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AN INTERVIEW WITH EDWARD RAPPAPORT
FOR THE
NOAA 50th ORAL HISTORY PROJECT

INTERVIEW CONDUCTED BY
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Molly Graham: This begins an interview with Dr. Edward Rappaport for the NOAA 50th Oral History Project. The interview is taking place in Miami, Florida, on January 6, 2020, and the interviewer is Molly Graham. Can we start at the beginning? Can you say when and where you were born?

Edward Rappaport: I was born in 1957 in Southern California.

MG: Were you born in Los Angeles?

ER: In the greater Los Angeles area, yes.

MG: I was curious about your family history and how they came to settle in that area.

ER: Both sides of my family are originally from Chicago, at least since they came over from Europe more than a century ago. My parents met in the Chicago area, but ultimately moved west, went to school, graduate school, in Oregon, and then moved south to California, where they got their first professional positions in Southern California, and that's where I was born.

MG: I was curious about your heritage, and where your ancestors came from.

ER: Both sides of the family came from Eastern Europe in the nineteen-teens and 1920s. One my father's side, my grandfather came here about 1915, and almost immediately became part of the World War I effort. He did not go overseas, but he was part of the military at that point. Ultimately, he settled in the Chicago area and that's where my father was born. On the other side of the family, they were from, again, Eastern Europe, and came over about the same time. They didn't know each other until my parents met, but that grandfather worked mainly as an electrician. The grandfather I mentioned before originally worked a family farm, and had a number of various jobs in the Chicago area.

MG: Do you know how your parents met?

ER: I don't know the details of how they met. I know they were introduced, I believe, when they were at college in Illinois.

MG: What brought them to Southern California?

ER: Both of them majored in psychology, then got their master's degrees from the University of Oregon in psychology. My father took a job in Southern California as a school psychologist. My mother worked there for a while as well in the general psychology field. I think she was a psychometrist. But she wasn't there long before I was born and my sister was born. She then spent the years after that helping raise the children at home before she went back to work in the social services field, working mainly with the elderly for the county of Santa Cruz, which is farther north in California. We had moved there after I was about five. We moved up to Central California, to the Santa Cruz area.

MG Was your dad the school psychologist for the school district you attended?

ER: Originally, he was in Santa Cruz County, but I think most of his time, he worked in neighboring counties, so he had a long commute. But I don't think he spent much time as a school psychologist there while I was growing up there in that county.

MG: It's an interesting job. My dad was a school psychologist, too, and I have a lot of memories of phone calls from parents on the answering machine and people coming by the house.

ER: We didn't have that much [work at home by my father]. I know he did do some private work at times, which I was shielded from for important reasons. But it did lead to a nice adventure that the family had. When I was about eleven, and with my younger two sisters, the family went overseas for a couple of years. He worked as a school psychologist again, but as a civilian for the Department of Defense in Japan. The U.S. still had numerous bases in Japan as a follow up to World War II. He worked for some of the bases in the central part of the country. We lived just outside of Tokyo for a couple of years, which was an interesting experience.

MG: I want to ask you more about that. But first, did your father serve during World War II?

ER: He came in towards the end of the war. He was too young to be drafted, but then volunteered toward the end of the war, and actually entered just before he turned eighteen and was part of the force maintaining the peace in Italy for a year or so after the war ended.

MG: Was he in the Army?

ER: It was the Army Air Corps, so the predecessor to the Air Force.

MG: Was he able to use the G.I. Bill to go to school?

ER: I believe he did, and my parents maybe even used that to buy their first home. I don't remember the details.

MG: Yes, you weren't around. Are you the oldest of your siblings?

ER: I am. I have a sister who is a year younger and another who is eight years younger.

MG: How did this opportunity in Japan come up for your father?

ER: I believe that he knew someone from his position in Southern California who then, in turn, went overseas, and was in a supervisory role in Japan, and invited him to come over and continue his work there. We took a few years off and then came back to California after we were there.

MG: As an eleven-year-old, how did you feel moving to a foreign country?

ER: It was really the best of all worlds. I was old enough to appreciate, to some extent, the culture and the uniqueness of the experience, but not too old to have really any major responsibilities. So, I got to have the fun without much of the worry.

MG: Tell me more about your life there, where you lived, and the school you attended.

ER: We lived just off of an airbase, Tachikawa Air Force base, which was about twenty miles or so west of Tokyo. It's now been converted to part of the city of the same name by the Japanese. The U.S. no longer has their interests there. But while we lived just off the base in civilian housing I went to school with the children of the dependents of the military folks who were there.

MG: Was this during the Vietnam War era?

ER: This was during the latter years of Vietnam. It was '69 to '71. In fact, Tachikawa Air Force base was the site of the burn treatment unit for the military, where those who were severely injured were brought if they needed to be treated for those symptoms.

MG: Were you following along the events of the war? I was curious if your perspective of the war was influenced by being in a foreign country?

ER: I've been interested in the news from an early age. But, I wasn't that knowledgeable at eleven years, as a twelve-year-old, about the politics and the international ramifications. I did, as I said, pay attention, but I hadn't developed any serious political thoughts at that point. Most of our information came from U.S. Armed Forces Radio.

MG: This is also where you had your first experience with a typhoon.

ER: Yes. So my first experience with what is a hurricane in the Eastern Hemisphere was there. The airbase would notify the people living in the area, dependents, by actually posting on signs at the gates what the readiness condition was or, however they were calling it, at that stage. So there were a couple of events that we were warned in advance that in a few days we may have the impacts from a typhoon. As it turns out, we did not have anything severe while we there in the couple years that we were there. But, this was my introduction in some ways to hurricanes.

MG: Did you feel interested then in the warnings and the weather conditions?

ER: Apparently, I was interested even before that without necessarily knowing it, according to my mother. She said I showed signs of having an interest in the weather as early as three years old. She found me one day sitting with my elbows propped up on the windowsill watching it raining outside, which was interesting in its own right, given that we were in Los Angeles, and it almost never rained there, so how I [came to be staring out at the rain] that one day to demonstrate that, I'm not sure. It turns out that many people in my profession have had an interest since they were very young. One of my colleagues has said it's a defective gene. The weather folks, many of them, have always been interested in the weather. It's been fortunate

when they, and in my case, I, have had had the aptitude to go on and do the math and the science that are required to actually make a go of it in school and in a profession.

MG: Talk to me about how that developed throughout your high school and college years.

