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AN INTERVIEW WITH MR. JEROME "NICK" HEFFTER
FOR THE
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INTERVIEW CONDUCTED BY
MOLLY GRAHAM

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TRANSCRIPT BY
MOLLY GRAHAM

Molly Graham: This begins an oral history interview with Jerome "Nick" Heffter. The interview is taking place on September 25, 2019, in Bethesda, Maryland. The interviewer is Molly Graham. Can you tell me again about your family history? It is really fascinating, and I would like to get it on the record.

Jerome Heffter: Let's see. On my father's side, my grandfather was born in Opatow. We found that out since I'm an amateur genealogist. He came over to this country at the turn of the century, the last half of the 1800s. I know the name of the ship he came on, and have looked at the manifests, but his name doesn't appear. He came over, and he married my grandmother in Chicago, Illinois. She was also, I think, from Poland. Then, since Jews were not allowed to own land or have anything to do with land in Poland because of anti-Semitism always there, he decided he wanted to work on the land. Knowing nothing about it, he thought of homesteading. My father was born in La Porte, Indiana. They all went off to Grand Forks, North Dakota, and he went back to Chicago where he was making some money. He was just a kid. He must have been about twenty-five at the time. Anyway, he returned to North Dakota, and they moved to a homestead just outside of Denhoff, North Dakota, which was a town of a few hundred people at the time. Because of the era of depression and drought and not knowing anything about farming, they did not do well. So when my father was in high school, he had to drop out of high school, and he went into Denhoff to work at a bank there to make money to send back to the homestead. So that was my father's side, and how they got out to the Midwest. The other thing was that they were the only Jewish family in North Dakota west of Fargo, which had a small Jewish community. There was one other family, a farming family, about twenty-five miles away, but that was it. Of course, nobody was religious in those times. You couldn't be because it was just too far from anything. Most of the Jewish families were from the Fargo–Moorhead area. My mother was born in Lithuania, in Panevėžys. She came over as a child about the same time, a little later, probably 1901 or 1902, with an older sister. When she came over, she had measles or whooping cough. They came through Ellis Island. They kept her on Ellis Island, and were going to deport the family, but since she was just a kid, just one or two years old, they stayed. They had family in Minneapolis, Minnesota and Fargo, North Dakota. Her father went to Fargo and her uncle was in Minneapolis, and that's what got them there. That's how she got into that area. She then got a college degree in music from Grand Forks, the college at Grand Forks [University of North Dakota] in music. That's what she did. She was a professional musician, had a trio. They played all over the Midwest. I've got a lot of clippings and things from the local papers. It was a fairly well-known group. They did some concertizing in Minneapolis with her next youngest sister, my Aunt Belle, who was a cellist, and a very famous cellist. Belle went on to become the principal cellist of the Honolulu Symphony, and was out there for many years. That was how they got to the Midwest.

MG: Tell me again about your uncles.

JH: Her cousins were fairly famous in the area. One of her uncles – the family name was Lippman, L-I-P-P-M-A-N. The whole name, by the way, was Lippeshalit in Lithuania. Each family had to send one boy into the Tsar's Army. When you went into the Tsar's Army as a Jew, chances are you never came out alive. Since one family could keep one boy back, they decided to split the name up, Lippman and Shalit. So her side, her father was Shalit. The brother's side was Lippman, and that's where the name came from. They just continued the separate names when they came to the United States through Ellis Island. They kept those names. So her cousins, one of them was a very, very famous songwriter, [Sidney Lippman], who wrote "Too Young," which was his big hit. He had many other big hits. He had a Broadway show that ran for eight or nine months, *Barefoot Boy*. Max Shulman wrote the words, and Sidney, who we called "Shep," wrote the music to it. He wrote all kinds of other hits. He was one of the leading composers on Tin Pan Alley at the time.

MG: You also had a relative who was a well-known psychologist.

JH: Yes. The other cousin was a child pediatrician, probably the leading pediatrician in Minneapolis. Then his other cousin, Hyman Lippman, was a child psychiatrist that studied with Anna Freud in Europe. Those were some of the more famous of the Lippman Family. That was what I was going to tell you about. Oh, well.

MG: I think you have to tell me again how your parents met.

JH: Sure. Well, since my father then decided that he could not make it on the homestead, the farm, during the Depression, he got a job in St. Paul, Minnesota, at the Federal Land Bank. It was not easy, practically impossible, to get a job during this time. Somehow, he got it, which kept us out of total poverty for the entire Depression-era. My mother then was playing music around the whole area. She was with one of her cousins in downtown Minneapolis, back in – I'll tell you exactly – 1931. They had just played some concert there. So she was downtown shopping. She was always very interested in the underprivileged, especially in black people, which was, back in Minnesota, in St. Paul/Minneapolis in those days, really a rarity; you did not see very many blacks. But she did a lot in the whole community music-wise. She was walking downtown and saw in the window of a novelty shop, a little black man figurine playing a banjo. She was intrigued by this. As she was walking on, she decided she had to buy that. She and her cousin turned around and came back to buy it. Just at that time, my father, who she never saw before, got out of a car with somebody who the cousins knew. They introduced them, and that's how they met. They got married and produced me.

MG: You were born in 1933.

JH: 1933 in Minneapolis.

MG: What stories about the Great Depression or the Prohibition era did your parents share with you?

JH: Yes. Prohibition is interesting because my grandfather, he always had money. By money, nobody ever starved in our family. He probably was a bootlegger. They lived about a mile from us in St. Paul. In fact, we moved in with them when we first came to St. Paul. He probably had a brewery in the basement. I don't know. But whatever it was, that was what went on at the time.

MG: I also was wondering about the Depression.

JH: You know, as a kid, I had no idea. I was too young. Since I was never hungry, we always had a place to live. What I do remember about growing up in St. Paul is since we lived in a fourplex on the top floor with a flat tarred roof – what you can say about the weather in the twin cities is that it's colder than hell in the winter. Let me tell you. In the summer, during the Depression and the heatwave, it was hot. I remember that it was too hot. With no air conditioning, it was too hot to remain inside and sleep. So the families would go out in the front yards. That's the way we spent many a night, sleeping outside on whatever, just a pulled out mattress or chair. This I remember about St. Paul weather. But the Depression, I was really spared any of that. I don't know anything about it from that standpoint.

MG: I meant to ask for your parents' full names.

JH: My father's name was Jacob, Jack. My mother's name was Leah. My oldest grandson, who's a pharmacist in Milwaukee, is named Jacob. One of my granddaughters, who's now in college – she's going to be a PA [Physician Assistant] is named Leah. So we have a Jacob Heffter and a Leah Heffter in her honor.

MG: What was the name of your mother's musical group?

JH: I can't remember. It was made up of my mother, who was playing violin at the time, although she was violist; my aunt, whose name was Belle; and a pianist from the college, Peg temple. They were a very well-known trio in the Midwest.

MG: There were also a lot of notorious figures and gangsters in the Twin Cities during this time.

JH: Ooh. In the next apartment on the upper floor were the O'Learys. Mrs. O'Leary's mother had a house about a mile from where we were. This was during the '30s. She kept telling Mrs. O'Leary [that] she looked across the alley, and there was a lot of activity going on in a house on

the other side, people coming and going maybe with music instruments. She said it was very intriguing. Well, it turns out that the people living there were the [John] Dillinger mob. This was their headquarters. This was during the '30s, during the big racket. Dillinger was coming in and out, whatever he was doing – killing people and robbing banks. There was a lot of stuff. That was just one of the stories, but she was right. We found that out, of course, afterward, after he was shot in Chicago, I guess. They traced him back to the Twin Cities, to the apartment. Oh, yes. But I was a kid. I was spared all of this stuff.

MG: Kid Cann was the other notorious figure in the area during this time.

JH: Well, Dillinger had a lot of his cohorts coming in and out. I can't remember the names. There was a lot of – well, it wasn't like New York City, of course, but the Midwest had their share of them.

MG: I also read that in this area during the 1950s, there was a lot of anti-Semitism.

JH: You know, there's anti-Semitism all the time, all over. The Twin Cities, as far as I knew, I knew none. Absolutely nothing. I was really spared. After all, it was a white-collar area, pretty much all professionals and college-educated people. I don't think overtly that I could see anti-Semitism. But some things I recall shocked me all of a sudden. I went to some gathering outside a fair or something, and I saw some – by the way, the main people who lived there were Scandinavians. These were pretty much all Lutheran, hardy bunch, absolutely wonderful people. I don't think there was an ounce of anti-Semitism or anti-anything with these people. These were typical Midwesterners. This is what I grew up with. Everybody got along. But I did see this woman – there was a kid who was complaining about something, a little kid maybe five, six, years old. She just looked at him and smacked him across the face as hard as she could. I thought, "My god, I've never seen anything like that in our community." You just didn't do this kind of thing. That's one thing that shocked me. But there were many synagogues and temples. We all were brought up religious, although not super religious. We all went through Hebrew School and the whole bit. Not really any overt anti-Semitism that I could see. Maybe in hiring practices, yes. What I could say is a good friend of mine, a fraternity friend of mine – when I was at the university, I was in a Jewish fraternity. That was the name of the game then. One of my fraternity brothers then went on to become a politician and became Mayor of St. Paul, the first non-Catholic mayor that St. Paul ever had, and he was Jewish. He then went on to become a judge.

MG: What was his name?

JH: Larry – I can't think of his last name. [Editor's Note: Mr. Heffter is referring to Lawrence D. "Larry" Cohen, who served as mayor of Saint Paul, Minnesota from 1972 to 1976.] I don't know.

MG: That's okay. Were you and your family following the events of World War II closely?

JH: Oh, absolutely. Yes, on a regular basis. First of all, my mother played at many of the military induction proceedings. We knew that practically every family had people over fighting during the war. Even though we were in the Midwest, you were affected. One of the biggest things, which I find very interesting today, is that if you go downtown to the World War II memorial in Washington, as you walk in, there's a big plaque with gold stars on it. I don't know how many – each one says, "Ten thousand casualties" or something. I've been down there many times. I've just offhand asked people, "Do you know what these represent?" – younger people. Nobody has any idea. A gold star during World War II meant that somebody in the family was killed in action. So you could see people put gold stars or silver stars, wounded in action – many houses, all over, no matter the neighborhoods. All neighborhoods had stars. You were very aware of what was going on.

MG: I was curious if your parents still had relatives in Poland or Lithuania.

JH: Yes, I'm sure they were all killed. This brings up, of course, my wife's whole family. Her sister-in-law, who was a product of – went through the Holocaust, was born in Poland, and they managed to get through the war. They lost everybody, the entire family, except for just a few of them, but that was the other side. That was my wife's side. Interesting you ask. We had no direct people that I knew of that remained in Russia or Poland. Now, I'm sure there were and some of my uncles and aunts, I think, had relations over there. I can't remember anything about then or even afterward as far as visiting them or anything. Some, I think, did – yes. Some did go to Israel – so they visited them – we found out well after the war.

MG: Tell me more about the schools you attended growing up and what that experience was like.

JH: Well, I could tell you, growing up in Minnesota, we were about five or six blocks from my grade school. In those days, bussing? You got to be kidding. So you walked in the wintertime uphill in the snow to school, five feet of snow. Coming home, you walked uphill in six feet of snow. I remember being out one winter. It was thirty-five to forty [degree] below. Nothing closed. Interesting – the University of Minnesota never closed their classes until well after I left, and then they had to. They had an ice storm that was, I guess, terrible. But you were expected to come no matter what the weather, any time. This developed the tunnel system at the University of Minnesota, the heating tunnels. The university, when I was there, on all three campuses, had

fifty-thousand students. Some were in Duluth. Some were in St. Paul, the head campus. In Minneapolis, all students used to head for the tunnels when it was cold. Since the Minneapolis campus was the largest campus in the United States area-wise, you had to be very careful what classes you picked because if you were too far away, you couldn't get between them. So this is the way you set up your classes; you had to make sure there was time to get to them. So growing up, grade school and the high school I went to was the elite – although you can't say it – but it was the big high school that most of the kids that graduated there went on to some university. By most, I'd say a good two-thirds. A lot of the other high schools were more trade schools. Most of those kids went on to get jobs. Some of them were really very good. They were really good trade schools. My high school, Central High [School], is still there. They still want money from me.

MG: Is it a public school?

JH: Yes.

MG: When did you graduate?

