NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
VOICES ORAL HISTORY ARCHIVES
IN PARTNERSHIP WITH NOAA HERITAGE AND THE NATIONAL WEATHER SERVICE

AN INTERVIEW WITH EDDIE BERNARD
FOR THE
NOAA 50th ORAL HISTORY PROJECT

INTERVIEW CONDUCTED BY
MOLLY GRAHAM

BELLEVUE, WASHINGTON
FEBRUARY 12, 2020

TRANSCRIPT BY
MOLLY GRAHAM

Molly Graham: This begins an oral history interview with Dr. Eddie Bernard for the NOAA 50th Oral History Project. The interview is taking place on February 12, 2020, in Bellevue, Washington. The interviewer is Molly Graham. I like to start at the beginning. Could you tell me when and where you were born?

Eddie Bernard: I was born in Houston, Texas, on November 23, 1946.

MG: Can you tell me a little bit about your family history starting on your father's side?

EB: On my father's side, Edward Bernard was a 7th generation descendent of the Acadia migration from Canada to Louisiana. They made this migration around 1766 and became landowners by an agreement with the Spanish government, who owned Louisiana at that time, that they would maintain a levy along the Mississippi River. In exchange for maintaining their levy, they were given adjacent property. My father's family was landowners and farmers. Edward was born in 1914 in Brule, Louisiana, a small town outside of Thibodaux, south of New Orleans. So, the Bernards were in Louisiana from 1766. That's my father's side – French. On my mother's side, Irish. My Mother's name was Geraldine Dempsey. Her grandfather, Thomas Dempsey, migrated to the United States in about 1867 to New York City. My grandfather, her father, was born in New York City in 1894. So, I'm a combination of French Irish by descent. In reading the history of genealogy of my family, I think the takeaway message is that they are fearful of governments because, on my father's side, they moved from France to the French settlement in the Canadian province of Nova Scotia. Following the French/Indian War, the British took over Canada and confiscated their land. Then they went to Louisiana, which was owned by Spain, which was later owned by France, which was later owned by the United States. So, they lived through five different governments, and each government had a different currency, different policies, different practices – so they had to be very adaptive. I think that one of the take-home messages is that you have to be flexible because you never know who's going to be in charge. [laughter]

MG: Do you anything more about your father's family's experience of migrating and making the journey from Nova Scotia to Louisiana?

EB: Yes, that was a pretty harsh thing. The English were pretty cruel. They took the Bernard's land. The Bernard's had worked the land for about two generations. One of the tricks they had learned in the Bay of Fundy was, because of the high tides, they would place sticks in the beach area, the surf zone. Then, over time, this would build up the beach with sand deposits, and they would have land. They recovered land this way. I think the total of all these French landowners was something like the size of Manhattan Island. It was a huge amount of land. Then it was very salty, so they would use a salt marsh to let their cattle feed. Then eventually, the rains would flush out all the salt, and they could farm it. So, they reclaimed a whole lot of land. Then when the English took over Canada, they said, "Thank you very much. You're kicked out. In fact, you have to go stay on this island in Halifax under surveillance." Because they were landowners, they had some capital. They were able to pay for their passage to Louisiana. A lot of the French Canadians weren't so lucky; they wound up as slaves in Massachusetts and other colonies in the U.S. The Bernard's were the lucky ones. Because they had some wealth, when

they migrated to Louisiana, they converted that wealth to more wealth by acquiring land from the Spanish government.

MG: Which generation would this have been?

EB: This would have been eight generations ago. The migration took place in 1766. On that side of my family, it was very fascinating. My forefathers were very skilled in recovering land from water. I think, if I compare it to today's culture, what they had was a technical skill. They knew how to build and maintain levies. That skill parlayed those skills into land ownership. That was pretty remarkable. If I think about my own career, I got into computers when I was in graduate school, and that was a forerunner of all this technological acceleration we've had in the last fifty years. I got in on the ground floor. So, if I do the analogy, it's like I had a technical skill that enabled me to advance my profession and make a successful career out of it.

MG: Were there farmers and landowners on your mother's side of the family?

EB: No, they came to New York City, so they had to learn urban skills. Once the family migrated to New York City, some of them left and went out to Oregon. My grandfather, Gerald Dempsey, was invited to come work on a farm in Oregon, and that's where he learned some engineering skills, which he was later able to parlay into a career with a large oil company. It was called Mobile Pipeline Company. That's where he became chief of a pump station. When I would visit him and my grandmother when I was young, he was always going out in Mobil's large compound that was a pump station for the pipeline moving oil from the oil fields to the refineries. He would take me out and introduce me to the people, the workers, and all the things that they were doing. It was a really exciting period to see him do his thing. He'd take me along as his sidekick. That was a lot of fun. I have good memories of my grandfather at the pump station in Cleveland, Texas.

MG: What do you know about your mother's childhood and her experience growing up?

EB: Well, she was an only child. Her mother, Ruth, was a schoolteacher. Her father, Gerald, was an engineer at this big oil pipeline company. My grandmother was very strict, but she was very kind. Every day at 2:00 PM, when I would visit her, we would have tea. There would be these little sandwiches that she cut the crust off, and it was like high tea. She'd always have lemon meringue pie and little sandwiches, usually egg salad or tuna salad or something like that. Good memories. Good memories. My Mother was trained as a dancer and had a dance studio where she taught dance to other students. After she married my father, she would teach ballroom dancing to earn additional income. Most of her students were girls and I would participate in the lessons so the girls could dance with a boy. I learned ballroom dancing at an early age.

MG: And what about your father's childhood in Louisiana?

EB: Well, he wasn't so fortunate. Being a farmer in that time, in 1914 to '20s, and the Depression hit in '29, he was part of that whole economic downturn. His father passed away in 1930 when he was sixteen. Edward was the second oldest of a family of eight children. He had to quit school and go to work. He was hard working and went to work for an oil exploration

surveying company, where he acquired some surveying skills. They were still exploring for oil in Louisiana at that time. That surveying activity brought him to Texas, where he met my mother at a dance hall one evening. Then, my grandfather hired him. Edward married the boss's daughter and continued to work for Mobil for the next 40 years as a machinist. They had three children. I was the youngest. I was the only boy. I have two older sisters. Probably more history than you need to know.

MG: No, this is all very interesting. How long did the family stay in Texas?

EB: Well, my parents stayed in Texas until they retired. My father retired at age sixty-five and my mother was a stay at home mom. My mother and father moved to Florida for retirement. We grew up in Beaumont, Texas, outside of Houston because that's where my father's job was located. My sister still lives there. My grandfather lived in Cleveland, which was about ninety miles away. We saw each other on all holidays; it was pretty common to get together. It was a good childhood. My two sisters remained in the area. I moved out when I graduated from college in 1969. That year Richard Nixon sent me my "Greetings" letter, but I had received an educational deferment because I had been accepted into graduate school at Texas A&M in oceanography. During that year that I was in graduate school, I met another student from the National Oceanic and Atmospheric Administration Commissioned Officer Corps (NOAA Corps), Don Florwick. We were talking one day, and he said, "Why don't you join the NOAA Corps?" I said, "What's that?" The rest is history. He recruited me and said, "If you could get your master's degree completed, you might be eligible for a small promotion." So, I did that, and sure enough, I got the early promotion.

MG: I wanted to ask you a few more questions about growing up. Could you describe the area where you grew up, what Beaumont, Texas was like?

EB: Yes. Beaumont, Texas, was an oil town and the south part of Beaumont had a refinery. The South Park school district was supported, by and large, by tax dollars, but also by contributions from the large oil refineries, which was Mobil at that time. We had a very good school district. It had lots of resources. I grew up in an excellent educational environment. They were good teachers. They were dedicated teachers. A lot of my life's influence was by those teachers. They had excellent sports programs. I played basketball, ran track, played football for a little while until I broke my finger, and decided maybe this isn't the sport for me. It was really a nice community. Hard-working people, blue-collar. They all aspired to send their kids to college. That was one common thread they all had. There's a university nearby; used to be called Lamar State College of Technology, and now it's Lamar University. I was able to go to high school close by which was a feeder program for Lamar. It was natural for me to go from South Park high school to Lamar college. I had high Scholastic Aptitude Test (SAT) math scores that qualified me for the advanced math program. I majored in math for about three years, and then I tired of doing theoretical math, and I switched over to physics, which was more applied science. Applied math appealed to me. Two things happened while I was growing up, and that, I think, influenced my future career. One was a fishing story. My father and I used to go crabbing near Galveston in these big salt marshes. One year, we were out crabbing, and we noticed a huge abundance of crabs. We used to take a number two washtub, and we'd be lucky if we filled up the bottom after about four hours. Well, that particular year, we filled up the

whole tub. I couldn't believe it. We had sometimes six, eight crabs on our bait, and just couldn't believe it. They were little blue crabs. So, I asked the guy at the end of the pier, "Why are there so many crabs?" He said, "Well, there was a hurricane last year, and it flooded this whole area – the crabs went berserk. They spiked in population and hatched eggs survived because there weren't as many predators as there were crabs." So that was one life experience that showed me the connection between fisheries abundance and the environment. That was one lesson learned. The second thing that happened to me when I was in high school – I had been elected president of the student body in high school. There was a big hurricane that came into Port Arthur, Texas when I was in high school. They evacuated people. One evacuation site was the South Park High School gymnasium. The principal asked me to participate in setting up and welcoming people, make them feel comfortable, and stuff like that. I remember the feeling that they had of anxiety – "Was this hurricane going to destroy our homes? Was it going to destroy our lives?" They were very anxious people. That clicked with me. I said, "I wonder if we could do something to improve that situation? Could we use science to improve people's lives for these natural disasters?" In this case, it was a hurricane. Well, that played out when I showed up in graduate school with a scholarship. It turns out that my draft board had told Texas A&M University that I was drafted. Although I had been given a one-year deferment, the draft board didn't update it with Texas A&M. Long story short, Texas A&M gave away my scholarship. But the dean at that time said, "Well, would you be willing to do research and we could pay you?" because I had no sources of income. "So, we can pay you to be a research assistant on a project." I said, "What's the subject?" He said, "Tsunamis." I said, "What a tsunami?" [laughter] That's one of the coincidences. Then I learned more about tsunamis, and I said, "Well, this is cool. This is a natural disaster, which people evacuate. Hey, I had that experience in high school." So, click. It just resonated with me. I said, "Hey, maybe a part of fate or something." I don't know, but it was quite unusual that that experience I had in high school, then the mix-up in graduate school led me to a career in a tsunami. It gave purpose to my research.