ER: There wasn't anything available in high school in terms of coursework on meteorology, though I had, by then, started a home weather station, for which I'm actually proud of my parents. Well, I'm proud of my parents in many ways, but proud in that when I left Santa Cruz after high school to go away to college and thereafter, that my parents actually continued on making the measurements. It was a really wonderful experience when, a few years ago, we were able to get them recognized for more than forty years of taking weather observations by the local National Weather Service forecast office and the local newspaper-- the newspaper to which they had reported their information. They came out to the house and did a story on them [his parents]. They honored them and it was a very warming experience.

MG: Who taught you to make these instruments and take these measurements?

ER: Well, it wasn't hard. We had a simple rain gauge and had an anemometer, which measures the wind. But we made essentially daily rainfall measurements. My mother now, at age ninety, continues to do that in the same location. I then, after high school, went – I spent the next two years after high school doing junior college work at a community college in the area, and then went away to do my university work at the University of Washington in Seattle and majored in atmospheric sciences there.

MG: Did you go to the University of Washington for that program?

ER: I did. I wanted to stay – my preference was to stay out West where the family was. There's about one university program per state with meteorology or atmospheric sciences. California had one or two. Oregon has one. The state of Washington has one. Ultimately, I chose the University of Washington.

MG: How come to that program, and not the ones in California or Oregon?

ER: They had a good reputation. I had considered going to the other schools, but that was the one that struck me as closest to my interests.

MG: Tell me more about your two undergraduate years at the University of Washington, the classes you took, and the professors you had.

ER: I started there because I transferred as a junior and finished my bachelor's degree there in a couple years, and then stayed on for a master's degree, which was another three years. Now that I've been in the profession for many years, there are times when I'm asked to give talks to younger folks about career advice and guidance. One of the points I make is these people are very bright. Most, I'm sure, are smarter than I am. But one thing I've mentioned to them is don't discount luck, both good and bad. Part of that comes from my experience first in the University of Washington. Another experience where serendipity really played a role in my

career. One of those experiences – those two primary experiences came that first year that I was in Seattle. It was the first year that I was in that program as a junior. I was taking introductory-level courses in atmospheric science. About two months into the term, near the end of the term, one of the professors approached me, really out of the blue, which I guess is appropriate for meteorologists, and said that he had just received some grant money from the National Science Foundation to do analysis and research on data that had been recently collected in a field program. It turns out that that field program was just off the coast of Africa in the tropics. Of course, I was thrilled. I was delighted. I'd only been there a couple of months, and here I'm being offered an opportunity. So, of course, I agreed. Ultimately, the work that I did for this professor turned into my master's thesis, and some of the work I did there as well was for another one of his students who – one of his students was a graduate student who was completing her PhD work. Later on, when she finished, she went on to go be a professor at Texas Tech University. Little did I know that behind the scenes the professor who had asked me originally, plus this professor, had been plotting to steer me towards going there after I finished my master's degree, and that's actually what happened. I wound up going and being one of the graduate students for Dr. Leary, who was the graduate student of Dr. Houze, who had invited me to be in his program. So I wound up doing my PhD work in Texas at Texas Tech. But the serendipitous part about all this was that when he – and we laugh about this now, years later, was he invited me to be in his program. As I said, that was a great honor, and actually wound up not only giving me experience but got me started in tropical meteorology. So here I am, at the University of Washington-Seattle, which has no connection, really very little connection, to tropical weather, and I wound up in tropical meteorology because of this. But the funny part is that we realized later on he had mistaken me for someone else, who I'm sure was doing much better in his class. I was in his 301 introductory course. He realized that sometime later, and we laugh about it, as I said, now, because if he hadn't made that mistake, he would have chosen someone else, and who knows where I would have wound up or what I would have been doing if that hadn't occurred. So that's one of the two important cases of good luck for me.

MG: With the professor who ended up at Texas Tech, did she confuse you for someone else? Because you said she also wanted you to be in the program.

ER: No. Colleen Leary and Bob Houze both knew of my work because I worked for both of them – she before she went on to Texas Tech, and him for almost five years. So they knew what they were getting when I was going there. [laughter] But the other lucky moment for me actually came at the end of my time at Texas Tech. It took me five years to earn my PhD. I'm a little slower than some folks, so it took me some time. What happened then was I had begun to look for possible positions to continue on in tropical meteorology when I finished my doctorate work. As part of that, I went to several different facilities, offices, and had interviews or gave talks. One of those, I was invited to come to South Florida to give a talk at the Hurricane Research Division, part of NOAA's [National Oceanic and Atmospheric Administration] Atlantic Oceanographic and Meteorological Laboratory [AOML]. I knew some of the folks already there because I had been in a field program. They had several people who had been in that as well. So, I knew some of the people there. But they invited me to come down and give a talk, a seminar, which was ostensibly a job interview. They didn't say it that way, but I knew what was at stake there and why they were inviting me. So, I came down, had a pleasant experience. Hopefully, it was pleasant for them, too. I gave a talk. But there was no job offer forthcoming

after that. That was a little disappointing given that my background was then in tropical meteorology and they were…and are…the premier research organization within the government for tropical cyclones. But the serendipitous part of this was that while they never offered me a position, there was someone else who turned out was going to attend the talk, too, from the National Hurricane Center. That was Bob Sheets, who was, at that point – the Hurricane Center was in a transition with Neil Frank retiring that year as director. Bob Sheets, who had been at the Hurricane Research Division for a number of years, was then the deputy director of the National Hurricane Center and becoming the director. He was going to come out and listen to the talk as well. Not long thereafter, I did hear from him and was excited to learn that he was offering me a research position with the National Hurricane Center, which I ultimately accepted. That was how I started at the NHC, at the Hurricane Center in late 1987. The funny part about this though – again, another change in direction – was that, as it turns out, he didn't go to my talk. Thank goodness he didn't, because if he had maybe he'd come to the same conclusion as the folks at the Hurricane Research Division and maybe wouldn't have offered me a position! So I got lucky that he didn't go. Rather than going into tropical meteorology on the research side, I wound up going to tropical meteorology more on the operational side with the Hurricane Center. I did join and did applied research here for the first several years, before moving into the operational units.

MG: How did he find you?

