BS:  This is an oral interview with Dr. Nate Gerson taken as part of the Oral History Project of the American Polar Society and the Byrd Polar Research Center on a grant provided by the National Science Foundation. The interview was conducted by Brian Shoemaker at the Cosmos Club in Washington, DC on the 24th of October, 2001.

Well, Mr. Gerson, as you pointed out . . .

NG:  Call me Nate.

BS:  OK, it's Nate and I'm Brian from now on. This is your life and I'm interested in your background and what you brought to the International Geophysical Year and polar research. Tell me where you're from and how you got into your field of work.

NG:  Gosh, it's such a long story. I hope I don't ramble too much.

BS:  Well, we'll just listen to you here and . . .
NG: OK. First, I was born in 1915, October the 15th, in a place called Chelsea which later was absorbed by the city of Boston. And my life during school years was more or less normal. I discovered, though, that I had a propensity for the physical sciences and I would give up baseball and other sports all of the other kids wanted me to play in favor of looking at my algebra and physics. And this continues. And in high school, I discovered that MIT had a series of lectures on physics. The teacher would hand out tickets and I was surprised after a series of these that I was the only one who persistently wanted the tickets which was, so to speak, instructive in its own right. Nonetheless, I liked physics and I continued in it through high school. When I finished high school, during my last years in high school, I took the college entrance exam tests, now called the SATs. I was admitted to MIT, but we did not have the $500 a year to allow me to enter the college, so I had to disregard that and I entered the work force. My father had left home by this time, and I got a job at 60 hours a week for $6. And much of the time I had to carry these bags of coal, pea coal, for the black cast iron stoves that people had to heat their homes with. I would take three or five, sometimes, 25 lb. bags and carry them up three flights of steps to deliver them. Some weeks I was tired.

In any event, I soon discovered there was something called the Massachusetts National Guard. I joined it because they gave us a dollar a night for the routines and every three months, you got a $12 check which I brought home to my mother. Now, someplace in this period, I took a variety of Civil Service Exams, because I discovered the Civil Service System. And after coming home from maneuvers with the Massachusetts National Guard one summer, my mother, who had gotten a ride to the Armory with a friend, picked me up and told me on the way home that I had a job in Washington. She was convinced that President Roosevelt himself had picked me out because he saw the plight of the family, as she put it. But in any event, a day or so later, I got on the train and went to the great city of Washington.
I was uncertain about the job or whether they would accept me. So, the first thing I did was check all my baggage in the lockers which they then had at the Union Station and I walked over to the Government Printing Office. While there, I had to take a physical exam. It then involved picking up a load of books stuffed into a mail bag. The mail bag must have been about three yards long and a yard wide. And every time I lifted it, the books slid from one end to the other and I was afraid I couldn't lift it. But, I was so determined that the women who were watching me to judge my strength said, "Stop, stop, stop, you'll hurt yourself. You passed."

(50)

So, I went out and found in the paper a room at 314 A Street, NE. I think it was $3.50 a week without meals. I was getting $90 a month, minus a 15% federal discount because of the Depression. And I sent 60% of that home to my mother and I lived on the 40%. Now during this period, I still took some Civil Service exams and I was somewhat dissatisfied because I just didn't have a predilection to be a laborer all my life. But in any event, I was invited to take a job with the Railway Mail Service in Boston. And the first test I had . . . they made arrangements for me to take another test at the local post office which is now opposite Union Station. So, I went there and they gave me a bundle of little cards and a box and I was to learn how to sort these into various boxes. I would practice at night with these things. Unfortunately, I never turned them over, but I'll tell you about that later. And when I thought I was ready, I called them up and they had me come down and take the tests. When I passed, they gave me a pass on the New Haven-New Hartford and New York Railroad to travel from Boston to Washington until such time as I moved my mother back to Boston. Very nice of them.

But in any event, I got a room near the college district of Boston on the Boston side.
BS: *When you say the college district - what is that?*

NG: That was near BU-MIT.

BS: *Oh, I see.*

NG: Within sight of the river. Charles River. They had boarding houses there for students and I slipped in, so to speak, and got a room. And I then worked on the railroad and on weekends, I had time, I would travel back to Washington to see my mother. All this traveling, incidentally, was done on coach so I got pretty used to sleeping trains and cramped quarters on the old Washington Night Owl run to Boston. In the course of time, I found an apartment and I moved my mother up and we lived in what was then Dorchester. The work was rather arduous. I'd have to lift these mail sacks and dump them onto a box on the table and the older men would stand around and sort them into baskets that went into the big mail bags. And one night, I was really exhausted, but I finished it all faster than anyone realized. They told me to lie down and I lay down on these old mail sacks until we reached New York. In New York City, they had the Railway Mail Organization - the union - had hired or rented an entire room in one of the downtown neighborhoods within walking distance of Penn Station and they converted it to dormitories. They had these cots almost side by side, lots of showers. You signed in and when you got in, you told them what train you had to take out and they would notify you at the proper time.

Now the Railway Mail - the transportation industry - has a peculiar system. That is, you work only several days a week and you get the whole week's pay and the rest of the time is yours. One of the foremen, so to speak, on the Railway Mail Service, told me that he organized and had a real estate business on the side because he'd work two days
for the mail service and then three days on his real estate business and his wife took care of it while he was on the train. So, it was a pretty good system as far as I was concerned because you worked two days then had the three days - the rest of the week - off. So I enjoyed it. We had had to know when the trains changed their schedule and they changed rather constantly on the old routes to New England. There were times when, as a temporary, I could work for them the two or three days a week and they gave me overtime pay for that. So, my salary was rather nice. And my mother enjoyed the living. She really enjoyed the apartment.

(100)

BS: *You took care of her the whole time.*

NG: Oh yeah, yeah. I did until I was married. Then I had to take care of my wife. I was a bit dissatisfied, though, because this, again, was labor of a rather heavy kind. And in the course of time, I could pick another route on the Railway Mail Service, like the one from Boston to Montreal, but that would take years since I was so junior in the system. And the senior men had first crack at all these plush assignments.

BS: *They'd bring booze back, huh? This was during the Depression?*

NG: This was 1938 period.

BS: *Still Depression then.*

NG: Yeah.
BS: *They could go to Montreal and then sneak booze back across the barrier.*

NG: I wouldn't be a bit surprised. I didn't know about that though.

BS: *I know they did.*

NG: Now hold on. I learned a lot of things in my youth. But, let me continue. I didn't think I wanted to work for the Railway Mail Service constantly, so I kept taking these exams and one day I got a call, or a note from the government saying, "Appointment in the Weather Bureau - US Weather Bureau." So, I filled it in and I joined the Weather Bureau. There was my entrance into science and meteorology. Now, I should say something earlier.

BS: *And what year was the Weather Bureau appointment?*

NG: Hold on.

BS: *About '38?*

NG: '38-'39 period, yeah. Now prior to that, however, during the period before I went to the Government Printing Office, I had enrolled in night courses at MIT. It was part of what was called then the Lowell Institute - a grant by the Lowell family for students to learn at night. The courses were the same as those taught during the day by the same professors, but they were more or less curtailed and concentrated so that we had the first course just like we would have elementary physics at MIT the first year. Then we had some math, calculus, etc. Then we had various specialties. First I had to take courses in steam boilers and design, reciprocating engines and I learned a lot about thermodynamics
which is also physics. Electrical engineering. I knew all about heavy motors. I recall one
day I was in the lab at MIT and I was phasing in a sub-station, a power of 40 volts, and to
take a chance to see how far I could synch it in even though it was not quite in synch. So,
one day I overdid it and there were arcs this long of violet light. I was blinded completely
for about 20 minutes. I was afraid to move.

BS: *Violet light.*

NG: Yeah. You know the big arcs are always ultra violet. You wouldn't believe it.

BS: *Did it burn you?*

NG: No.

BS: *Didn't burn you. Hurt your pride.*

NG: But, it blinded me. Blinded me completely. Couldn't move. I didn't know what to
touch.

BS: *Sun-blindness. A kind of sun-blindness, in a way.*

NG: So, I stayed there for about twenty minutes. Finally, a guy brought a chair and put it
under my bottom, so I sat down. I learned a lesson. That is how far not to go.

BS: *Good education.*
NG: But in any event, when I was going through the physics course, I discovered one night that I was not keeping up. So, I went to the very beginning of the textbook and went through every page and did every problem and I did that in addition to trying to keep up with the assignments until I brought myself up to date. And at the very beginning of the course, the instructor told us that there are 500 of you in this class and less than 100 will graduate. You know what? He was correct. I graduated from that and then took another course. I also discovered I was no good at drafting. They had a course in machine design and in those days, power transfer was undertaken by gears and pulleys. So I had to draw pulleys from an angle. I never could get it at an angle, but an ellipse was . . . I could never get it straight.

I was the only one in the class who had to erase an entire sheet of thick paper and never could get my ellipse right. I didn't pass that one too well. But in any event, I passed all the courses and I had that behind me, then.

BS: *That was during the '30s, too?*

NG: That's right. So, I graduated in 1932 at the age of, I think, 15.

BS: *From?*

NG: English High School, Boston.

BS: *English High School in Boston. And that was from your night school?*
NG: No, that was high school. Now, I graduated Lowell Institute, of course, after I graduated high school.

BS: And you graduated from Lowell when?

NG: Must be 1934 period.

BS: And let me get this straight. Lowell is now, today, part of MIT?

NG: No. Lowell . . . they kept things distinct. The Lowell Institute was a grant by the Lowell family and then MIT was run as a college. But, the same professors that taught at MIT taught us in the same classrooms. So, whoever went to college at MIT, although we used to joke and say that it was, but I can't really say that it was. It was Lowell Institute. That has since been abolished, incidentally.

BS: So, you got a bachelor degree from the Lowell Institute.

NG: No, they didn't have a degree.

BS: Oh, I see. Just a certificate.

NG: Just courses, yeah. I took the electrical engineering course. And that's why I went and took power engine there. It stood me in good stead, incidentally, in later years.

BS: OK, you graduated from Lowell Institute.

NG: I wouldn't say graduated. I completed the course.
BS: *Completed the course -a certificate of completion.*

NG: Yeah.

BS: *Right, and you talked about the Weather Bureau.*

NG: Yeah. In the Weather Bureau, I was what was called a meteorological observer. And in the Boston office in those days, they produced maps showing the current weather situation for the United States. And one of the things I had to do in the morning was to take the map that was given me in hard copy - map, lines on it, lows, highs, isobars, isotherms - and cast that in metal -lead and titanium mix - and then run off enough copies to mail out to their distribution.

BS: *Original faxes? Were these the original faxes? Fax-weather-things?*

NG: It was pre that.

BS: *Pre-that, OK.*

NG: I had to melt the metal, pour it into this cast where it made the lines scribed in the casting. The lines were where the isotherms and the isobars were, write down the numbers so people would know what it meant, and then I would print that on a map that was standard. I discovered later on that my boss was impressed with what I had done. But, one day a really noted meteorologist that had been invited to Washington by the US Weather, Dr. Bierkness. . .
BS: _Bierkness, from Norway?_

NG: Yes, I gave a talk at MIT. I went to that and I could transcribe the notes that I made and I sent it down to the Weather Bureau to their Chief Scientist, Dr. Sarle, and he remembered that for many years, I discovered.

(200)

Now while in the Weather Bureau, I still wanted to go to college, but they transferred me to New Haven, so I moved my mother there. And then they transferred me . . . I went down from New Haven - I thumbed from New Haven to Washington. No money, you know. You wouldn't do that today. Too dangerous. And I spoke to some of the higher ups and told them I'd like to be assigned to a location where there was a university where I could work all night and go to school all day. So, finally they sent me an offer to go to San Juan, Puerto Rico, where there was the University of Puerto Rico. So, I left there and I wasn't certain my mother wanted to come. She finally decided that she wouldn't. So again I made arrangements to have 60% of my salary sent to her and I lived on the other 40%. And my salary at that time was $1440 a year.

BS: _That was late '30s, huh?_

NG: No, this was '41. Yeah, time passed. '38-'41 with the Weather Bureau, I think.

BS: _So, you went down to San Juan._

NG: That's right.
BS: A quick question - did you know Gordon Cartwright at that time? Gordon Cartwright, with the Weather Bureau?

NG: I've heard the name.

BS: He was in the New York office at that time.

NG: I've heard the name. I know of him, but I don't know if I ever knew him or not.

BS: He worked for Harry Wexler during IGY.

NG: Oh, did he?

BS: He was the first winter over with the Russians at Mirny.

NG: How neat.

BS: But, he was a heavy, and they sent him even though he was one of the heavies by then during IGY because the Russians sent a heavy to McMurdo.

NG: Oh, is that right?

BS: And then Mort Rubin followed him.

NG: Oh, yeah.
BS: Mort was the one that made the Weather Central at Little America the first year of IGY and the second year of IGY, Wexler came in and said, "Who's going to go next of Gordon Cartwright's caliber?" and there was only one answer. It was him. He's over here - lives here.

NG: Well, I'll tell you about Wexler. I met Wexler.

BS: I didn't mean to interrupt. Cartwright was active at that same time as you with the Weather Bureau.