MG: Those are great stories.

EB: Is it told in a way you like?

MG: Yes, of course. Very much. I wanted to ask you a little bit more about the teachers you had in high school. You said they stood out to you.

EB: Oh, yes. I still remember Lyra MacFarland was my math teacher. She was so inspiring. She said, "Little Eddie, you got to learn the calculus. You got to learn the calculus." Okay, I did. [laughter] Also, I remember she said, "There's an emerging science coming out that's really important." I said, "What's that?" She said, "Oceanography. It's going to be a big deal one day because seventy percent of our planet is covered with water. If you got into this field, you'll be on the ground floor of a very exciting career." I said, "Well, what do you have to do to be an oceanographer." She said, "Well, let's go look it up." We looked it up, and it had four disciplines. It was physical oceanography, chemical oceanography, biological oceanography, and geological oceanography. She said, "Well, with your math skills, why don't you pick up physical?" So, I did. I went down the math field and became a physics major, which was a prerequisite for going to graduate school in oceanography. At that time, oceanography wasn't

offered as an undergraduate program, only a graduate program. I remember my father, when I graduated with a degree in physics, said, "Well, why are you going to grad school? Why don't you just go to work?" I said, "Well, a physics degree isn't very valuable." He said, "What? Why did we spend all this money on going to school?" [laughter] I said, "Well, I really want to be an oceanographer." So, the person who influenced me the most was my math teacher. Plus, I loved going to the Gulf of Mexico to crab and play in the surf.

MG: I get the sense that you must have been pretty popular in high school. You were the student body president and captain of the basketball team.

EB: Well, yes. At that time, sports were a really big deal. So, dating girls, I said, "Well, I need to be in athletics." I was an all-American boy, just like everybody else, interested in girls and cars. At that time, we were doing things in high school that probably today – [laughter]. I got away with things that I don't think you'd get away with today, but we won't go into detail. I had a good childhood. I had a good high school experience. And yes, I liked people. They liked me. When I got into science and when I was in graduate school, I liked to be around people, and I liked to engage with people. When I was finishing up my PhD in Colorado, I was doing my research at an institute called the National Center for Atmospheric Research (NCAR), which had the largest computers in the world at that time. By today's standards, it's like your smartphone; it's about that powerful. But at that time, it was leading-edge technology. Like I said, I was into computers very early in my graduate career, and that launched my career into the future. But one of the downsides of this was a lot of being alone. I would spend all night at the computer center. Because my programs were so big, you couldn't run them during the regular day. You had to run them at a special time at night when the whole computer was available. Well, this was exciting from a scientific standpoint, but from a social standpoint, it was isolation. I remember one night, driving down from NCAR – it's up on a hill, and you've come down this steep driveway – and there was a herd of deer in the road. I looked at that herd of deer, and I said, "I can't do this. I got to be around people." So that's when I decided I'll finish up my technical degree, and then I'll try to go into science management because I figured I could use my skills, social skills, and my technical skills to do that. The epiphany of that moment was seeing that herd of deer and realizing that I wasn't an isolated person; I like to be around herds of people. So that's what attracted me to science management.

MG: I'm curious to hear about where you went from there, but I still have a couple of questions. You mentioned you have two sisters, and I was curious if you got along well with them or were close with them growing up?

EB: Well, when you're the youngest of the family, and you're the only boy, and the other two are girls, there's a lot of good things and a lot of abuses that take place. My oldest sister was six years older than me, and my other sister was four years older. I was the baby. My sisters always accused me of being the favorite. I think, looking back, my mother – because I was the only boy, there was a bias there. My father tried to raise me, [saying], "You got to be a boy, you got to be a boy," but I was mothered a lot, smothered, and probably over-loved, but that didn't hurt me. I think I was lucky in that I got along well with both sisters. They both viewed me more like their child instead of their brother. My older sister passed away at a fairly early age, age

sixty. My second sister is still alive, living in Beaumont, and we talk weekly over the phone. So that's a good relationship.

MG: When you were getting ready to apply to college, did you look at any other schools, or did you know you wanted to go to Lamar?

EB: No, Lamar was the only thing I could afford. My parents weren't wealthy, and I had two choices: go to Lamar or don't go. So that was a pretty easy choice to make. I graduated with honors in physics, and I applied to Columbia, and I applied to Scripps, and they didn't accept me. I applied to Texas A&M, and they did accept me with a scholarship in oceanography. It was a pretty easy choice where to go to graduate school.

MG: Were you living at home while you attended Lamar University?

EB: Yes, I did, for my undergraduate degree. I joined a fraternity, and it was a pretty nice thing. I could stay at the fraternity house most of the time just to have a different college experience. A lot of my buddies from high school joined the fraternity. All of us in this middle-class, blue-collar environment did the same thing. We stayed in touch, and all of us were the best men at our various weddings and stuff like that. So, I had a good experience, lots of friends, surrounded by lots of people I knew. That's where I met Shirley, my wife. In college, I was still interested in student government. I ran for vice president of Lamar student body and won. Then, the next cycle, I ran for president. While I was campaigning for that role, I was a fraternity guy, so the Greek system usually won these elections because we're more organized than anybody else. Well, the year I decided to run, the independents decided they were going to do something different. They want different leadership. I was campaigning for president of the student body. One evening, I was going to give a talk, a campaign pitch to a group of independents. I said, "Well, I better go talk to them because they're voters, too." So, I was going over some notes, standing underneath a light post, and this beautiful young lady came up and said, "Are you nervous?" I said, "A little bit." She said, "Well, good luck. Don't be nervous. You'll do fine." I said, "Okay." When I went inside, and I spotted her in the audience as I was giving the talk. It turns out that she was the campaign manager for my opponent, Mike Coppinger. So, the election ended, and he won the election. But, long story short, I won her heart, and we've been married for fifty years. So probably the best thing that happened to me in college was meeting my future wife.

MG: And you became vice president of the student body. Is that right?

EB: I was elected vice president, yes. But president I didn't make. That's one of those things in life where you say, "Well, things happen for a reason." Probably, if I had won – well, who knows where that path would have taken us.

MG: I think it was a good trade-off.

EB: Yes, I think so. I think it's a good trade-off. If you can give up an election and win the heart of a person, you're going to spend fifty years with, that's a pretty good trade-off.

MG: Were you interested in politics or government on a national level? This was during an interesting time in our country's history.

EB: Well, that's an interesting question. The short answer is no. I was interested – I mean, one of the fascinating things about my job, as director of the Pacific Marine Environmental Laboratory (PMEL) was the opportunity to go to D.C and talk to representatives of our government. I found that to be the most interesting part of my job. My job was to market the lab, and that was another word for fundraising. And who gave us the money? Congress. So, I'd go talk to our sponsors, if you will, the people in Congress who would support NOAA and, in turn, support our programs – PMEL and other programs, such as ocean acidification, underwater volcanoes, El Ninos, and tsunamis. I enjoyed that probably more than anything. I loved to go in and talk to the staffers, and occasionally get to meet the representative. By and large, I was always impressed. I remember Mark Hatfield, who was head of the Senate Appropriations Committee at that time. Probably the most powerful position in government in any time is the person who controls the budget. He was the most statesmanlike person I'd ever met – very impressive. If you had the stereotype of the perfect person to represent your country, he would be my candidate. I did run into some people who were less impressive, but we'll cast that aside. By and large, most of these people I've had the privilege of working with – Senator Maria Cantwell here in the State of Washington. She's just a wonderful person. And Representative Jay Inslee, who ultimately became governor of our state, he was a wonderful person. Inslee and Cantwell were very strong sponsors of the Tsunami Warning and Education Act in 2006. I guess that's how the connection between my interest in serving student government was translated into serving the federal government. I felt very lucky to have that opportunity to influence policy, and then try to bring along the technical, scientific story in such a way that they could understand it. I always had this philosophy that we owed them an accounting of how we were spending their money. One of my strong beliefs was that I'm here to tell you what we've done with your money before I asked you for anymore, and I'm not going to ask you directly, because that's not legal. But I do want to give you an update about how we've spent your money. So that you'll realize we're not just taking it and doing something else. We're going to be accountable and responsible for the money you've given us. I always made that my strongest line. I wanted to make sure that they understood what we were doing, why we were doing it, and what success we had, and if we had failures, this is why they failed, and this is how we learn from it. Because I was only reporting progress to them, they kept inviting me back. It was an opportunity to build long-term relationships with these influential people.

MG: At the time you were in college and in graduate school, a lot of the student movements on college campuses were ramping up. This was during the Vietnam War. Was that on your radar?

EB: Most definitely. Lamar University wasn't Berkeley. Most of the people at Lamar were commuters like me, and traditional protest wasn't part of our DNA. I mean, we worked within the system and tried to change it from within, instead of yelling and screaming outside. I was drafted and I was fearful that I'd be sent to Vietnam. But fortunately, our country offered another way to serve your country, and that's through the NOAA Corps. When I realized that I could use my science skills in that capacity, I said, "This is a wonderful alternative," because

some of my high school buddies were coming back in body bags; they weren't surviving. Again, talking about what's right with our country, the fact that we offer alternatives for people who have a different skill set is a good indication of how our country is offering every something for everyone and opportunities in different fields. I could serve my country in a capacity to which my skill set would make a difference, and I didn't necessarily have to put my life on the line. I think we all serve the country in different ways.

MG: Had you completed your graduate degree before you join NOAA Corps?