ER: He knew that I was giving a talk and maybe he got some information that was positive from those who heard the talk. What he had done was he had encouraged me to apply to the Hurricane Center as a post-doctoral fellow for the University Corporation for Atmospheric Research, UCAR, which is associated with NCAR [National Center for Atmospheric Research], another of the premier institutions in meteorology. It was a one year position. I started here in late 1987. Again, timing can be everything. About six months into that year, one of the people in the four-member research group that was a federal employee retired, and the position became available and was advertised as they do for all government positions, and I applied. The timing was great in that I hadn't been here so long that I already had to make a commitment to going somewhere else. I started to think about what am I going to do now? I'm six months in. But I was here long enough that, apparently, they found me useful enough that ultimately I did get that job. That's how I started here, I was in the postdoctoral position, followed by a research position here at the Hurricane Center.

MG: I want to go back and just ask you a couple of follow-up questions.

ER: Sure.

MG: Can you tell me a little bit more about the research in Africa you did during graduate school?

ER: Well, I actually didn't go to Africa. The research that Professor Houze was doing was using data that was collected in the field program that had occurred there …it would have been a couple of years before. He was in that field program as well as others that I came to know, but it was the data that came from that experiment that formed the basis for the research that he and

others conducted, and which I contributed to over the years. Again, it just so happened that the research that was done was in the tropics. In fact, one of the weather systems went on to become a tropical storm or hurricane, so there was some connection there. So I started by analyzing tropical weather data for a storm that was on the first day of the – it came from the first day of the experiment. This field has many acronyms, and the acronym for that program was GATE, which has an embedded acronym. It's the GARP [Global Atmospheric Research Program] Atlantic Tropical Experiment. I'm trying to remember – GARP is something like the Global Atmospheric Research Program. Anyway, it was a big research program. This was a component of it that happened to be in the tropics. The National Science Foundation funded research based on that data.

MG: Did you continue this research during your doctoral program?

ER: I used some of that data, but also analyzed data for similar weather systems in the midlatitudes. The dissertation was really a comparison of the structures and evolution of tropical versus non-tropical thunderstorm type systems, convective type-systems. That was the focus of the work.

MG: I want to understand better how you went from a young boy measuring rainfall and interested in the typhoon in Japan to really pursuing this in your education and as a career.

ER: I think a key moment came when I was going to junior college. I was interested in meteorology, but I wasn't quite sure exactly how to go about moving forward or what I would or could do. I went into the library at the community college and took out what was a textbook of meteorology, and opened it up. I was, frankly, overwhelmed by the math and the science that were involved. I really started to question whether this was going to be the right place for me, the right field for me. [Telephone rings.]

[TAPE PAUSED]

MG: You were talking about this book you found in the library.

ER: Yes, which was a little bit shocking in terms of all the equations and discussion of science. So I wasn't sure whether I was going to have the skills. I enjoyed math and science, but I wasn't sure I was going to have the skills. So then it was a matter of those next several years finding that out. There weren't any meteorology courses at the community college, but there were the prerequisite courses that I would need if I wanted to transfer to the university that did have that program – physics and advanced math and calculus, and so forth. I did pretty well in those. So I was hopeful. Then when I transferred to the University of Washington and began taking the courses there, I was successful enough that ultimately I got my degree, and it turned out to be my profession.

MG: What was your experience at Texas Tech like, being in Texas and the PhD program?

ER: Well, there's certainly a significant difference between Seattle, Washington, and Lubbock, Texas – very different cultures, the interests of the people are somewhat different. In fact, if I

can diverge a bit here, I recall when I arrived there and started setting up an apartment and the various services I would need – back in that day, we didn't have online options. I remember I went into – I guess it was the AT&T phone store to set up service. They wanted to know, for reasons that are understandable, if I'd previously had service that I had paid for. So I filled out where my previous residence was, and I indicated Seattle. I always remember that the comment made by the person behind the desk – she said, "Yeah, you didn't look like you were from around here." Well, that probably was the case. I had a beard, which is typical for someone from the Northwest. I wouldn't have been so surprised if she had said, "You don't *sound* like you're from around here," because in West Texas, there's a Southern-type accent. But to say you didn't look like you were from around here was, I thought, amusing.

MG: Did you adjust eventually and find a community there?

ER: To the extent that I could, yes. Having grown up on the West Coast, Washington State was more similar to California than was Texas, but there was plenty to learn while I was there, both in terms of my schooling and in terms of community and culture.

MG: Were you still focusing on tropical meteorology?

ER: Well, at that point, my PhD work – maybe I mentioned – was a mix. I was using some data from the tropics, but there were also field programs that were conducted in the middle latitudes, including one that was called PRE-STORM [Preliminary Regional Experiment for Storm-scale Operational and Research Meteorology], another acronym. That was centered in Oklahoma and Kansas. That was a field program that I participated in for a couple of months in one of the summers. This was the field program I mentioned above where I first worked with people from the NOAA Hurricane Research Division. Some of the data that came from that influenced the result of my PhD work.

MG: When did you finally earn your PhD?

ER: You put it the right way. When I finally got my PhD, I finished there in 1987, and I started here. Technically, the degree was granted in 1988. It was a long haul. It was thirteen years in college – something I was proud of. But as proud as I was, my mother put me in my place when she said afterward – after I received my PhD, she said, "Just remember that fifty percent of all doctors graduated in the bottom half of their class," which, again, gave me some perspective, not only about myself but perhaps about the medical profession or any profession. Depending on how you look at it, you get a new introspective look at yourself and also what's going on in the outer world.

MG: What did she mean by that?

ER: Probably be humble, be modest, realize that just because you got this particular degree doesn't mean that you're necessarily at the top. I took that not only to heart, but I took it as becoming somewhat circumspective of others as well about titles and accomplishments. Just that the particular way she phrased it was both humorous and enlightening.

MG: Remind me of your first position when you came here to the National Hurricane Center.

ER: Well, when I first got here I was not a federal employee. Under the UCAR research group, a fellow would be the term – [I was a] research fellow. But, then I was a research meteorologist within the Hurricane Center. That was the first of about seven positions that I've held here, and I've been here ever since.

MG: Did you get to work under Neil Frank, or had he moved on?

ER: When I came here, originally to firm things up in terms of position, he was actually moving out. So I didn't meet him. We've had a nice professional and cordial relationship for the decades that have followed. I was very humbled and honored a couple of years ago when I received an award under his name. It was the Neil Frank Award from the National Hurricane Conference. It kind of came full circle. It was thirty years later from the time that I had first got to meet him to receiving this award, which he was present [for] as well. I wanted to thank him. That's when Bob Sheets was just starting as the director then. I've been here through quite a few changes, including changes at the top.