JH: I graduated in '51. I was very smart. I graduated, I think, third in my class. Then I went to the University of Minnesota, and I wasn't third in my class anymore, let me tell you. Boy, what an enlightenment I had when I got there. I remember taking Mathematics. There were not very many girls in science classes there. But there was one gal who was obviously much smarter than me. It killed me. She was a really good friend. I wonder whatever happened to her. But, there were not a lot of women when I got into college. Most of my classes were math and statistics. The big statistics class I took, which I really liked, was called biostatistics. The professor was a post-doc who worked on the study linking smoking and cancer, which was done in Michigan. She was on the original team. She was teaching biostatistics. That was a course that was required in pre-med. Of course, if you know medical students, [they] absolutely hate anything with mathematics. But she made that course so fascinating. These kids came, and she was just really good. It was a wonderful [class]. It's what got me interested in statistics, really.

MG: You studied a lot of math, but you ended up graduating with a liberal arts degree.

JH: That's all that there was – science, literature, and arts was my degree. There were no science degrees, anything like that. That essentially saved me because I had depth of field problems. I was in ROTC [Reserve Officers' Training Corps]. If you wanted to stay out of the Korean War, you joined ROTC, and that was the thing to do. I was in Air Force ROTC. Between my junior and senior year, I went to boot camp in Colorado. I managed up until that time to qualify in pilot training. Everybody who was in ROTC Air Force wanted to be pilots. Well, there were some who were observers, which was the other option. When I got out to boot

camps, they gave me a couple of tests, regular tests. Then we went into a lab, and there was an eye test where you look into some machine with dots or little circles, three by three – depth of field, I guess. The guy said, "Now, which one is sticking out?" I said to him, "What do you mean, sticking out?" He said, "Which one comes out at you?" I said, "None of them do." He said, "Okay." So I was informed I could not be a pilot because I didn't have depth of field. So I was going to fall back into the observer category. But, since it was the Korean War, the observer positions were all filled. So I had my choice. I went back to school, and some officer gave me my choice. He said, "Look, we can get you into the Army as a Second Lieutenant. You can graduate, go over to Korea, and probably go on the front lines. Or, we'll send you to become a meteorologist, to grad school." So, guess what I chose. That's what got me into meteorology.

MG: Did you have any interest in meteorology?

JH: I didn't even know what a meteorologist was, literally. I had no idea. We had weathermen on television. I might have known. So I got my choice. I went to NYU [New York University] for a year to grad school.

MG: Was your entire grad school experience at New York University?

JH: No, no. That was just the start. Then I went into the service for four years, which was part of the deal with the Air Force. I was originally sent to Hanau, Germany, which is just outside of Frankfurt, to an Army airfield there. This was kind of a ruse by the Air Force; they were not very honest with us, because where they needed meteorologists was in Africa. So I was in Hanau for about, I don't know, three or four months. Then they shipped me down to Wheelus Air Force Base in Tripoli, Libya. So I had all of these blues and things I bought for cold weather in Germany. I went down to Tripoli, and that's where I spent the rest of the time I was there for two and a half years then, as a weather forecaster in Tripoli, Libya.

MG: That is so interesting. Tell me more about that experience and what that was like.

JH: Well, first of all, the day after I graduated from university, I got married. My wife was just finishing up her nurse's training, an RN [registered nurse]. I met her at the University of Minnesota. She was at Minneapolis General Hospital. Their family, at that point, had practically no money, certainly not enough to send either her older brother or her to college, so she went to Minneapolis General Hospital to be a nurse, and they didn't have to pay them for training. But the nurses had courses at the University of Minnesota, which was a couple of miles away. They could walk back and forth. So I met her at Hillel House one Friday. We went together the whole time and got married the day after [we graduated]. I went to New York in the Air Force, and she stayed back until I got settled in New York. Then she came out and joined me there. She worked as a nurse at Fordham Hospital, which then became Bronx Municipal

Hospital when it opened up. I was at NYU uptown, which was the science end of NYU. It closed many years ago. They closed because it was too dangerous to be up there. It was terrible. It became a terrible neighborhood. It was in the upper part of Manhattan. There's another school now that took over. Then, when I went overseas to Germany, she went back to Minnesota to finish up some other graduate work there and stayed with my folks. In North Africa, in order to bring your family over, you had to have housing. I was not a high enough rank; I was just a lowly Second Lieutenant, so I had to live off the economy. So that's what did. We lived in town, and I went into the base on a daily basis. Finally, she came and joined me. She was pregnant when she came over. She had a miscarriage there. She got pregnant again, and my oldest daughter, Deborah, was born in Tripoli, Libya, at the base hospital there. She had an opportunity when she was twenty-one years old to become a Libyan citizen if she wanted, but she declined it. She never got a birth certificate. She was born on a U.S. base, but it was not official. It was leased from the Libyan government. Anyway, she finally got the certificate, but, boy, did it present problems no matter where. What, no birth certificate? It was an interesting tour. It was a MATS, military air transport service command base, the largest overseas base I think that we had. What it did was to shuttle transport planes between the United States, North Africa, and Saudi Arabia. So we were the hub of that, and then on into Turkey. It was also the base that was the training for fighters from Europe to come down for practice bombings and whatever else they did because the weather in Europe was not very suitable for year-round operations. So the squadrons would come down and stay and do their exercises out on the desert for months at a time. We had to brief them on a regular [basis]. The United States Air Force had a weather squadron. Wheelus AFB had a weather detachment. The squadron headquarters was in Spain. Meanwhile, other people from the class – our entire class went to exotic places. They went to Germany, to England, to Japan. Most of them that came that way wound up back down in either Tripoli or some in Saudi Arabia because the Air Force did not want to send a whole class to terrible places. They wouldn't get any more people to enlist. They did this to a couple of good colleagues of mine, one that was sent to Italy. He was there and got married. He was there for well over a year, and then they sent him to Tripoli with his new wife. This was really rough. She was young, and her whole family was in Italy. They also sent a couple of people from England down. It was not a good deal. So, in a sense, I was fortunate that I was there early. But it was quite fascinating. It was a fascinating tour, but you could go nowhere. There were three places you could visit the entire time; two on either side of Tripoli. One was Sabratha. The other was Leptis Magna. They were old Roman ruins. They're still around today. They're some of the most well-preserved ruins. The theater at Sabratha is still in use. Well, who knows what's going on in Libya now. The third place to visit was the sandbox south of Tripoli called the Sahara Desert. We went down into it a couple of times on various strange personal missions. But that was it. You got several trips. I could get out because I could go on training flights, which was nice. If I would be sending aircraft back and forth – for instance, to Rome or Italy or Greece – I was allowed to go along on some of these flights just to observe, which was a good deal – what weather conditions were or how things were. It helped us as

forecasters. In those days, forecasting was so different. No computers. Everything was done by hand – absolutely everything. We had no computers at all. We had airmen that drew maps; sat and did nothing but draw maps that then we analyzed and then did our forecasts from. The weather in Tripoli – there was no air conditioning, and it was hot. I mean, it was miserable. When you got winds from the south, which we called [Ghibli], G-H-I-B-L-I-S. [Editor's Note: "Ghibli" is an Arabic word that means "hot air blowing in from the Sahara desert."] They would come in and last sometimes four or five days, sometimes as long as ten days. Everything was sand. There's no way you could shut windows. You ate sand. Everything was sandy. And it was hot without air conditioning. Of course, we worked shift work. There were three shifts a day. You could get stuck on the midnight shift, which was twelve to eight, in a huge operation center that heated up all day [with a] flat top, [and] fans, a couple of them. It was just miserable. The poor observers were sweating, and you'd get maps that were just wet. I felt so bad for these guys, but they had to bear it. I have to tell you about – one afternoon, I was working a dayshift, I guess. We had sent a team of weather observers out into the desert, near [El] Azizia, [Libya], which is where the record temperature had been recorded on Earth, 136 degrees Fahrenheit. It was done in 1936. It was on the record books as the hottest ever recorded. We were getting regular reports from the team that we had sent out because the planes that were flying in were very critical on temperature. If the temperatures were too high, they couldn't fly. Or, if they were doing dives, they had to be careful. So we were monitoring temperatures on an hour by hour basis out there. This day I looked, and I noticed the temperatures that the observers were sending in were 133, 134, and I thought – I knew about the record; I don't know how. I think at graduate school we were talking about it. I thought, "We ought to keep alert." I knew the record was 136. So when it went up to 135, I radioed to them, and said, "Start taking measurements every five minutes," and they did. We got to about 136. We had it made. "That was it." At least we got the record. When we came back, we took the reports and set them aside. Anyway, years later, I read – back ten years ago or something – a new record had been set somewhere in Needles, [California] at 135.8, in the world of records. So I thought, "You know, I knew it was 136 in Azizia." So I called the meteorologist who was in charge of records in meteorology for the World Book, a really nice guy. I got him. I talked to him. I told him about this situation. He said, "We know about Azizia. We're not using that 136 because," and he gave us several reasons. One of them – they didn't know enough about the thermometer that was measuring it. It was not up to standards back in 1930. They didn't know who was recording these records. There was not enough known to go in officially, so that's why they used the Needles [record], which was well-documented and observed. That's 135.8. Then I said, "But I can give you documented stuff, 136, that I was there." He said he was fascinated. He had never heard of this before. He said, "You got to give me the documentation." [I] never could find it. Whoever I gave it to, it probably was put back with the regular records. We went to records in wherever they keep National Weather Service records; in Omaha, I think. The stuff all got thrown out.

MG: What about the Air Force? Would they have records?

JH: I'm sorry. It was the Air Force records. No, no. So what can I say? These are stories I don't think anybody else knows about, except the guy who I talked to. It's too bad. I would have loved to have been able to find the recorded record. I met some very fascinating pilots that came through. While I was there, I got the quickest top-secret clearance ever issued. I was working a dayshift, and there was a flight of B-36s coming through Wheelus Air Force base, flying to Turkey. The B-36 was critical on fuel. There was no air-to-air refilling, so they stopped at Morocco, from Morocco to Libya, and from Libya to Turkey. I can't remember the name of the Air Force base in Turkey. They had their own meteorologist on the mission. I don't remember how many planes. There might have been six or eight of them. Anyway, this was a very unusual and dangerous mission. I think there were only two personnel on each one of these planes, a pilot and a copilot. The meteorologist came down with the flu or something; he could not join them. So they got somebody to come out to Morocco, but they needed a weather forecaster to get the planes from Morocco to Tripoli, and from Tripoli on. There was nobody around, and I was probably the lead forecaster in those days at that time. So they said, "You've got to brief and debrief. Do it on your own time, but you've got to do it." But I needed a top-secret clearance. I didn't have any clearance at all. So I said, "I don't have one." They said, "We'll get you one." Overnight, I got a top-secret clearance – "Top Secret." I guess I had to sign something. I interviewed these pilots as they came in. Oh, god. They were nervous wrecks doing this. Unfortunately, the weather was not good, so they had to hang around. They wanted so badly to get this mission out of the way and just get out of Tripoli. Tripoli was terrible. There was nothing. They couldn't leave. They were pressuring us to get good weather as such. Another thing we did was brief the two aces of World War II and the Korean War, Robin Olds and Chuck Yeager. This was Colonel Robin Olds. They had shot down more enemy planes than anybody else. They came through Tripoli on their way to Ankara or somewhere. I was going for supper at the end of a mid-shift. I knew they had been there, and Robin Olds was walking up next to base operations. I walked by him. I didn't know who he was. I nodded to him. I said something. All of a sudden, as I walked by, I hear, "Lieutenant." I turned around, and he looked at me. He said, "You walk by an officer and don't salute. We don't do that in the Air Force." He gave me, boy, a talking-to. He was going to talk to the base commander about this. This was some kind of guy. So, the next day, who would be working and who came in for a briefing? Olds. He was not very nice to anybody it turns out. He was not a nice guy. He was an ace. The weather was – you could not fly if the cloud cover was five-eighths or more. Clear to four-eighths was okay for taking off. Well, the observer on duty was calling for five- eighths. This infuriated Olds. So he came to me. Unfortunately, he didn't remember me, and said, "Tell that observer to go out and look again, and let's change that." So I went over to an airman, first-class. I said, "Go out and look at the sky cover." He came back in. He said, "Sir, it's five-eighths." So I said, "Okay." I could not correct him. This would have been totally illegal. So I thought, "I got to get out of this." Luckily, at that time, the detachment commander came in, and Olds went up to him – he was a major – and said, "Major Harrell, go and tell the guy who's

working for you to get us up flying." Harrell and the observer went out, and they decided maybe four- eighths was okay. That was my experience on that.

MG: Did everything go smoothly with those flights?

JH: Yes, yes. I think, at one point, the base commander – this was the base commander at Tripoli, who was a one-star general – did send a letter to the detachment commander. It was Major Harrell thanking him for a job well done. It wasn't just me. There were a lot of other people who helped in this whole operation. It was appreciated. Not often did we get anything like that. This was our job. This is what we did. A lot of good forecasters came through that program and went on. Some of them were colleagues of mine in the Air Weather Service afterward. In fact, I think many of them went on to NOAA [National Oceanic and Atmospheric Administration], or then it was the Weather Bureau.