EB: Complete? Well, no. I joined the Corps, I was accepted, and then, about three months later, I got my master's degree. I had a bachelor's degree and a master's degree, and a master's degree qualified me for a quicker promotion. Usually, you came in as an ensign, and you'd spend – I forgot exactly how long – a couple of years as an ensign before you could be eligible for a lieutenant junior grade. Because I had a master's degree, they compress that time requirement; I only had spent twelve months as an ensign, and then I was promoted to lieutenant junior grade. That showed your MS degree paid off.

MG: I want to hear a little bit more about this professor who offered you the research position doing work on tsunamis.

EB: Okay. Yes, it was it was Professor Robert O. Reid. His colleague was Professor Andrew C. Vastano. They both were on my master's degree committee. Professor Reid was probably one of the best mentors. He had a very organized lifestyle. He showed up at eight. He left at five. He had four kids. He balanced his life. He was my role model. I said, "That's who I want to be like, Bob Reid." His colleague, Drew Vastano, was a very passionate and engaging person, wonderful, totally disorganized. He was like, "I'm going to go play basketball because I'm stressed." "Well, wait. It's the middle of the day." "Doesn't matter. I had to work until midnight last night.". The contrast between these two styles gave me an opportunity to see which one would prevail. Of course, Professor Reid received all kinds of accolades. He graduated twenty-five Ph.D. students, and all his students went on to do meaningful things in oceanography. He was the mentor's mentor. So, I was lucky that Bob Reid was on my committee, but I also enjoyed Drew's mentoring. Drew was a lot of fun to be around. My social needs were met with Drew, and Professor Reid was the teacher, the mentor. But I learned how to organize my life. I learned that you can balance your science with your family. I think that's an important lesson learned in life. If you learned it in graduate school, that's really important because a lot of these students were going off the deep end, working seven days a week, many hours a day. I think it affected their creativity. They got too bogged down. But that's just my opinion.

MG: You refer to yourself as the "accidental tsunami guy." So, I was curious about what that process was like when your professor introduced this idea to you. How did you catch up? What did you learn about tsunamis?

EB: Professor Reid started research on the hurricane problem, but the money for that hurricane project had run out. Meanwhile, the US was doing nuclear testing on some islands in Alaska. One of the things they were worried about was, would they accidentally trigger a tsunami by

detonating a nuclear bomb on an island. So, there was a big project that Professor Reid joined, because of his background with storm surge and flooding – mathematically the problems are the same. The flooding problem for hurricanes and the flooding problem for tsunamis are exactly the same from a mathematical standpoint. The only difference is what's forcing. One is an abrupt disturbance; that's the tsunami. The other is a wind forcing field pushing water against the coastline. But the resulting flooding and damage from the flooding are identical. So, Reid quickly translated all that knowledge and technical know-how from the flooding from storm surge to flooding for tsunamis. That's where I came in. I had to do a lot of reading and research. The way this worked was, you'd meet with Professor Reid once a week for an hour. You'd go in, he gave you things to do, and you did them that week, and you reported back to him. Then you could ask all your questions. In that one hour, you made the most of it because you knew that was what he expected you to do. Again, this organization that he had set up was phenomenal. So, I adhered to his assignments. I read everything I was assigned. The more I read, the more interested I became in the problem. Then the fact that I could have some technical ability to actually address this hazard was phenomenal. Then when I got to NOAA my first assignment in NOAA Corps was a ship assignment. So, they train you to be a line officer. You go to sea for two-three years. You drive the ship. You make sure you don't crash it, and you try to dock it. But after that, you go do something that supports NOAA. So, I found out that NOAA had a tsunami research group in Hawaii, and I said, "Oh, Hawaii, that sounds good." So, I applied and, because my master's thesis was written on tsunamis, I met another great mentor, Gaylord Miller. He was head of the tsunami research group in Honolulu. Fortunately, he said, "Come on," and I was transferred to Hawaii. That was a dream right there because I had been trained as a scuba diver on the ship, so I could go diving every weekend in Hawaii. I got to do body surfing and scuba diving and, and research. I mean, talk about paradise, that was it. But Gaylord encouraged me to get a PhD. He said, "I can't use anybody who doesn't have a PhD." So, on my way to Hawaii, I stopped at Texas A&M, talked to Professor Reid, we set up a PhD committee, and I could do my coursework at the University of Hawaii, and it would count toward my PhD program at Texas A&M. Long story short, Gaylord Miller made it happen. He was the guy that I learned the philosophy "win-win." It was like, "You win, I win; everybody wins." That was a philosophy I had never encountered. Up until then, I'd always encountered, "I win, you lose." This was so inspiring and fresh, in my mind, that you could do both. You could set up things that everybody would win that I just fell in love with the idea. I said, "This is the way I want to lead when I get into management, I'm going to try to adopt that philosophy that we'll set up situations where everybody wins." One little glitch was I had to spend a year at Texas A&M to finish up a PhD program. So, Gaylord said, "Well, I think you need to go to Texas A&M for a year to enhance your training. So, I said, "Okay." He cleared it with the NOAA Corps, and they all agreed to send me back to Texas A&M for a year to finish up my PhD, and everybody wins. NOAA wins. Eddie wins. Gaylord wins. So, they all agreed, and I got a PhD out of this whole experience. It was pretty amazing.

MG: Did you then return to Hawaii after that year?

EB: I did. As soon as I finished up my PhD program, Professor Reid wanted me to do some more research – well, both Gaylord and Professor Reid then were coordinating on a project. That project was to do numerical modeling of tsunamis. The place to do it was at NCAR's computing center. So, I went from Texas A&M to Boulder, Colorado. That's when I lived in

Boulder for a year. Then, at the end of that year, this project was over, and NOAA Corps wanted me to move to another position. What came up was the head of the Tsunami Warning Center. They temporarily promoted me to commander and assigned me as the head of the NOAA Tsunami Warning Center in Hawaii. It was at Ewa Beach outside of Honolulu. Because I was a freshly minted PhD and I needed some management experience – for the progression of the NOAA Corps - they want you to go into a management position to exercise my leadership skills, so I did that. That was pretty impressive. The bonus to the Weather Service was they didn't have to pay my salary, and they loved that. So, in my career, I got a chance to be in the National Ocean Service through the ship assignment and to be a part of NOAA Research at the Joint Tsunami Research Effort. Then, I worked for the Weather Service as head of the Tsunami Warning Center. Then, I went back into research at PMEL. So, I was able to serve in three parts of NOAA. Then my interactions with the Fisheries Service, especially through Bill Aron, gave me a lot of exposure to the National Marine Fisheries Service. So, I had a lot of interactions with people in four different elements of NOAA, four of NOAA's five components.

MG: That's very impressive.

EB: So, I'm a NOAA guy. That's what Admiral Harley D. Nygren used to say about NOAA Corps officers, is that we're NOAA people. We're not Weather Service People; we're not Research people. I think that rang true because I was always open-minded and receptive to other parts of NOAA because I said this is a big organization, and if we all work together, we'll win-win.

MG: Did you know Admiral Nygren well? We hoped to interview him, but I know that he passed away recently.

EB: Admiral Nygren was another great mentor. When I was assigned to head of the Tsunami Warning Center, he came to Hawaii. The Warning Center had just experienced a pretty bad mistake. They had blown an earthquake and a tsunami warning. NOAA wanted to shake up the whole system. So, a few NOAA headquarters executives came out for the review with Admiral Nygren. They were doing a review of why things went wrong. They asked me to sit in on this review. Part of that reason I was there for the review was to give me some marching orders for how to improve the tsunami warning center. They thought this was a good leadership challenge, management challenge for me, to take an organization that needs to be redirected, and you jump in with your youth and your energy and your knowledge, and let's make this work. I guess they put a lot of trust in me, thinking back on this, that I could pull it off. And we did. We upgraded the warning center to a computer assisted operation. After three years there, I was ready to switch over to be a civilian because my next NOAA Corps assignment was a sea duty assignment, and I wasn't too excited about that. I'd been to sea once, and I didn't see how that experience was going to improve my scientific credentials or my family life. So, I was prepared to resign and move into the Weather Service. In the meantime, John Apel, who was head of the Pacific Marine Environmental Lab, wanted an oceanographer to be his deputy. I had the credentials. I had the research interest. I came up to Seattle and interviewed for the job. It was a wonderful experience. They offered me the job, and I accepted it. I became deputy director of PMEL in 1980.

MG: When you were talking about your graduate research earlier, you mentioned the nuclear detonations in Alaska. Who was in charge of that project? Was it part of Project Plowshare?

EB: Well, it was a Tamaron commissioned report. This whole project was led by Los Alamos National Laboratory. Los Alamos, at that time, had the most advanced computer models of fluid dynamics in the world. They still do, in fact. What Los Alamos wanted to do was have other research activities going on. Gaylord Miller got a piece of this action, and Bob Reid at Texas A&M got a piece of the action. They were working on the same project, only different aspects of it. I was the connecting tissue between Texas A&M and Gaylord Miller and the Joint Tsunami Research Effort (JTRE) in Honolulu. But the upshot of this whole thing was when nuclear detonations took place, there were very, very small tsunamis. In fact, they were so small, nobody could detect them. That's when the concept emerged – we should be able to detect tsunamis in the open ocean. Gaylord's group was working on detecting tsunamis in the open ocean. They were spending money, but like most academic institutions, the University of Hawaii didn't have a very strong engineering infrastructure. They've got little groups of people who are typically underfunded, and they try to get by with chewing gum and baling wire. They tried to make things happen, but in oceanography, the water depths are too great, the pressures are too great. You need really concentrated engineering to make anything work. As a result, JTRE didn't have much success. One of my take-home messages from being in the tsunami research group was we need to be able to detect a tsunami in the deep ocean. When I was selected to manage PMEL, which specialized in ocean observations, I said to Hugh Milburn, who was the chief engineer at the time, "Can we do this?" He looked into it, and he said, "I think so." It took us ten years, but we developed the technology for detection of tsunamis in the deep ocean and report these data in real-time. The common thread is the accidental tsunami scientist, who became head of the Tsunami Warning System. Then PMEL, which specializes in ocean observations, took on the challenge of tsunami observations in the deep ocean. This couldn't have been done any other way. Another agency, it wouldn't have worked. Only in NOAA could this have worked. I joined NOAA Corps, specialized in tsunamis, and then I took it from there and added to the state of the science– well, it's win-win-plus. That's what Gaylord would have said about this whole process.