MG: Yes, I want to ask you about that. But I was also curious about Neil Frank because he has a unique view on climate change.

ER: He does. He's very outspoken about climate change. I am more reserved.

MG: He was a signatory to an evangelical take on climate change, that this is in God's hands and plan.

ER: I understand that, and I've heard that from him, but I'd prefer not to talk any further about that.

MG: Sure. Of course. Do you know what he went on to do after he left?

ER: After he left the National Hurricane Center he became the on-air meteorologist for one of the big television stations in Houston. So a very big audience. He already developed a following when he was at the National Hurricane Center. I'm sure he was well-liked there. Of course, his background made him extra special to have in that community, which has and remains at risk from hurricanes.

MG: Can you talk about the directorship of Bob Sheets? He was in that position for about seven years.

ER: Yes. I grew up professionally under Bob Sheets. He was my direct supervisor for at least part of that time. The position of director for the National Hurricane Center is a very difficult one. If there's any one person – I wouldn't want to pick out someone and not recognize others, but if there's any one position that has been perhaps the most important in terms of mentorship or people that I've learned from, it would be the director position. One of the issues which I've talked to others about, as they've been interested in, for example, applying for the director

position, is how difficult a job it is. Since I've been here, six or seven directors – every one of them has developed some kind of what I think is a stress-related health-type issue. It's a very difficult job. In fact, if you go back to the person who's considered the first director of the National Hurricane Center, even though the title of the organization hadn't been established yet, it was Grady Norton. He was the director in the 1950s and well-known for his forecast ability and also ability to communicate the information. He was the director during a very active time, the middle '50s, where among the hurricanes that hit the U.S. was Hurricane Hazel, which went up the East Coast, and ultimately even caused havoc in Canada. But, one day after a twelve-hour shift here [during Hazel], he went home and passed away. I don't recall whether it was a heart attack, or maybe it was a stroke, but it seems like it was a stress-related loss, sadly. But I think that was the first instance where it became clear that the stresses upon the director here are really extraordinary. I'm always in awe at those who have been in that position and have been able to move ahead, even with those stresses, even at times having a physical bearing of those stresses as well.

MG: You have been acting director a couple of times. Did you experience that stress?

ER: Sure. But as it turns out, I've also been fortunate to have a wonderful staff here, people that, for the most part, I'm day-to-day colleagues and coworkers with. But there have been periods where I was also the acting director and have been grateful for the expertise and the personalities of the folks who have – they're the ones who make it happen. Itwas my job, to the extent I could, to provide leadership and facilitate. It worked out well during those periods, at least from my perspective.

MG: Has that been your reason for not applying for the permanent director position, the stress of the position?

ER: I have had an interest in it. There have been times where there's been an opportunity, and it didn't work out, but I've enjoyed my time here, in essence, supporting the director and the staff. I've been now the deputy director for five different directors. In some ways, I suppose the position, beyond its technical and administrative management responsibilities, requires, to some extent, supporting the director in doing what I can to supplement or augment the director in areas where their skills maybe aren't as strong, and I can make a contribution. In some ways, the deputy director is like a chameleon. You change your color to best suit the leadership, help make it work.

MG: Can you tell me a little bit more about Bob Sheets and his approach to the job?

ER: That was a long time ago, and I was, at that stage, mainly in the research part of the organization, [not as] a forecaster. Bob brought a lot of experience from his time at the Hurricane Research Division, and prior to that, in the military. He had experience as a flight director on some of the research missions. So he brought a diverse background, which added a relatively strong science foundation to the work that the director was doing. He also emphasized, as did his predecessors and successors, the communication part of the program. The expression I first heard from a later director, Max Mayfield, is, "It doesn't matter how good your forecast is if you can't communicate it clearly so people can take action," and he lived by

that during his time. So, not only was he pushing on the science to advance the organization, but he also moved the organization forward in terms of communicating the risks, both in the off-season in terms of our education and outreach programs, and during the season when storms were approaching--via the media.

MG: During his time, Hurricane Andrew happened.

ER: That's right. That's a key moment in many people's lives. Hurricane Andrew was the first category five hurricane to hit this country in almost twenty-five years and the first that had hit South Florida in almost sixtyyears. As it turns out, it came right across South Florida, and across where the National Hurricane Center was located. Our office at the time was located in a different part of town. That was an extreme example of an added challenge. There are stresses involved with this job, not only for the director but for just about everybody in the organization – the forecasters and all the support staff. But, there's an added stress when not only are you forecasting a category four or five hurricane to hit the United States, but you're forecasting for it to hit your own community, because you have to prepare your own family and home, at the same time as trying to keep your focus on your work. I was still relatively new here then, 1992. I'd been here a few years, but hadn't experienced a hurricane. So I was somewhat naïve. I had an idea of what to expect with a hurricane coming. I know that there were some surprises the night that Andrew came through, even for the staff. I was the lead forecaster, but with plenty of support. The night that Andrew came through, we had switched to twelve-hour shifts. Andrew came through somewhat before daybreak, around 4:30, 5:00 AM, across the Miami area. We were on 7:00 PM to 7:00 AM shifts. But the day shift was already there through the night because it wasn't clear if they'd be able to get into the office the next morning. So there were many of us there. What we experienced was rather unique, along with the rest of the community experiencing rather unique conditions. It's something that I'm also very proud of, again, how the staff performed during that event.

MG: Can you say more about that experience? What happened during and after the storm?

ER: Yes, the strongest recollection is how even during the approach and ultimately landfall of this disastrous hurricane, how professional and focused was the staff. As an example, as we were getting close to the storm making landfall, it was also right about the time that we were issuing our updated forecast with all the associated – what we call – advisories and products at 5:00 AM. I and others were so focused – and there's a picture of this that perhaps we can find, of us basically staring over a computer screen and typing in the advisory text. We were so focused on that that I didn't realize until afterward when somebody told me that the building was swaying back and forth. We were on the sixth floor of a twelve-story building. Apparently, it was noticeable, but I had no idea because I was focused on making that forecast. As that was going on, the cover for the radar that was on the roof blew off. There were cars flying around in the parking lot. In fact, just about that time, one of my colleagues from the Miami Weather Forecast Office, which is collocated with us, walked over and said, "We just had a gust here," and showed me the chart, and it was a 164 miles per hour. It's interesting because years later, someone who wasn't here, who I knew from the field, said that they found it interesting how I then sent out a short message, which apparently was very terse – not negative, but very succinct and brief. It said something to the effect of, "National Weather Service has experienced a wind

gust of 164 miles per hour and the radar is not operational." What they thought was amusing about that was that those are real dramatic outcomes, but it was just par for the course. We had to get the information out. There was no fluff in it. Just report the facts and move on. So that occurrence was unique in that way, professionally. It was also unique in terms of my own family situation, which we could discuss a little bit if you'd like.