NG: I know the name, but I don't think I met him. I knew Gordon Dunn. He was at the Hurricane Center at San Juan teaching there with Fuchs, David Fuchs. Norwegian. So, there I was in Puerto Rico. We released radiosohrn balloons all night and sent the data to Washington, and upper air wind measurements, etc. etc. So, I used to work from 10 o'clock to 0600. I woke up at 8:00. I lived on the premises. They had a charge for me to live in a room right on the premises. So, it was very quick. I worked outside. I got on the bus, went to school from 8 - I usually arranged to get there within the 10 minute window before you were considered late for class and I stayed there until 4:30 and some days, 5:30. And I would come home, eat, study, go to sleep for two hours, wake up at 10 PM, and continue and I did that for three years.

BS: So, school all day and work all night.

NG: Yeah. On week-ends, I was tired. I used to sleep a bit.
So, finally, I graduated Magna Cum Laude. I was lucky. They took a liking to me.

BS: *What was the subject?*

NG: Physics. It was in my blood. If you want to hear something interesting, while I was at the university, they came to me one year and said, "Look, if you can get into Med School, the government will pay all your costs for four years. Why don't you try it?" So, I changed all my electives to pre-med because I went into physics. And I took all sorts of stuff that really came in handy including organic chemistry. Also things, like biology, that I had always neglected earlier. I just wasn't interested. I became fascinated with it, but somewhere along the line, I discovered I didn't like medicine as well as I liked physics. So, I gave it up. I remained in physics. And do you know how many lives I've saved by not going into medicine? I'm not certain I regret the decision. I enjoy what I do. I still do.

They took a liking to me. There were two professor in particular. One of them was Facando Bueso. He wanted me to stay and teach after I graduated and he promised me that within they would send me to the University of Chicago so I could obtain a doctorate, all expenses paid.

BS: *Oh wow.*

NG: So, I considered that.

BS: *Now who was the gentleman who offered you this?*

NG: Facando Bueso. After he passed away, the university now has the Facando Bueso Physics Building now up there. You'll see it on Rio ____.
BS: So he was one of the heavies at the University of Puerto Rico.

NG: Oh yes, you bet. Wonderful guy, with all sorts of stories about physics. The other one was Dr. Kendrick, and I'll come to him shortly. Kendrick was organizing some radio studies of hurricanes, among other things. He had his electrofinding system and where the most noise came in, that must be where the hurricane is, with all the lightning strikes. So, if he had three of those over the Caribbean, he could locate the hurricane. And he had other experiments going. He was always funded. He used to tell me, so you don't forget, I was sending my mother all this money - so my income was limited. He would tell me, you're crazy for buying US Bonds, buy stocks, stocks, stocks. Now, if I had enough money and even if that's $1000 in 1943, do you know how rich I'd be? He was right.

BS: You're rich now. I was talking to, was it your daughter on the telephone? Who was the lady I talked to on the telephone? That your daughter?

NG: Oh, my wife.

BS: Your wife? Oh, that's your wife. OK.

NG: Best thing that ever happened to me.

BS: That's why I said you're rich.

NG: You bet. Absolutely. She made me the person I am, honestly.
BS: *You give her all the credit.*

NG: She had _____ and handed it to me.

BS: *Maybe she wouldn't want the credit, eh? That's a great. I'm glad. I have a wife like your wife.*

(300)

NG: Sometimes I think, and I cannot say this out loud, that no man is as kind to his wife as he thinks he is. I'm afraid to say that out loud. You didn't hear it.

BS: *I think I'll agree with you.*

NG: Anyway. Where were we?

BS: *Well, you just mentioned that Dr. Kendrick could locate hurricanes through pressure patterns, right?*

NG: Now, he wanted me to work for him, even during the period I was going to college. And I would have gotten a big increase in salary - possibly double - but, I felt it was more important for me to continue and get my degree, so I did that. However, he took a great liking to me also and during this period, he used to meet with people in Washington all the time. And he arranged that after I left Puerto Rico, I would get a job at the Washington office with the Weather in the technical investigation section.

Now, before that he inveigled me into doing an experiment which I look back and marvel at. There was a battery - you know, I was there during '41, and you know what
happened on December 7th. So, immediately everything changed. For example, no gas. Tankers were sunk. The streets were deserted. You could walk down the streets because there was no traffic. We had trouble with the buses. Well, we used to call them ______. I learned Spanish since I was there. See, I needed the bus to go to school and come back. We also had to black out all of the windows because we had to work and the lights couldn't be seen, so we blacked those out. I used to, at that time, sleep under mosquito netting because of malaria - mosquitoes. Some night my foot would touch the mosquito netting and I'd wake up because of the bite and I would always hope it wasn't malaria. Thank goodness it never was. But, in any event, we lived through that.

BS: *Now what?*

NG: Then I graduated. I stayed there an extra few months and I took courses even then and I finally left in December of '44. That's not right . . . December, '43, to go to the great city of Washington. And they sent me by plane. They sent me down from New York to San Juan by boat. First big luxury liner I've ever been on. The government had a peculiar arrangement, namely they subsidized the ships to carry the mail and the ships, in turn, provided X free rooms to the government to use. They sold as many rooms as they could and then the government people would get the leftovers. My leftover was first-class on the deck.

BS: *Interesting. So, you're in Washington, DC, mid-war then.*

(350)

NG: That's right.
BS: *What was your job there?*

NG: Aha. That's when things became interesting. I sort of liked that. I could use my physics too. I had a boss, Louis P. Harrison. He and Wexler would argue all the time on technical matters. They liked each other personally, but they could never agree on technical matters. Louis P. Harrison was a stickler, absolute stickler. He was harsh and firm, but very honest, even-handed. I learned a lot because of him and his tutelage. That is, you had to be precise. He was sick one period and we got a wire coming from a place called Denver. At that time, you know the aircraft had altimeters with their pressure systems - not the radar. So when the pressure was calibrated in feet or whatever, so the pressure would activate them. Now, obviously the pressure at Denver a mile high was a lot different than that at Boston down at sea level. And you had to take into account the weather systems. But, it had to be calibrated so planes would know they were approaching the ground. And these were essentially aneroid barometers converted to altimeters. So, we had to take the pressure maps which were based on sea level pressures and bring it up atiabatically to the pressure of the locality. Now, I had never done this before. I had never thought about it. But, I knew my physics and it was nothing but the atiabatic equations, so I took a chance and never having done this before I booked it out. Experimentally . . . plugged in the comps. We calibrated the results and sent them up to Denver. Guess what? When my boss came back, he said it was exactly the way it was supposed to be done.

BS: *They're still doing it.*

NG: I don't know if they're using altimeters that way or not. I thought it was all radar now.
BS: Well, that's the way a plane determines how high it is from the ground, but as far as figuring out what the pressure altitude is in Denver, planes still fly - it's changing - but, they still use pressure altimeters as their main altimeter.

NG: Oh do they?

BS: But, you can recalibrate them as you go along by calling the ground station and say, "What's your pressure altitude?"

NG: Yeah, well, I worked out those equations which are more or less standard. I had some trepidation.

BS: They're still using them. We have GPS now and that gives you a vertical as well as, you know. Planes have a radar altimeter which is what you use when you're landing, but if you see a mountain in the distance, your radar altimeter doesn't help you. You have to get over that mountain and you can't fly up to it and do this, so you have to know the height of that mountain pressure altimeter wise. That's what keeps you from hitting those mountains. So... your equations. That's great!

NG: I enjoyed the job, honestly. I used to come back and work at night, I was so intrigued.

(400)

In any event, I did a lot of things there and Harrison was always precise, so if I made a mistake, he would ____ me no end down to every minor detail. But, everything I
did he accepted, only it was like a quiz at the end of a course, only it was periodic or aperiodic.

BS: So, you spent the remainder of the war in Washington, DC with the Weather Bureau?

NG: That's right, until '45. Now, at this time, I'll tell you how I met Wexler. One night I became intrigued - you know what the pseudo atiabatic equation is?

BS: Yes.

NG: You know when you have a gas and you reduce the pressure, it loses temperature according to this atiabatic equation. And if we have water vapor in that, that changes the equation into a very complicated thing, I think it's a [Klaperton-something] equation - a transcendental equation, very different to deal with. I became intrigued with it because I had to make up all sorts of new thermodynamic diagrams for the Weather Bureau. So, as I was doing the other, I thought about this. Finally, when I finished designing all the other diagrams, I worked on that equation - what I called Newton's method of approximation. I learned that in college, I thought I'd apply it. And I worked it out and I got the equation at the top of this pseudo-atiabat, as it's called. And so my boss was rather intrigued with it and he showed it to Wexler. That's when I met Wexler. Wexler says, "Gee, I had a graduate student at Chicago. I gave him the problem and he couldn't solve it." He looked at the results and because of the approximations, something wasn't right at the tail end of my computations. We never worked it out. Maybe with better computers . . . I had these old hand computers for decades. And I spent hours and hours a month working to one or so in the morning at the old Weather Bureau office. At any event, I did that. Then I worked out a TD gram - another thermodynamic diagram. If you look at it and look at the
area under certain curves, it tells you how much energy is involved. So, you know a big thunderstorm or a little thunderstorm because you know how much energy was available to squeeze out of the atmosphere. So, I arranged a new one - new style that was more amenable for the meteorologists in the field to use. And all these were done and issued and they were sent to the three services - Army, Navy and Air Corps. They used to come down WBAN charts.

BS: What are the charts again?

(450)

NG: WBAN - Weather Bureau Air Force and Navy, or Army and Navy, at that time.

BS: So, that was right after the war or towards the end of the war?

NG: No, it was during . . . the war ended when?

BS: '45.

NG: OK, yeah. That was just before we were married.

BS: So, after the war, you did the same thing, continued with the Weather Bureau, or . . . ?

NG: I was still working at the Weather Bureau.
BS: And you met Wexler through your physics and I guess you worked with him for a while.

NG: No, no. I didn't. He just came into the office. I don't know if he was still a Major in the Air Force or not.

BS: Yeah. He was quite a leader, I understand.

NG: You bet. And I got into a time with him later on. But, my life changed. We got married in 1945 and I began to quibble with my boss a little bit because I felt I should have a raise. So, they finally got somebody to come interview me to see what I did, and that somebody recommended I be given three grades higher.

BS: Wow.

NG: Of course, that did not sit well with the Weather Bureau, so after they finally gave me a one grade raise, they didn't agree with it. They said it would set a bad precedent. Now during this period, guess who showed up in the office one day? A professor Kendrick - George W. Kendrick.

BS: Same guy from before?

NG: That's right. Exactly. He just said, "Hi, Gerson." That's what he used to call me. And he spoke to my boss and told my boss he wanted me to work for him - Kendrick. That didn't go off too well with my boss. Now, the first time, I just listened. I got down a meteorology book - big book - and I looked at it so they wouldn't see me because I didn't know what to say or what the outcome would be. Hadn't discusse it with my wife or
anybody. So, they went over me back and forth. Remember the Rhyme of the Ancient Mariner?

BS: *Um-hum*

NG: They tossed the dice to see whether the man would live or die? So, there was my fate being decided by these two moguls, so to speak. Because I didn't know what to say. I hadn't discussed it with my wife. Didn't know what the job was. But in any event, about eleven o'clock my boss became exasperated and said, "I cannot give you an answer. You have to speak to the Chief of the Weather Bureau."

(500)

Well, Kendrick gets on the telephone, calls the Chief. "OK, I'll be right down." So he grabs me and off we went. I would normally not have seen the Chief of the Bureau for another 25 years. There I was in this great big plush office, all these big leather brown chairs.

BS: *And the Chief was?*

NG: F. W. Weikeldurer. He got to know me afterwards with the IGY. That's where I learned - I know a lot of these people. And I sunk in this big chair hoping they wouldn't see me. I never seemed to know what to say. So, they discussed pleasantries for a while, then Kendrick told him what he had in mind. He wanted me to __________. "Gerson, what do you want to do?" I hadn't the slightest clue. Honestly. That's a true answer. [So, I _____ . ____ noticed.] They both accepted it as a "yes," so they transferred me to the US Army Air-Force in 1946.
BS: *That was Kendrick? Kendrick was there?*

NG: Kendrick was . . . that's right. At Fort Monmouth, New Jersey, at what was called then the Watson Laboratories dealing with radar, navigation systems and what not. So, I left one Monday morning - I told my wife, "Be back on Friday night." You know, a young couple, she was bawling on the platform and I waved good-bye on the train and I went to New Jersey, got a room, discovered where the labs were, went to the labs and went to work. And you know, first it's all ____. You don't quite know what to do or why. Don't know anything. So, one Thursday - Thursday of that week - secretary came in and gave me two envelopes. When I looked at the first one, there was a one-way ticket to Ottawa and the second one was 120-day travel orders. You know how long that is? - Four months?

BS: *To Ottawa?*

NG: Now wait. The travel orders had every known and unknown place in Canada you can think of, many of them beyond the Arctic Circle.

(550)

BS: *So what were you to do there?*

NG: Now wait. The objective of that office where Kendrick was the Chief Scientist was simple. They were out to throw up a long-wave navigational system to cover the Arctic and it was going to be - do you know your radio frequencies? It was going to be LF.
BS: *LF?*

NG: Yeah. Low frequency.

BS: *Low frequency.*

NG: Actually, this experimental system was 180 kilohertz and there were three transmitters. And they worked in pairs although one was common, so it worked with each of the two slaves. One was the master, the other two of them were slaves. Now, in principle, very simplified, here's the objective. If you have two transmitters and you know their distance apart and you would take the time difference and you're someplace, if you're right between them anyplace in this mid-normal line and the time transfers from that transmitter A to transmitter B, so the time difference is zero. Right?