MG: Where did you sign up for the NOAA Corps? What was that process like?

EB: Well, it's an interesting process. You have to go through an interview. Like I said, Don Florwick was at Texas A&M, going to graduate school with me; he was a classmate. Any NOAA Corps officer can become a recruiter in certain situations. So, I took some tests, he interviewed me, reported back his findings, recommended that they select me, and they selected me. Then you go to Kings Point, New York, for twelve weeks' training. Because it's a Merchant Marine academy, you learn how to be a ship driver, rules of the road, how to wear a uniform, the military decorum that you need to be aware of. At that time, reflecting back, it was 1970, and so Vietnam was still very much a part of our culture at that time. Some people in our training class had very strong political opinions about things. I felt very lucky that I got into the NOAA Corps, and I didn't have to go to Vietnam and still serve my country. I thought it was a good alternative. I was quite happy to be there. I did meet some people that became lifelong friends. It was a good experience. After we graduated, we each went to our respective ships. My ship was the *Researcher*, and she was homeported in Norfolk, Virginia. Shirley and I got

married in May 1970. In October 1970, I went to Kings Point for the training. Then we moved to Virginia around Christmastime 1970.

MG: How many were in your class at Kings Point?

EB: Good question. I think about twenty, twenty or so.

MG: Were women in the NOAA Corps at that point, or was that a little later?

EB: No, it was later.

MG: Tell me about some of the other guys in your class at Kings Point.

EB: Well, there was Kurt Schnebele. This guy had a photographic memory. He aced every test we took. It was always, "Kurt Schnebele, one-hundred percent." I was in the lower A group, nineties, stuff like that. But we did have a guy who had a PhD in physics. He could do the technical stuff, but he really had a tough time with the military stuff. When you're in training class with these guys, your paths cross over your careers. Once you're in the NOAA Corps, it's like the Marine Corps. People are very supportive of each other. So, while I was director of PMEL, I always liked to have NOAA Corps officers in our laboratory because, one, I knew they were on a short assignment. I tried to give them encouragement to do certain things and check certain boxes. I wanted to make sure they each had a publication with their name on it so that they, at some point in their lives, could say, "I helped publish this paper, and here's my citation." When you're a research lab, that's the one take-home you should do. Number two is don't get in any trouble. They usually accommodated. Because I'd been in the Corps, if they ran into problems, they'd come to talk to me. We did have some scientists that were rather insensitive to NOAA Corps officers, the fact that they had to move around all the time. They weren't sensitive to the NOAA Corps lifestyle, and so I had to educate the scientists in certain ways. But I always asked my NOAA Corps officers to report anything that they saw was out of line because they would be there temporarily. It was a good way for me to learn details about the organization I couldn't learn from my employees who were long-term. PMEL scientist wouldn't tell you everything you need to know, but the officers would share with me things that I probably needed to know, but I couldn't learn any other way. They weren't spies, but they were just people saying, "You need to look at this a little bit more carefully," or "have you thought about that?" So, it helped me in my management role to learn things about the organization that I wouldn't have learned otherwise.

MG: Were there other service members from other military branches with you at Kings Point?

EB: Not at that time. We were the only – I think we were the first NOAA Corps class because NOAA was nine days old when I joined NOAA. They'd had classes before. It was called the U.S. Coast and Geodetic Survey. But we were the first NOAA Corps class.

MG: Can you say a little more about being the first NOAA Corps class? NOAA was newly formed at this time. Were you aware of the organizational changes?

EB: No, I wasn't. I only learned through – probably one of the most interesting experiences was when I was assigned as head of the Tsunami Warning Center, and I sat in on those reviews. I met some senior people from NOAA headquarters on the review team, who had participated in that "birth of NOAA" transition. One of the stories I heard – and I can't tell you how accurate it was, but this was the story that was told to me was that Robert White was the first administrator of NOAA. They told me he was a very smart engineer and an astute politician. Part of the negotiation in the Richard Nixon reorganization was that NOAA was going to be formed from all these different elements that were supposed to be the ocean/atmosphere groups of the country. The Stratton Commission's report said we need something, an ocean focal point in the nation's government. So, Richard Nixon's reorganization pulled those components together. Well, as you can imagine, the organizations that were losing these components were struggling to hang on to every penny they could. One transfer was the earthquake program that used to be in the Environmental Science Services Administration (ESSA). Then, when NOAA was formed, the earthquake program went to the U.S. Geological Survey. Okay, now this is the dilemma. You had the earthquake specialist in U.S. Geological Survey, and you had NOAA, who was responsible for protecting the public from natural disasters. NOAA had the infrastructure to issue warnings. What do you do? Well, they did the worst of all things. They split the groups. The people sent to NOAA were all earthquake people. They weren't tsunami people. So, the tsunami program in NOAA at that time was basically an earthquake program. One of the solutions NOAA management thought about in 1977 was "Bring in an oceanographer," to add the tsunami program -we're not here just to do earthquakes; we're here to do tsunamis. So that was my role, to try to turn the big ship a couple of degrees. NOAA wanted to change from, "We're earthquake people," to "We're tsunami people." That was probably the most difficult task of any … trying to get a scientific culture that was comfortable in one science interested in another science. Because the whole time they were on watch, they had never encountered a tsunami. They thought, "All we have are earthquakes." Between 1946, when they created the first warning center and 1964, that's a long period. Then 1964 happened. Then the US created another warning center up in Alaska. That was the answer. Every time you had an earthquake and tsunami, you would build a new warning center, but again, it was filed with earthquake people, not oceanographers. Tsunami is a flooding problem. It's not an earthquake problem. I spent my whole career trying to make that change. We still have a way to go. [laughter]

MG: You just mentioned two important tsunami events; one was in 1946. Can you say what happened?

EB: Well, in 1946, there was an earthquake up in Alaska in a remote location nobody knew about it. There was a huge tsunami. Scotch Cap Lighthouse was nearby, and the tsunami destroyed the whole lighthouse; it just wiped it off the land. Because there was no warning center in place at that time, by the time the tsunami reached Hawaii, nobody was prepared for it. Probably the most tragic story was Laupahoehoe, which was a point on the island just north of Hilo. On this point was a schoolhouse. When the water receded, the children and the teachers went out to pick up shells and fish, and then the tsunami came in and killed them all. That stimulated – at that time, it was called – the U.S. Coast and Geodetic Survey to set up a rudimentary warning system; it didn't actually take place until about – actually, in terms of a real warning system – probably about 1952, '56, somewhere around there. It wasn't until 1965 they became international. It was a very crude system using military teletype communications

systems. The idea was, "If you have a tsunami, tell us. And we'll tell the rest of the world." It had branches all over the Pacific, monitoring and telling people what was going on. That took hold in 1965. In 2015 was the fiftieth anniversary of the creation of that international tsunami warning system. Again, all the people were earthquake people because the skill was to determine that there was an earthquake somewhere. The earthquake and communications effort took all the energy and all the money. In fairness to them, they did what they were supposed to do. What happened over the ensuing decades was that they would issue alarms that were unnecessary. In fact, seventy-five percent of their warnings were considered false. After a while, nobody paid attention to them. Nobody paid attention to them.

MG: You mentioned that happened in the 1980s in Hawaii.

EB: Yes.

MG: Can you say what happened?

EB: Well, yes. There was a warning issued, and Waikiki was evacuated. Because everybody trying to evacuate simultaneously, all the roads were gridlocked. Some of these roads were in the flooding zone, inundation zone. If a real tsunami had happened, they would have been killed. Well, as luck would have it, a three-inch tsunami showed up, and of course, all the hoopla about this and everybody was up in arms – "Why did I have to do this? I lost all this money." The State of Hawaii did an economic analysis of what it cost Waikiki for a false alarm evacuation, and it was over $40 million in 1986 dollars. That's when Senator Daniel Inouye's office called me and said, "What can we do to prevent these false alarms?" I said, "Well, we are working on a promising technology." The staff member said, "Well, what do you need?" I said, "Give me four hours to put together a little proposal, and I'll send it to you by email." So, I did. By golly, the next day, I got a call from a contractor, who was working on a military contract, and he funded that proposal. That half-page proposal supplied enough money to do the engineering for what became the DART [Deep-ocean Assessment and Reporting of Tsunami] system. It was all because of a false alarm. That was the motivation. Hawaii did not want to evacuate people unnecessarily. That was the motivation. Then, after the 2011 tsunami, which was the first tsunami we had with an array of DART buoys in the water. PMEL forecasted that Maui was going to be flooded, and parts of Oahu were going to be flooded. This tsunami demonstrated that not only could DART data eliminate false alarms, but these data could accurately forecast tsunami flooding. This technology had met both requirements, and that is to avoid unnecessary evacuations; that if you measure a tsunami in the deep ocean and it's small, it's not going to cause any problems. But if there's a big tsunami in the ocean and DART measures it, there's data to forecast flooding. DART did both. So, in 2011, it all came together, and all the hard work we put into this paid off. At that time, I was retired, but I got many calls from sponsors of the tsunami bill. I provided them with enough information so that they could renew the 2006 Tsunami Warning and Education Act. It was reauthorized after it had expired. So timing is everything on this whole thing. These tsunamis occurred at the right time in order to have the right technology develop. Then, after it was developed, it showed its value. This is a very rare story in science, where you can go from the research stage to the applied stage, and then to the results stage. That's pretty uncommon in science.

MG: That is so neat. I also wanted to ask you about the 1964 earthquake and tsunami.

EB: Yes.

MG: What happened?

EB: Huge earthquake.

MG: Where was the earthquake?