MG: Yes, tell me.

ER: I wasn't married at that time, but I was seeing someone seriously. The protocol for a storm approaching South Florida was that for their protection that you could bring a family member to stay there [during a local hurricane threat]. It's a safe location, a safer location than where they could be. It's also a matter of being with family, too. There's some psychological strength that's built when you're with others that you know. It turns out that my wife-to-be was someone I asked whether she'd want to come and stay at the Hurricane Center. She agreed to do so. Interestingly, she spent much of the night, before the phone lines went down, calling the spouses and loved ones of others on the staff who were at home, just to check on them, see how they were doing, report back also on how the folks on the staff were doing. That was a very proud moment for me. Ultimately, a couple of years later, we were married and have been ever since. But at that point, we were just dating. What I tell people now is I really knew how to show a girl a good time. [laughter] "Here, come spend the night with me at the National Hurricane Center." Although, I'm not sure we talked at all that night because, again, the staff was so focused on what they and the others were doing. Nancy was helping in another way.

MG: Has Nancy come back to stay during hurricanes since Andrew?

ER: She has not. We have now since moved to a place where we had a home constructed that we believe is hurricane-ready, hurricane-safe. She's welcome to be here but has found it to be fine to stay at home. Our children have done that as well; they've stayed there.

MG: What does it mean that your home is hurricane-ready?

ER: Following Hurricane Andrew in '92, Florida upgraded their building codes to become – they're already relatively strong – by far, the strongest in the Hurricane belt. There's a South Florida building code. Also, a variation of that called the Florida Building Code. Our home was built to those new code standards. I had some extras included as well. It's a two-story home. Typically, at least back then, the first floor would be constructed of concrete block called CBS [concrete block structure or stucco] construction. The second floor then would be a wood frame in a particular "hip-style" roofing. That was the standard back then. But we were fortunate to be well-enough off that we could afford an upgrade. I insisted that the second floor also be concrete block. We're safer in that way. Of course, we have, like everybody now does, hurricane shutters installed so we could put them up as needed. In that way, I think we're ready.

MG: It's interesting you brought up the codes because I was reading about Hurricane Andrew, and there were so many unexpected outcomes after a big storm takes place, including updating codes and changing laws. I also read about how the environment changes – all these [pythons]

escaped the zoo and have changed the South Florida ecosystem. And also instances of PTSD that really change lives permanently.

ER: Right. All of that I'm aware of as well. The Miami Zoo was badly damaged, and some of the animals were lost. Now we have an infestation of pythons in Florida. I don't know to what extent that contributed, but we have a problem here with that now. There are other animals that because the enclosures were destroyed, they got out. So, yes, there are unexpected outcomes. Sadly, there are also outcomes that one could anticipate. We have loss of life, which was tragic as it is in the other storms where it occurs.

MG: What goes into the analysis part of a story? How is that handled?

ER: The National Hurricane Center is part of a much broader network of offices and capabilities that ultimately extend beyond the Weather Service, and even beyond NOAA and outside of the government. There's a long chain in terms of what goes into making a forecast that can go back decades in terms of the research that occurs. Over the years, I think NOAA should be proud of the advances that have occurred in the hurricane program in terms of forecasting. NOAA has made major contributions. It's also been assisted along the way by advances that have occurred in academia, in other government organizations, and worldwide in some of the other meteorological centers around the world. That research has contributed to improved methodologies for forecasting and improved inputs to the forecasters, whether it be in the computer models, which people have heard the term before that NOAA and other organizations run these computer models, which make forecasts of the weather in a variety of contexts. There are what they call global models, which forecast the weather everywhere around the globe. Then there are also specialized regional models, among which are hurricane models. We have, for our forecasters, a variety of inputs that they use to make the forecast. Over the years, those forecasts have improved dramatically.

MG: I know you wanted to talk more about the technologies and how they have advanced over the years.

ER: Yes, a little bit. To provide a view or a feeling for how the field has advanced, let's take us back to when I first came to the National Hurricane Center in the late 1980s. As we did then, we still now assess the quality of the program in one way in terms of the forecast accuracy, how good are we making forecasts of hurricanes? There are two primary components that we look at. One is how good are we at forecasting where the hurricane is going to go, and the second is how good are we forecasting how strong it's going to be when it gets there. In the late 1980s, when I started here, the metric that we would use typically is the forecast accuracy for the track of the hurricane and where we're forecasting it to go two days from now, forty-eight hours out in advance. As you might expect, the forecast accuracy decreases in time in terms of how far out you're looking. So a forecast that we're making for one day from now is going to be almost always better than a forecast that we make for three days from now. Back in that time, the average track forecast error for the two-day or forty-eight-hour period was about two-hundred-and-fifty miles. So what that meant was that if we say the forecast center is going to be here and it winds up over here two days later, on average, that distance back then was two-hundred-and-fifty miles. Today, the average forty-eight-hour forecast error is closer to eighty miles. What

that means is that we've cut off two-thirds of the error in forecasts, of where the storm is going to be, down from two-hundred-and-fifty miles to roughly eighty. The other time periods have seen a similar improvement. That's remarkable, I believe. In fact, what I've said in a number of talks is that given the complexity of the issue, forecasting weather, and given the importance of this particular issue, forecasting hurricanes, I'd consider this to be one of the greatest scientific advances in the last half-century. I recognize that there have been many others, but this one has to rank up there but doesn't get nearly as much attention as some of the others have, and perhaps for a good reason – in medicine and other areas of science, the acknowledgments and the awards and recognitions have been great, but quietly, behind the scenes, the National Weather Service and NOAA have been making progress and really should have been credited much more broadly and significantly than has occurred. So that was one of the two forecast components that we would evaluate and still do, and you can see the advancement. The other is intensity. Speaking more briefly, we did not have the same kind of success for the first couple of decades, making improvements. If you show a graph, it was flatlined in terms of improvements on the intensity at that scale. But the last ten years – actually, now there's been significant improvement as well. So, again, very proud of my colleagues and those who I have not met, but who have contributed from the outside to this.