MG: Was any of the work you were doing in Tripoli connected to the Korean conflict?

JH: No, this was after. The Korean War finished – it must have been '57, '58. It was done by then. Vietnam, of course, hadn't started at all. No, not that I know of. Of course, a lot of the pilots, such as these guys, were pilots from the Korean War. But remember, this was a MATS base. It was not primarily a fighter base. The fighters came in from Europe. A lot of them from both France and Germany and England. England was even worse because of fog and low clouds. They were in and out of Tripoli, where flying could be done practically every day. There were very few flying restrictions. There was a commercial – the British had a commercial airport south of Tripoli, which is the one they're fighting in now. This is where a big war is going on. They're fighting, I think, at that airport, Wheelus [Air Base], which I've kept track of what's going on there. Well, when [Muammar] Gaddafi was ousted, the Libyans kicked us out of Tripoli, and they took over. The Libyans took over the airport. That totally took any American influence away from there whatsoever. I've looked at Google a lot. Our house was one block from the king's palace; this was King Idris at the time. Gaddafi then deposed him. I could not find the palace. It was a magnificent palace. It had beautiful grounds. I could not find it on a [map]. I finally did. It's now become a library and tucked away. Of course, the street I lived on, which was just a dirt road I'm sure now ceases to exist. It's totally changed. The road that we went on every day between the town and the base, we went through a town called Souq Al Jum'aa. It was a dirt road, two lanes, and it had a depression in it. So when it did rain, and occasionally in the wintertime it did rain, it would fill up with water. You'd have to drive through the lake. The Arab kids just loved it because the cars would all get stuck, and then they'd push them out for a little *bak sheesh* [charity].

MG: What years were you in Tripoli with your family?

JH: I was there from ’56 through ’59.

MG: Your tour came to an end in ’59.

JH: Well, they let me out because I had to rotate back, so they let me out early because I had applied to grad school, and I got accepted at MIT [Massachusetts Institute of Technology]. I got into MIT then in the winter, the first semester. I was out of the service about four or five months before my four years were up. So I came out as a captain; everybody did, but I never went through the continuation of the program. A lot of people did in our group. John Miller, Dr. Miller, who’s a good friend of mine, got to be in Germany the whole time. He lucked out. He then stayed on, and he wound up in the Air Weather Service as a colonel, which was very nice. Some of them did stay in the service, yes. I had it with the military at the time. I saw too much of what was going on. However, it was a great experience. Yes.

MG: What went into the decision to apply to MIT?

JH: I knew I was going to go back to graduate school since I was fascinated by forecasting. But, one of the things I was more interested in was research. I did a lot of that when I was over in Tripoli doing stuff like looking at some of the statistical things, looking at the probabilities of fog coming at certain times, weather-related things, and I liked that kind of stuff. So, I thought, I’d like to go back and get into meteorology, into the research section. So I applied to, I don’t know, three or four schools. Every school I applied to accepted me. Here’s somebody who’s been in the Air Force doing this stuff. It was not that I was so smart. It was just that I had good experience. I figured, “What the hell? I’ll pick the best one,” which was MIT. I liked the idea of living in the Northeast, and there was family there. So that’s what got me to MIT.

MG: What was that program like?

JH: Well, I worked. I was a research assistant working on radar. This was the big thing that was coming up: weather radar. This was my job. I was there as a research assistant because we needed the money. My wife and I already had two kids. Lisa was born in Boston. So we had two kids. My wife was working as a nurse, and we were broke. We had absolutely no money. I was going to school. It was practically free for grad school because I was a research assistant. She was working nights. We’d go back and forth. I would be at school during the day, then come home. She would then go to work at night. So we saw each other every once in a while. I worked for a husband and wife team at MIT, one was the initiator of weather radar. [Editor’s Note: Mr. Heffter is referring to MIT researchers and professors, Dr. Pauline and Dr. James Austin.] Very well known. That got me into the computer work. In those days, MIT had the first IBM computer that was used for science, The IBM 704. It spanned the entire top floor of the meteorology building. It was a huge building, and it had all of these big tapes and stuff like

that. It was a huge place. Graduate students could work there if they wanted – the only way you could run programs was to sit at the console. We could use the computer between the hours of two and five in the morning. So, this is what we did if we needed [to]. I became fascinated by computer technology and started programming. I started working with a gal who was developing Fortran at MIT, which was very interesting. Though, I never worked in Fortran because then we worked in what was called machine language. You take the number six, and you put it here. Then you take the number seven, and you put it next to the number six. Then you take a plus sign, and that was machine [language]. Every single step had to be done by hand. I was working with two radar assistants, whose names I can't think of, studying rainout of particulate. Since, when it's raining, anything that comes into a raincloud is going to be either rained out or washed out in some way. They wanted to know the effect of these processes, and we had the radar data. They decided I should apply some theoretical equations to the particulate and see what would happen. That got me then interested in the transport and dispersion of hazardous material in the atmosphere. That made my entire career. That was my thesis then. I developed a computer program for looking at rainout. This then came to the interest of the Weather Bureau Special Projects Section in Washington, D.C., and Dr. Lester Machta, who was lab director. The lab was looking at radioactive fallout. Of course, with fallout, you have rainout, and you need some way to include this phenomena. So they found somebody that they needed badly because they were going back into a big period of testing. One of their main meteorologists, Frank Cluff, who had been at the lab, was sent out to a branch lab in Las Vegas, Nevada. So they needed a replacement for Frank, and they needed him badly and in a hurry because of an upcoming experiment series. So they found out about me, and boy, they grabbed me, and they gave me a really good deal. It was hard to turn that down. I was working on my PhD, but for several reasons, I never got my coursework done. In order to continue, I'd have to do a thesis. At MIT, it was a long [process]. They kept you there. We had no money, and I was anxious to move on, so I thought, "Well, I'll come back." So I went down to the DC area, and of course, there was never time to get back, but I never needed a PhD. It was silly to even think about it after that point. But we were literally broke, and a third kid on the way, too. So we moved from Arlington, Massachusetts, to Arlington, Virginia.

MG: What was your first title?

JH: Research meteorologist at the Special Projects Section of the Weather Bureau. The head of the Weather Bureau was [Dr. Francis W.] Reichelderfer. He was directly responsible to the president. Kennedy? Under Reichelderfer was a chief scientist, and then came Lester Machta, my boss. So between my boss and the president, there were only about three or four steps. I mean, amazing.

MG: You mentioned Fortran earlier.

JH: Yes.

MG: Can you say what that is?

JH: Sure, sure. When we first came D.C., machine language is what we were using. That required punch cards. You'd punch out the various records, what you wanted to do, [and] put them on cards. Those would then be fed into the machine. During this time, Fortran was another machine language that was being developed by a team, but at least partially by this gal at MIT. So it had gotten fairly well-developed when I got down. I decided that I wanted to learn it, so I took a two-year course here [at] nighttime at the Department of Agriculture in Fortran. I became very literate in programming and Fortran, which is still a scientific language being used. There are fewer and fewer people who can use it anymore, but it was very powerful. This was the earlier [version], Fortran 66. Then it developed into Fortran 95, which was a bigger version. Of course, now there are dozens of these computer languages that do things that Fortran couldn't even consider, but much of scientific programming still remains in Fortran. I got into some of the other programs, but nothing was this powerful at that time as Fortran. I've done all my programming in Fortran, and that's what I still use today. Luckily, I've still got some colleagues at work that know [Fortran] because I keep forgetting. So all of the work that I did was in Fortran.

MG: You were living in Arlington, but where was your office at the time?

JH: Well, the office situation was very complex. I came in at 24th and M [Street]. 24th and M was the Mexican Embassy during the '30s. During the [Franklin Delano] Roosevelt administration, the WPA, [Works Progress Administration] built a building next to the embassy at 24th and M, and that became the main building. The embassy building was still there with stables behind. Our offices were in the stables – two floors overlooking a women's hospital [Columbia Hospital for women], which is no longer [there], which was near 25th and M. So you'd have ambulances coming in all the time with pregnant ladies. It was an exciting place. Anyway, it was a pretty bad place. They had to close our offices in the stables. Special Projects was there for several years. It was rat-infested. When the secretaries would come in the morning, walking up the steps, they would see rats going back and forth. That was not acceptable. So we were then shipped over to Connecticut and M for a year. From Connecticut and M, then we came back to 24th and M, but they had torn down the stables, so we went into the embassy itself, which was a grand old building, but in terrible need of repairs. From there, we went out to Executive Boulevard in Rockville, Maryland, for a year until that building was condemned. It was a new building. We were on the fourth floor. They couldn't figure out, in case of a fire, how they'd get all of those forecasters out of the building without them jumping. So they closed that building. Where did we go from there? I think we came back to 24th and M. Then we went out to Gramax Building. We were at Gramax, which is Silver Spring, Maryland,

for ten years until that building got condemned. It was wonderful. You'd come in after a rainstorm, and your desk was soaked because everything was coming in through the windows. Then we went to the Silver Spring Weather Center four main buildings. We started in the second building. The first one had been condemned before anybody moved in. It's wonderful, isn't it? Then we switched to the third building after that. From there then, because we do so much work with satellites and with the National Weather Service, we joined them in College Park, Maryland. So that's how the lab got out to College Park. We've been here now five or six years, I think. I think they're very nice quarters. Have you been there? No? Okay.

MG: Not yet. Can you describe your first detail? What were you doing when you first arrived?

JH: Sure. This was all related to nuclear testing. Since I had the programming experience, we did – most of the work was by hand at that time. So the tests had been going on – the lab was involved in the tests from 1948 in the Bikini and Eniwetok tests. This was well before I was there. Lester and his crew initiated all of that work. They were forecasting fallout from the tests, radioactive fallout. Those tests went on until, I don't know, '58 or something like that. Meanwhile, there were a whole series of tests in Nevada, which I don't think I mentioned to you, but we had a huge branch lab in Nevada. They were supporting the test site out at the Nevada Test Site. They were doing a tremendous amount of sub kiloton and kiloton testing out there. I mean, for years. Of course, every test that went on had to have somebody forecasting fallout no matter what. So that was the primary job of the lab after the initial tests stopped in the Pacific. So when I came out, we were expanding our nuclear test program. The scientists from the big Pacific tests were looking to keep up-to-date. They were not being utilized. They were beginning to lose these guys. These were some of the top people in the field of nuclear computation, nuclear work. They needed a project to keep them interested and busy. So they decided they wanted to do another big series of tests in the Pacific with megaton size weapons, much bigger than they had at Eniwetok and Bikini. They needed something to work into that. This initiated Project Plowshare. Plowshare was peaceful uses of atomic energy. One of the first projects in Plowshare was to create a nuclear harbor in Alaska. Nobody was really interested in a nuclear harbor at all, except maybe to keep the scientists happy. They decided, at that point, that they needed to do further nuclear testing out in the Pacific, and so this is what the Dominic series was established as. They were going to set off a major series of tests at Christmas Island in the Pacific, which is due south of Hawaii, just a few degrees north of the equator. They needed fallout forecasters for that whole series. So we decided to split it up because this was quite an extensive trip out. My boss at the time, immediate boss, Bob List, and Gil Ferber, who was my colleague, went out on the first shift, early summer 1962. They were detonating very large megaton shots. They were out there for a couple of weeks. Then Bob decided he was getting too old for this, and he wanted to get home. He took off. He left Gil all by himself out there. They needed somebody else. They needed two people. So they said to me, "You go out. You're qualified." They were using some of my forecast techniques I had done in preparation

for this, looking at trajectories and things like this. So I went out to replace Bob, and I went out through Hawaii. By the way, I had to leave in a day or two days with three kids at home, not knowing anything about what to wear or what they're doing. Anyway, I got off the plane at Christmas Island. Gil was there in a jeep to meet me at the airport. This was not a big airport. It consisted of one little shack. But Gil never drove. I couldn't exactly figure out how he got that jeep from the base to the airport. Well, Bob, the day before, gave him a driving lesson, which is okay, [but] you're driving a jeep with a stick shift. This is already a problem. And since the island was administered by the British, you drove on the British side of the street. So that complicated things more. I got in the jeep, and Gil said, "Okay, I'll drive you back." He turned the jeep around. He went a hundred yards and drove into the ditch. So I drove the rest of the way. Anyway, he decided he couldn't take it any longer either. So he left. We went to one briefing together, and then he left me alone there. I was there for the briefings until Gus arrived – this is Kosta Telegadas, a very good colleague of mine, who died, unfortunately, very young. We lived together out there. It's like Army buddies; we had a wonderful relationship. Actually, we were the best hat makers in the islands. We learned how to make hats out of the leaves from coconut trees. I've got them downstairs. They're wonderful. So, the briefings were quite fascinating. There would be an announcement of a test the next morning. So you spent that entire night preparing for the test, starting from about nine in the evening until the test went off at seven or eight the next morning, working all night. Then about an hour or so before the briefings, you would go into a big briefing room, where they had some of the top scientists in the world sitting around – people from many labs. Edward Teller was never there, but many of these scientists had been to Eniwetok and Bikini. The guy who was running the show, physicist Dr. William Ogle, from Los Alamos National Lab, was the leading scientific commander. Then, each member of the service was represented at the table. There was a general, an admiral, several scientific advisors, colonels or captains, and people from the labs, and then many other scientists monitoring fall out and shock waves. I had a very good friend who did all of the shock wave forecasts, which was really essential to have, and then many who were working in the technical end of keeping these things going, like communications. The overall operation was run then by the military, who theoretically had command. But everybody knew the scientific commander was really in charge. The military people would come at this hour in the morning – and it was hot – all in dress uniforms with all of their medals. The Ogle guy came with sandals, a pair of old, torn-off khakis. He would come in, he put his bare feet up on the table, and get briefings from people. The military would just agonize over Ogle's demeanor. They didn't dare say a word. But he was good at organization. So I would give a briefing to these people about where we would expect the fallout to go from a particular shot. It was totally up to me. The tests were unlike the other tests that were done before. These were all air bursts. Bursts at about 15,000 feet, high enough so that they would not scoop up any of the ground material, which in this case was over the ocean water, which meant that the fallout from it had no solid particulate. The only particulate in it that was solid was from the device itself, and some of these devices were big. They were really big. So you had to be very careful. There was nothing else.