EB: It was in Alaska, near Anchorage. Valdez, Alaska, was totally flooded. They had a big oil terminal there. Most of Anchorage was knocked offline. Then the tsunami that was generated actually propagated down to the West Coast and killed sixty people in Crescent City, California, and did lots of flooding in Hawaii. By that time, we had a warning system in place, so they evacuated. Nobody was killed in Hawaii. But the 1964 earthquake and tsunami lesson learned in Crescent City was the tsunami came in and flooded, and because it was such a huge earthquake, the time between wave crests was about thirty minutes. People in Crescent City thought the tsunami was over, thought it was one wave. So, they returned, and they were killed by the second and third waves. That's where we had to start getting the message out – it's more than one wave – and our campaign to educate the public and public awareness. These were so infrequent – '64 and '46, that's a big gap. In between, what do you do? There's not a whole lot you can do to make changes. But when 2004 happened, and 230,000 people died in four hours – that changed everything. Everything was changed because there was so much TV coverage of the destructive power of a tsunami. I was on the Larry King show for a couple of episodes. It was just amazing what was going on over there. The tsunami was fairly benign in terms of the environmental consequences, but the death toll was enormous because people didn't know what was happening. One of the saddest stories was in Banda Aceh, where they were experiencing a civil war. As the tsunami was coming to shore, it was hitting these homes, and they would explode – *pop, pop, pop*. Well, the local people thought this was an attack and the pops were gunshots. So, they all ran to the mosque, which was closer to the ocean than their homes. It doubled the problem, and more people were killed at Banda Aceh than should have been if the civil war hadn't been taking place at the same time. So, these people were dealing with real threats – being shot versus this thing about, "What's a tsunami?" Nobody knew because the Indian Ocean had no tsunami warning center. They had no public awareness programs – nothing. People didn't know what the heck this was.

MG: It's interesting to hear about the intersections of the tsunami, and what it tells you about another time and place.

EB: Yes. The other thing, a cultural aspect, was that – they looked at the death tolls and they did the distribution of who died. It was mainly young, elderly, and women because women in this culture were not taught to swim. So, they didn't know how to swim, and, of course, their clothing was not appropriate for swimming. You start to look at the compounding effects of cultures and it makes you more compassionate about the problems we're dealing with, and that is, you can't ignore who lives where they're living. That's why this problem is very difficult to characterize one shoe fits all because it doesn't. There's no way. Unlike other natural disasters-

hurricanes, earthquakes, river flooding- tsunamis cross boundaries of culture. Tsunamis cross boundaries of nations. Each culture/nation have different policies about different things. So, when you start to look at this problem from a thirty-thousand-foot level looking down at it, it's very complex. The only solution is to localize. You have to start with the local community, give them the tools to protect themselves. No other thing is going to work. All these other things – uniformity and standardization – cannot possibly serve this diverse population that lives on the coastline.

MG: In reading about, I think, the 2004 tsunami and earthquake, I was struck by the story of Tilly Smith, a girl who helped predict the arrival of the tsunami and saved lives as a result.

EB: That was the 2004 tsunami, yes. She was in Thailand. That's where a lot of tourists died. In fact, that was the focus of the *Larry King Show* – "Oh my god, there was a celebrity who got trapped in a tree." Two hundred thirty thousand people died, and Larry King is focusing on one celebrity who survived– do you know what I'm saying? Come on.

MG: Who was trapped in the tree?

EB: Some model that was a celebrity, and you know how our culture overemphasizes celebrities – "This poor woman." And I'm saying, "Well, she survived. She got a few bruises, but she survived. What about all the other 230,000 people who didn't survive? Do we have any compassion for them?" Anyway, to say the least, I was a little put off by that sensationalism. But I got my message through. I know a lot of people watch Larry King. Larry King said, "Well, what do you want to say?" I said, "Well, I have to give them the message." He said, "Okay, okay. At the end of the show, I'll let you have the floor." I said, "Okay." When I had the floor, I said, "If you feel the earth shake, see the water recede, or if it's at night and you hear a loud roar, those are natural signals that a tsunami is present. So, run to high ground. Don't stop and ask any questions." That's what the little English girl did. Tilly, who was vacationing in Thailand at that time, told the people that a tsunami is about to come. She convinced enough people – over a hundred people followed her. It shows you how an educated person in the right place at the right time can save lives. That was an inspiration. I think she won an award for British maritime safety.

MG: I read that she just learned about tsunamis in school the week or so before this happened and recognized the early signs of water receding.

EB: Yes, that's right. Well, they felt the earthquake. It wasn't very strong in Thailand, but you could feel it. But she did recognize a key thing - the ocean receding from the shoreline.

MG: I still have a number of questions, but I wanted to check in to see if you needed a break.

EB: Good timing, yes.

[Tape paused.]

MG: You mentioned earlier that you married the summer before you joined NOAA Corps. So, I was curious about your wedding day and if you went on a honeymoon.

EB: Well, Shirley and I were married on May 30, 1970. I was trying to finish up my master's degree, so time was precious. We had a short honeymoon in Galveston. It was pretty short. [laughter] We went back to Texas A&M, and I had to wrap up some research so that I could write my thesis and finish up my degree before I went into the NOAA Corps. At that time, I knew I was going to the Corps. In fact, I told her I couldn't marry her until I found out whether I had been accepted into the Corps because, quite frankly, it wasn't fair to her that if I had to go off to Vietnam, I may not come back alive. We decided to hold off on setting a wedding date until we knew that. So, we knew it before May 30, and went ahead and made plans to get married, and had a big church wedding in a Catholic Church. Both sets of parents were there and all the family. It was a nice event. As luck would have it, all of Shirley's relatives had to come in from California and other locations. So, we bundled the wedding and her graduation for the same day. We got married that morning in Houston. Then we drove back to Beaumont so she could graduate from Lamar that night. We were pretty exhausted after that. It was a great wedding, and everything is still great.

MG: It will be your fiftieth anniversary in a few months.

EB: Yes, in May. We got married in 1970. This will be May 2020, and that's fifty years.

MG: Do you have any big plans?

EB: Well, we're working on that. When you're retired, you do things as you see fit – don't have a specific date in mind. We're still trying to figure out what we want to do. I think a combination of things. Maybe a special event, but maybe some other nontraditional activities. We're working on that right now. We've had some things come up in our lives recently that took some time that we weren't planning on. We'll make sure that we celebrate it properly for us. [laughter].

MG: Good. Well, tell me a little more about Shirley and her family background.

EB: Shirley was born in Houston, also. In fact, we were born in the same hospital, although at not the same time. She was born in '49; I was born in '46. Her early life was in Houston, Texas. She spent most of her elementary and middle school in New Jersey. Then she returned to high school back in Houston. She elected to go to Lamar University, and that's where we met. I dated her when she was still living at home. She was going to Lamar, but her parents were living in Houston. I'd go to visit her when she was at her parents. My sister lived in Houston. So, I'd stay with my sister, and Shirley and I could go on dates. It worked out very well. The first summer we started dating, I got a job with a geophysical surveying company, and went to sea – offshore geophysical surveying. That took me to Halifax, Canada. Then we did a big project around Prince Edward Island. That took me away for about a month. I came back and we dated. I had to go to California for another month. She was working at AstroWorld; it was a big theme park in Houston at the time. We dated that summer and the next school year. I graduated in 1969 and found a summer job with an oil company in Houston. That fall, when I went off to

graduate school, we became engaged. We decided we were going to get married, but we didn't set a date until I found out about my draft situation. She got a degree in early childhood education in 1970. While I was at Kings Point, she was at Texas A&M and was able to get a kindergarten certificate, which means she could specialize in that age group of children. When we moved to Virginia, she got a job as a teacher at the Norfolk school system. She taught third grade. She was very happy. I was gone all the time, so it was really good that she had that job. Good teachers spend their whole life with their students, and she did that. She immersed herself in teaching. Then, when we moved from Virginia to Miami and then we had a short tour up in Lake Ontario. We moved to Genesee, New York, lived there for a few months, and then I got the assignment to Hawaii. We went to Hawaii, spent three years there, came back, finished up my PhD, went to Boulder, and then went back to Hawaii in 1977. That's when Elizabeth was born. She was born at Tripler Army Medical Center because I was still in the NOAA Corps, and we qualified for military healthcare at that time. We wanted a child. Once we had a child in Hawaii, we knew that the public-school system there was not the best in the world. Most people sent their kids to private schools, and they were really expensive. On my government salary, it didn't look like it was very promising. Then, along came the PMEL opportunity in Seattle, and Bellevue, Washington, had an excellent school district. So, we were able to capitalize on that. With my government salary, we could afford to send Elizabeth to public school.

MG: I'm curious about your time on the *Researcher*. What were your duties on that assignment, and where did you go?

EB: Well, the *Researcher* was an oceanographic research vessel used by the NOAA labs, the Atlantic Oceanographic and Meteorological Lab (AOML) was in Miami, and the ship was based in Miami. We had a great time in Miami as most of our cruises were in the Caribbean. The ship would port in places like Barbados. Shirley and the other wives would fly down and meet us during the layover at the ship. We had a great time – all of us young, same age, same status, before children. So, we were just married couples out there having a great time. It was a great experience. It was from there that we went up to New York.

MG: Can you say a little more about your time on the ship? That was a three-year assignment?

EB: Yes, yes. I had three duties. I was a line officer first. Then they had this position called scientific officer who was supposed to be responsible for any scientific issues that came up. Since I had a master's degree, that was my job. Then scuba diving. Sometimes the ship operations required divers to do different things, maybe for the project or for the ship. Say the props got fouled or something like that, we'd go underneath the ship and untangle it. I had to go through extensive scuba diving training. That was really exciting. I loved that. One project we had was with the Johnson Sea Link, a research submersible. The ship went down to the Florida Keys, and we were in three-hundred feet of water. I went down with the sub, and I was in the dive chamber. Then I would lockout and go collect samples and bring them back into the submarine, and we would go up to the ship. So that was quite an experience. Not many people got to go three hundred feet and lockout. I have some videos of that. The Johnson Sea Link is a big plexiglass sphere, so they can see everything. I gave the pilot my eight-millimeter camera, and he took videos of me going out. So, it was quite an experience, quite an experience. That was probably the most exciting thing we did. But I got to meet a lot of oceanographers because

we were out there with each of them. My job was to make sure that the ship operations and the scientific project were coordinated so that we didn't mess up anybody's project. At that time, we had computer systems that were just being brought up to collect data and store the data. So, I was involved in some of that. So, a diving officer, a scientific officer, and line officer. I did three things. It was a very interesting experience.