MG: Can you say how these advancements are made? Who is involved? What are the tools?

ER: There's a broad spectrum of advances that have occurred in terms of observations, the kind of instruments that are available to make these observations, largely weather satellites, which provide data. These satellites are typically developed, in most cases, by NASA, but they're then essentially run by NOAA. So NOAA data has made a great difference. I should back up and say that we've made these tremendous advances over the years, much of that could be attributed to the performance of the computer models that the forecaster is using. In a moment, I'll describe, as you've asked, what's contributed to this. It's really what's contributed to the computer models. But I want to say first, that while the computer models have driven us forward, the professional forecaster still is able to add – as the term is widely known – value. They add value to the forecast. In fact, [they] make even better forecasts in almost all cases than individual models do themselves. That's because they are familiar with the strengths and weaknesses, the biases of individual models. Yes, the computer models are much better than they used to be. The hope is they'll continue to get better and drive us forward. But beyond that, there's even advanced skill that's added by the forecasters. But now, if you step back to what it is that they're using, these computer models – what's important is really there are three different areas. One is the observations that go into them. As I mentioned, weather satellite observations are critical and have been responsible for much of the gain. The second is the formulation of the internal configuration of the computer models themselves. We know much more about meteorology now than we did fifty years ago, and we can observe more of it now. In combination, those two have led to enormous advances. The third, though, is computerization. We now have these computer models that can run billions of calculations using tons of observational data, but to be of value to the forecaster, those computer simulations have to be able to run fast enough so they can provide timely input to the forecaster. So we've been fortunate that, in parallel to these advances in observational techniques and the internal compositions--the physics of the models, is we've had the IT, information technology and computer gains over the last several decades, which have

enabled us to run these higher resolution more-detailed computer models and provide us the forecast improvements.

MG: Were these advancements related to the Modernization and Associated Restructuring [MAR] at the Weather Service?

ER: Yes. There have been advances along the way, some of which we can probably identify explicitly as a--this contributed to that--particular advance. Other gains are harder to identify the sources for, but the Modernization and Associated Restructuring of the Weather Service, in part, led to the deployment of the Doppler radars. That data is very important. It's also led to the advances in some of the infrastructure and capabilities to generate the so-called products that we have to visualize the observations that we just talked about.

MG Did the MAR impact your day to day work at all?

ER: Not immediately, but more gradually; that was early in my years. It may well have impacted me, but not in such a way that I could detect beyond the normal advances or enhancement of day-to-day activities.

MG: Did you want to explain these charts to me, even if it doesn't quite translate for the audio? [Editor's Note: The diagrams being discussed here have been inserted at the end of this transcript for reference.]

ER: Sure. This is what I was referring to before, and I'll turn it around so you can see it. What we have here are the average forecast errors of the track. Again, where we said it's going to be versus where the storm wound up being. We averaged it out over a period of a decade, just to be able to compare one decade to the previous one. So what you see here is up the Y-axis is the actual track forecast error. Across the X-axis is the forecast period. So what I was referring to is forecasts for the 48-hour period, so two days from now. What the graph shows is that – if you go to the purple line, you see the 1960s. Actually, 1960s, '70s, and '80s, there was a decrease in the error during that time, but the errors were still around two-hundred-and-fifty miles or so. This is in nautical miles. I was actually referring to statute miles, which is somewhat larger. But in any case, around two-hundred-and-fifty miles for when I started here thirty-plus years ago. You can see that the improvements have actually accelerated over the following decades. So you see the 1990s here, 2000 to 2009, and we don't have this year's 2019 data yet, but basically almost an entire decade you can see the errors are down here now, on average seventy to eight miles as opposed to two-hundred-and-fifty from before. Something else to point here is that these gains, the decrease in forecast errors, are, in part, what gave us the confidence to extend the forecast to longer lead times. Through the 1990s, the forecasts that we made went only out to three days from now. Effectively, if we look a little earlier – in the 1960s, the forecasts were only for about a day during the [inaudible] 1960s, then became two-day forecasts, and then three-day forecasts. The large improvement, the great improvement we made in the three-day forecast, two-and-three-day forecast, by the end of the 1990s, gave us confidence to extend the forecast. So now, in the last almost twenty years, we've been issuing forecasts out to five days. You can see from this chart that even those forecasts are improving. Experimentally, in-house, for the last several

years, we've been making six and seven-day forecasts. We're not ready to go public with those yet, but there is some hope that in the near future we'll be able to do that as well.

MG: Very cool. Can you trace the different positions you've held throughout the years? You said there were six or seven.

ER: Yes. So, I mentioned I started as a post-doctoral fellow; had that position for a little less than a year. Then, for three years, I was in our Techniques Development and Applications Unit, doing some applied research, making some new kinds of products. In fact, during that period, I began working on what has become the graphical products that are on our website. Prior to about 1990 – well, we didn't have the web then either, but beginning in the late '80s and early '90s, I developed some software that could be run on a regular desktop computer back in the days when DOS [disk operating system] was the operating system. Those became popular with the leadership here. They started using them here for helping them make their briefings during approaching storms to show the forecast track of the storm and some other information. They were predecessors to some of the graphics we see now on television or on the National Hurricane Center website. So that was one of the areas that I was focused on when I started here, and doing research. I was also looking at other kinds of more science-related issues. Again, there were some new satellite capabilities, and I was charged with evaluating those. Ultimately, though, I also was – to the extent that I could, I would assist the operational folks. So, I had an interest in forecasting. My next position then was as what was then known as a junior hurricane forecaster. That position did hurricane forecasting during the hurricane season and worked in our marine forecast branch during the off-season. A few years later, I moved up in that area and became what's known as a senior hurricane forecaster. From there, I moved into some management positions. Briefly, I was our warning coordination meteorologist. Then the chief of our Technology and Science Branch for a couple of years. Then I became the deputy director in 2000. At that stage, the deputy director, in addition to having some operational role during the hurricane season and supporting the director and standing in for the director at times during the off-season – but that position also was the supervisor for the hurricane forecasters, as well as for the chiefs of other units and the front office administration. So for about ten years, those responsibilities were part of the deputy director's job.

MG: And then –?