BS: *Um-hum.*

NG: OK. But, if you're close to the one, your signal A will come first and B will come second, so if you draw the line, you get hyperbolas around each transmitter. So, if you know which one . . . now if you don't know anything else, all you know is on this parabola or that parabola, so you don't quite know where you are. And if you have a third transmitter, you have another set of lines where they cross is where you must be. Right?

BS: *Yes, yes. I understand. Later became LORAN. LORAN is similar.*

(600)
NG: That's right. It was so successful that it came across installed globally as LORAN-C at 100 kilohertz and that's still in existence today. Now, our objective, though, was to see if it worked across the Arctic - our US Air Force objective.

BS: So, this was Air Force then. Army-Air Corps.

NG: Army-Air Corps. Yeah. I'll tell you how it split later on.

(End of Tape 1 - Side A)

(Begin Tape 1 - Side B)

(000)

BS: We were discussing the development of LORAN and its use in the Arctic.

NG: LF LORAN.

BS: LF LORAN, right.

NG: Now, I should explain there was something called SS LORAN which was . . . no, LORAN A was standard LORAN and that was at 2 megahertz and it was good for the ground wave range only - for distances of only several hundred miles, if that, over water, not over land because of absorption by the land. So, if you put a transmitter in the wrong place, too far in from the coast, you couldn't . . . they had to take some down and reuse them. Somebody said, "Aha, that's because it's reflected by the ionosphere. I can extend
the range by double." It never worked. But, I don't want to give you a big tutorial on those things now.

BS: *OK, here you are up in the Arctic trying to see if it works.*

NG: Now the first thing you must do with a navigational system is, you must check its accuracy and secondly, something I learned from Harrison, never believe anybody because the people with the ____ system will always claim it's the best one in the world. Somebody independent who couldn't care less must examine it and check it's validity. And there we were in this Texaco evaluation section checking the validity of LORAN C as it became known - this low frequency LORAN. Now there were a number of stations that stretched from western Hudson Bay to Alaska and also into mid-level Canada - mid-latitude Canada. In addition, these were ground stations whose positions we well knew. So, you can check the location as determined by low frequency LORAN and compare that with the true position of the station, because that's the way you evaluate navigation systems. Half of ____ true. Right?

BS: *Yes.*

NG: Now, in addition, to check things at extreme distances, there were three B-29s stationed at Edmonton. And these would fly from Edmonton almost to the North Pole, just about to the North Pole and almost to Bermuda, checking navigational accuracy of the system. Now, let me pause and say this. It was really difficult for the aircraft to really get a good description, so to speak, of the error involved because their only other means were the transits and similar things. They could not use their compasses at those latitudes.

BS: *You can use sun compasses in the summer.*
NG: Yeah, a sextant.

BS: Well, a sun compass and a sextant.

NG: __________ it's like this. So, then you get the other one with LORAN C and you were never quite sure how good your fix was, whether the ground station was right here and it didn't move last night, so what - and something I learned that I applied many times after this was what I called the station wandered. If the station was right here, if we take a reading once an hour, holy cow, you get a scatter plot don't you? You've got your propagation. That's right. The ionosphere is a _____ aurora.

BS: *The ionosphere screws it all up.*

NG: That's right.

BS: *And the sun screws up the ionosphere.*

NG: So, even today, no matter what navigation system you have, you have the same problems involved. Show me the scatter plots, even with GPS, there's a scatter plot. You'd be a bit surprised if you want to check this out every day. But at any event, that's another long story. Don't want to get into that.

BS: *I've got to ask you a question here. Now what . . . knowing the Army, there must have been a name for this project. What did they call it?*

NG: Musk Ox, then Operation MUSCALF. And then it became Project Beatles.
BS: *Later was Project Beatles. OK. And so you were working out of Edmonton. You lived at Edmonton?*

NG: You know Canada?

BS: *Oh yes, I was born there.*

NG: Really? Where?

BS: *Quebec. Northern Quebec.*

NG: How neat. Lovely place.

BS: My dad was consulting as a mining engineer and he was on a job up in Noranda, Quebec - Noranda mines.

NG: I've heard of them.

BS: *It's the biggest coal mining company in the world now. That's where he got his start.*

NG: There used to be coal mines at Yellow Knife. I had to go to that one once, too.

BS: *Anyway, I know the area quite well. Did you know a guy named Pete Greenaway then? Canadian officer. The Canadians had to work there. Pete Greenaway?*
NG: Yes, I know him.

BS: *Very good friend of mine. He's a general now, retired, living in Ottawa.*

NG: Well, you must tell him hello for me. I’ll bet he remembers me.

BS: *I know he will. He just became an honorary member of the American Polar Society.*

NG: Did he?

BS: *Yes, he joined Admiral Byrd and others because he became a great navigator and wrote books on it.*

NG: Do you know where served after LORAN C project?

BS: *Well, he had a couple tours with SAC in the United States, plus tours all over Canada.*

NG: Was he once the CO at White Horse?

BS: *Yes.*

NG: That’s where I met him again years afterwards and that was my last job.

BS: *OK. Let's talk about Musk Ox. You say later it was Operation . . . something else?*
NG: MUSCALF, then Beatles.

BS: Later was Project Beatles.

NG: Yeah. Now don't forget and this is going to make me ____ with the LORAN C system, don't forget your travel time of radio waves depends upon the refractive index, doesn't it?

BS: Yes.

NG: Light travels slower in glass than in a vacuum. So, when you have extreme temperatures in the Arctic, which I well know because of my previous experience with Harrison, and plotting the weather maps, it would change the refractive index qualities of the atmosphere. So, it would introduce errors into the LORAN C system. So, I took a look at those at Yellow Knife and I did find that there are [corrections? coordinates] that had to be applied - we never applied them. They ignored them, ultimately. But, there were errors that would creep in because of the meteorology and the low temperatures involved. Now I gave a paper on that at the Watson Laboratories.

BS: On the refractive index.

NG: Yeah, affecting navigation.

BS: Of radio waves.

NG: Yes. And there was a Captain Albert C. Trakowski there who took note of it and do you want me to go to that?
BS: **Well, here you are up in the Arctic. What were the results?** **Well, tell me something about** the problems that you had? Did you fly with the Air Corps any of the times to test their . . . ?

NG: 99% of my travel was with the Royal Canadian Air Force or the US-Army Air Force.

BS: **Did you go to the North Pole with them flying out over the Arctic Ocean?**

NG: No, I didn't go in the B-29s. I was confined to the ground stations.

BS: **OK. And where was your main station that you were?**

NG: I could be either in Edmonton or at Portage la Prairie.

BS: **Where is that?**

NG: 60 miles west of Winnipeg.

BS: **OK.**

NG: There's an RC Air Station there.

BS: **But, they were flying - you directed the research program, I take it.**

NG: No, no. I was calibrating the stations.
BS: OK, you were calibrating the stations.

NG: And then analyzing the results.

BS: Then analyzing the results. OK. Who was the head of the project?

NG: Dr. Kendrick.

BS: Oh yes. Dr. Kendrick, OK.

NG: And Colonel Higgenson, George Higgenson. He also took a liking to me later on. Colonel George. They used to call him Handsome George.

BS: OK. So, Kendrick was the Chief Scientist and of course, the Army has to have an officer in charge.

NG: Right. Standard procedure. And Higgenson was in charge of the evaluation section. And that's where I learned to be impartial. You don't care who made it - find out the facts.

BS: From him, huh? He told you that?

NG: No.

BS: You learned that the hard way.
NG: That's right. The point is I agree with it even though that's where I get in trouble.

BS: OK. So, the Canadians were partners with you. Was there a head Canadian that worked with you too?

NG: Oh, my heavens.

BS: Greenway was a young man like you.

NG: That's right. We had an office in the Defense Research Board in Ottawa which then was a building, rather dilapidated, opposite the Hotel Elgin in Ottawa. They've since torn that down. We had an office there and I would drop in there every so often. And they sent me to all sorts of places. You can't imagine. Had to go to Fairbanks, Alaska, and this was all propeller driven aircraft.

BS: Did you go to Yellow Knife?

NG: Had to go to . . .

BS: White Horse, Yellow Knife?

NG: Yeah, I went to all of them. The USAF had a ____ flight called the Alcan Route that went from Edmonton - started at Great Falls, went through Edmonton, north to Fort Nelson, sometimes Watson Lake, finally got into Fairbanks. Long, long flight. We used to stop at Fort Nelson for refueling because we didn't have enough gas and you know
some things are beautiful. It's hard to describe. The standard Air Force, they were all air strips. There was a standard building spacing for ___ft. pillars, every 20 ft. long. Base ops ____. So, we stopped there for gas and we stayed there for about an hour or so while they gassed up and the pilots rested. And on four pillars, holding the roof up, they had a painting of a US GI, a Canadian GI, a Russian GI and an Australian GI - the most beautiful paintings I ever saw by some war time artist. I just said to myself, "Gee, I wish I could take them up because they would be a museum piece." I think the Russians came to that where they transhipped things from a US to Russian aircraft.

BS: Yeah, we gave them aircraft. They picked them up there.

NG: So anyway, one day when I came in, the Cold War had started, so the Soviets painted out the Russian guy.

BS: Oh, no kidding.

NG: Yeah. So, I was sorry I never took a picture of that. Too late. Lost in history. He was a good artist with my limited knowledge of art. I enjoyed the pictures. It used to make me think. So, we stayed there and get on the plane again. Finally . . . drone, drone, drone, finally landed. Always tired, so we went to the BOQ, slept then went to work.

BS: Yeah. So, you did a lot of traveling during the project.

NG: Constant, almost constant, yeah.

BS: Where was your wife during all of this?
NG: Oh. She finally moved to Kansas City to her parents'. I didn't see my first born until he was three months old. I was up in the Arctic and she made me change jobs, so to speak.

BS: So, you had a newborn, huh?

NG: That's right.

BS: OK. So, you enjoyed that. Scientifically and intellectually it was quite an experience.

NG: Oh, impossible to tell you all the stories that go with it, believe me.

BS: Yes.

NG: One day before I could go home for Christmas, I had to go to two places. One was Baker Lake and I'll give you an illustration about science and feedback. Baker Lake was a very important station in the eyes of Fort Monmouth. You know why it _____? It validated the whole system. The results were almost on line, just as what you'd expect.

(150)

BS: At Baker Lake.

NG: Yeah.

BS: How come?
NG: Nobody caught it, believe me. Had I known what I know now, I would have been suspicious immediately, you see. So, we were there and one day before we left, I noticed - I was looking - I sat down, you have to sit down with the guys or you'll never know what's going on - you can take his word for it, it doesn't matter, you're in trouble. I said, "Why are you ____ on that one there?" He said, "It isn't what it's supposed to be." And down at headquarters, "Aha, look how good it is." That's true no matter what organization you're in. The boss likes to say what they want. Up to you and me to find the truth.

Harrison's legacy.

BS: So, they put it in from what the book says it should be.

NG: So, I want it negative tested, everything. You never tell the guy what it's supposed to be, never, never. "Tell me, what is it?" Ask him and see what he says. Don't put the words in the man's mouth.

Now at Baker Lake, one day I was working in Winnipeg. Don't forget my home port at that time was Portage La Prairie, 60 miles west. And these internal Canadian flights were undertaken by the Royal Canadian Air Force, and so the captain came in and said, "Get in the plane. We're going to go up to Baker Lake." I said, "What? My Arctic ____ is Portage La Prairie." "Get the plane revving up now." I said, "Chief, it's going to be cold there, it's November up in the Arctic Circle. I'll be ____." "That's all right, you'll be OK." I had thin socks, you know, regular shoes, no excessive heavy underwear or anything like that. So, I thought it over and I finally told him, "No." He became very exasperated with me and finally he said, "Dang it, get in the plane. I'll take you to Portage. It's only 60 miles away." Like he was taking a streetcar. He flew me there, I ran from the airstrip to my BOQ, got my heavy Arctic gear, threw it on the plane and up we went. We stopped at Winnipeg to pick up my companion who was Ensign Doan. We were both assigned to this. And off we went to Baker Lake. We landed at Churchill in a
snowstorm and a great, great blizzard and we were socked in there for almost a week. Cold outside. Really cold. And to give us status, they had two Canadian military men whose names I've forgotten - one a Major, one a Captain. Two nice guys. I wish I remember what their names were. And they were to accompany us to give authority to our mission. So, they played chess all day until they got tired being inside and I liked the outside. I used to put on my heavy flight boots and my parka and other clothes and I would tromp out to the blizzardy streets. To show you how homey it was, one day I was lost. I stopped at a door and knocked and, "Oh, come in." Happened to be the CO of the station. They had me there for tea and about two hours of chat. Then he took me out to the barracks. At any event, we finally took off and we landed at Baker Lake. Now, have you been to outposts in the Arctic?

BS: I have. Many of them.