MG: What was the size of the boat and the crew?

EB: Three-hundred feet long. The crew was about eighty people, officers, and crew. It was quite a contrast from the private sector. When I worked for the offshore surveying company, we did everything on a budget. Peanut butter and jelly sandwiches were what you had to eat. Sometimes we'd lease fishing boats, and the captain would catch fresh fish, and we'd eat that, but it wasn't very much. Then I got on a NOAA ship. My god. They serve you three meals a day with linen cloths and linen napkins. I'm saying, "Wow?" So, I gained about twenty pounds. I'll tell you, all you do is eat, and there's no way to work it off. I had to curtail that. I couldn't believe the kind of food they would serve. Then somebody would come to make up your bed. I said, "Wow?" Anyway, it was like living on a cruise ship, in my opinion. So, it was a good experience. They spoiled us; I think. I'm pretty sure today's there's nothing like that. I would hope not. Anyway, at that time, it was pretty luxurious living.

MG: What was the assignment you had in Genesee?

EB: Well, it was called "The Year of the Great Lakes," and we were doing a weekly survey of Lake Ontario. We had different stations we'd go to. The biggest problem with that was dodging these big ships that would bring ore in and stuff like that. It was a beautiful part of the country. I got to see a little bit of New York culture around the Genesee River. That was an interesting – it was a very short stay. Shirley and I moved eight times in nine years. We were all over the place, but we loved it. She loved it. That was one thing. She loved to travel, and she didn't mind the constant moves because there was a new place, a new activity. But after we had Elizabeth, we said we got to put down roots. Moving is fun when you're without children, but with children, it's another order of magnitude of complexity to your moves, and you've got a third person to consider.

MG: What was the "Year of the Great Lakes?" What did that entail?

EB: That was a NOAA program that was underway. I think it was international, and NOAA was a participant. The guy I was working with was studying waves within the lake itself. It would generate these large waves. Then they had somewhat of a flooding problem. Sometimes a windstorm would come across a lake and push up a storm surge. They were trying to get the natural oscillations of the basin and see if a storm speed would coincide with one of these natural periods of oscillation. You could have amplified flooding. There was a natural hazard aspect of this that I thought was quite fascinating. We talked a lot about waves because that was my specialty in graduate school, wave theory.

MG: Were you getting away from your focus on tsunami research and going where the NOAA Corps took you?

EB: That's it. You were along for the ride. But I had done my homework. I think another characteristic that Bob Reid taught me – do your homework. So, I talked to everybody – "How do I get an assignment with the tsunami group?" They explained to me how to do it, and I did it, and it turned out okay. The bonus was that when I got assigned to it, then the head of the tsunami group told me, "Go get a PhD." I said, "What? What a bonus." [laughter]

MG: I've interviewed another Corps member, who explained that officers had a "dream sheet" of preferred assignments.

EB: Well, I think that may have come later. But our first request was – "What would you like for your next assignment?" It wasn't a career path. Although there was some talk about career paths after a couple of years. I was in the Corps for almost ten years, so there were some discussions after that. One of the dreams that Admiral Nygren had was that the NOAA Corps officers, when they were not on ships, should be project managers for other projects within different components of NOAA, which made a lot of sense. In fact, I did that. Whenever I had a NOAA Corps officer at PMEL, I would assign them to a project to lead, so they would get the management experience they needed, and they get the research experience they needed. But there were these different lines. You could specialize in charting, like hydrography. You could specialize in aircraft. You could do that. But there wasn't really a pathway for research unless you had a PhD. Since I had one, I could have gone that route, but there were the intervening three years of shipboard experiences that I found wasn't going to work for me.

MG: In Lake Ontario, were you re-charting the water, or was it being charted for the first time?

EB: Well, we were not charting in the traditional sense, trying to map the seafloor. What we were doing was water column chemistry. We would take water samples at different depths, and then we would repeat those stations once a week. So, they got a profile of what was happening with the mostly chemical and biologic – well, mostly chemical because at that time we were fighting some pollution issues in the Great Lakes.

MG: Why was that a short assignment?

EB: Well, because the ship was only assigned to that for one season. NOAA Ships are expensive. These projects have to line up and bid on NOAA ship time. Some projects last two weeks, three weeks, maybe one cruise. Others last months, maybe ten or twelve cruises. In this case, we were there from when the ice broke up in Montreal, Quebec. We were there in May, and my assignment on the ship ended at Thanksgiving. The ship was about ready to take off before the ice formed again. It was one season. They had to be there only in the summer season because getting in and out – you couldn't because the ship didn't have an ice-reinforced hull. In fact, it had a bow bubble, and ice would have crushed it.

MG: Can you talk now about the move to Hawaii, what that was like, and your work there?

EB: Well, it was great because Shirley and I were young with no kids. We showed up in Hawaii. Gaylord Miller was a perfect guide. I asked, "Where can we live?" He suggested that we go look at some condos in a certain area. Well, he introduced us to a real estate person that

owned the condo. It was a gorgeous place. It was on the thirty-fifth floor, overlooking Diamond Head and the Pacific Ocean. The owner asked me how long my assignment was going to be. I said, "Three years." She said, "Well, I can give you a three-year lease at this price. It was three-hundred dollars a month. I called Gaylord. I said, "Gaylord, is this a good deal." He said, "If you don't take it, I will." [laughter] When I invited him over, and he said, "Wow, this is wonderful. What a deal you made." I could walk to the lab from our condo. Shirley taught kindergarten on another part of the island. She got really engaged in the culture because she was teaching the kindergarten children in Hawaii. They'd do all these Hawaiian things, go to different parts of Oahu on field trips. So, she got really immersed in the Hawaiian culture. I got immersed in the research world. The University of Hawaii had a decent computer facility, and so I started using it a lot. It was in the same building as our lab. I had access to a big computer, did my thing with numerical models, went to classes, and fulfilled my PhD course requirements at the University of Hawaii, which was transferrable to A&M. It all worked out very well. I went to school, did research, got paid. Shirley got to teach kindergarten, got paid. So, we did okay.

MG: Any other stories from this time stand out to you?

EB: Well, we got to do some scuba diving. We had some instrumentation that we were testing as part of this deep-water tsunami measurement program. One experience I had was in 1975 – the Environmental Protection Agency (EPA) had a scientific exchange program with Russia. Gaylord wanted me, because I was computer-oriented, to go to Russia and show people how they could use my numerical model for their tsunami problems. It was a six-week exchange visit. I went to a place called Akademgorodok. It's in the middle of Siberia. There was a computer center there that I used. So, it was quite an experience. Shirley and I both went. At that time, Russia was still under tight Soviet control. So, when we landed in Moscow, and we took the plane to Novosibirsk, there were people with machine guns, and you couldn't take any photos. I had a camera with me, of course, and they said, "No, no. Don't do anything." So, we went to Novosibirsk. They told me that I needed to stay in this hotel. The hotel cost a hundred dollars a day. My per diem was like, thirty dollars a day. I said, "This isn't going to work." They said, "Well, this is the alternative. The alternative is you have to live in one of our apartments." "Okay." "AND Shirley has to teach. She's a teacher, right? Why doesn't she teach conversational English to our scientists?" I said, "Shirley, what do you think?" She said, "Sounds good to me," because she didn't know what she was going to be doing while I was gone all day. Her salary was the same as the differential between our per diem and the rent for the apartment. So, we moved into the apartment. It was quite interesting because we were living like the other scientists. It was a very nice two-bedroom apartment. It had a TV – only spoke Russian, so we couldn't figure out what the heck they were saying, but okay. So, we had a very good time. Everyone was very gracious hosts. We still have lifelong friends from that experience. But one little thing happened there that was interesting was – at that time, the Russians were very protective of any charts of their coastline, as you can imagine, for national security purposes. Well, to do a tsunami model, you had to have bathymetry. You had to have the underwater topography. From that, you made a grid, and from the grid, you built a model. So, I said, "I have to have access to this chart, or we can't do this project." The project was to do a numerical model for a Soviet Kurile Islands as I had done for the Hawaiian Islands. So, I came home one night, and I told Shirley. I said, "Look, if I don't get that chart, well, then the next

day, we're going to leave." The next morning, I was invited to a coffee and tea with some scientists in this special room. So, I go into the room, and they're there. They said, "Here's your tea," and they left. I'm sitting here by myself at this huge table. But at the end of the table is this rolled-up chart, and I got access to it. That's when we knew our apartment was bugged. [laughter] After that, we didn't say anything. It was clear that that's one of the reasons we wound up in that apartment was because it was under surveillance. We didn't find any cameras, but we did know it was audio-bugging us. That was the experience we had. It was a very positive experience. That was the only thing that I could say – anyway, long story short, we finish the project because I got access to that chart. But the way I got access to it was rather circuitous. It wasn't straightforward. [laughter]

MG: [laughter] Very bizarre.

EB: Yes.

MG: How long had the Joint Tsunami Research Effort been in place?

EB: That's a good question. I think it was formed about 1964 after the Alaska earthquake. That's how things generally happened in the tsunami business. There's a big tsunami, and then something happens. So, I think about '65, '66 it was formed. Gaylord Miller was a fresh PhD out of Scripps. He was chosen to lead it, and it was joint with the University of Hawaii and NOAA. All their funding came from NOAA, but the university housed him, gave him office facilities and stuff like that. The good thing was students were available to work in the labs. So, I was basically a student, but I was paid as NOAA Corps officer. It worked out very well. Probably the most important thing was Gaylord. He really instilled this concept of win-win, and it worked. I saw for the first time how well it worked. Amazing.

MG: Did you have a different title during your first stint in Hawaii?

