, Anton grew up in South Africa; his father's a -- I think -- a prominent surgeon. And the family moved to New York, and Anton went to high school there, and I guess he was a big chess expert there, and then he became interested in the atmosphere and came up to Albany to study atmospheric science. And shortly after he arrived, why, Lance Bosart realized this guy had an extraordinary understanding of what went on. And Anton continued on in atmospheric science and I guess was -- I understand, at times -- giving Bosart a run for his money when it came to forecasting. And when it came time for Anton to graduate and get his degree, it turned out that wasn't possible, because he hadn't had enough math. He didn't like math and did not have enough of it, and so he transferred to geography and got his bachelor's degree. And Lance, bless him, kept him on! And I guess Lance is still trying to get him to take some math, but...

Droessler: (laughter)

Vonnegut: But Lance recognizes that this is really quite a guy.

Droessler: Yeah. That was a very nice paper that he published recently.

Vonnegut: Pretty good, for a guy without any degree and who did it all on his own...

Droessler: Yeah, very nice.

Vonnegut: That was a *damn* nice paper.

Droessler: Yeah.

Vonnegut: You bet!

Droessler: And that was his first publication in meteorology?

Vonnegut: I don't know.

Droessler: Possibly.

Vonnegut: And I told him -- when he told me -- what happened was, he told me this discovery he'd made, this thing he observed, and he said, "I think you might be interested." I said, "Am I interested!" I said, "You ought to write that up; I suggest you send it in to *Geophysical Research Letters*." And he said, well, he didn't think the meteorologists would see it there, and besides, he wanted to write up some more... And he kept writing and writing on that and sent it in to the *Monthly Weather Review* and it got turned down there, and I kept telling him to just put it on a postcard and send it in -- "What you've done is very important." Well, it took several years and a number of rejections; he got some very nice

(cough) reviews that played an important part in improving his paper, and he finally got it accepted in the *Bulletin*.

Droessler: Yes.

Vonnegut: And just a matter of, I guess, a month ago, he got a thing from the editors of the *Bulletin* with this comment on his paper. I forget who the authors are, but they are the tornado experts, and they're pointing out that this storm wasn't really as singular as Anton says it was, and furthermore that -- he didn't realize it, but that [another?] storm system 150 miles to the east *did* make tornados. He said that that one didn't make tornados; it turns out that it did make a pretty good one in Canada. But now Anton has got to get to work now and -- to reply to (laughter) this thing, which is the beginning of an excellent thing. I mean, this is what science is all about!

Droessler: Yes, yes. Yeah. It's really --

Vonnegut: And, well, he's --

Droessler: And you were saying he --

Vonnegut: He didn't get around to writing that right away because he had planned on this trip to Bolivia, and he was gone for, I don't know, damn near a month. And now he's back, and he's getting to work writing this reply to -- so I hope this starts a lively exchange in the *Bulletin* that will liven up this backwater of atmospheric electricity.

Droessler: That's right, and bring the atmospheric electricity and thunderstorm electricity and tornado electricity to the fore again.

Vonnegut: Exactly, yeah.

Droessler: Mm-hmm. Great. Well, this ends the interview with Bernie Vonnegut in Schenectady, New York, on the 9th of May, 1939, and --

\_\_\_: '93.

Droessler: 1993. And I would like to thank you, Bernie, for --

Vonnegut: Well, thank you for inviting me. It's great to come over here again and see, you know -- I enjoyed yesterday very much. And, gee, I guess if things work out I'll see you tomorrow again!

Droessler: Yeah. Well, you're one of the precious guys in atmospheric sciences. I've always thought that. You know, one of our *different* fellows, you know? And that's what atmospheric science is made up of, of a lot of unique and interesting and very vital people like yourself. So, thanks again for the interview, and many happy days ahead.

Vonnegut: Many thanks to you, Earl, doing this. I look forward to hearing some of these tapes that you've been doing, that I think are going to be a real treasure and important for those of us who have been in the field -- be a lot of fun to listen to -- but even more important for the new people coming along.

Droessler: That's right, yeah. Thanks again.

**END OF INTERVIEW**