Christmas Island, by the way, is five thousand miles to any [place], aside from a few small islands to the North. Most of them were very sparsely populated. Nonetheless, if there was any chance that fallout would come over the island, that was the end of the mission. There were several times that I simply had to say, "I'm forecasting with unfavorable winds, and we're going to have some problems with a couple of the small villages at the ends of the Christmas Islands." One of them was called London, and the other one was Paris; they were at the end of a horseshoe coral reef. London had about twenty people living [there], and Paris – nobody lived there. But if fallout was coming near any one of those, they'd have to call the tests off, and they did. Nobody was very happy with me, mainly because the planes had probably flown down. It was not easy. Anyway, that was what transpired, on pretty much a daily basis.

MG: This was Operation Dominic.

JH: Dominic, yes. It lasted throughout the summer of '62. The reason for the timing of the operation was that the [Partial Nuclear] Test Ban Treaty went into effect, I think, fall of '62. That was the end of atmospheric testing. Even at this time, we had not perfected models. Everything was done by hand. This was all done with trajectories, with just looking at wind flow from single levels and such – no big computer modeling. I was at Dominic for maybe ten or fifteen large tests. The biggest one was Big Horn, which was an eight megaton shot. That's like a thousand times bigger than Hiroshima. The first shot when I was there was Yeso - three megatons – since I was all by myself and my friend Jack Reed at the Sandia Lab, who was the guy that was forecasting the shock wave. I was a little nervous. We'd stand out next to BaseOps. The shots would be about fifteen miles out from the south end of the island. It was dark. The sun had not come up yet. So Jack told me what to expect since he knew I was a novice at this. He had been to all the Bikini [tests]. He said, "What you do is you put one foot in front of the other, the other behind, and you crouch down. When you see the trees ripple, that's the shock wave coming through. Hold on because it's going to get you." Well, the first shot was the three megaton Yeso, a pretty good sized one. We had high-density glasses, so you could look directly at the blast. In the past, you had to turn your back, but now with high density classes you could look directly at where they were firing. When the blast went off, the entire sky lit up. It was like the sun was out. It was just like noon. Then you could see the cloud rising in the back, and then you saw the trees rippling. I got all ready, and what happened is – *crack*. A tremendous crack came. I thought, "Oh." It practically knocked me over. I turned around to Jack who was standing next to me. He was on the ground. He was laughing at my stance, and the crack hit him; it knocked him over. He missed the forecast. This was a double wave. The first wave he had not forecast; it was sharp. It not only knocked him over, but it also broke every dish in the base. What a mess. That was my first shot. Gus came out then after about two or three other shots, and we worked them together, which you really had to do. In addition to fallout forecasting, we conducted a very valuable experiment, called Stemwinder, to determine the radioactivity particle distribution in the stem (lower portion) of a nuclear cloud. A highly

qualified researcher pilot named Paul Goethels from Sandia lab flew a plane in and out of the outer sections of nuclear mushroom stems sampling radioactive particulate. The inner portions of the stem were too radioactive hot for humans. After several missions, Paul exceeded his limit of exposure and had to be sent to the States. Amazingly, he returned to Dominic to complete the experiment. Then Gus went off at one point to Johnson Island, which is where they were testing a nuclear device on a rocket. They needed a fallout forecaster there. They were very worried about the fact that if the device blew off before the rocket got into the stratosphere, anywhere in the troposphere, the fallout would go over Hawaii. That was a no-no. So he went to Johnson Island and stayed on to the end of the test. Then I guess he came back, but I stayed on at Christmas Island. When we left, we smuggled hats back home, which was illegal because there were agricultural restrictions. Gus was a good hat maker. That was the whole series. I continued to go out to the Pacific for planning operations. The series had stopped, but they still decided they wanted to test a big bomb. The Russians, at this point, had blown off a fifty megaton shot called – let me see–

MG: Tsar Bomba?

JH: Yes, the Tsar Bomb. It was decided we had to go ahead with a twenty megaton shot. The place that they were going to do that planning was at Johnson Island. Christmas Island was off-limits at that time. The British were not very happy about us being there in the first place, and we were not going to go back. Johnson Island is even more isolated. It's west-northwest of Hawaii, many thousand miles, in the middle of the Pacific. It is one massive aircraft carrier – they added on both ends of the island so that planes could come in and out. It was a place that if you got assigned there, there was nothing you could do. You couldn't even scuba unless you were a professional because the waters got too turbulent. They had a swimming pool, an Olympic-sized swimming pool, and they brought in freshwater. It was the largest freshwater pool in the Pacific at the time. When I was there, they opened up a second swimming pool. So they had two Olympic pools next to each other. If I occasionally got off in the afternoon, I would go over, and I had the pool practically to myself. There I was with two Olympic pools and all this freshwater. But the idea then was to plan for a twenty megaton detonation. My first time out, I was on the team that was going to forecast fallout. In fact, I was the team at the time. The planning group used forecasts from Las Vegas well after I left. I got a chance to go through Hawaii to the lab where they were keeping this twenty megaton device, and they gave me a tour. There it was, a twenty megaton bomb. It was like a big jelly bean, stood about eight feet tall. It was about three times as long. This was twenty megatons; you could put your hand on the side of it. The problem was they didn't have a plane big enough with a bomb bay big enough to put this in and drop it out safely. This was a major problem. So they had to take the aircraft they were going to use and change the bomb bay doors, take them off, and expand the exit area so that there would be no way that that bomb would get caught – because you didn't want twenty megatons getting stuck in that bay. The first test flight had just plain explosives in the device;

there was no nuclear stuff. The problem was twofold. Number one, they had to make sure it got out of the bomb bay. Number two, they wanted to make sure that it fell into the water and went to the bottom and exploded on the bottom because they didn't want the Russians to send submarines in and look at the design. So this was the two-pronged set-up. We had all been sitting for two or three days in a huge chamber on Johnson Island, talking about all of the problems – very little to do with me; it was all very technical. The aircraft was to come and drop this dummy package many miles out. Once again, it was theoretically going to explode at fifteen-thousand feet or so, and the debris was going to sink to the ocean floor. So somebody asked one of the statisticians, "What's the probability that something is going to go wrong." They did some calculations. The point is, they spent an entire afternoon doing calculations, and they decided that the probability that something would go wrong would be about one in a million, which they decided was good enough so that they could go ahead. The plane with the device took off the next day. We were just communicating by radios – it was the only thing. They had big loudspeakers in the Johnson Island complex. A guy was announcing the plane is now heading towards ground zero. The bomb bay was open, and they're going to release the device and the time went on nine, eight, seven – and then there was silence. Nothing happened. People figured, "Well, it will take a while for communication." It went on, and it must have been a minute, maybe two minutes. Then people started getting worried. Then the announcement came over the radio – "Well, we had a little problem." The bomb got out of the plane perfectly. It was supposed to detonate. The detonation didn't go off, and it fell into the water. That's right. It was supposed to blow up and scatter. It fell intact into the water and fell to the bottom, and the TNT never exploded. The statistician stood up and said, "Wonderful. The next time we do this – with our now one in a million chance of failure, it's guaranteed to be successful." It broke everybody up. I went out on several other occasions for this type of event, but that was the end of the big testing. From that point, everything turned to Plowshare. Everything went underground, and it all happened in Nevada. That was the whole new program that I got involved with. You say, "What do you worry about fallout from an underground test? There isn't any. That's the idea; you're putting it underground because you don't want fallout it in the atmosphere." But you cannot totally contain an underground test. We saw pictures of what happens. A device gets put down a shaft, then filled with dirt,

and then there's an explosion. Then there's a mound that bubbles up, and there's debris that fizzles out sometimes fairly high. By fairly high – tens or hundreds of feet, but nothing way up. So they still needed a fallout forecaster. So they thought, "We've got to do something more than just pour dirt on." So they tried some other things, and that didn't contain them. Finally, some scientist said, "Let's put a cement plug, a whole thing, on top." So I guess they brought a cement truck out. They put the device down, and they filled the hole up with cement. The scientist was so sure that this was going to work, he said, "I'm willing to go out and stand on the top of that cement plug when you blow the device up." And these were small devices. They were mostly

sub KT devices. They told the scientist, "No way." Well, they detonated the device. The plug came out like a bullet. It went way up into the air. The reason I know this is that I came out after the shot and was shown on a recording camera the plug coming out. So that technique didn't work. Then somebody then got the idea – this is ingenious, and this practically changed the whole fate of the world – that if you went straight down and then drilled sideways with their newly developed drilling techniques you could obtain containment. So they did. They put the device straight down and then moved it off sideways, and that solved the problem. That technique then became the start of the Iraq War because the Iraqis then went into the oilfields in Iraq, drilled sideways into Kuwait to get the oil out of Kuwait. That whole technique is what really developed during Plowshare – they do it all the time now, I guess. That's what we did. I went out many times to the test site, to the Nevada Test Site, got a chance to see some of the old craters. It's a fascinating place if you're ever out that way. They have tours, I think, once a year. It's like the moon; it's pockmarked. They've got the biggest man-made crater ever made, Sedan Crater. It's unbelievable. They have one of these huge trucks at the bottom of it. It looks like an ant. Well, this was Plowshare. The next phase we got into was digging nuclear trenches. In other words, practically underground, so the detonation would just excavate dirt and make a crater, or if you put craters next to each other, you would get a trench. Somebody decided it might be nice to put a trench in along the Rio Grande, from the beginning of the Rio Grande to the Pacific Ocean. You could do that by detonating a series of nuclear tests all along the way. Well, it was the most ridiculous thing I've ever [heard], but it was considered. If they would have done that, you wouldn't have an immigration problem now! There'd be this nuclear trench. If you crossed it, you'd die of radiation poisoning. Anyway, that never got off the ground, but what did get off the ground was a decision to build a nuclear canal paralleling the Panama Canal. Of course, our lab was directly involved. I was looking at fallout from cratering shots. There was not an awful lot of literature, totally different from atmospheric shots, totally different. I was collecting a lot of data from that. Not only me, but other people working with me. So the project took some of our people. Bob and Gil went down to Panama with the surveyors. [They] spent quite a bit of time and effort looking at what was going on, setting up, doing soil sampling, looking at the terrain, and all kinds of things for use in a parallel nuclear canal using cratering shots. It got well off the ground. It went beyond planning stages. The project was already moving equipment. They did some preliminary testing and found that in order to get through the central part of the mountains, which were high, the devices they would need would be so big that it would be a at least hundreds of years before the radioactivity dissipated. So that ended the whole project. It was pretty far along. Yes. In addition to that, there's a very interesting side effects story of Albert Oshiver who came to us when we were at M Street and Connecticut. He heard that we were going down to do surveying and working on the canal. He was a sportsman. He was the only guy that swum the Panama Canal in 1962. He swam back and forth the English Channel. He wanted to be the first person to walk from Colombia to Mexico – it had never been done successfully before – all by himself. A team started out from Colombia many years before. They never heard from them again. The team [was] totally lost. He found out that we were

doing climatological research work in Panama, and he really needed as much information as he could get. So he came to visit us, and we supplied him with a lot of the climatology that we were going to be using for a nuclear canal down there. He was very grateful. He also had a contract with NASA for food technology. He would have to take food on this trip, and it had to be dried. So he was testing out food parcels that NASA was going to then be using for the astronauts in space. This was an instigator for his trip. He left us, and he went off. We never heard from him until maybe four or five years later. We were back, I remember, at 24th and M. He walked in the office. He was a little guy. He was about five foot six [inches], but he was well-built; mostly but muscle. He walked in the office. He looked like he aged ten years. He was still in good shape, and he told us his story. He got down to Colombia. He started out walking north, and he did fine. He got through the Panama area, the first guy ever to do this. He used our data and was fine. He headed up into Costa Rica, and he got sick. He lost consciousness in the middle of the jungle, and he had no idea how long he had passed out, but he said for days and maybe even weeks. When he got up, he had lost all his belongings; there was absolutely nothing left. He was immobile for a period of a couple of weeks; he couldn't move. But he was smart. He got water from the rain. He ate some plants. Anyway, he had no idea where to go. There was no GPS [Global Positioning System] or anything. He knew east and west because of the sun and the stars, but that didn't help him. He didn't know which way to go. He knew he couldn't north and south. He either had to go one coast or the other. He had no idea how far – it took him several months, and finally, he got out. I can't remember which ocean he finally went to. But he thanked us because he had used our data through Panama. That was the Panama Canal project. All of these strange remembrances. That was the canal stuff. That's pretty much all of the nuclear things.