(200)

NG: This was an airstrip. There was one bulldozer and two or three RAF GIs assigned to keep it clear. We landed where the airstrip was full of potholes. We got someplace and we noticed a big snowmobile pulling a 10 ft. wide and about 20 ft. long sled on runners. So, it was 38 below. Threw the door open and the Captain said, "Get out." I said, "What? Propellers are running, it's cold out there." He said, "What do you think . . ?" I said, "Turn it off." He says, "What? You think I'm crazy. If I turn it off I might not get it started again." So as soon as we got out, we clambered onto the sled. He went to the edge of the runway and took off. [We saw him ___ riddled in the sky, less ____ to humanity and mankind.] We were there north of the Arctic Circle. 38 below for the entire period we were there.
One day there was a snowstorm. Now, I lived in the Hudson Bay Prefect's House. $6.50 a night to sleep in my government sleeping bag on the floor. Keep yourself ____.
you carry a caribou shoe that an Eskimo shot  and so on. Too bad in that respect. We had a ___ meet us to the RCCS shack - Royal Canadian Cold [Sikles]. That's where the equipment was. And one day there was another blizzard there and I went out and they said, "Oh don't go out. There's a blizzard. You'll get lost. If you get lost, nobody will find you for centuries. You'll be frozen solid." I didn't believe them. They got one of the Eskimos to come and lead me. So as I was walking to the RCCS shack, I fell. You know how your eye picks out heights because of the shadow. No shadow! So, I stepped - plunk. And then I discovered I couldn't see him and I couldn't see the shack. Couldn't see anything. Dang if he didn't come back and help me up and ____ me. I held onto him as he led me to the RCCS shack and I worked there for the day. About 4 o'clock, he opened the door. Snow was up to here. So, I shoveled it out.

BS: *About 6 feet of snow, huh? What year was this?*

NG: '46.

BS: *1946.*

NG: And then '47.

BS: *They hadn't started the. . . had they built the railroads to Churchill by then?*

NG: Oh yeah, the railroad was there, yeah. I'll tell you about Churchill in a second.

Yeah, the railroad was there. All these are impressions. Sorry, I don't want to divert you.
So, we were at Baker Lake. One day, then we had what was known as a monitor transmitter so we could calibrate the signal intensities at the station.

BS: *Um-hum. This was at Baker Lake.*

NG: Baker Lake. We were supposed to go out about two miles or so to put up an antenna wire - radiate, see what I got. So, Doan went and got the sled, pulled his gear on, put a Put-Put aboard and off we went. It was a put-put - he had a tent with a 100 watt lightbulb.

BS: *Was this a long wire on the ground?*

NG: No.

BS: *On towers. Oh, right.*

NG: Yeah. Not too long, just vertical. All they had to do was . . . radio waves travel about a mile. You know the power output for that given antenna.

(250)

So, he went out and was . . . don't forget it gets dark early up there. So, I worked on it until about 10 o'clock and I couldn't get the signal. So, I finally said, "Something isn't right. No walkie-talkies now. This was well before that time period." So, I went outside and I couldn't see a thing. Black. You saw the whole camp was stars from horizon to horizon because you were way above the tree line. So, I ____ a woman. "Gee," I said, "Where's the put-put?" She said, "You see that yellow star on the horizon over there?" So, finally, I located the star and then he said, "Don't go in this area. That's where the
dogs are." The dogs were underfed so they pull better and they used to kill each other.
That's why they used chains to chain them with. If you go near them, they'll chew you up.
Well, of course, I go to the camp. So, the shack, as I recall it, had two lights over four.
So, I slowly walked and every hundred paces I would turn around to make sure, I said to
myself, or I'd get lost, one or the other. Keep my eye on these yellow lights. I would turn
around and look back until finally they became like a big dipper - you know stars with
points. I kept walking towards these yellow lights. So, finally I could hear it, so I went
there. Doan said, "Gee, I can't get it working." So we called it quits for the night. We
went back. Well, this time going back was easier because it's always easier to see four
lights than one.

BS: Nowadays you would have called and said, "What's wrong?"

NG: That's right.

BS: How far was it? A mile?

NG: Now in Churchill, there was also a Navy station. These are all Royal Canadian . . .
you know . Navy station which was about 2 miles north on the river, on the railroad. So,
we went there one day when we were at Churchill before we went to Baker Lake and it
was really bad, so we walked to the railroad station and walked another bit. No, first we
called . . . there was one telephone in town from the barracks where we were to the
railroad station, another line from the railroad station to the Navy station. You won't
believe it. So, we called the railroad station and said, "Hey, can you send a message to us
to the Navy?" "Yeah, sure." He picks up the other telephone and he said, "Now tell me,"
and I'd say, "What'd I tell you?" He would tell me and he would change more words - he
actually came back over there. He couldn't use it. So he'd try to correct it. Another garble.
We spent four hours and nothing happened except that our frustration built up. So, finally we said, "Well, the heck with it. We'll have to go and visit." So, we called them up. Now, we went down by foot. Went to the Navy station. This was early. So at lunch, you know . . . food, food, food. You're cold. You burn it up. We've got to go back to the railroad station, so we walked back. I've never had such a meal in my life. There was a big woman - you know that they say the Arctic attracts different types of people. You know I'm not that big and Doan was bigger than me. She ____ and gave me a great big bowl of potatoes. Great big potatoes and Brunswick stew. Stood over me like Aunt Jemima.

(300)

BS:  *Made you eat it, huh?*

NG:  That's right. You know, there's a camaraderie up in that part of the country because you depend on each other. There's no one else. You'll never find it elsewhere.

BS:  *Yes, there's a camaraderie . . . polar people and when you meet one another, if you didn't know them, or if you were there at different times, there's an instant camaraderie.*

NG:  That's right. Immediately, yeah. So, anyway, now the whole thing - that was, so to speak, on the eastern part of Canada. Now we had to go to Yellow Knife and Norman Wells. So, I didn't know . . . I was in the mess hall at the RCAF. I was in Edmonton. And one day the captain came to me and he said, "We have to take you to Yellow Knife. The planes will be under you're control. The only way for the Canadian government to be able to do that, we will make you the master of the aircraft. They'll be under your command. When you release them, they can come back." I said, "How do we go?" He says, "Well,
two possibilities. You can have a Norseman aircraft or you can have a Beechcraft." Now, my knowledge of aircraft was about as good as my knowledge of carpets. So, I looked around the next day and I heard some stories and the consensus of one story stuck in my mind. Norsemen aircraft are truly reliable. No chance of anything going wrong. But, they're slower than blazes. Then they said, "Let me tell you a story. Apparently a bush pilot had a Norseman. He was going from one place to another. his motor was running. Trees were on both sides of him. When you're on an aircraft, how do you get trees to you? What happened was his skis had just grazed the top of a hill and caught. Because the motor was running, he couldn't pull it out. That's where the trees were. So, once he analyzed the situation, went outside, put on his snowshoes, trimmed down the path, cut off any trees in the way. Made himself some tea and after he was , he took off. So, I said, "No, this is going to be too slow for me. I don't want that." I took the Beechcraft.

So, we started on one bright day from Edmunton and the pilots said," Portsmouth, let's drop down and have lunch," - another air strip or whatever it was, so we went. And you know, I tell you, this experience in me. We always see firsts. Now once used to talk about four focal points, sun dogs, around the sun during certain ice crystal conditions.

(350)

And he said they had never seen the four although theoretically there should be some, but they had pictures of three and he showed pictures. They all went out and there were four sun dogs in the sky. I 'm sorry I didn't have my camera.

BS:  Oh yeah. I've seen three.
NG: Yeah. Because of the peculiar ice conditions up in the Arctic.

BS: *You want a drink of water?*

NG: No. I'm all right so far.

BS: *OK.*

NG: Did you want lunch?

BS: *Yeah, we should go to lunch.*

NG: Tell me when. What time is it now?

BS: *Well, we can run this tape out and then do it. It's 12:30.*

NG: They're open until 1:30. You tell me when, we'll go down.

BS: *We've got about 15 minutes of tape left.*

NG: OK. Anyway, I'm getting up to _____. So, we stopped there. And the captain said, "Hey look, we are part of the search and rescue squadron, but our beacon doesn't work. Can you fix it?" Now electronics is not quite my forte.

BS: *This was in Yellow Knife?*
NG: No, no. We had left Edmonton and I think it was Fort Smith, although I'm not quite sure now of that.

BS: *Fort Smith. OK.*

NG: One of the isolated locations. So, we decide . . . so, the co-pilot said, "Well, look, it doesn't matter. We're part of search and rescue. If we don't report in at a certain time, they'll go looking for us. No problem." So we went and had lunch, came back, took off. And you know on these Match flights, because of my experience in Puerto Rico, every time I _____, I sleep. Build up so that in case of an emergency, I can keep on. I was in Greenland, then, Puerto Rico. Got three hours sleep, four hours sleep a day. So, I took a nap on the plane. And I woke up and I heard them saying, "She was no more ____." It was '46. The maps were bad. They were supposed to find a place to land and they couldn't find it. It was getting dusk, so all I can do is listen. Pilot said, "Well, look here's the river. Where do we go, left or right?" Well, they couldn't tell. So, finally they decided to go one way or the other. So, we found a spot and landed. There was an airstrip. And it was Canadian Pacific Airlines, so they had an inn there. So, they taxied up in front of the inn and there was a gas pump and they were going to fill their wing tanks by hand. A lady came rushing out and said, "Oh no, no, no. You can't have that." They said, "We're military." She said, "Doesn't matter. That belongs to Canadian Pacific. Can't have it." "Well, where do we get gas?" She said, "Go down the runway. Great big _____, about two miles down or whatever."

BS: *Now where was this? Do you remember where that runway was? You still hadn't got to Yellow Knife.*

NG: No, no. On my way first to Norman Wells.
BS: OK.

NG: I can find out, but right now it's not in my head.

BS: It doesn't matter.

NG: I may have mixed up [Fort Smith].

BS: Doesn't matter.

NG: So, we taxied down there. "Oh," she said, "there's a whole field of 55 gallon aviation fuel gas tanks. You'll see the caretaker there. Just take how many you want." So we taxied down. There were about 4 inches of snow and we . There were all these tanks like a phalanx, embedded, standing up, all ice encrusted. So, we didn't see the caretaker, so we got hold of a great big plank, like a 4 x 4 and turned over two tanks and we rolled them over to the plane. We had our Arctic mits on - Arctic parkas, and so on. So, we were well protected. But, in the process, we didn't realize we were mixing in rust in the oil drums. So, finally we got them to the plane. Now how do you open them? So, we found a chisel and a hammer and I think was possibly pack ice , so we hammered them open. Then he had a bilge - you know what a bilge pump is on a boat? You can do this? You pump out a spoonful at a time? He had one of those on the plane in case of emergencies. He put that in and he said, "Oh no, no. Look at all the rust." He squirted it on the snow first. "Too much rust." So, he put a chamois in front of the funnel. So, every . . . and snow began to fall. Every 5 minutes he'd say, "I have to empty the
chamois because of rust." So, we filled one wing tank, then we filled another wing tank, taking turns because it was laborious and we had gotten cold because the sun had set. So, we finally had it filled. We taxied back to the gas pump and he said, "We can't go in yet." So they had me put the covering for the cells - is that right?

BS:  *Um-hum.*

NG:  And then the wings to prevent ice from forming. So, it was about 10 o'clock at night that we got in. Dead tired. Really dead tired. She gave us a great big meal and off we went to bed. I think we all fell asleep instantly. Beautiful rooms. So, the next morning, we got up. Good thing we'd done all this. Revved it up and took off. Of course, we had to pay our bill first.

BS:  *Canadian Pacific, huh?*

NG:  That's right. Took off and went to this big city called Norman Wells.

BS:  *Norman Wells, huh. You went to Norman Wells.*

NG:  Now, we finally got there. We left this place, got to Norman Wells. And it was just about dinner time. Landed. Found my guy and . . .

BS:  *Now Norman Wells was where?*

NG:  On the Arctic Circle, on the McKenzie River.
BS: *OK. So, what was your purpose there?*

NG: We had a station there. I had to calibrate it.

BS: *Oh, I see. You were calibrating the station there. How long did that take you?*

NG: About two days.

BS: *About two days with two days travel each way, though.*

NG: That's pro bono.

BS: *Quite a game. Yeah.*

NG: Now the GI there was very nice to me. He had killed a ptarmigan. Shot it. And he had the cook stuff it for me - whole ptarmigan. You know, up there it's a heat flow problem for the human body. My appetite was like this. And when you think of it, of course, I didn't gain weight, when you think of heat flow in and out. You had to withstand that harsh climate. So, anyway, we finished one afternoon and he said, "Look, I have a trap line here. Want to go with me?" I had never seen a trap line before, so I went. So, we crossed the snow and the pine trees. See the western Canadian Arctic is different than the eastern. The eastern is way above the snow line, but the western has trees almost up to the Arctic Ocean. So, you have these Scotch pines and other pines. So, we went along this trap line. He knew where to go. I was just trudging after him. And we were all dressed now. We had the flight boots, thick, lined, my regular trousers, my over-trousers, heavyknit nylon to keep the wind out, my undershirt, overshirt, jacket and parka. I never
wore a hat. I just threw the parka over my head. So, I was trudging along after him because I didn't know what to do or what to look for. He found his box - you know those boxes you put a stick in to hold the door up - put some food inside?

BS: *Trap box.*

NG: Yeah. So, he found that. He said, "There's something inside this." You know, I would not have known. So, he shook it and he said, "Dang it, it's that bird." He opened it up and this poor, frightened little creature was there. He grabbed it and threw it. She flew up and stood on a branch. You feel for the bird at that place. So, we went further and further. Then, at one place, he yelled to me, "Look, a wolverine was here. She took the bait and left the trap."