ER: Well, there was some restructuring. Some of those duties were offloaded to others. I've retained and added other responsibilities. It's now been almost twenty-years that I've been deputy director. As time has gone on, and I've become more familiar with the field and the job and perhaps due to attrition, I've gained other responsibilities, including being on a number of panels and committees and steering committees for various kinds of research.

MG: Such as the Joint Hurricane Testbed?

ER: Right. We established, almost twenty years ago, what's called the Joint Hurricane Testbed. Joint meaning it was the – originally from the combined efforts of several agencies, but NOAA's been the leader of it. The primary focus for the JHT, Joint Hurricane Testbed, is to facilitate the transfer of promising technology from outside of the National Hurricane Center into operations

within the Hurricane Center and elsewhere within the Weather Service. It's had a successful run. There have been several dozen projects that have ultimately, in one way or the other, been adapted into operations. It was probably one of the first of its kind. There are other testbeds now within the agency. So it's something else that we've taken a lead on within the hurricane program.

MG: Who was the director when you first became deputy director? Was it Jerry Jarrell?

ER: No. At that point, it was actually Max Mayfield. Max became the director in early 2000, taking over for Jerry Jarrell. He was the director for about six years, followed by Bill Proenza. Then Bill Read and Rick Knabb and Ken Graham. I've been fortunate to be the deputy director for each of them.

MG: Was Max Mayfield the director during Hurricane Isabel and Katrina?

ER: That's right. So 2004 and 2005 were rather extreme, in terms of the number of storms, their intensities, and their impacts. In particular, those two years were very intense in many ways for this office with Max as the director.

MG: Can you say more about those years, particularly the impact of Hurricane Katrina?

ER: It's interesting because when there's a landfall threat to the U.S., the National Hurricane Center spins up its own operations to be more than what's the day to day – what we have on the day-to-day activities. Overall, it's the same process and much the same cadence as well, same responsibilities. In fact, that's part of what is so compelling about the work that's done by the hurricane center, is that like an Andrew, regardless of what the situation is, everybody's doing the job. Regardless of whether it's a threat here or somewhere else, the job gets done. As we talked about with the statistics and other results, it's been done in an improving way over the years, not only in terms of the forecast, but I think in terms of the way we're communicating information. I mentioned the graphical products. That's just one of the ways we've advanced over the years. In terms of Katrina, yes, it was an extreme event. But it was the same forecast cycle, same forecast product. Yes, we ratcheted up what we said during the communications; the risks certainly were greater and over a larger area than many other storms. But it was the same kind of approach. It was unfortunate that there was loss of life there that was especially large, in fact. But to a great degree, that was independent of the work that we did. Unfortunately, the levee system failed in New Orleans. That's where most of the casualties occurred. But there are always lessons learned. One of the lessons learned was despite what was a good forecast we made, especially in the last two or three days before hit it the Gulf coast, and what we thought was adequate – what we call warnings and watches – that even outside the New Orleans area where they have the levee system failure, that there were many lives lost along the Mississippi coast, almost entirely from the storm surge. Storm surge, for those who aren't familiar, is where the water is blown ashore by the very strong winds. If one can maybe think about if they have a cup of hot soup they're holding in their hand, and you blow on one side of it to cool it off, you see the soup pile up on the other side because you're pushing it across. That's a very simplistic way of describing it, but that's what the storm surge is. That storm, and some of the others, had because of their storm surge losses prompted us to put in greater emphasis on the science and the

communication of storm surge. It's not to say that we weren't doing it already; we've known all along that storm surge is a deadly hazard, but it became even more clear with storms like Katrina and Isabel, as you mentioned. Ultimately, that led to what I consider to be a great advance, if not a breakthrough, in terms of communication of the risk from storm surge in that we…within the past two, three years…we've introduced not only a new graphical product but watches and warnings that are explicitly tied to the storm surge hazard. Again, that's something I think that's worth emphasizing.

MG: You mentioned earlier the toll the position of director can take. Max Mayfield stepped down shortly after Hurricane Katrina, and I didn't know if there was a connection there.

ER: I don't know. I've talked to him about it before. We're good friends even outside of work, but I would leave that to him to decide about how he made that decision. Max had a long and very notable career, more than thirty years, and deserves the accolades he's received. He's gone on for more than ten years – also like Neil Frank before him – served the community in many ways, including as an on-air meteorologist for a television station, in this case, in the Miami area.

MG: After he stepped down, Bill Proenza took over.

ER: He was here for not quite a year. Then Bill Read for about five years and Rick Knabb for five years or so.

MG: Do you want to say anything about Bill Proenza's time here?

ER: No, I don't think we need to focus on that.

MG: Sure.

ER: He was very dedicated to the mission, as have all the directors been.

MG: Good. After he left, was your first time stepping into the acting director role?

ER: In a way, yes. When the director's not in town, then the deputy becomes the acting director. That occurs actually quite a lot in the offseason. Because of the importance and enormity of our outreach and education program, the director is often away during the off-season – at speaking engagements, attending emergency management meetings, going to media events, giving preparedness talks, domestically and abroad. Actually, the deputy director, even when there is a director on staff, is the acting director more than a third of the time because the director is away from the office. So over these twenty years I've been the acting director quite a bit because of that. But there have been two other times where we actually didn't have a director, and I was more officially and for a much longer period the acting director. 2007 and 2008 was one period of almost a year. Then 2017 to '18 was another period of almost a year, between directors.

MG: Right. In those instances, does someone become the acting deputy director?

ER: Can be. Yes, we did that in both episodes where I was the acting director. Not on the day-to-day basis, but over a longer period.

MG: Can you talk about the hiring process for the director position?

ER: The hiring goes as it does for the rest of the federal government positions. It's announced publicly. The process works through the NOAA human resources process. Ultimately, the applicants are first screened for, I suppose, technical capabilities and then the process advances in their interviews [inaudible].

MG: I also wanted to ask you about the Hurricane Reanalysis Project. Are you involved in that?

ER: Not directly. That project has advanced our understanding of historical storms. The folks who are involved with it have gone back and reanalyzed some of the storms with data that maybe wasn't available then at the time, and became available since. Also, they did this in consideration of how much we've learned and what we understand now that we didn't then, with an eye towards using contemporary techniques and knowledge, as opposed to what's available to people a half-century or a century ago.

MG: I'm curious about this project. I would love to read a narrative of the findings. Is that available?