MG: There are other projects at the Air Resources Laboratory.

JH: Well, there's Vela. This is the detonation off of the – yes, here it is. Vela was the detonation off of South Africa, which I guess was in 1979. Lester came in and said he got word that there was some event that happened off of South Africa that the military said we should look into. It could have been a nuclear test. It could have been a shooting star or something in the atmosphere; they weren't sure. The satellites could not pick up the location, but they knew there was something. So we should run some trajectories and see what was going on. We treated it as a nuclear test, and these were just in the trajectory days. We had no idea where it was off the South Africa coast. We had some idea of the time, maybe within a day or so. Anyway, we took the best meteorology we could get, which was not very good in the Southern Hemisphere, and ran some tests. Those tests took it towards the east into the Indian Ocean and heading towards Australia. Of course, we kept track of sampling in Australia. They never found anything, and we never found out much about what happened. Later, when I looked this up in the encyclopedia, there's a tremendous amount of material on it. It was well-documented. It was a nuclear test, and was probably a joint operation between Israel and South Africa. Remember,

South Africa was developing a bomb at that time. The South Africans said they really didn't have anything to do with this. The Israelis have never admitted to it one way or the other. The other fascinating thing is this whole Cuban Missile thing. That, I think, is well-worth relating.

MG: I agree.

JH: I worked on this. We, at that time, were still just running fallout trajectories – just the direction where fallout would go. But no areal coverage. Then we developed an envelope of fallout out to twenty-four hours, with individual trajectories at various heights out to forty-eight hours at several different upper heights. So it looked like a bug, an envelope with two "feelers" sticking out. This was the latest way we were looking at things. The government became very interested in this type of presentation. It turns out they thought it would be useful during the Cold War. The Chinese now had nuclear weapons and were testing them. We did a lot of work observing Chinese tests of atmospheric emissions. The Russians, of course, had nuclear weapons. So the government was very worried about somebody initiating a mass attack on the United States. They decided that our program could be useful in real-time, something that could be run fast, but we had to develop it, and it could not be run by hand. So we had to figure out a way to do this by computer. Nobody had ever used a computer to do contours before. This was now being tested by NOAA or the Weather Service out at Suitland, Maryland. They had a machine which was about three by three feet in size with two arms on it, one that went one way and the other went perpendicular the other way, with pens on them. Those arms could be programmed to draw a contour. That's the way they were starting to put isobars on. You could actually then include numbers and symbols on them. So this was a fascinating way to take these "fallout bugs" that we were developing and put [them] down on a map. So Milt Smith was a great programmer. He came to our lab a little bit after me. He had been working at Suitland, and so he was familiar with operations there, but not this machine.

MG: This is Milt Smith.

JH: Milt Smith, yes. He's still around, by the way. In fact, I might see him at the big party tomorrow for one of the retirees. We got permission to use that machine, somewhere between two and four in the morning. So many a night did we spend going out to Suitland and working on this project. We got it to be able to draw these "fallout bugs." So now they wanted this product to be sent out to the public; never been done before. What's the best way to do that? It had to be done several times a day. It had to be done quickly. It had to be done for a lot of locations. So we decided we would take twenty locations at big cities around the United States, and theoretically assume that those would be ground zeros. We would compute one of these "bugs" drawings for each of the cities using the latest meteorology, and draw them on a big map of the United States indicating fallout forecasts out to twenty-four and forty-eight hours. How to get that to the public? Well, in those days, there was facsimile; one way you could do that. The

facsimile circuits went out twenty-four hours a day. They were totally filled up, and certainly, just after the numeric forecast models came out, there were not even seconds to spare. This was a serious bit. They were really worried. But they found us time. They found us something like one minute to get these maps out and a sequence was established. Milt did most of this – programmed our map so that they could use our forecast in real time – directly from my program in our computer. It would be put on fax and sent out twice a day (00Z and 12Z) within minutes after the numeric forecast went out. That was the way things were. We had to alert the public and the forecasters that this was a new product coming out. We had to explain to them what it was. They'd never seen anything like it before. So bulletins were sent out to all of the stations around the country, telling them that starting next Monday, this is a new product, how to interpret it, and what you can and can't do with it, and so on. Meanwhile, the Cuban Missile Crisis was going on. The Russian aircrafts were flying missiles on into Cuba. Later in that week, it got really serious. President Kennedy was informing the nation what was going on. Here was a new fallout forecast coming out. Somebody decided this was no time to introduce this brand new product. The public was shaken up enough as it was. We were on nuclear alert. To put a map out like this, which the public didn't understand, was not wise. The forecasters barely did. Somebody called Lester and said, "Do not send that map out at the prescribed time." That was the end of that. It never got sent, and it never got off the drawing board to be sent. It went out finally in digital form. But that original product was around for a couple of years. Somebody from the government found out about it, and said, "This is what we need for our nuclear exercises," which were taking place at the secret location in the mountains of Virginia. [They wanted] me to join George Allen, who was representing NOAA on this high-level committee, to prepare a briefing for this group. They would then put me on that board to do that. George got them to put me on it. We got this thing all set to be able to be run at Suitland from the relocation site. George and I went out to the relocation site for the first time. He had been there many times before. He went out by his standard way you get out there, and then from there, he knew how to do it. It was not on maps or anything.

MG: This is Mount Weather you're talking about.

JH: This is Mount Weather, yes. Of course, in those days, nobody knew what it was. It wasn't Mount Weather until they had a plane crash, and then it was identified as Mount Weather, but that was well after. So we went out, and that place was quite amazing. You go around, and you drive around in a big circle down to the most immense gate, like a safe. The safe door would open. It must have been three feet thick, and you went through a contamination chamber. It was huge. Once you got inside, and it was a series of tunnels. I don't know how many miles of underground tunnels with rooms and cafeterias and sleeping rooms. The place was immense. It had a huge auditorium. There was a stage with all kinds of huge panels and screens, a whole series of them that stretched across the stage. In the back, [there were] booths like at a football [stadium], where all of the big wheels would be. This was the Vice President's retreat in case of

an emergency. The Vice President had his booth up there, all of his advisors and people from Congress. Then they had rafters that the scientists and the people who were running the show would sit. I stayed overnight. George got to stay at the VIP quarters. I, unfortunately, had to stay in a bunk bed with bathrooms down at the end of the hall. They had a briefing, and I spent a lot of time getting it set up; it took a while. For the briefing, we were there [for] a couple of days. We got the map ready in time. I didn't show it. Somebody came in from the government to take over. I thought, "Oh, my god." [But] this guy had done his homework. He was a scientist. He knew what I had. He made some really good suggestions. He did the whole briefing. He did a beautiful job. I couldn't have done it better. He was used to this kind of [thing]. He answered questions and everything. George and I just sat. Anyway, the nice thing about the cafeteria was you could get anything. And since it was underground, they had painted windows with beautiful scenes with forest and deer. It was like being outside. We went out [for] a couple of weeks later for a second briefing. The first time we had a government car. The second time he couldn't get a government car, so George drove his own car. We were heading out to Route 29 with many stop-and-go lights. There was a new highway going up, called Highway 66, which today down here is the big bottleneck on the East Coast. It has up to eight lanes both ways. It was two lanes then. We thought, "What the hell? It parallels Route 29. Let's go on that." So we drove on it. As we were driving out west, there were fewer and fewer cars. There weren't many. Then, all of a sudden, for miles, we were the only car. It was about eight o'clock – nothing. [Interstate] 66 went down a big hill and came to a stop. No equipment, no nothing; it just stopped. There was a little dirt road off to the side, a two-lane dirt road. We had no option but to go on it. We went on it and went for many miles until we came to a one-pump gas station. There was some guy smoking a cigarette out in front, the proprietor. We stopped and went over to him. We said, "We're lost." He said, "I know. I've seen guys like you coming out before, and I've given instructions before." He said, "You're looking for the secret relocation site." We said, "Yeah." He said, "I know how you should go. You go this way, and so on. Then you take a left." We said, "How in the world?" He said, "You know, you're not the first government people that have been out that have been lost." He's been directing them! We thought it would have been easier to go to the Russian Embassy and ask them how to get to this place. It was a fun story. Anyway, that was the end of that. There was a bad plane crash there many years later. A lot of people got killed – a commercial airliner. That was when everybody then discovered it was called "Mount Weather," and that it was a relocation site for the Vice President. The President, in that case, was supposed to be in Air Force One in the air. They were going to helicopter the Vice President out, and we were supposed to go out by helicopter for the briefings, but it never panned out. I would have loved to have done that. Anyway, it didn't work.

MG: I read that on September 11th, members of Congress were helicoptered out there.

JH: I think so. Okay, yes. I imagine it's still there.

MG: Was your goal to create an emergency nuclear response strategy?

JH: Yes. That was the whole point. Then after a while – well, then the Cold War ended. And as far as I know, the program fizzled. Well, we were no longer involved. At that point, Nevada pretty much took over. Plowshare continued. They did a big experiment in Colorado, an underground excavation. That was the newest thing: excavating to get natural gas. There was a big experiment done. Frank Cluff pretty much handled that. I'm pretty sure it was in Colorado, and they detonated a device. It was a successful detonation, but the gas that came out of it was so toxic that it would have been thousands of years before they would ever be able to use it. That whole concept was abandoned. That was part of Plowshare. I think it pretty much died. I don't think there were any other underground nuclear detonations to free up gas. Essentially, fracking is what they're doing now. That's the onset of it, but it's not nuclear. So they're releasing shale and gas from fracking. But all the drilling techniques were perfected by the nuclear program that was done during this period.

MG: Was the Air Resources Laboratory working with other agencies?

JH: Always. We always worked with DOE [United States Department of Energy] – very closely with DOE. A lot of our people then went over and ran sections of DOE. Dave Slade became a manager out at DOE, had spent a lot of time with us. He was not involved so much in the nuclear, but when he went out there, he was the liaison. There were a couple of other people. Then we worked with other nuclear related agencies – AEC [United States Atomic Energy Commission], which was, I guess, same as DOE. And NRC, of course. We worked with the Nuclear Regulatory Commission. Lester and a lot of these people were doing the administrative stuff. I think Lester developed a lot of the trajectory programs when he was in research. Then when he became lab head, most of his time with Don Pack was spent on administrative and liaison with these [agencies]. There was so much of that that was going on all the time. They were always off traveling or going to meetings. The rest of the research was done by the scientists.

MG: When the Weather Bureau became the National Weather Service, did your role change at all?

JH: No, the Weather Bureau became ESSA [Environmental Science Services Administration] and the lawyers took it over. Then ESSA became NOAA; I guess it is the way it went.

MG: Can you talk about that restructuring?

JH: At that time, way over my head, and I could have cared less. Our tasks were so specific. We had things that had to be done, and no matter what the top people said, [it] didn't make any difference. We had to just go ahead with all of our programs. Not just me, but there was a new climate interest that came. We'd gone through all kinds of lab directors. The lab itself was restructured. I don't know really much about that. I was not interested because I was much more interested in other research and not involved. The main policy I was involved with pertained to volcanic ash forecasting. That took up least twenty years or so of my time. That was the whole volcanic ash program.