(500)

So, we set it and we went along. Finally, we came across the place and there was a lake all frozen about three or four feet thick. We slid down the embankment and I could see something fluttering around. Not fluttering - moving in the center of the lake. He said, "Oho, I've caught something." He said, "This is where I put my muskrat traps." So, we went closer and there was a poor fox and when it saw us or smelled us, it became frantic and tried to pull and pull and pull. Of course, with these steel traps, it couldn't get out. So, he said to me, "I tell you what. I'll keep him distracted here." He had a branch and of course the fox snarled and twisted. Couldn't get a way out of the trap. He said, "You go on and step on his tail." So, I walked around and stepped on his tail and then another step, little by little you step on the backside. Then he came over with his rifle. He was carrying a rifle and said, "I don't want to hurt the pelt with the bullet. He just smashed the brains
out. Then he said to me, "Do you want the pelt?" Well, you know what my answer was, although looking back in a way, I'm sorry I didn't take it.

BS: You didn't take it.

NG: No. Now if you want to hear another story about pelts, I'll go back to Baker Lake. I'm afraid I'm distracting you.

BS: No, this interesting. Remember I was talking about you.

NG: At Baker Lake, we were in the Hudson Bay's Trapper's House - Hudson Bay Prefect's House. So upstairs, he had all his skins, pelts that they were going to send back to England on a Hudson Bay ship when the lake was unfrozen. Well, when I was there, the ice was 4 feet thick on the lake. So, I looked... I finally decided I would get a pelt, so I went upstairs with them and I got a pelt for about $1.50 - a wolf pelt. Well, that's no problem. I could have it tanned in Edmonton because I knew where the tannery was. Then he showed me a polar bear pelt.

(550)

He laid it out. It must have been 10 feet from nose to tail - another $1.50. Can you imagine how stupid I was. I said, "Look, he must have scratched himself here. It's stained rusty here." He says, "It's an old male. That's why it's rusty." He said, "If you come in the spring, I'll have a good one. So, I said, "OK," and I didn't take it. I never got back. Or rather, I got back many years later, so unfortunately I have that wolf pelt, tanned. All my kids grew up standing on it when they got out of bed, but I don't have the polar bear pelt.
BS: *For $1.50, huh?*

NG: And $4.50 Northwest Territory tax.

BS: *That's $10,000 today.*

NG: That's right. It shows you how bright I can be. That's the story of my life.

BS: A bright scientist. We're out of tape here, just about, so we can cut this off and go to lunch and come back and put another tape on if you've got enough energy then. I think we need a break anyway, don't we?

NG: Oh yeah.

(End of Tape 1 - Side B)

(Begin Tape 2 - Side A)

(000)

BS: *This is Tape 2 of the oral interview with Mr. Nathaniel Gerson - Nate Gerson - on 24 October 2001 at the Cosmos Club in Washington, DC. So, we've pretty much . . . have you anything else to say, I guess, is the best way to open this on what you did in Canada. Was this the late '40s?*

NG: Yeah. That's right.
BS: OK.

NG: ‘46-’47. And one thing more I should mention which more or less cleans me out of Canada for a little time. The last trip I had to make was to Yellow Knife. Both Norman Wells and Yellow Knife. We discussed Norman Wells.

BS: Yes.

NG: Now the same crew had to take me to Yellow Knife which was my ultimate destination. Afterwards, they could release me or rather, I could release the plane and they could go home. And something peculiar happened on the trip from Norman Wells to Yellow Knife. We left on a lovely December day. Clear sun, bright day, no precipitation and flew in this Beechcraft which was now overloaded because we had picked up freight and people en route. So, it may have been overweight and on the way, we passed over herds of caribou. And the pilots amused themselves by diving down and scaring the herd. You could see the wolves around the edges of the herd waiting for a nice fresh meal. In any event, they continued this and finally as they continued flying, don't forget these were all obsolete, not good maps because they had not been surveyed in years, and we ran into ground fog, obliterating the ground. The pilots, however, soon noticed that the air speed was dropping and they made the assumption that the carburetor was icing up, so they saw their way out. They finally came near Great Slave Lake and the Russian-most ____ contained a ____ which had an air strip. We could see it from the sky. The air strip was cut amongst the trees. So, they decided - we all had our noses to the windows, trying to see if there was smoke from any of the chimneys that would indicate it was habitated. But, the pilot finally decided we could break in, get fuel and keep warm. So, we tried to make a landing. We landed in several feet of snow and huge snow clouds flew in front of
us. However, the air speed had dropped to zero and the pilots then realized the ____ tubes had frozen up, not the carburetor. They gave it the gun and we cleared the edge of the trees by about 12 inches.

So, now we flew over the Great Slave Lake to Hay River because they did not think they could make Yellow Knife. So, as we flew over the lake, you could see large open leads. I still do not understand that, how in mid-winter a freshwater lake at that latitude could have open leads of water.

BS: Wind.

NG: And there was a big argument between the pilot and the co-pilot. The co-pilot wanted to crash land on the lake - frozen portion. He said we had a__, two met could set out, kill a caribou and get meat. Others could get driftwood so we could make a fire and keep warm. The pilot objected. He said the propeller would be bent and that we couldn't take off and since we had no ____ , we could not be found readily. And it was already about 40 below zero Fahrenheit. In any event, the pilot won. We kept flying until we reached where Hay River should be. However, they could not find the air strip to land on. Again, we had our noses glued to the small windows. Finally, just about the time the pilot was going to land on the frozen lake a beacon came on. He swerved, just went right down - don't know how you call it. He landed, so to speak, on a dime. Quick maneuver. He complained to whoever was there that they did not have the beacon on. They explained rather clearly - they didn't expect an airplane.

(50)

BS: So, safe landing.
NG: Safe landing. The pilot claimed he had 3 gallons of gas left.

BS: Wow.

NG: Now, if you want to hear something personal, which one day I must tell the medical profession. Before leaving Norman Wells, I usually . . .

BS: Now this was at Hay River, wasn't it? This emergency landing at Hay River?

NG: That's right, having left Norman Wells. Now, before leaving Norman Wells, I had breakfast including several cups of coffee which was most unfortunate because as we flew, the bladder pressure kept building up and building up, but there was no place to go. At one time I thought I would just do it in the corner of the cabin, but everybody would smell it, so I didn't do it. So, I kept keeping it, keeping it, keeping it. When we landed at Hay River, my bladder was empty and I didn't feel good bladder-wise for about 6 or 7 months. Somehow it had drained back into the blood stream.

BS: Wow.

NG: Now, I should say this also. Once it was evident that we were running out of gas, the crew chief became panicky. He was a French Canadian sergeant and he became a bit wild. He accused me of leading the plane there, other things that made me uncomfortable, but I couldn't do anything about it. We were all in the same boat. Claimed he had a wife and seven children and now what would happen to them, so I didn't know what to say. You feel bad, but I didn't know what to do. You see how people are. Other guys were like myself, they just said, "Well, can't do a thing." People are different.
BS: *Pray for deliverance.*

NG: Anyway, the next morning, I sat on the floor by a pot-bellied stove. It went out in the middle of the night and the room temperature, when I awoke it was 40 below. One flight lieutenant, I've forgotten his name, decided to sleep on the snow, but our sleeping bags were good to minus 40, so that was all right.

BS: *Yeah, they can be more comfortable in the snow, especially if it's that cold. There was probably no wind.*

NG: That's right. Anyway, we went to Yellow Knife and that's a story in itself. Now, when I returned . . . well, we left Yellow Knife and you'd think you're in one of these old stage coaches. There were men in miner's clothes, trappers, denims, everything but dress clothes. And we hedge-hopped back to Edmonton. We arrived - when we left the outside temperature was -49 and I had decided to leave the RCAF shack where we were sleeping on the floor and walk to the "airport office" - another shack. There was quite a wind. I had not put on my outer trousers, heavy nylon knit to keep the wind out. When I got to the airport office, my thighs were somewhat frozen. I went into the tiny washroom, got them out of my duffel bag, and put the trousers on.

(100)

Now, in any event, we landed at Edmonton about 1:00 AM in the morning. and I was surprised to be paged and an RCAF sergeant showed up and said I had to be at Gimli tomorrow morning. The plane would leave at 0600.

BS: *Where'd you go?*
NG: Gimli - I had to go to Winnipeg and then north to Gimli.

BS: *Oh, Gim . . . I see. And Gimli is where? Northern . . . ?*

NG: About 60 miles north of Winnipeg. That's where one of our transmitters was. There was a big conference on the efficiencies of the LORAN C system - the LF LORAN system.

BS: *What were you going to do there? Check the LORAN?*

NG: Oh, they had called in everybody for a round table discussion.

BS: *OK. Was that one of your headquarters sites?*

NG: Gimli was a transmitter site and so was North Battleford and so was Dawson Creek. Dawson Creek in British Columbia.

BS: *So you had G-i-m-l-e-y?*

NG: L-i. Gimli. It's on Lake Winnipeg.

BS: *Sites were Gimli, North Battleford, and Dawson Creek.*

NG: Dawson Creek is mile zero on the Alcan.

BS: *OK. I know where that is. I've been there.*
NG: I've been to all these places. Do you want to hear an interesting story? When I was in Dawson Creek, I learned that I could get a quarter section by homesteading from the Canadian government. All it required was that I spend three years there and then the property would be mine free and clear. The first year I would have to clear the timber to _____ ____. Second year, pull out the stumps. Third year, plant wheat and the proceeds would pay off all of my debts. But, it would take three years and the Canadian government . . . I toyed with that idea for some time because I liked the outdoors and I liked Canada. However, I decided I liked physics better.

BS: *Liked science better, huh?*

NG: Would have taken three years out of my life.

BS: *Oh yeah, all kinds of good deals as you go along in life, but you've got to stay focused.*

NG: You have to make a decision.

BS: *So, what did you do after the LORAN C business?*

NG: Now wait.

BS: *Oh, we're still at Gimli.*

NG: So, after leaving Gimli, I was due into Edmonton, took Match to McCord Air Force Base - at that time it was Fairfield ____, now called Travis Air Force Base. Then I took
the Continental Alcan, got off, grabbed a train and went to see my wife who I hadn't seen in some months. It was the first time I saw my son. He was now three months old.

BS: *That was what year?*

NG: 1946. There are two things that changed my career - two events happened that changed my career considerably. I told my in-laws that Edmonton was a lovely place to live and I could be stationed there and I wanted to bring my wife and young child there. Unfortunately, I also told them that the temperature at 40 below was lovely and I saw kids there playing in the streets. They couldn't understand that. But, when I told my wife that ____at Great Slave Lake in mid-winter, she put her foot down.

(150)

So, I then returned with my wife and young son - baby - to the east coast. Took the train to Fort Monmouth and told my boss that I would have to quit. My wife didn't want me to work in those places any more - in the Arctic any more. However, Colonel Higgenson had sort of a fit. He said, "Oh no, no, no, no. Work here," - at Fort Monmouth. I was a bit surprised, but grateful. Then, we moved to New Jersey, to Edentown, New Jersey, and I was at Fort Monmouth.

BS: *What did you do there? Or what was the organization, I guess, is a better question?*

NG: It was still the evaluation section. . .

BS: *For TAC and LORAN C.*
NG: Yeah, LORAN C.

BS: *And how long were you there with that?*

NG: Let’s see, ’47 - one and a half years. See, while at Fort Monmouth, I worked on the evaluation of the noise intensities, LF noise intensities that we had made at all the Arctic sites.

BS: *Were these recordings?*

NG: These were recorded on Esaline Angus tapes.

BS: *What kind of tapes?*

NG: Esaline Angus. You know, _____ _____ recordings.

BS: *OK. So, LF recordings, so the LF noise variation was it, you were working on?*

NG: The LF noise intensities in the north American sub-Arctic, the first such study ever made. I also worked on the evaluation of the results and the accuracies of the system.

BS: *How did you measure these? How did you take these? Were they recording sites at each base there or . . . ?*

NG: At each of the various sites that we had, and I can list them for you if you want, we had a receiver tuned to something off 180 kilohertz to measure the ambient noise level - just _____ the intensity - it varied considerably. There was a level_____ _____ more or less
and the normal variation, normal noise emission we could tell. So we would look at the intensity and to our surprise, we found that the sensitivity of the equipment was insufficient to measure how low the noise levels were. In other words, we found out that in the Arctic, rather the polar region, is one of the most quiet regions on earth for radio noise. And the reason was simple, as I later wrote. Most radio noise on the earth - that is terrestrial radio noise - arises from three primary noise sources. In the tropics, one in Africa, one in Brazil and one near the east Indies and the lightning strokes in these areas generate the local noise that is found almost everywhere.

BS: *Someone must have had to go down and measure those there, right?*

(200)

NG: Where?

BS: *Brazil, Africa and the East Indies.*

NG: Not at these frequencies. We just knew the thunderstorm intensities and we knew that the thunderstorms, the lightning strokes, radiate from ultra violet all the way down to VLF, so we know that whole whole of noise.

BS: *So, you get radio frequency noise from lightning too?*

NG: You bet.

BS: *I didn't know that.*
NG: Yeah. Been the subject of a lot of studies by some of the guys you mentioned. Whislers, for example. The Clicks that the Stanford people . . .

BS: So, all from lightning strikes.

NG: All from lightning, yeah.

BS: And during this period of time that you were there, that's when they discovered a lot of this. Is that correct?

NG: We discovered the intensity of the noise because it comes from the equator upwards, so the further north you go, you have a . . .

BS: The less you have. Same thing in the Antarctic.

NG: Right, attenuation. But, that was the first study made of LF noise. The Bureau of Standards later incorporated some of those results into their handbook of radio noise levels on the earth.

BS: So, those were earth generated radio noises.