EB: Well, yes. JTRE was part of PMEL. When John Apel was selected as director in 1975, he wanted everything under one roof. His concept of management was a little bit more controlling than Gaylord's concept. So, Apel set about shutting down the Hawaii operation because it was more expensive than he wanted to pay. At the same time, his perception was that there were some pretty weak scientists there. He thought he could leave them in Hawaii. He saved money, saved positions, so he could do other research. So, he changed the emphasis of PMEL away from tsunamis, but he set up a small tsunami group in Seattle. Basically, there was some fallout for me from that change. There wasn't any place for me to go back to in Hawaii to a research organization because it had been moved to Seattle. So, I had very limited choices. There was no NOAA tsunami research in Hawaii. If I stayed in NOAA tsunami, I could only stay in operations; I couldn't do research. Then I wanted to do management, so the management position in science came up at PMEL. Then eventually, I became director, and then I built up that tsunami group in Seattle with a different set of scientists than had been conducting research in Hawaii.

MG: Okay. Can you remind me of the dates? What year did you come to Seattle?

EB: 1980.

MG: That the same year you retired from the NOAA Corps.

EB: Yes, that's right.

MG: How did you feel about retiring from the Corps?

EB: Oh, I felt great about it, and so did the NOAA Corps. Admiral Nygren called me and said, "Well, as far as I'm concerned, it's a success because you're going into NOAA. You're not taking all your experience and what you've learned to another organization. You're just transitioning from one part of NOAA to another part of NOAA. So, he felt very good about it. I told him, "I loved my time in the Corps, but my interests and expertise had gotten to a stage where the three years' ship time duty requirements weren't going to work for me." He understood.

MG: You started off as deputy director of the Pacific Marine Environmental Laboratory.

EB: Right, in 1980. Then a year later, John Apel left. He was frustrated with NOAA management, and he accepted a job at Johns Hopkins, back in Laurel, Maryland, which is right outside of D.C.

MG: Is that when you became director?

EB: I became acting director, and then I was selected as director. Part of the reason I was selected as director was because of Bill Aron, the Director of the Northwest and Alaska Fisheries Science Center. Bill tried to engage with John Apel on Fisheries and PMEL interactions. John didn't want to have anything to do with Fisheries. But because of my experience when I was a kid, I said, "This is natural. We do the environment; you do the fisheries. We should get together." Bill and I started going out to lunch, talking about different things. We realized that the work PMEL had done in Alaska could help him do better research on his fisheries responsibilities in Alaska because he couldn't afford to do both the oceanography and the fisheries research. We thought if we joined forces, then we could help because this is a huge industry for the fisheries people – pollack, crab fishing, all this stuff. I was fascinated by it all. Then, Bill, unbeknownst to me, was advocating that I should become the next PMEL director because I was interested in something besides waves. [laughter] Anyway, that's how I was selected. I was the youngest director selected; I think. Well, I was young. I was in my thirties. Anyway, there were a lot of doubts. I had to comply with some unique requirements from my headquarters in Boulder, Colorado. But it seemed reasonable. Because I was the youngest lab director, all these other lab directors were from the World War II generation, and it was fascinating to see them operate. Talk about the clash between "win-win" and "I'm in control." [laughter] These guys were passionate. I remember going to my first lab director meeting. I said, "Holy cow." There were fireworks everywhere. They argued about everything. Lab directors were supposed to go out and raise money. One lab director from Oklahoma said, "I'm not going to do that. That's not in the national interest. I'm supposed to use the money you give me and use it well. I'm not supposed to raise money. Are you crazy?" This was an eye-opener

for me. I got an education in lab directorship at a very early age. Then, as lab directors retired and new people replaced them, you could see the switch in the cultural management styles. But the original directors were very successful scientists. The Air Resources Lab (ARL), for example, they had the responsibility during the Cold War of tracking nuclear fallout – when you detonate a nuclear blast, it would eject nuclear waste into the atmosphere. Then you had to track where the plume was going to go. They had developed a technology where they could track where these plumes were going to go and what was going to happen. They were critical to the nation's security at that time. Lester Machta, who was head of the lab at the time, was a classy guy. He was the same status as you would give Mark Hatfield, just a classic gentleman who could articulate his ideas. He was sincere about his service to the country. Those kinds of people you really did respect. Several other lab directors in Boulder had the same attitude that we're in NOAA to serve a larger cause, and this marketing is selfish; we're not going to engage in it, and science is everything. It was really a good experience. A good experience.

MG: Your office's headquarters were in Boulder?

EB: Yes.

MG: I thought Lester Machta was in Silver Spring.

EB: He was, but the labs were all over the country, you see. We would come together twice a year and talk about our common problems. Usually, it was budget issues, and it was how to market new ideas and get additional money. It was an interesting experience, the whole thing.

MG: The directors of which other labs would come to these meetings?

EB: Well, the director of the Atlantic Oceanographic Meteorological Lab. There were four labs in Boulder. There was the Aeronomy Laboratory. There was the Earth Resources Laboratory. There was a laboratory that monitors the sun – a solar lab. Then there was an air pollution lab there, too. We had one in Oklahoma, one in D.C., one in Miami and one at Princeton University. Seattle was the only West Coast laboratory. We would usually come together in Boulder, which was centrally located. It was called the Environmental Research Lab at the time. It eventually became NOAA Research, and they moved the headquarters back to D.C.

MG: You said earlier that you faced doubt when you were selected for director of the Pacific Marine Environmental Laboratory. Was that self-doubt or coming from others?

EB: Well, yes. I guess before you take on new responsibilities, you need to analyze it. I was fortunate to have been the deputy director for a while because then I could see John Apel's mistakes. He was making a lot of mistakes, and I could see them from a deputy perspective. Because I was a deputy, the scientists in the lab and the others would come to me with their problems – sort of the mom and dad thing. I was the mom. I would listen to them, and I could learn their problems more intimately, and then convince John that what he was about to do was wrong. I was somewhat successful, not totally successful. I had built up trust within the lab. When Bill Aron started giving some external support, then NOAA management thought they could take a chance with a youngster like me. Bill Hooke, who was in one of the labs in

Boulder, became a friend of mine. We met at one of these lab director meetings, and we had a lot of common interests, so we hit it off. Because I told him, "Well, I'm going to have to break in a new lab director." He said, "Well, why don't you become lab director?" I said, "I don't know. I'm not sure I'm ready." He said, "Well, I think you're ready." So, he called me once a week and said, "You're ready, Eddie." So, I stuck with it. Then my association with Bill Aron became stronger and stronger. I felt more confident that this could work. I think I grew into the confidence as opposed to having it from the beginning. So, when they did finally select me – to be honest with you, a couple of other people were offered the job before, but the lab was such a mess that nobody wanted it. I inherited a mess, sort of like the tsunami mess in Honolulu, and then I proceeded to try to see if we could straighten it out. We went from the number ten lab in performance to the top three. I don't think anybody could say who was number one, but in my thirty-year span, I converted the lab from being nobody wants to have anything to do with it to one of the premier labs.

MG: How do you measure or determine which labs are in the top ten?

EB: Well, publications, citations, honors, awards, and money. Money, in my mind, was the key thing. I set up the lab to operate like a conglomerate. Each of these scientists were very skilled at raising money. I tried to set up the lab to support that skill set, and they would bring in money. When I arrived at the lab, it was one dollar from NOAA research and fifty cents from outside. When I left the lab, it was one dollar inside, three dollars outside. For every dollar NOAA research gave us, we raised three dollars. I thought, "What a bargain." Then because we had so many resources and we had so much success, then we were being included in some of the key national and international programs. We had become the premier lab for ocean observations. I built up an engineering group that pulled it off. We delivered. That was what I told them. I said, "We delivered." Like I told you earlier, in the academic setting, scientists didn't have enough engineering infrastructure to make things work reliably, and we did. I could concentrate engineers so we could do the problem right and get data back. So, our data return rate at PMEL was about ninety percent. The data return rate from a university like Woods Hole or Scripps was along the lines of sixty percent. So, when you compare – if you were going to fund somebody to do oceanographic observations, would you take the one that has a ninety percent data return rate or the sixty percent? That's what we accomplished by concentrating the lab resources on these infrastructure issues. Then, when you have the data, you can publish. Pretty straightforward. But if you underfund your infrastructure, then you get no data, and then you're competing with all these other people that are sixty percent.

MG: I want to trace now, in a little bit more detail, what led to the DART program, which we mentioned earlier.

EB: Well, like I said, while I was at the Joint Tsunami Research Effort, while I was still a student, the number one problem that we had identified, but were not able to technically complete, was measuring the tsunami in the deep ocean. There the tsunami was free of influence of the coastline, and then you could actually use these data to forecast. That was the whole objective – to forecast. So, I carried with me that idea when I came to PMEL. I realized that the engineering of this technology had been underfunded. I carved out a little piece of the lab's budget to start making these investments in the engineering. So, we took very small steps. Each

step we made sure was successful. Then, like I said, I think 1986 is when the false tsunami warning in Hawaii motivated Senator Inouye, who was the very senior senator of Hawaii, who had lots of influence. His staffer called and said, "What can you do about it?" That launched it right there. 1986 was the trigger, and it was caused by a false alarm. A false alarm led to this money, which led to improved and accelerated engineering, which then led to – we were set up so that when the next tsunami happened, we said, "We're this close. We can invest some more." So, each time we had a tsunami – and in 1992, we had a tsunami in California – guess what? Money started pouring in. We took that money, and we parlayed it into the next generation of technology. Then, PMEL had six DARTs in the water in 2004 when they said, "Okay. Proof of concept's been demonstrated. You've got a technology that works. The only thing we need to do is put thirty-nine of them in the water instead of six." That was what Admiral Conrad C. Lautenbacher took to President George W. Bush at that time. That whole experience in 2004 was the culmination of – you've heard of this "twenty-five-year overnight success". That's what happened. But we were poised to take advantage of the opportunity because we had this technology that was going to really make a big difference in the tsunami world. Plus, Admiral Lautenbacher had done his PhD thesis on tsunami modeling. How lucky could you get? How lucky could you get? And he was from the military, and he said to me, "This is Pearl Harbor." We're going to make this work. So, he and all his other lieutenants at that time, all the heads of the different parts of NOAA were of, in some form or another, a military background because George Bush had filled up NOAA with retired military people. But they knew what to do. They knew how to take advantage of the situation and move forward with the plan. They knew what President Bush would accept. So, Admiral Lautenbacher looked to me, and he got it. I thought about this because, see, James Baker was the administrator before Lautenbacker. I knew Jim would have formed a blue-ribbon committee, and he would bring in all these academics, and we would discuss this for six months. By that time, nobody would care. Admiral Lautenbacher, with his military background, said, "This is the moment. Seize the moment." Bingo. Again, timing is everything. You think to yourself, "If the 2004 tsunami had happened two years earlier or later, a DART array wouldn't have existed today." We wouldn't have those buoys in the water, and we wouldn't have this technology working like it is. Because I'd been around NOAA long enough that the administrators, when they came from academia, they usually trusted their academic scientists over the NOAA scientists. NOAA scientists fought that battle their whole careers. But the NOAA scientists turned out to be just as good, if not better because they could concentrate their whole career on a particular specialty. Dick Feeley is a good example of that. He wanted to study the carbon cycle in the ocean. I made sure that he had resources to do it. Eventually, he was able to – after twenty years of research – discover the ocean acidification connection. But nobody in academics could have done it because it couldn't have been supported for twenty years. That's the difference between a NOAA scientist and an academic scientist. Very few can sustain the money to work on a particular subject for that long of a time. That's why you need a NOAA. That's why you need NOAA scientists, and that's why you need NOAA research.