MG: So were you doing work around nuclear reactor incidents before looking at volcanic ash?

JH: Oh, yes. Well, the two big events we were looking at in the nuclear field were Chernobyl and Three Mile Island. That occupied a lot of time. Chernobyl, which you've got a whole write-up on, and Three Mile Island. The big interest in Chernobyl came with the television series, [HBO's *Chernobyl*]. That got me back interested. I've told this story to my kids and grandkids many times years ago, but when the series came in, they said, "Grandpa, you've got to write something down." So that really got me to write down my participation of which I think nobody else knows. I talked to Roland the other day. He was involved, but he doesn't remember a lot.

MG: Who is this?

JH: Roland Draxler, who took over the lab, and is now retired. Barbara Stunder, who took over the volcanic ash program had just been hired, but was not involved in the forecasting program itself. Everybody in the lab, including the secretaries worked around the clock thing for a long time. But how things got started, I guess I'm the only one who really knows what we did and everything that came directly after as a result of our computations. That's all in the [article]. I couldn't say it any better. [Editor's Note: In September 2019, Mr. Heffter published an article in *The Bannockburn Back 9*, a local newsletter, titled "My Involvement with the Chernobyl Nuclear Accident. That text is included here to provide more background on the 1986 Chernobyl disaster.] "Years ago, I was a research meteorologist working for the National Oceanic and Atmospheric Administration's (NOAA) Air Resources Laboratory (ARL). I specialized in forecasting the transport and dispersion of pollutants in the atmosphere. On Monday morning, April 28, 1986, I was at the lab, headquartered at The Gramax Building in Silver Spring, MD, when the lab director, Dr. Lester Machta (who also lived in Bannockburn, on Brigadoon Drive), told me that the State Department had just informed him of an exceedingly high measure of radioactivity taken at a sampling site in central Sweden. The State Department was concerned that thousands of U.S. military troops stationed throughout Europe might be in danger of radioactive contamination. At that time France had numerous operating nuclear power reactors that could have been the source of the high radioactive measurement. Dr. Machta asked me to immediately compute a trajectory from that sampling site, backward in time, to determine the origin of the contamination. I used a computer atmospheric trajectory program I had developed (ATAD model - Atmospheric Transport and Dispersion model). The trajectory was computed from the time of detection at the sampling site backward in time about two-and-a-half days, that

time period determined by the calculated age of the measured radioactivity made available from State. When the ATAD model run was completed, the output trajectory indicated the origin of the radioactivity was not in France but in the Ukraine USSR. The State Department was immediately informed of this result. Later in the morning we were told by the State Department that the Russians had no knowledge of any excessive radioactive releases. However, by early afternoon we were informed that the Russians had been forced to admit to an accidental release of radioactivity from their Chernobyl nuclear power plant at Pripyat, Ukraine, on Friday, April 25, 1986, just about two-and-a-half days before the Swedish measurement, thus confirming our backward-in-time trajectory computation! As the afternoon progressed the Russians further admitted to massive explosions at the Pripyat site that continued to spew radioactive plumes into the atmosphere to heights of 15,000 to 20,000 feet. Given this latest information we quickly proceeded to run trajectories forward in time, at several atmospheric levels, from Chernobyl. We started the trajectories at the explosion time finally admitted by the Russians, using observed southerly wind data out to two-and-a-half days and then we used forecast wind data from two-and-a-half days out to about five days. The results were somewhat staggering. The lower level trajectories did indeed show the radioactivity moving northwest to Sweden and then forecast to continue west and south over Norway, Denmark, through central Europe, up into France and southern Great Britain, then over the North Atlantic into Iceland, and finally into southeastern Canada. (Radioactivity was detected in France, Iceland, and possibly, southeast Canada.) The upper level trajectories, however, showed the radioactivity moving more to the north and then the forecast to curve to the east and continue eastward over northern Russia to the North Pacific heading toward Alaska. (These trajectory forecasts were of considerable importance because President Reagan was visiting in Japan and nearby radioactivity would have been a major concern. Subsequent aircraft sampling confirmed radioactivity at upper levels over northeast Asia.) The nuclear plant continued to release lesser amounts of radioactivity into the atmosphere for another ten days or so. With changing wind directions and speeds the radioactivity spread to southern Europe, northeastern Africa, Turkey, and the Mideast. Continued trajectory computations reflecting this spread of radioactivity were transmitted to the State Department. The next several days were spent by most of the ARL personnel devoting their time to updating the Chernobyl accident events. Dr. Machta was asked to give a briefing at State to high-level government officials and scientists. Since he was to present the trajectories I computed, he asked me to accompany him. The briefing was held at State in a conference room with a huge oval conference table that seated about two dozen people. Dr. Machta, given his rank as a noted scientist, sat at the table and I sat behind him as his consultant. His presentation was exceptional, and I believe I was acknowledged for the work I had done computing the trajectories. We returned to the State Department a day or so later to brief on the latest output from the continuing model runs. On this second day of briefings, a Russian film was shown (possibly sent out of the USSR by USSR security) showing us how the Russians were seriously dealing with the accident by decontaminating the reactors. The film showed cloth face-masked, lightly-clad men pumping water through garden hoses directly onto the reactors and all around the container areas. I'm sure they all died of radiation poisoning since the radioactive levels they encountered with totally inadequate protection must have been way off scale. Chernobyl still remains the worst nuclear accident that the world has experienced. The city of Pripyat continues to be unlivable 34 years after the accident and will probably remain so well into the future. As horrific as this disaster was for the residents of Pripyat, things could have been far worse: had northerly winds prevailed they would have sent the original radioactive plume southward to impact the major city of Kiev."

Lester was amazing in the way he could brief. He could brief non-scientists. He didn't try to impress. He tried to make sure they understood what he was saying. Of course, he did that with this audience. He had mostly non-scientists. He gave a wonderful briefing of exactly what I had done. Then he asked for questions. He turned to me, and he said, "I hope you're around for questions." Well, he didn't need me. He could answer them himself. At this point, Livermore people and the military were involved. Of course, the Russians then had to admit the disaster. Chernobyl continued for about another ten days. The wind swung around. Luckily, as far as we knew then, they contained a lot of activity. I don't think any of it got into the capital Kyiv. I think the capital was far enough to the east. A lot of activity went then down to the south. It went into Greece, Italy, North Africa, and into the Mid-East. From the trajectories and from sampling that was done – I got to say we did well and were in competition with Livermore all the time. I thought some of their assessments were questionable. But they had the money, and they had the presentation. They were smart people. Joe (Knox?) was at the head. He was a former Weather Bureau man. Joe was one brilliant guy. He knew how to use his smarts. He knew he was [brilliant]. Livermore presented some beautiful stuff. I got to give them credit. They actually sent a team over and got sampling from the entire area, from the entire European area, put it together, and gave it to the community. It was a beautiful job done at the spur of the moment. I don't know how they did it. I'm sure they got a lot of dough for it. This is what we used for verification after. It turns out that our trajectories were really good – no question about the fact they went through France, and got into Southern England. They measured activity in Iceland. They didn't ever really get any of it in Southern Greenland. They might have seen some of it in Nova Scotia, but that was not clear. The stuff that went around to the Mid-East was all over the place. Very low levels, but nonetheless, it was there, certainly in Egypt and Turkey. More in Turkey because Turkey was more in a direct path. Also, in Syria and that area. That was Chernobyl. This is an undocumented series of events that Lester Machta and I participated in during the "cold war". The nuclear reactor site at Cienfuegos, Cuba, mainly being built by the soviets, became of major concern due to the site proximity to the southeast U.S., and particularly Florida. A U.S. congresswoman from Florida, running for reelection, was briefed on our nuclear detonation trajectory program and officially requested that we apply our program to determine the threat to Florida imposed by a possible nuclear reactor accident at Cienfuegos. I requested and obtained from the NMC two years of upper air wind data, which was a product of their North American model runs. Using my trajectory model, I computed a climatology, by season, throughout the southeast U.S., of trajectories starting from Cienfuegos. This was a unique use of trajectories, never having been done before. The resulting maps showed contours of the probability of impact over an area from a nuclear accident at Cienfuegos. These maps were sent to the Florida congresswoman who then wanted a presentation to a committee on the "hill". After accepting the request, the location of the presentation was shifted to Miami where local publicity was probably more favorable for her reelection. Lester and I then traveled to Miami and were taken for the presentation to a very large auditorium, open to the public and the press. The stage seated many politicians, the auditorium was packed, and there was a large press corps present. Lester did his usual comprehensive briefing for non- scientists explaining probability contour maps and I operated a devise displaying the visuals. I noticed that throughout the briefing the congresswoman was not paying attention to the subject being discussed. At the end of his briefing, Lester asked if there were any questions. Since the congresswoman was chairing the session, she felt obliged to ask the first question. After consulting with some of her aides, she came up with an embarrassing question totally irrelevant to the subject being presented. Lester,

in his infinite wisdom, saved the day by answering the question in a way that was very relevant. I don't think she comprehended what had happened. Anyway, we heard later that she had not been re-elected. That's pretty much all of the nuclear related material until we get into my later work with volcanic ash. The other thing, however, are the balloons. I made a table. Somebody asked for something for a publication of all of the balloon flights that we were involved in, which might have been a couple of dozen at least. These balloon flights are outlined in "A Personal Event History of ARL/NOAA" - Part 2, and were manned balloon flights. They were all supposedly record flights, or they were going for records, really long-distance ones. We had the trajectory program. These were open gondolas pretty much all the time, and they went to very high levels from about five-thousand feet close to thirty-five-thousand feet. They went out distances of hundreds to thousands of miles, and they were totally dependent on the wind forecasts. In other words, there's no way you could use a motor or sail or anything. Totally on wind forecasts. Wind forecasts would be wind trajectories. Who had the trajectory programs? We did. So we got together with a guy who was going to run this whole program, a guy by the name of Bob Rice, who became a very good friend of mine, a fine meteorologist. He was going to handle all of the communication from the Boston area to these balloonists – wherever they were going to be all over the world – take the work that we did in Washington and transmit the forecasts to the balloonists. The liaison between Bob and the individual balloonists went out on a real-time basis. So the first one was a flight from Egypt in 1981 into India. I don't remember who the balloonist was in that case. Anyway, we did the forecasts, and they managed to get out of Egypt – some locals shot at the balloons in Egypt. The trajectories, hopefully, they were going to go south of the Himalayas and then on. They were going to go for a record. Well, they had some balloon problems. What did they do? They were heading for the Himalayas and decided it was time to come down. That ended that one. The next one then was a big one from Japan to California. It was the first flight across the Pacific. This was 1982. We did all of the forecasting for that. It was successful. It was the first time anybody had gone that distance. Then there was another first flight with Steve Fossett. Steve was the most famous balloonist at the time. This was from Newfoundland into Germany. That was really a great flight. I would work here out of my basement. I would run trajectories, which I could do in those days, from the computers because I could get directly to Suitland. I would take all the information, send it up to Bob. Bob would then relay it on to the balloonists out over the Atlantic. But at one point, Steve wanted to talk directly to me. So at three in morning here, with all the kids upstairs, I was talking from downstairs, through a connection on the phone, to Steve flying at 35,000 feet in the middle of the Atlantic. I didn't mention balloons couldn't go sideways, but they could go up and down with ballast. That was the only way they could [travel]. They could go up or down very little. They could go down by releasing some ballast. So if there were some better winds lower, they could release ballasts and get into those winds. That was the only movement. So Steve was very interested. He wondered if maybe being in a lower jet [would help], but he had to talk to me because we had to do some quick additional runs. Anyway, I had a nice talk with Steve. I never met him, but I worked with him many times. He gave a talk at the Smithsonian on manned balloons. It was by invitation only. They closed the Smithsonian, and he gave the most fascinating talk [with] pictures. Afterward, they had a huge reception. It was in the Air and Space Museum with all kinds of government wheels. There's Steve talking to all these people. I was bound and determined to say hello. So I walked over. When there was a break, I went over and introduced myself to him. He threw his arm around me, and he took me away from all the people. We had a five-minute conversation, thanking me for all of the work. I thought it was so

nice. He was a wonderful guy. Unfortunately, he went on a little balloon flight in Utah, and they never heard from him. They found remnants of the balloon about ten years later. The longest duration flight at the time was from Switzerland to Burma. That was really strange. Usually, you're going from west to east; that's the way the winds prevail. This one started out going to the west. Then it curved around to the south and to North Africa. They continued eastward all the way to Burma, ten days out, which was the longest flight at the time. Then Steve went out of Argentina – the southern hemisphere, winds are much more steady. By that, they're less variable. Much more predictable. There are few high mountains. So if you're looking for long flights that's probably the way to go. So Steve decided he wanted to leave from Argentina, obviously to get around the world. This was in '98.