NG: Yeah, lightning generated. Those were the three principal noise centers on the earth. Now in addition in North America, you have another factor and that is this. The thunderstorms sweep like a tide from the Gulf of Mexico, northwards during the summer and they generate their own noise intensity superimposed on these three principal sources. It's a semi-constant. Thunderstorms come up and go down. And you can see this from the weather records. How many thunderstorms in Fairbanks, Alaska? Almost
nothing. How many in Florida. Heck, an awful lot. In fact that's one of the peaks in the United States because it's near the Gulf coast. So, the more thunderstorms, just like the more hurricanes, the more radio noise.

BS:  *I didn't know that.*

NG:  And that's taken into account in all the assignment of frequencies and the power that broadcast stations radiate, because you have to overcome the local noise or you can't hear the signal. So, it has to be taken into account.

BS:  *Interesting. So, that was your principal studies at Fort Monmouth.*

NG:  That's right. Now, during this period I also wrote a paper on the refractive index in polar regions and it's effect on radio noise. I told you about that earlier. And I also published a paper on the effect of the earth's magnetic field on radio wave propagation.

BS:  *Was there anything revolutionary that you discovered in this respect?*

NG:  Well, I extended the old work from two dimensions to three dimensions. Nothing revolutionary, just an extension of the theory.

(250)

BS:  *So, how does it affect it? This is magnetism now. . . on radio propagation.*
NG: In practical terms for you or for the average citizen, there's almost no effect. But, it provides an insight into some of the complexities of the wave path in a magnetic field in a plasma.

BS: *I understand.*

NG: This is almost a pure theoretical paper. Not ____. I thought of using it, but it's too difficult to handle on the computer, even now. New material has out-dated it.

Then, at the same time, I obtained my Master's degree from NYU in physics. And the government paid for that for which, incidentally, I was very grateful. As a matter of fact, the director of the labs, General Kohl - ultimately General Kohl, then Colonel - saw me in the yard one day, parking lot, and he said, "Nate, I want you to go to NYU. We'll pay for it." How can you refuse?

BS: *Get some time off?*

NG: Within the working hours. Yeah. How can you refuse that?

BS: *I wouldn't have.*

NG: So, I went and got a Master's degree in physics.

BS: Good. And that was recognition of your ability, I'm quite sure.

NG: *I have no idea. I only know that I was very lucky.*

BS: Your charming personality, perhaps.
NG: *Don't ask my wife. I've been very lucky.*

BS: Fort Monmouth. Where did you travel to or what was your next . . . ?

NG: Well, they sent me to Canada to check on some of those things that had to be done, to check the systems.

BS: *Short trips.*

NG: Short trips. A week, or two or three, maybe a month. They sent me on one trip to Dawson Creek to check the field intensities by our transmitter because they wanted to check why some accuracies were not panning out.

BS: *This was when the guys were filling the data in with what they thought you wanted.*

NG: Never believe anything. Check it yourself. Now, I took a jeep and I discovered something on how difficult life can be. ____ jeep everywhere we were on the station, several miles up. We had a little receiver calibrated to receive signal intensities. Now, one thing I found which came to me again within the past 10 years of my life - it's funny how your experiences come to bear on future problems. I was going along this road really out in the boonies _____ or not, but it had like ____ and as I was going along making measurements, I was surprised to see that it went up and it went down and I couldn't understand it. Now I know why. Do you know why? Seq____ were traveling along the wire in the _____, so about the ____ ____ measurements. At that time I didn't understand it. Now I know. I learned the hard way.
But, that's not the exciting thing. The exciting thing was we went one place to _____ a ______, and there was so much . . . did you ever walk in the Canadian muck? Do you know those scrapers at each doorway? The muck gets on this thick on the bottom of the soles of your shoes. If you don't scrape them off before you into the house, your wife will kill you. So, we went through this and the jeep sunk to the axles. Both axles stuck and we were about 20 miles from anywhere, really out in the boonies. And it was getting close to noon, so then I noticed there had been a forest fire. All these trees were lying down. They had been burnt down. So, this other guy and myself went and took a tree. We made a corduroy road in front of the truck. With this heavy wood, we took some more of the trees and made a fulcrum and I took the tree we leveled and little by little, little by little we got the back wheels up on the corduroy road, more trees, then we did the front wheels and we got to the point where you . . . so we got all this back on wheels about 6:00 PM in the evening. The government is paying me to get all this exercise. Boy, were we tired. Then we had to put another to go backwards, back out. So, I didn't get the measurements on that one. Sorry about that.

BS:  *Lucky you didn't sink up to the top of the jeep in the mud.*

NG:  Don't remind me. Anyway, we had to get the radiation patterns. I was radiating. We used balloon born than antennas. The antennas were 1400 foot of copper wire, for balloons. Now I learned a lot of practical experience on that assignment. But, in any event, now I was back at Fort Monmouth. One day, this Captain Trakowsky who had been in the briefing I gave on refractivity index and it's affect on navigational accuracies, tapped me on the shoulder. I was in the car and he said, "Nate, I'm making you the chief of this radio propagation laboratory."
BS: *This was a Navy captain?*

NG: No Army.

BS: *And what was his name?*

NG: Albert C. Trakowski. He lives in Fairfax or so . . . Arlington.

BS: *Is he still alive here?*

NG: I don't know. He was several years ago.

BS: *And he made you chief of . . . ?*

NG: The Propagation Laboratory. At the Watson Laboratory. See, Watson was part of the Army-Air Force Laboratories. And Fort Monmouth was part of the Signal Corps Laboratories. So, we were at a little place different.

(350)

BS: *So, Watson Labs was part of the Army.*


BS: *OK. So, you became chief of propagation.*
NG: Yeah. So, I was reluctant to go to this new job for several days or weeks because a friend of mine, a Dr. Newman, a very respected individual, was chief of the lab and I understood that he did not want to leave until they finally wheeled him out in his chair.

BS: *Oh, he was sitting in his chair and they pushed him out?*

NG: I shouldn't laugh. I respect him very much.

BS: *He didn't get along.*

NG: I don't know what happened. And I think this is where I really got into geophysics in a big way. I had just completed my thesis at New York University on nocturnal ionization in the F2 layer. We tried to find out why ionization existed in the F2 layer throughout the night when according to theory, it should not. And I had two advisers, one was Dr. Korff.

BS: *Serge Korff?*

NG: This could be. He was an adviser. He was in cosmic ray - ING physics. The other one was Dr. Bernard Haurowitz. And when they went over and reviewed my thesis, Dr. Haurowitz said to me, "You know, I think you should stay in this field," which just sort of amazed me.

BS: *This is the thesis for your Master's degree.*
NG: Right, that was published in the *Reviews of Modern Physics* and I've been told by people in Australia, Europe and the UK that they used that when they studied ionospheric physics, which sort of surprised me.

BS: *So, you're still at Fort Monmouth. What year was this?*

NG: This was late '47. Now, about that time, the Army-Air Force split to the Army and became USAF.

BS: *So, that was about 1947. That's when the Rand Corporation recommended the Air Force be formed?*

NG: I don't know.

BS: *So, this was 1947 and USAF formed. Did they take over the Monmouth Labs?*

NG: Well, they did and then they brokered in this peculiar fashion. Now up to this time, I did not know that they were going to split at all. They split it in two fashions. They took the bulk of it and sent it up to Rome, New York, at Griffis Air Force Base. It became RADC - Rome Air Development Center. All those guys dealing with equipment, engineering and so on. They took the geophysics part of it and sent it up to Boston as part of the Air Force Cambridge Research Center and that formed the Air Force Cambridge Research Center and they had five laboratories. I have to back up a bit. Still at Fort Monmouth before we reach Boston, I had this lab that I inherited from Dr. Newman. So, I went down to see what they were doing and it was just what I thought which I didn't like,
forgive me. If the Air Force wanted to set up a radio ____ from here to there they'd set up a transmitter here and receive it and test it in about 6 months to see how things were, local noise, blah, blah. When they want to move it 20 feet, they had to make a new test. They didn't know how that would work. So I complained bitterly and said, "I don't want to do that. I'll never finish this. Just be a _____ getting measurements. ____ through the medium and its fluctuations I can predict what would happen. Says here we have to change to physics. That was supposed to be under meteorology because they have UHF there as well as rainfall and HF and ____ because you had the ionosphere there and they are supposed to change with the sun and what I call weather. So, I said I want to change the name to Ionospheric Physics Laboratory. So, they ultimately gave me that name and I began looking at physics in this odd way.

(450)

BS: This is what year - '47, '48?

NG: I think we moved finally in '48.

BS: Moved to . . . Cambridge?

NG: Boston area.

BS: So, you changed the name to Ionospheric Physics Laboratory.

NG: Ionospheric Physics. Physics. I wanted to know the medium. What happens in the medium. If I know what happened, then I can predict what happens. Otherwise, I'm guessing. I'm wasting my time running around making measurements. And they gave me
free rein. I should say before we left Fort Monmouth, they said to me, prepare a program, and they left me alone. Now I told the boys working in the lab to keep on. Don't bother me, just keep on, you're doing well. Why excite them? So, I sat down and I thought things out and I had my secretary and I dictated to her what I wanted to do, so my secretary ____ was on the entire program. Now, at the time we thought we would do some infrared measurements also, electromagnetics is broad. So, I included some infrared, HF and UHF, ____ ______. So, I designed this whole big program and they bought every thing of it. They rubber stamped it. In fact, they used to have people from the Pentagon come down and see me. They'd say, "Nate, we have to write up what you're going to do. Write it up for me." I would scribble it out. And one day, I made a typo and it came down through channels including the typo. I was always a bit amazed. But, again, like I said, that's how you get things done, from the top down.

BS: Well, who cares about typos?

NG: Now, at that time, the chain of command was the Pentagon, Wright-Patterson Air Force Base, and then the two laboratories - the Rome RADC and ourselves AFCRL.

BS: AFCR . . .


BS: Chain of command went from Pentagon . . .?

NG: Yeah. Wright-Pat, General Rives . . .
BS: *So, from Wright-Pat to Air Force Cambridge Labs and from there to the Ionospheric Lab, huh?*

(500)

NG: Now along the way, we had some local commanders who had some minor fits as to what was going on because they couldn't understand it. They were being overruled and we knew why they didn't. We were very careful not to tell them.

BS: *They didn't understand what you were doing, so they were by-passed.*

NG: They thought they should dictate and what they said didn't . . . Pentagon would just go along with it because we told the Pentagon differently.

BS: *That's too bad that a young man would do that. I mean, you have to depend upon your authorities and of course, they want to put a military guy in charge of these things. But, I imagine you had some good ones, too, that understood that you were over their head as far as the technical went, and they could grease the skids for you to get money, to get support from planes and other assets that the Air Force had.*

NG: Well, the Pentagon had a problem with Wright-Pat and I'll tell you what it was. They had some meteorological officers when I assumed command. The Air Force said, "The atmosphere, we have to know about the atmosphere." And the general, the various chains of command, knew about equipment. They didn't care that much about the atmosphere. And still____ radio wave propagation aircraft performance. So, you see ultimately the ___ Physics lab took care of ____ because the aircraft had to land there. So, we had a terrific science laboratory. And we had general atmospheric, which is a
catch-all. Then they had ____ which is the ionospheric propagation as well as HF________________________. Then they had, hold on, ____ Laboratory. Now, sooner or later, they developed a balloon laboratory. You won't believe what happened. That was a ______effort. The Pentagon convinced the government intelligence committee that they could get the photographs of Russian installations by a balloon because they had developed these enormous balloons as big as this whole building that were launched in Nevada or in that area. They could circle the US several times and take photographs. I'll come to that later. In fact, my boss at that time, Colonel Westburn had a sister lab. He and I worked together, but I didn't know what he was doing. It was all classified because my work was mainly unclassified. He developed the balloons. You won't believe what happened. I'm jumping ahead 19 steps now.

Now, Kruschev once came to the UN and he pounded the table and yelled at the US. He said, "I have a roomful of balloons that have landed in my territory, each carrying a camera in a parachute." They had prematurely flown and the parachute descended to earth and he, of course, grabbed them and they _____ them. Now, the net result of that was interesting, although this is an aside. Colonel _____ was now in charge. Obviously he went to the CIA, but before he left us, he went down and spoke to General Shrever, Bernard Shrever, and said, "Look, the balloons are not working because the range controls are not _____. We cannot tell them to go over this city or that city, or this installation or that installation. Remember that the stuff was hard to get. He said we can get it if it lands on US territory, but we can't get it if it lands in the Soviet Union or in the sea. He said, "Headquarters Air Force will not support me." He said to Shrever, "I think we should go to Casey, who was then Director of CIA, get my ____ a classified program." So, because the balloons didn't work as well as the US wanted, it also led to
what is now called the NRO. So, that Air force error The ____ I want to get I can't get unless I go to satellites."

(600)

Again, so the interesting thing about the AFCL is this, two people in there ordered the visual, the camera imagery and I did the radio site and they both were under contract with what's called the NRO. These two guys who came from the same institution started the whole lab. It's amazing to me when I look back.

(End of Tape 2 - Side A)

_____________________________

(Begin Tape 2 - Side B)

(000)

BS: OK. Here we are Tape 2 - Side B, and we've just discussed the development of the labs at the AFRC when the Air Force formed and that you had the Ionospheric Lab. So, where do we go from here? How do we get to the Antarctic and the IGY? How did you get involved in that or am I getting ahead of you?