ER: Yes, there is a write-up for each storm, I believe. In particular, the emphasis would be on what's changed and why. That's available, I believe, through NOAA's website as well. Some or most of it has been published. The project is continuing. I believe they're at least into the 1960s, moving forward.

MG: Is there anything I'm missing up to this point? Your survey said you've had some rewarding moments and have worked outside your comfort zone during your career, and I was curious about what you were referring to.

ER: In terms of the most rewarding moment, it came within the past couple of years. It has to do with a time spent with my wife. It was after Hurricane Irma, which -- following Andrew – was the next threat to potential exposure to a high-end hurricane for South Florida. As part of my job during Irma – actually, during Irma, I was the acting director again. But, part of my job over the past twenty years as the deputy director has been during storms to provide, through what we call the media pool, television interviews on approaching storms, a storm coming towards the U.S. Those interviews are provided in, basically, five-minute blocks to network television and local television stations that are in the threatened zone. Because of my long tenure in the position, I've done quite a few of those now. Occasionally, I'm recognized locally. Sometimes, otherwise, as – "Do I know you from somewhere?" In this particular case, it was after Hurricane Irma, maybe a week or so later. My wife, son and I were out for dinner. As we were finishing up and getting ready to pay the bill and leave, the waitress came by and said, "Oh, there's no charge here. This family over there is paying for your dinner." We were really incredulous and shocked. "Why is this the case?" We went over to them. It was an emotional moment. The waitress said first, "They're paying for your dinner. They want to thank you for

your service." What was shocking about that – two things. One, somebody is paying for my dinner. The other is the terminology. Usually, you hear that spoken to someone who's in the military. You thank them for their service, and of course, they're more than deserving of that recognition. For me, I'm a civilian. I'm doing a job where my own well-being isn't really at risk, although I guess it is for everybody when a hurricane is approaching. We went over to meet these folks. It turns out, it was a family, an extended family. There were maybe five people there. Three or four of them worked for the Broward [County] Sheriff's Office. So they were in law enforcement. They, like the military, are the ones to whom you would say, "Thank you for your service." Here it was them saying that to me. So, as I said, it was very humbling and touching to hear that from them. While we tried to protest their paying for our meal, they insisted. We were, of course, very grateful to them, and we talked for a while. The reason they had done this is they had recognized me from some of the television interviews that I had done. But we were really taken aback. My family is well enough off that we didn't need to have that done for us, although we were thrilled that it happened. So we did ultimately – after we left, we were trying to think of how do we reconcile all this. We called the restaurant back and asked them to tell the family that was there, and they still were there, that we would make a donation of the same amount to the relief effort for Irma, with our thanks to them. So, to me, that was maybe the most rewarding moment among many moments that I've had here.

MG: That's such a nice story. Did that family make changes in terms of their preparedness for the storm based on your reporting?

ER: I don't know. I'd like to think that the work that I do is functional enough that I'm getting the message across. Nobody would confuse me with a TV personality. Fortunately, I don't need to be – I hope – a TV personality. I just need to be able to get the message across – the terminology is – in an actionable way. Hopefully, I've been able to do that over the years.

MG: What did you mean by "learning to work outside your comfort zone?"

ER: Actually, it's that. I, as many of my colleagues in this field, am more introverted than extroverted, and never saw myself as being a TV meteorologist. That just wasn't going to be for me. In fact, when I first got here, I remember a day in the first year or two where somebody had – there was a call from the public – no, it was a call from a radio station wanting to speak to one of the hurricane forecasters. I wasn't a forecaster yet, but I was helping them out. They wanted to do an interview on whatever storm was approaching. So the forecaster who was on duty – maybe they had something else they needed to – asked if I would take the call. I was really reluctant and reticent because I wasn't sure I really knew the field well enough to speak, but also because giving an interview that would be on-air was not something I was comfortable doing. That's where I've had to learn to be outside of my comfort zone over the years. I never considered becoming a TV weatherman, in part because I didn't have the necessary pleasing appearance expected of an on-air presenter. For that reason, and because I was usually only seen when bad news was on the horizon, I've come to consider myself "The face of disaster!" As I said, while no one would confuse me with someone with actual skills, over the years, I have had to learn to give these kinds of interviews and television interviews, and now over 1500 interviews I've given. It's not surprising some people would recognize me. Hopefully, they recognize me for doing a reasonable job.

MG: I'm sure they do. You've talked a little bit about your wife, so I was curious about how you met.

ER: We met in South Florida. Ironically, both our families are from Chicago. But we both moved to South Florida for different reasons and met playing tennis. We learned later though that – small world stories – Nancy's father and my mother actually went to the same elementary school. While they were a few years apart, they knew some of the same kids, the same teachers in Chicago many, many decades before. So, my in-laws and my parents hit it off really well when they met. That's always an interesting finding that we had.

MG: Can you tell me a little bit more about Nancy and your family life?

ER: Nancy's background is in marketing, but in the financial industry. For the past fifteen years or so, she has been president and CEO of a credit union in South Florida. With her as the head of her organization I often say that I'm the deputy director, both at work and in the family. Again, something else I'm very proud of her for – leading that organization, which coincidentally is about the same size as the Hurricane Center. She's done very well in a time where actually, as I understand it, the numbers of credits unions have dropped dramatically through failures and mergers. That's not been the case with hers. She's an award-winning head of her organization.

MG: You have two kids.

ER: Two children, both have now finished college. A daughter who just finished her master's degree in speech pathology, and later this week will be moving out West to pursue her profession and new life there in California, not far from where I grew up, actually. She likes the area there. My son just finished his undergraduate degree in business, but with a sports management minor. He's got a position now – an entry position in that field, and our hopes are that he'll go a long way in it.

MG: Well, again, have I forgotten to ask you anything about your career with NOAA or anything else?

ER: No, I think we covered quite a lot of ground. I appreciate the time that you put in. The NOAA history project, all the work that they've done in bringing to light what's been, for me, a career with tremendous opportunities, met great people, saw some wonderful advances as we've talked about. I'm pleased to be able to contribute not only today but over the years.

MG: Well, it has been a treat to talk with you. I appreciate all the time you spent with me this morning and the tour before the interview. So thank you. Again, if there's something we forgot, we can add it later.

ER: My pleasure, thank you.

MG: All right. Thank you.

----------END OF INTERVIEW----------
Reviewed by Molly Graham 3/5/2020
Reviewed by Ed Rappaport 5/29/2020
Reviewed by Molly Graham 5/30/2020