MG: Yes, '98.

JH: Yes, '98. He got as far as the Coral Sea, which is a long way. Then he got into a typhoon and crashed. He managed to survive that. I don't even know if he had a lifeboat. Anyway, they picked him up. I think he was in the water for hours and hours. That he survived, but he couldn't get from Salt Lake City to – amazing. Let's see. Switzerland to Egypt. The record then was set in 1999. By that time, they were not using my model. Roland was developing a model that was more sophisticated than mine. It took into account a lot of other factors and could forecast multiple trajectories at different heights. This was of great value because balloonists then could see what Steve asked me before. They could see if they should go up and down. Precisely, they could get all those forecasts. This was a great advantage for balloonists. Anyway, they used Roland's model. They did a record flight; it was an around the world flight in twenty days. They left from Switzerland. Once again, starting the wrong way, but winding up eastward all the way around the world, beyond Switzerland just to make sure of a record, and they landed in Egypt. That was the big flight.

MG: Who was on that flight? It was a twenty-day excursion.

JH: Bertrand Piccard and Brian Jones were the balloonists aboard the first balloon flight to circumnavigate the entire globe in March 1999. He's the head of the space agency. He was another big balloonist. Another balloon adventure. There was a guy, and I don't recall his name, who was somewhat of a nut, who was an amateur balloonist, and found out that we had a model that could predict balloon trajectories that would help him. He wanted to fly and get some records. He came in one day; just walked into the office and came up to me and said, "You can help me. I want trajectories. My base is in Colorado, and I want to fly from Colorado around the world. You've got a product that will help me do it." I think this must have been either before the record – or maybe he wanted to do another around the world record from Colorado. So he was there with his own meteorologist. He had hired a meteorologist. So I said to him, "This is a government agency. You just can't come in. You got to ask permission." So they went to Machta, and Machta or somebody said, "Listen to what he's got to say." That's what he wanted. He wanted to use our product. Well, in order to do that, they would have to sign a

contract with NOAA that if anything happened, NOAA and the government was not responsible. There's no way we could do a thing without that contract. So I guess he wasn't happy about that. Anyway, that was the end. But, several weeks later, I get a call from headquarters, [Department of] Commerce, downtown. I go in. The Assistant Secretary of Commerce is there with this guy and a general from the Air Force, the meteorologist, and I think a senator from Colorado. Lester wasn't with me. I went alone. They wanted to hire me, and they would get permission to do so. What was I going to say, no? I said, "Fine. You get permission, and if my boss tells me to go ahead, I'll do it." So they did. They got permission. So I started. The guy got all set up in Colorado, and he said, "Let's have the forecast." So I would run forecasts out there once, twice a day. The problem was that the FAA [Federal Aviation Administration] was not at all happy with him flying out of Colorado. You don't put a balloon this size in the air in with all of the aircraft going back and forth. We never really got off to a good start with trajectories. He never really got off the ground in the United States and that was the end of it. Several months later, I get a call from his meteorologist from Argentina. They had evidently heard about Fossett's attempt to go from Argentina. He wants to run balloons from Argentina, and he wants to hire me. He doesn't want to talk to me – "I talk directly to the meteorologist." So we started running forecasts all over again. We had a lot of trouble with southern hemisphere data. It was not easy to get trajectories from the southern hemisphere because most of the relevant models were in the northern hemisphere at that time. We did not have any global ones. Anyway, we ran them for a period of a month or so. The problem was that it was in between seasons down there – fall or spring. The trajectories, instead of getting into the lower jet stream, were curving up into the high pressures centers at the equator. Of course, you're not going to get around the world like that; you'd be there forever. He was not very happy. So one day, I came into work, and the word is I've been fired. He didn't like the trajectories. I'm fired. I had never been fired before. [laughter] That was it. I said, "Fine." I didn't have to worry about this guy anymore. It turns out that he had gotten an Air Force plane to move his balloon equipment down to Argentina, and sent up into mountains. He eventually took off from the mountains, and went halfway to the coast. The balloon crashed, and he got killed. I was so glad I was not involved. If I would have been part of that, it would have been a disaster. It wasn't the wind; it was the balloon equipment or something.

MG: Was this part of John Petrehen's Project Share?

JH: This episode didn't have any kind of a name. It was strictly off the books. I don't think anybody really knows about it. That takes us into volcanic ash and modeling. The volcanic ash program has a long, interesting history. The thing that started it all was Mount St. Helens, which was in 1980. It was a major disaster. We ran a lot of trajectories. That really was the start of the volcanic ash work. It was discovered that aircraft engines, whether they were propeller or jet, did not take well to volcanic ash. The ash itself is made up of very small particulate, sharp like razor blades. What they did was they got into the engines and coated out on the engines, and the

engines then would stop. If you're in the air, this is not so good. At that time, they realized that they had to initiate some kind of a response program. So there was an MoU [memorandum of understanding] that was put out to develop a program for volcanic ash and aircraft safety. I was put on the board of that. There were several of us that ran that program in conjunction with the airlines and NOAA and the FAA. We spent a lot of time developing procedures [on] how we would get information to the airlines about the movement of volcanic ash, as it would affect aircraft flight operations. That program started about 1980, and it took us roughly nine years to get that implemented! It had to be implemented through the FAA – it was very complex. It required a lot of different agencies and people to be involved. Then it had to be available on an emergency basis. So they needed something that could be presented. Not only the work itself but a way to get that work to pilots or to agencies that could then transmit the information to pilots that were going to be flying. I developed what I called VAFTAD, which was the Volcanic Ash Forecast Transport and Dispersion model. We knew how to proceed because we had great trajectory programs at that time. We could run them at kinds of levels and do anything you wanted with them – backwards, forwards. This was, of course, just forwards. But the problem was how to get that information to the pilots or to whoever would get it to the pilots, and what the pilots would understand from it. They had to know what was going on. There were no procedures; there were no little bugs with feelers. So I developed a series of panels that could be sent out over facsimile at the time. Trajectories could be done in color fax at this point. Panels that showed various trajectories at heights and times, and so on and so forth, starting at different times based on what information I got from the airlines themselves, from my contact with the Air Line Pilots Association, what the pilots would like to see and would understand. We spent a lot of time on this. I would develop something and send it off, let the people look at it, then make comments – different panels, different times, the things that they might be interested in – look at the total cloud going out, look at just the lower parts of the cloud, the upper parts, the mushroom section – these volcanic ash eruptions look a little bit like nuclear clouds. We finally got a product that we got running operationally, got out it out, and I think running on fax just months before [Mount] Redoubt. Now, Redoubt was a volcano in Alaska. It was December 1989. This was a KLM [Royal Dutch Airlines] 747 flight going from the Netherlands to Anchorage. It was flying over the pole, and Redoubt erupted just at that time. Not knowing about the ash, it flew into the ash cloud. It was a full flight with about four hundred people aboard. It lost all four engines in flight. The pilot managed to get two of those engines started. It was already preparing for landing. They landed with two engines. The co-pilot had to stick his head out the side window; they could not see out of the front window because it was totally opaque from the volcanic ash. They landed safely, and that was the beginning of the volcanic ash program. From that point on, we continued the program. Redoubt erupted for ten days or more. The forecast trajectories came down the western continent. They said that planes flying in California saw tremendous dust clouds of stuff going by. They could stay out of it because they could see it, exactly where our forecasts went. The interesting thing was whether they got down into Southern California and turned eastward going through big meteorological systems. It turns out

then that there were reports from Texas, from the panhandle, of small planes seeing dusty clouds out at about the time of our forecast, thousands of miles from Redoubt, and one plane had to land because they were having engine problems. So those forecast trajectories were really working. That was the first indication that this was not nonsense. Another event was the Spurr eruption in Alaska. It was sometime later. It was a volcano that came down western Canada into the Great Lakes area, down through the south Great Lakes up into New York, and then up into New England. This was a big shot. There was no way that planes were going to be able to fly through the ash. It was big. Ash was up at flying level. This level is where most of the flights between central United States and the East Coast went, hundreds of them a day. Because of our forecasts, they closed the airlines for part of a day. Sure enough, by then, they were getting good satellite data. You could see ash on satellites going over the Great Lakes. So we forecast that and we did well. Volcanic ash was a serious threat to aircraft flight operations. Another eruption of great interest was Popocatépetl out of Mexico City. Mexico City had a population of seventeen million people. If the ash was going over the city, they were concerned about the ash itself, but they did care about aircraft flying in and out. You could fly over it if it was low, but in order to land and take off, you had to fly in and out. So even a small eruption of Popo towards Mexico City would screw up all of the traffic coming from North America to South America. Everything stopped because of that. Another big eruption was, of course, [Mount] Pinatubo. Pinatubo was the biggest we've had since Krakatoa, which was in [1883] or something like that. Pinatubo was an immense eruption. We don't know how big, but we know it went up well over a hundred thousand feet. Since it was in the easterlies, it pretty much all went into the Indian Ocean, out over Africa, and into the stratosphere. It persisted for years. It was monitored in Hawaii for years afterward. My quick story about that is I was at the Kennedy Center for a concert weeks after Pinatubo. It was a late concert, and I was standing out on the balcony as the sun was setting. I looked up, and I saw way up high, as far south as you could see and as far north as you could see, this absolutely magnificent sunset. I mean, the sky was red. There was never a sunset like this. So people started coming out to look and the concert was delayed. The next day, the [*Washington*] *Post* got hold of this, and they said if you were at the Kennedy Center and looked out to the west, you saw an amazing [sunset]. They called it the Pinatubo sunset. That got its name. That was quite something. That November, another huge one, [Mount] Hudson, blew from –

MG: Chile.

JH: Chile, yes. It was totally overshadowed by Pinatubo. But it was another huge eruption. It did not affect anybody really because the ash went out over the Southern [Pacific]. Qantas [Airways Limited] was mainly involved. They were the leads in being careful because they flew regularly through the ring of fire, through Indonesia where volcanoes are erupting daily. I got to know one of their top pilots at one of the many meetings we had, who was in a flight that lost all engines because of a volcano out over the Indian Ocean. They were going from Calcutta to

Perth, Australia. He miraculously got that plane back to Calcutta. Everybody was in crash position. They never knew they could fly a 747 without engines that long. It had never been done before. That's pretty much highlights of the volcano program. Barbara [Stunder] took over. It's still in use. The worst [of] all eruptions from a volcano [in] Iceland. My friend that I worked with coordinating volcanoes information with the airlines, said that if there was ever anything that would disrupt airline traffic, it would be a volcano in Iceland. Nobody ever heard of a volcano in Iceland until this one erupted about twenty years ago. I can't remember the name of it, and even if I could, I couldn't pronounce it. [Editor's Note: Mr. Heffter is referring to Eyjafjallajökull, which erupted in 2010 and disrupted European air travel for a week.] It stopped all the traffic between Europe and the West, the United States, and Asia. As it went on, I was retired at the time. It no longer became a problem of forecasting where the volcanic ash was, but it became an economic problem. The airlines were losing so much money they were willing to take risk and fly through an ash cloud. It was all over the north. You couldn't see it, but it was there. The United States, as far as I know, never lifted flight restrictions. They did not allow any of the planes to fly if they were going to fly north. I guess they went southern routes. The Europeans, the English, the French, however, flew through it. Had I not been retired, I would have raised such a stink because if something happened, who was going to get the blame? The people who were doing the volcanic ash forecasting. So it was totally economic at that point. It's too bad.

MG: You became director of the volcanic ash program.

JH: There was no title. It was my program. I started it. I maintained it and did all of the work, the administration, and all that stuff.

MG: With VAFTAD?

JH: Yes, that was the model that was developed. I went to an international volcano meeting. I gave a big talk on VAFTAD. As I was looking at the agenda, a good friend of mine was there, who was the head of WMO, World Meteorological Organization, [Godwin Olu Patrick] Obasi was my classmate at MIT. We studied together. Obasi was one of the smartest guys I've ever met. He was brilliant. He went on to become head of the Nigerian service. Then he became the director of WMO. He was there. But when I was looking at the program and what we were going to do, I looked at a back page, and there was a printout of a VAFTAD forecast with the latest changes that we had made. We were making changes every week. I couldn't believe it. I never gave it to anybody. It was strictly within shop. I had no idea what it was doing in this international program. It turns out that that was accepted as the norm for the entire globe probably through Obasi. They've used it or parts of it up until today. Barbara Stunder took over the program, and she has done an amazing job. She worked with me for a long time on that, of taking things over. Now it's pretty much all run by NESDIS [National Environmental Satellite,

Data, and Information Service], by the satellite people because it's now highly involved with satellite information. You can now verify more ash with satellites than in the old days. The nice thing about this program is that as its long as it's been run, there has never been a fatality incident related to volcanic ash in the history of the program. There are hundreds of volcanoes that go off every day, hundreds. So it was a very successful program, and I hope it continues.