NG: When I was at new Jersey, I designed the things that I wanted to do and when I was transferred to the Boston area, I had to know what I planned to do. I recall the first ___ I made of the laboratory I wanted and of all the 25 or more slots, my name was in as Acting, that is, there was myself, there was a secretary and no people. So, I had to recruit and I slowly went about doing this, trying to get the best people I could. And as you can
judge, sometimes you make errors in judgment about people. But, once they're hired under the Civil Service rules, very difficult to change. I learned the hard way. Some guys are opportunists, some guys are truly _____, some guys pound their chests, some guy are really good, but you have to do with what you have and not complain. So, I had various people, although most of them were good.

Some of the things I wanted to do were based upon my thesis and I looked upon that as very simple. If you want to stay in research, you must not stray too far from the nipple. Otherwise you will not be nourished. The nipple in this case was Air Force Communications and Radar. So, I tried to keep that in mind in everything I planned. That is, I felt I could do more basic research with an applications end point to help the Air Force in both communications and radar. Some things came directly from my thesis like how does it happen that most of the US effort on their ____ up-to-date was based upon this point to point study and predictions when they did not know what the medium was like? So, I set about trying to establish work with knowledge of basic physics of the upper atmosphere. The dynamics, the properties, the characteristics and the changability of the time and the sun. One of the great unknowns to me was what happens in the polar regions because the polar region was an Air Force problem. If they wanted to send bombers over the Pole, they had to communicate. At that time, the best means of communication was HF because line of sight wouldn't allow the propagation. Further, my thesis had shown me that somehow ionization persisted in the F2 region, despite the theory. The theory claimed that the ionosphere was caused by the sun, namely solar ultra violet and [ex-radiation]. But, if there is no sun, there should be no air ____ it should drop to some negligible value. But, here we could see that the F2 regions maintains itself throughout the night. Question: How come, what caused this and why? And I had two or three theories in my head. One was ionization could be brought in by winds from other regions of the planets. Another was, could there be non-solar sources of ionization that
brought the energy in and ionized the atomic elements - nitrogen and oxygen. It was quite plain, however, we did not know.

(50)

BS: So, this phenomenon in the polar regions drove your thinking at that time.

NG: Yeah.

BS: This was '48-'49.

NG: Yeah. Now, only in the polar regions is the sun not present for a month at a time. If ionization was found in polar regions, it had to be from one of the two causes I mentioned. Now, it also could be that the recombination coefficients were in error. I should say three reasons, recombination coefficients in error.

BS: You talking about winds, solar, non-solar generation and . . .

NG: . . . erroneous recombination coefficients. That is, we thought the atoms and electrons combined faster than they really did. So, erroneous recombination coefficients.

BS: These were all theoretical at that time.

NG: That's right. No knowledge. Nobody was looking at this in the polar regions.

BS: 1949.
NG: At that time, Joe Fletcher was chief of the laboratory - Colonel Fletcher. I think _____ gave him a hard time. He also gave me, for a while, a hard time, but that's all right. He's a good guy.

BS: He was Chief of the whole Air Force Cambridge Lab.

NG: That's right. Director. Now, Joe Fletcher told me. . . let's go back. To measure the electron densities, what I wanted to do was get enough aircraft, put the equipment aboard and send them to the North Pole and just look. Have a circle around and then come back with measurements so I could see what's happening. Otherwise I'm blind. I don't know what's occurring. I'm just speaking out of my head.

BS: So, you want to just fly up there and take measurements.

NG: That's right.

BS: All year round?

NG: No. Well, one thing at a time. With an aircraft, I could send it to Thule, have it fly to the Pole, circle and come back to Thule, refuel and rest and do it again. So, repetitively, I'd come up with a series of measurements that would show what was happening. And since the sun was absent, that's exactly what I wanted. No sun. Why should there be any ionization?

BS: Let me just interject a question here so that I have full understanding of this. When you say ionization, you're talking about ionization of the air particles?
NG: Yeah.

BS: So, they ionize. *How does that change them from times when you have good radio propagation?*

NG: First we have to speak of ________ from the ionosphere. Are we saying the same thing?

BS: *I know about losing it and having it. When I was commander at both ends, I lost it often and I couldn't talk to anybody. Because when I lost it, there was no radio. Before satellites.*

NG: The ionosphere say is up here. I'm going to keep this hand separate for the time.

BS: *OK. You're describing this with your hands.*

NG: And so when you get ____ , consider you have a bad mirror here. Well, the same things applies if you send a ray up, like a search light and it comes out over here. Now, if I put in an opaque screen below that, the ray can't get up to be reflected back. Opaque screen? Can't get through.

(100)

BS: *Yes, opaque screen.*

NG: Black velvet. Now, the case you speak of in polar regions is the following. We know it now. We didn't know it then. We just knew it happens. We didn't know it then.
Now we know. Powder was ____ with a plane. Particles form below the ionosphere and when they're below, they cause absorption, not like this opaque screen. That's because the collision of the frequencies of molecules are about the same as the radio frequency that you use that causes absorption of energy. So, you can't then get through. If you do get through coming down, you lose it again.

BS: So you've got a double whammy.

NG: That's right. Now at that time we weren't quite sure as to why this happens. The plan allowed interpretation.

BS: You still had the three questions.

NG: Now, first there was an administrative problem. Joe Fletcher did not think much of the idea. No. He said, "The thrust in the airplane won't allow this ionosohn to go aboard. You have to cut a hole in the plane." I said, "______. I don't know a thing about an airplane. I don't want to know. Let somebody else _____. Just do it. Don't trouble me.

BS: You pick the guys that you can say, "Here's what I want done." You don't even have to say do it. Before you can say, "Do it, " They're out the door. "Yessir, and off they go."

NG: I didn't know how to overcome this, so the Air Force had a Scientific Advisory Board and on this board there was a man called Henry Booker, very famous ionosphysicist from Cavendish Laboratories in England. He had come to the US to become a citizen. He would judge the ______.
So, I called Henry in and I told him, we set down in a conference room just alone, I told him what I want him to do, and I recall quite plainly, he took his glasses off and said, "How intriguing." I never had any problems after that.

So, we got the equipment - wanna hear another bad story? We got it from _____ and Williamson, I think. It didn't work. So, I didn't want to sign off ____ . They were supposed to do this, they didn't do this. Why should they be paid? I work for the government. Why should they milk the government? So, I kept stalling on the payments. In the meantime, I spoke to somebody in Germany. I said, "I need a man that can do this, that and the other thing." He said, "I have just the guy for you. A man called Gaston." So, I wrote all the paperwork, he came back [and it has a paperclip on. He said, "We pulled ____." ] Put him in the lab. Told him what I wanted to do. He knew exactly - took off like wildfire. He loved to work. He was a very competent chap. So, pretty soon, he came to me and he said, "Mr. Gerson, my wife, my wife, my wife . . . How can you bring a man and leave his wife? So I brought his wife over." All this paperwork. So, his wife was with him finally . Then he came to and said,"My family, my father, my mother . . . "

BS: Where was he from?

NG: Germany.

BS: Oh, OK.

NG: I got in touch with a very famous German physicist in propagation called Dr. [Demigar]. To show you the Air Force problem, I never forgot what he told me because it colors all the work since. We used to go meet on the URSI meetings, and said, "Hey, polar cap absorption, what do we do?"
He said, "You know, during the war, I worked on that and the German army came to me and said exactly what you said to me. Exactly, word for word." They said, "How many men do you need?" He said, "I'll take 20." So, he tried to find the solution and he said to me, "I finally, after three years, gave him back the men because I could not find an answer." It was just as important," I said, "to know what you cannot do, as to know what you can do," isn't it? What's possible and what's not possible. No point in my saying I can transfer you to Mars in 10 seconds, I can't do it. You've got to know what is possible.

BS: *I understand.*

NG: So, this is all pre-this. So, now we had the measurements. Want to hear something funny? Two things. So, when they measured, they brought me back the tapes, they were so startling, unbelievable. See, if there was no ____, nothing would show on the records. You've seen ___ on records?

BS: *Um-hum.*

NG: Nothing would show. It would be clear, wouldn't it? No reflections. Outer space. These are ___ dynamics, you couldn't believe it. Again, I'm back to the problem. It was impossible to be bad ionization ______ . It would have shown a slow decline in ionization densities, electron densities. It might be wafted in from other latitudes, but then there would be some stability before this [tongue] of ionization dissipated. So, it had to be from a new source. So, I try to get . . . maybe we need for me to give it at the Washington URSI meeting within the US. ____? They said, "Nope." I went to the meeting. We all sat around the table. I told him, "Not reissuable. Can't trust you." So, we
spoke about other things in science, radio science. But then, next week, they allowed me
to tell it to the international audience at the Hague, the Netherlands. You figure that out.
So, when I presented it there, what a stir it caused. Nobody could believe it, but it
showed, gee whiz, some particles coming and causing the ionization. It was not the sun, it
was particles. First time we realized how bad the polar cap ionosphere was.

BS: *Particles.*

NG: Yeah, from the sun.

BS: *On the back side of the earth.*

NG: On the night side, yes. On the polar cap . . .

BS: *Well, what particles? Protons?*

NG: Mainly electrons.

BS: *Electron particles.*

NG: Electrons and protons both, actually. See electrons cause the aurora that you see.
And in the polar ___ are both electrons and protons.

BS: *Protons and electrons . . .*

NG: Yeah, and they're ionized by collision.
BS:  *Caused ionization with molecules - with air molecules.*

NG:  Yeah. And oxygen, mainly.

BS:  *With oxygen. And so they're brought in by gravity around the backside.*

NG:  No, they ____ the magnetic field.

BS:  *They slide down the magnetic field.*

NG:  Yeah, the magnetic lines of force. Yeah. In a way, it's just like your TV tube.

BS:  *And you guys discovered that in your lab.*

NG:  Yeah.

BS:  *Or you figured out your lab. You had to go up and measure it though, right?*

NG:  The moment you get new measurements, you can start thinking.

(200)

There's another thing we wanted to do. You know, when you look at the sun here at this latitude, it's in the east. The sun rises on the horizon, comes to noon and then goes to the horizon at dusk. If you were at a high enough latitude, as the earth rotates, you can see the sun at the same angle above you, if you can travel as fast as the earth rotates. Isn't that right? You were a pilot.
BS: *Yes. Yes. Say it again, say it again.*

NG: See, if the earth rotates, she ____ here 24 hours. As I go up further north towards the Pole, at the Pole, I stand still. I go down a bit from the pole, I can move around the earth as fast as the sun does. So, now I can move with the sun all day long. Now according to theory . . .

BS: *That's why my base at South Pole was so important.*

NG: That's right.

BS: *Couldn't do it in the Arctic.*

NG: Right.

BS: *You could, but not for long.*

NG: So you can fly the plane just to keep the sun at the same angle, incoming angle to your aircraft.

BS: *Yeah. Gotcha.*

NG: Now, that airplane concept to go way to the end, was later copied by the Soviet Union and the ____ itself was taken away from me with Gasmon in ____ the atomic tests of the US, because it was not a mobile laboratory.
BS: You had the plane built? Or equipped?

NG: Equipped.

BS: What kind of plane?

NG: Oh my goodness.

BS: C-54, then?

NG: Don't ask me.

BS: Just a big plane.

NG: Yeah.

BS: Flying lab. First flying lab we ever had?

NG: I think that's right. Yeah. I often put microscopes on it.

BS: So, you flew it up to the Arctic?

NG: I didn't. The pilot flew it up.

BS: You had it flown up. Did you go with them?
NG: Well, I wanted to go with them and my boss at that time, Greenberg, a civilian, said, "Don't go." I'm so sorry I didn't. Would have been nice the first time.

BS: But you had this thing built.

NG: Yeah.

BS: Hmmm. I want to put a note here so that I know I have it right. Protons and electrons cause ionization of oxygen by sliding the magnetic lines of force and colliding with oxygen atoms. . .

NG: Actually, it's spiraling around.

BS: OK, spiraling down.

NG: Spiraling down around the magnetic field lines.

BS: And can do so on the dark side of the earth, or the sunny side?

NG: Depends on the energy. That's right.

BS: I understand, but it comes in in the daytime too. You blot them out. Suppose, now, this all comes due to events on the sun. Which events?

NG: We learned that through the next few years. In fact, we are still learning and I wrote a recent paper on that within the past year or two. You've heard of the solar cycle. Now solar output increases with the solar cycle as the solar cycle rises to its maximum.
There's more aurora radiation, that's why all the layers increase in intensity and that's why you can use the highest radio frequencies through the maximum cycle during the minimum. OK?

BS: I guess. I understand.

NG: And also the sun squirts out more material - more protons and electrons - and I use the term CME, coronal mass ejection, which is a cloud of junk coming towards the earth like an aerosol that you squeeze toward somebody.

(250)

And don't forget, and again I want to go back to your TV tube. How did your TV work? You have an electron gun that shoots electrons out. OK. And your screen is illuminated by where the electrons hit, so if you just want to ____, you'll see the dots on the screen. They may spray a little bit. OK? But, then the stream of electrons go through two plates - one is electrostatic, the signal moves it up and down. The other one is magnetic and moves from left to right. So, the incoming signal is put on these two plates and they drive the electrons by the forces of static - the forces of the magnetic field, left or right, into the pattern you want. Because the radio pattern, the pattern that comes out of the microphone, goes into your TV and modulates the beam.

BS: Yes.

NG: So the magnetic field then changes the direction of the particles as well as the electric field. Now, in the polar regions, you have - that's the end of the di-poles. The earth is a bar magnet, essentially. The ____ lines come up like this, don't they?
BS: Yes.

NG: You've seen them. On the equator, they're almost perpendicular to the earth, to the _____.

BS: Yes.