MG: It's very impressive.

JH: Yes.

MG: You retired from the Air Resources Laboratory in 1999. What has life been like since?

JH: I'm still working with model verification of tracer experiments.

MG: Is that HYSPLIT [Hybrid Single Particle Lagrangian Integrated Trajectory Model]?

JH: Well, there were many tracer experiments. They were actually not meant to verify any specific model. There are, and were, hundreds of models to examine hazardous particulate activity in the atmosphere under varying conditions. One of the main models that's still in use, is HYSPLIT, which is Roland Draxler's. It's a particulate Lagrangian model. It's used now all over the world. Roland is the guy to talk about that. I can't say too much about it. Everyone in our lab uses it. It's used commercially. It's used everywhere. It's one of the big transport and dispersion models for any kind of hazardous material, from chemical, biological, nuclear, smoke, any kind of material that gets in the atmosphere that can be of concern. The model itself now can run on a home computer. They have workshops and things on the model use. With all of these models, how well did they do? Nobody really knew. They had not adequately verified. We spent a lot of effort where we could identify the tracer. In many cases, natural tracers. For instance, one of them was radioactivity, krypton 85 being emitted for decades from a power plant in Savannah, Georgia. They knew the amount coming out, and there were means of sampling the emission. This is one of the big tracer experiments that I honchoed. We ran it for two years, sampling twice a day at about five stations along the East Coast, generating a tremendous amount of data. Then we ran the models using the source terms to see how well the models did. We needed other new tracers. So we got Jim Lovelock, who was a leading chemist in the world, from England, to develop perfluorocarbons. They're not fluorocarbons, but perfluorocarbons, manmade products that could be released. There was no background of these products that we knew of. If tracer has been coming out for decades, you've got background. So if you get low concentrations, you don't know whether it's from a source or whether it's from background. This has no background, so you could measure down to very small amounts with proper equipment. They used mass specs. If you released the tracer, you could sample down to one part in ten to the sixteenth, which was unbelievably low. They have since, I think – mass specs

can measure down two more orders of magnitude. It's unbelievable. Like ten to the eighteenth. Anyway, that's what we started using on all of our tracer experiments. To give you an example, one of them was ANATEX [Across North America Tracer Experiment]. Across North America, we had two releases, one from Montana and one from Minnesota. The tracer came in a big cylinder. You released the tracer slowly and you could follow it throughout the United States and Canada. We were actually looking for it in North Africa and Europe. We never did find it, but we have a feeling that some of it got there. An earlier experiment was CAPTEX [Cross-Appalachian Tracer Experiment] in which we released tracer across the Appalachians from Ohio. There we sampled the entire northeast United States. Of course, one of the big problems with perfluorocarbons is contamination. You could not have the samplers and the release mechanism anywhere near each other. Certainly not in the same building, and practically not in the same town. A lot of times in the early days we had contamination, which totally threw off results. We did an even earlier experiment out of Oklahoma. Miserable summer in Oklahoma. It was out of Norman, releasing tracers under highly specified conditions to test perfluorocarbon tracer technology, where we had samplers out six hundred miles, a long way at this early stage. Then there were a whole bunch of experiments done in Idaho Falls over small fixed grids. I mean, dozens and dozens of [experiments] releasing SF6 [sulfur hexafluoride], which was another (short-end) tracer. So, easy to see, but under totally controlled conditions. You know exactly where the winds were going because you wanted them to go over your sampler on the grid. The Europeans got hold of the perfluorocarbons and ran a huge experiment out of France using those tracers and measuring all over Europe just one time, a very well done experiment. They, of course, used some of our experience. We had a pretty good idea of what we could tell them to look for and not to look for. This has all been written up. I put this all on the internet. It was part of my first job after I retired. Roland got me to put it all together. It's all on the internet now. You can go and see absolutely everything about every experiment, all of the work, all of the sampling, everything that was done. So modelers can use this data if they want. It hasn't been used very much.

MG: I think I saw it, and my eyes crossed. I couldn't understand it.

JH: So this is what I was doing. The perfluorocarbons programs are done. They're not releasing them anymore. It's expensive, and the stuff, by the way, never disappears. It doesn't wash out. It doesn't do anything. Backgrounds will last thousands of years. The newest thing we're doing and what Ariel has been pushing, is using SO2 [sulfur dioxide] data, which has been around now for decades. There's so much of it out there you wouldn't believe, and nobody practically has used it for this purpose of model verification. So that's what I'm working on. We've got two or three other people that are involved, and it's very complex. As we were just saying, it's totally different from where you've got a controlled experiment; you know exactly what's coming out where. There are no significant outside sources, no contamination from anyplace, whereas, with this, if you've got someone that's sitting in a car with the automobile

running and close to a power plant, some of the exhaust can get in the measurement value [and] totally throw you off. That's what happens. You can't really work the same way you did before, and that's what we're working on now, and will go on and on. As far as can see, more and more people are probably going to be involved in this type of research, but many models are being run – so many of them. People really have to know how well they do and under what circumstances. It's so complicated. Most models have tremendous amounts of chemistry and problems with rainout and washout mixing. So the modelers are working fast and furious, but at some point, you've got to be able to give answers, and I don't even know what kind of answers. How good is your model?

MG: We've talked about so much today.

JH: Yes, I think that's pretty much all of it. There's an awful lot of material. I think I pretty much – yes.

MG: You've really covered a lot. I'm sure I could talk to you for four more hours and get more details, but you've really given me a great sense of the work you've done.

JH: To me, it's really interesting to try and remember some names. I had a very good friend who became the head of the USGS [United States Geological Study], Tom Casadevall. A good friend of mine, he was the head of the lab out in Hawaii, of the volcanic lab on Mount Kilauea. He got us out there on a couple of occasions and we got a chance to look at the volcano and stand next to where the lava was flowing out and put sticks in it, which most tourists don't get a chance to do. That was a lot of fun. But stuff like this, we met a lot of people. When Tom first got out there as head of the lab, he decided he wanted to buy a house for himself and his wife. So there was prime real estate on the main road south of Hilo that goes down to the southern end of the island – beautiful area. So he bought a hunk of land there. He was just about set to build a house, a gorgeous house, and the mountain erupted. It was a big eruption. It totally inundated his land and everything around, never to be used in the next thousand years. That was it. The head of the lab should have known better.

MG: [laughter] Well, this has been a real treat. I will be back this way in the future if there are more things to add to the record.

JH: Let me know. I think at this point, I'm going to be into SO2 data from now until, I suppose, my dying day. There's no end in sight. It just will go on and on. I've been around so [long]. God, it's been sixty years that I've been working. That's a long time.

MG: It's incredible.

JH: I don't know about that. But it's fun to – I'm glad my kids have gotten me to write some of this down. I know there are other tapes. [Editor's Note: Mr. Heffter is referring to another oral history project with the Air Resources Laboratory that he participated in.] We interviewed Lester for two full days. Some of that has been transcribed. His son and daughter grew up here and lived here. I saw them this summer. Phyllis, his wife, just died, and so they were closing the house up. They were looking through documents, and they found a lot of Lester's papers. They didn't know about the interviews. So I got John in touch with Ariel, and they got together, and Ariel gave him a lot of Lester's interviews. John is a professor at a college somewhere in Massachusetts. He teaches physics and math. He said he could use some of the interviews because a lot of it was very mathematical. Although Lester said he never could understand a thing John was trying to tell him! As far as I know, those tapes are not long for this world. They're just sitting in a box and deteriorating.
MG: Where's the box?

JH: It's in the library. It's in our library at ARL on the fourth floor. I think there's a lot of valuable material there. Many ARL interviews are in there. They had summertime students with earphones typing some of it. A Don Pack interview must be there; he was the assistant director. He must have some fascinating stuff. He was the chief administrator. Although Lester was the boss, Lester worked between administration and science. Don Pack had little to do with science; it was mostly administration. I was not in on his interview. But I did sit in on Lester's. There were all kinds of other scientists. I think another interview was with one of the great climatologists of our day, Murray Mitchell. The other interviewers were Bill Elliot and Dian Gaffen. Bill died, but Dian is still around. She lives in Bethesda. You ought to talk to her.

MG: Who is this?

JH: Dian Gaffen. She was the head of the climatological section of our lab for many years and wrote a lot of papers, a lot of publishing, and really was pretty knowledgeable about surface temperatures and water vapor. Jim Angell was into tropospheric water vapor. The two of them worked together. Jim was much interested in the boundary layer; Dian in the surface. Dian won the WMO award for writing. They had a big presentation here for her – very nice. But she would probably know a lot about this research.

MG: There's a great history here.

JH: Yes, there is. We had no idea why we did this [Air Resources Laboratory oral history project]. I think this was Bill's idea. He had insight into what might be needed. Nobody really said, "Do it." This never came from above.

MG: Are you talking about the volcanic ash or the whole office?

JH: No, all the office interviews. Somebody said the lab has been through so much fascinating history; somebody should put it down. I think that gave Bill incentive. Certainly, I, from the standpoint being around so long, and Dian from just a technical standpoint – they were both really good interviewers. There was really only one person who would interview at a time. You probably know, it gets confusing with several interviewers and probably harder to interpret what comes off. But I would certainly look into getting the other tapes and transcripts. I don't think Johnny Machta took any of the tapes.

MG: Let me turn this off. I want to thank you for all the time you spent with me and the stories you shared.

JH: Listen, it's my pleasure.

MG: It's really been fascinating.

JH: Come on. It's so nice that I can contribute to NOAA's history.

MG: Well, I appreciate this so much.

JH: Okay, good.

MG: Thank you.

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JH: I forgot something. This is interesting. For Three Mile Island, we were alerted at the very beginning: "There's been an accident. We don't know anything about how much radioactivity was released. We don't know anything about measured sampling. What we want to know is where's the radioactivity going. Where are the trajectories? Just tell us." So I immediately ran forecast trajectories from Three Mile Island, and found that we knew exactly where Three Mile Island [was] that was not in question – and we knew the time. The trajectories were coming down from Pennsylvania, across the border into northern Maryland, heading towards the Washington area. This was devastating. So that's what we released. Immediately, everybody went crazy. The lines were swamped. Somebody called [and] got through to me. I don't know how they got me. I know it was somebody from one of the radio stations; a news forecaster got to me – I don't know how – and started asking me about what was happening. Well, I figured had to talk to him. Then he said, "Do you think you should recommend evacuating Washington, D.C." I said to him, "You got to be kidding. You're talking to the totally wrong person. There's no way I would even do that. You've got to get to somebody else at a much higher

level." That took care of that. We continued to run the forecasts. The next forecast that came out turned the trajectory around, took it back up over the border, and back up through Central Pennsylvania. It was all very scary. I got a similar call from somebody in New York City, somebody from the city government who asked me the same question: "Since the activity is coming up through Central Pennsylvania, is it possible it could get over into the New York City area? If so, which way should we evacuate?" Of course, I told them the same thing. I was learning! I said, "You don't ask me this question. Ask somebody else." Then somebody asked me to give a briefing over public radio, and I got permission. Who knew that I could be interviewed? So I was interviewed over national radio about Three Mile Island. I emphasized that all I was doing was running trajectories. Anyway, I went back years later, just to see how well those trajectories did. We had all kinds of archived data at that point at much finer scales. Sure enough, those trajectories did indicate that a front had come through. The trajectories did a 180-degree turn and went into Pennsylvania. We got a lot of sampling data from central Pennsylvania that did indeed show radioactivity up into Rochester, where there's a photographic industry. Radioactivity kills them. So throughout the atmospheric testing period, whether Chinese or whoever, we had to call Rochester and tell them if any activity was coming over. Some Chinese activity came over the United States at twenty, thirty thousand feet. If it got over Rochester and rained, it would rainout. The photographic industry would have to know. What they did is close down if there was a problem. That was another offshoot of atmospheric testing. There were all kinds of fun things going on. They keep coming.

MG: There's so much to talk about. I feel like I could be here all night.

JH: You don't want to be here all night. I think that's it.

MG: Well, I want to thank you again.

JH: My pleasure!

----------END OF INTERVIEW----------

Reviewed by Molly Graham 11/14/2019
Reviewed by Jerome "Nick" Heffter 12/11/2019
Reviewed by Molly Graham 12/18/2019