NG: So, ____ particles, then, are deflected by these magnets, and they are so deflected that they come into the polar regions primarily. That's why the auroral zones are there.

BS: So, they come in with more force than they would at the equator, or more density.

NG: No, careful, careful. They're yeah . . .

BS: More density.

NG: The force changes things a bit. If they have a strong enough force, they can come right into the equator.

BS: Yes.

NG: Did you ever see a telephone pole with a piece of straw going right through it?

BS: Yes.
NG: Why is that? The wind is so strong it gets what they call rigidity, so if you have ____ field, most of the particles are not that strong in energy. If the ________ were strung up and come in to the equator in daylight. That's the most intense. If they're less intense, they're diverted, deflected by this magnetic field towards the north and south polar regions because of the aurora.

BS: I see, they're speeded up, or not speeded up . . .

NG: Not speeded up. Directions change. And then they can also come into the polar regions. So you have_______in both hemispheres at about the same magnetic location. And the polar caps similarly, except the polar caps, some in the ___ and some in the dark region.

BS: You know you're talking to a guy who had a plane take off to Christchurch once - one of my planes when I was commander down there - and he went into a com blackout and for two weeks we didn't know if he got to Christchurch safely or not. And I didn't send another plane because I didn't want to send him off in this. I could send him line of sight to use VHF. Amazing. And I didn't know why and no one could explain to me why.

NG: Now we know.

BS: But, I got a Lincoln Lab Satellite, LAS-9, and from then on, we've bounced signals off it and we didn't have the problem again.

NG: Yeah, that's right.
BS: Got personal permission from the president to use two of the channels. There wasn’t anybody at NSF or anybody they had, no scientist or anybody else, who could explain it to me. And I said, well, I know that VHF works line of sight and why the hell don’t we have a satellite. Well, we don’t have satellites to ____. I said, "We need one at the equator," so I got the LAS-9 from Lincoln Lab.

NG: Good.

BS: They've still got it. They still use it. NSF _____. I didn't like . . . I was worried about my boys being in the water.

NG: You need coms.

BS: They didn't have coms. They had com blackouts since Admiral Byrd stayed down there all the way up until 1984. And I ended that, but I never knew why until right now, thank you.

(300)

NG: It's because of this, you __electron coming downto say 80 kilometers, you create this opaque screen, this opaque screen to ____ the absorption. They stay up around 100 and above ____ reflection. So, the more energy to slow it down, they come and the more black outs you can have.

BS: So, that all depends on the intensity of the solar event. And some are intense and some are not.
NG: Yeah. Depends on the sun.

BS: *I understand.*

NG: That's why they're so difficult to predict.

BS: *So, you were involved with the polar regions from afar over this whole period of time. You were a natural for including in the planning of the IGY.*

NG: I don't know. I don't quite know how they picked me.

BS: *Well, partly it's because of your charming personality, I'm sure.*

NG: No, no, no.

BS: *I'm not teasing you. You do have a good personality. You're also a good scientist. OK, here we are.*

NG: Now that's just item one. Now let me tell you what happened to the plan. You want to hear a bad story?

BS: *That was to be a polar flying laboratory, huh?*

NG: It was, that's right, yeah. But, it was very flexible. It could go any way you sent it to, so . . .

BS: *So, you took it to Bikini, huh?*
NG: That's right, later on.

BS: Did you know Paul Ramsey when you were there?

NG: Who?

BS: Paul Ramsey.

NG: I don't know him. No. Don't think so. Don't forget, Gaspon did most of the flying.

BS: No, Paul Ramsey was a Nobel laureate in physics.

NG: Oh Ramsey! The physicist! No, I don't know him.

BS: You don't know him. OK. I met him on a trip in Antarctica. I took him to Antarctica as a tourist two years ago. We became very good friends. He was a roommate of Jim Van Allen's when they were grad students. They are very good buddies and we spent the whole time talking. I put him on the stand to talk about physics in the polar region just as a guest. He's one neat guy. Anyway . . . polar flying laboratory.

NG: So, anyway, let me tell you a funny story about this. Every so often I couldn't find the plane. Now, how in the world can you lose a plane? Guess where it was. In Oklahoma City because of reported oil leaks. So at first, I believed it. Don't believe it. I know nothing about planes.

BS: Or pilots.
NG: Or pilots, yeah. Then one day I discovered the pilots wives lived in the city.

BS: *I was going to say they were chasing girls there.*

NG: And that's why

BS: *Planes start leaking oil and having gas leaks and having shakes and rudders and all that thing, when you get over the good night spots . . .*

(350)

NG: Oh is that right?

BS: *You have to make emergency landings at New Orleans. Check the plane out.*

NG: It shows you how bright I am.

BS: *You should go along with them.*

NG: Because the plane wasn't at the North Pole long enough or reliably enough, when I got on the IGY committee, they made me chairman of the first two Antarctic committees and I said I need a station at the South Pole. And I wouldn't have a flying problem. I could have measurements all the time. They agreed with me. I told them the two poles are unique points in their sungeometry because they only have sun 6 months out of the year. At higher altitudes, you restrict that time. It's less. So, they gave me the South Pole.
BS: *When did you begin your first measurements there?*

NG: The committee began in 1953. You skipped ahead of me now. I was still with Air Force Cambridge.

BS: *So, these were the first IGY committees.*

NG: Yeah. No, hold on. There was only one - USNC. But I was chairman.

BS: *But, you had committees.*

NG: We had panels. There were several committees. I was chairman of the first two Antarctic committees. Then they had . . .

BS: *What were the two committees?*

NG: Different stages of the game.

BS: *Oh, I see - two different times.*

NG: Yeah.

BS: *OK.*

NG: One was to justify whether we should go there at all. The other one was to implement it. How? The details. And that's a story in itself. You won't believe what happened.
BS: Well, I'd like to hear it.

NG: OK.

BS: Well, are we jumping ahead or . . . ?

NG: We're jumping ahead, yeah.

BS: Well, let's back up then.

NG: You asked me about Air Force Cambridge.

BS: Um-hum.

NG: Now, in the 1953 period, that's when I was appointed to the USNC, and Kaplan, who was chairman, made me secretary of the committee . ..

BS: Of the whole thing, huh?

NG: Yeah, and I was also on some of the panels, plus other duties as assigned.

BS: So, Joseph Kaplan? This was Joseph Kaplan?

NG: That's right.

BS: What was his position there?
NG: He was chairman of the whole committee. Exceptional man.

BS: *And you were made Chairman of the first two Antarctic committees.*

NG: And secretary of the USNC. Shapley was the vice-chairman of the committee, and he was extremely skillful in handling people and details.

BS: *Still is.*

NG: I'm not sure I can do that.

BS: *I'm sure you can handle the details.*

NG: I think . . . yeah.

(400)

BS: *I think you're probably more skillful with people than you give yourself credit for, too. OK, so . . . USNC was formed.*

NG: Now, if you'd say this . . . we'll back up. Kaplan was also on the Board of the Air Force, the scientific Air Force of the AFCRL. And he became extremely impressed with the work I was doing on auroral physics. Don't forget, auroras are also caused by these particles from the sun, and deflected by the earth's mag field to the auroral zones around each pole - each ____ mag pole.
BS: *OK. That goes along with ionization.*

NG: That's right. Except, _____ exitation.

BS: *I causes exitation, what's that? Vibration?*

NG: You change the ____ electron a bit, when it comes back down it emits that ____ frequency of the atom. That's why most of the aurora are yellow-green indicating what? Atomic oxygen.

BS: *Atomic oxygen.*

NG: Yeah, with 55/77 angstroms.

BS: *Where are the reds and pinks? Where do they come from?*

NG: The reds and pinks also come from atomic more or less oxygen, but they're different wave lengths, different energy.

BS: I got you.

NG: And the violets, the purples come from nitrogen into molecules.

BS: *Interesting. So, you took ionospheric physics - this is what I was talking about when we first started the interview. I said we want to know the guy who comes to the project, to the polar region. What do you bring with you? Well, you brought life as you filled up and it's going quite nicely in this. And we're through two tapes, almost. And we're just getting*
started, aren't we? You just noted that Joe Kaplan was impressed with your auroral physics studies.

NG: Yeah.

BS: And he was the head of the national committee, so where do we go from there?

NG: So, one day I was appointed to the committee. I didn't know what it was all about, honestly. I had made comments at some of the URSI meetings about the IGY.

BS: I have to back you up a little bit because I'm just curious about something. It started out as the third polar year.

NG: Yeah.

BS: When did that change? Who changed it?

NG: Then there was a second polar year, fifty years later.

BS: I know. First polar year was 1882, second was 1932, and now, here we are - third polar year. When did it change from the third polar year to the International Geophysical Year?

NG: Oh, I imagine that was Berkener's doing.
BS: Berkener, OK.

NG: I would have thought it was the third polar year.

BS: But, he leaned across the table at Van Allen's to Sidney Chapman and said, "It's time we had a third polar year. What do you think, Sidney?" And Sidney said, "I was thinking of the same thing myself." And he didn't say it, but I'm sure Van Allen was sitting there gloating because this is what he wanted to happen. So, the name got changed by Berkener, you think.

NG: I'm sure of that, yeah. Then Nicolet was named secretary. It was a whole international effort. Chapman was the president.

BS: Yeah. Who was the secretary of the whole international?

NG: Nicolet.

BS: The Soviet?


BS: And then Chapman became a Yank.

NG: Yeah, he moved here.

BS: Moved . . . his papers . . .
NG: Did he get US citizenship?

BS: *I don't know, but his archival papers were sent to the University of Alaska.*

NG: Is that right?

BS: *They have all his papers. That's where he did most of his work afterward.*

NG: Yeah.

BS: *Interesting. OK, here we are. We just formed the IGY committee. How did it all come about?*

NG: Now wait, as to how it was formed, we have to go back to Van Allen's. All I know is they named me and I went to the first meeting. There were about 40 guys, 40 people, all senior to me.

BS: *Where was the meeting? This is the first US meeting?*

NG: I'm sure it was in the Academy somewhere. I don't recall. And I recall a very old gentleman, probably younger than I am now. I didn't know what he was doing there or who he was until the second meeting and I asked somebody. You know who he was?

BS: *I'm going to guess. Silas . . . Sir Charles Percy Wright.*

NG: No, no. I don't know him.
BS: *OK. You asked me to guess.*

NG: He was Marconi's radio man at Signalhead in Newfoundland who received the first transatlantic signals that Marconi _____ at Poldeau, England.

(500)

BS: *Oh, wow. OK. So, the first meeting they had what . . . 50 people?*

NG: Just about. I just added a few more. It was on the full committee. And then I'll tell you what happened to show you the skill of Audeshaw and Shapley. Second meeting was also large and the third meeting may have been large. And I said to myself, you can't get anything done with this many people. It doesn't work that way. They all want to say something. Nothing is done. No decisions. But, I was too junior to say anything - too timid, I guess is the word. But, finally, Audeshaw, at one meeting, called in a number of us, including myself, Shapley, Berkener, Stillhouse, one or two others. Executive committee and he said exactly what I told you. Too bulky, too unwieldy, you can't move with such a large committee. We have an executive committee to act, make decisions, then we'll tell the big committee what's here. Made sense to me. I agreed with that approach.

BS: *OK. And you were put on the executive committee.*

NG: Yeah, right. Still the secretary now and that's where I began making all the notes. And there were some side effects that happened. At one of the early meetings, I said to Berkener privately, "You know, why do we take an atomic bomb and make a hole in the ionosphere . . .?" You learn a lot from body language. Something I'm not good at. He
shook his head, but there was a trickle in his eye. So, after the - I guess it was exploded in the south Atlantic. I knew that he knew. Do you recall Argus?

BS: *One of the atomic tests that we did?*

NG: Yes. High altitude test. Because the magnetic field lines come close to zero near Brazil in the South Atlantic, they put an atomic bomb detonation there.

BS: *And that was right in the center of the South Atlantic ocean.*

NG: Yeah. And that radiation contaminated . . . and the radio ____ went berzerk. It contaminated the atmosphere for them for about five years until it leaked out, so to speak.

(550)

BS: Well, you made all these notes. Well, I don't want to inject the question yet? Where are the notes?

NG: Library of Congress.

BS: *Library of Congress?*

NG: Yes. In fact, there's a funny story. You know a man called Bulkeley from Oxford University?

BS: *I know the name.*
NG: He came down once to visit me and he had some startling things to say. He said he was writing a history of the IGY. I don't know if that was ever published or not. So he interviewed me about five or six hours. Then he said . . . scared the daylights out of me, he said, "You know, you were known to be at the CIA." So, I was taken aback. So, I just shook my head. Actually, that was not true. I was not with the CIA.

BS: Why did he say it? He was testing you. . . ?

NG: Do you see the minutes after I left the committee?

BS: I haven't seen them, no.

NG: We'll come to that in due course.

BS: OK. Well, here we are just beginning. Executive committee formed, you were made secretary.

NG: And I must admit, I spent a lot of time with the committee.

(600)

BS: So, tell me, you mentioned two other sub-panels - the one where you had to decide whether we were going to Antarctica, or whether we should.

We're going to have to get another tape.

(End of Tape 2 - Side B)
At this point we Nate Gerson and I agreed to get together at a later date and finish the interview. Unfortunately Nate died in the 12th of January 2002 before we could rendezvous. This part of the interview covers up through the IGY – Nate played a very important role in its organization. The second half of the interview would have covered his role in the NSA which was also significant. With the help of his family we will append that to this interview text.