MG: It's amazing the impact of this work after the 2004 Indian Ocean earthquake and tsunami. Bills were introduced, laws were changed, and thirty-nine DART buoys were deployed.

EB: Yes.

MG: Can you say more about that?

EB: So, it was a Sunday morning, the day after Christmas in 2004. Shirley and I were about to go to Canada and start talking about my retirement because I had 34 years at NOAA, and I figured it was time to go do something else. I got a call from Fox News. They said, "There's been a tsunami." I said, "Where?" They said, "The Indian Ocean." I said, "Any deaths?" They said, "Well, we've heard maybe, five-hundred." I said, "What? Five-hundred deaths?" "Would you be willing to come down to our studios and talk about tsunamis?" I said, "Okay, okay." So, Shirley takes me down to Fox studio in Seattle. They interview me. As they're interviewing me, we're getting new reports – one-thousand, five-thousand deaths. Well, the biggest tsunami we'd ever had in history was forty-thousand deaths, and we were at five thousand by mid-morning. Then, after Fox and CNN and a local news station, it was just a blur. I was doing interviews nonstop. As the day went on, Shirley was with me. She kept saying, "The latest report is fifteen-thousand." Then a hundred thousand. I said, "What?" Holy smokes. I got to get back to the lab." Vasily Titov, who was our key modeler at that time – I said, "We got to put together some animation about this tsunami so that we can explain to the world how this works." Within four hours, he had put together an animation that we could give to the news networks and outlets. Then the video media started using the animation. As I was preaching the safety rules, we had the animation to illustrate what we were talking about. The news media went berserk. They had an animation that they could draw the attention of the audience. Then, of course, that compounded the interviews. I was getting interviews from England, India, everywhere. Shirley was in the office taking down all the notes – who to call, when to call. We were setting up all these interviews. So, for ten days, that's all I did was interviews. It was at that time that Admiral Lautenbacher called and said, "We've got to have a plan." So, I broke out twenty-four hours to pull everything together. Vasily Titov and Frank González came in over the weekend. We pulled it all together, made a coherent plan, and sent it to Admiral Lautenbacher. After that, after we had developed this plan, we had to sell it. Lautenbacher had sold it to Bush. There was no problem. We needed to sell it to Congress. I was asked to go give individual briefings to interested Congressional people. Because I had known them in the past, I was coming in as a known entity, and so I was treated very well. Then they started putting together a congressional bill. The Senate Committee said, "Could you help us write the bill?" We needed technical expertise. That's when I started working with Congressional staffers on creating the bill, what was technically possible and what's not possible. During that process, I got to know these staffers very well. I was a hard worker. My day went something like this – I'd work, work, work until I couldn't work anymore, and then I'd take a nap. Then I'd get up after the nap, and I'd work some more. Then I'd take another nap. So, I'd just keep going until I couldn't, and then I'd take a nap. I didn't know when it was day or night; it didn't really matter because, with emails and stuff like that, I was feeding them information, doing briefings for different Representatives and Senators. So, the whole thing lasted about ninety days, about three long ocean cruises. It was a long endurance thing. My brain became much more functional. I couldn't believe the transformation of my brain. Things I thought I couldn't do I could do. I realized that this is like any other muscle in your body; if you exercise it properly, it functions better. I tell you, to this day, if I hadn't had that experience, I'd probably be less alert. But it did have a profound impact on my brain. I couldn't believe it. Because of the intensity, the duration, and the way I approached it – and I didn't get sick. That's the thing I could not believe. I didn't get sick through this whole process. My body was working with me. It was telling me it

was time to sleep, time to wake up, time to sleep, time to wake up. It was quite an experience. Again, I'd like to stress – no other agency could have pulled this off. No other agencies. You could have brought all the academics together, and three years later, you might have had a plan. But NOAA acted because the head of NOAA said to do it, and they did it. That's a unique coming together, alignment of the planets that the leader knew what to do, how to do it, and all the other people trusted his leadership skills, and they followed him, and it was done. I can guarantee you that no other organization had that combination at the time of the tsunami. So, it was unique.

MG: What was the name of the law that resulted from all these efforts?

EB: The Tsunami Warning and Education Act of 2006. The replacement authorization act is called the Tsunami Warning, Education, and Research Act. We inserted the word "research" in the title in the second authorization.

MG: Was the reauthorization after 2011?

EB: Yes. I think it was passed in 2017. It was the reauthorization. The authorizations usually last for five or six years. Again, it's an authorizations bill, not an appropriations bill. It authorizes NOAA to spend the money, but it doesn't guarantee that it's going to provide the money to NOAA. You have to convince Congress that it's worth funding.

MG: How soon were those thirty-nine DART buoys deployed?

EB: 2008, about four years later. It took four years to get the machinery at NOAA – that was done at the National Data Buoy Center down in Bay Saint Louis, Mississippi. During that time, they experienced Hurricane Katrina, which interrupted their operations for several months. But PMEL pitched in during Hurricane Katrina. There was a cruise out to deploy some buoys, and they couldn't do it. Our people went in their place. They successfully deployed them. Again, NOAA was working as a team, even in the face of a hurricane, which interrupted operations.

MG: Was the next tsunami an opportunity to test these buoys?

EB: Well, 2011 was the big test. 2010 we had buoys in place. DARTs detected the tsunami from Chile. We could see that in Hilo, there was going to be minor flooding. They evacuated Hilo, but no other place in Hawaii. It flooded like we had predicted. It was going to be minor flooding. But it did flood. So, we declared a success. 2011 was a big one. That warranted Hawaii wide evacuation. 2010 did not.

MG: I think I read something where you said there had been forty tsunamis in the Indian Ocean after 2004, and the difference was really night and day because of the work your team had done, in terms of the warning system.

EB: Yes, right. I think that's globally; forty is about right. This has been a very active period. Since 2004, it has been the most active tsunami period we have in history. There are two reasons for that. One, greater population, and everything that happens is detectable. Two, because we

built up so much coastline that it's done more damage, and everything is affected. Meanwhile, what we discovered was that port operations are also affected by tsunamis. The workers there, by the very nature of their work, they have to be there. So we realize that we need to focus and concentrate on the port operation because if you have a ship in port, the best way to avoid damage is to have the ship go out in the deep ocean, where the tsunamis are very small, but you need to give the ships lead time. Then, like San Diego, where you have military ships, that poses another problem. You don't want these big destroyers banging into each other and having some other catastrophe unfold, such as bombs going off and stuff like that. So, I started focusing my attention on the harbors and what can we do. We can, in fact, tell them how strong the currents are going to be because, in 2011, a nuclear submarine in Guam was damaged because in Guam Harbor, the currents were quite strong, and it bashed the sub up against a pier. If we had had that information available to Guam port at that time, they would have taken those subs out, and then you wouldn't have had the damage. It did several millions of dollars of damage to the sub. These kinds of studies, they're trivial compared to the cost of repairing a ship – a couple hundred thousand to do the study and give them some guidelines. Meanwhile, we'd done a project for the Navy to do just that. When I say "we," it's PMEL. I've been retired for nine years; I still can't break old habits. [laughter]

MG: Had you retired before the 2011 [Tōhoku earthquake and] tsunami?

EB: Yes. I retired on December 31, 2010. Then the tsunami occurred in March 2011. One of the reasons I retired was because my granddaughter was going to be born in March. She was born on March 12th, the day after the tsunami. [laughter] I call her my "tsunami baby." After that, my life got very busy. Very busy because I was the known quantity from 2004. So, who did they turn to? We did a lot of stuff at PMEL. More importantly, we had to get the word out that it worked. It worked, folks. We have proof now that it works. Let's continue down this path, so we did.

MG: Did you go back to work during this time?

EB: Well, I signed a personal services agreement with PMEL before the tsunami. But we had a clause in there – "in the event of a major tsunami." They put so many hours that I was going to work, but in the event of a tsunami, we could increase these numbers. The contract hours increased from two-hundred hours to one-thousand hours. So, I spent a thousand hours that year on tsunami activities.

MG: When you say it worked, can you talk about how it works and why the DART buoys are effective?

EB: Okay. When a tsunami occurs, it's formed by a disturbance of the sea surface. That can be done by an earthquake, a landslide, a meteor hitting – anything that disturbs the surface. So, in your bathtub, if you splash the water, it creates waves. That's a pebble in a pond. All those analogies are pretty close – not accurate, but close enough for you to visually imagine it. When the wave is propagating across the ocean, it's very uniform. That's where you want to measure it. You want to measure it away from the influence of the earthquake and before it gets to land. So, in a deep part of the ocean, it's very quiet – quiet in terms of the surface waves don't affect

the bottom of the ocean. So, all these surface waves you see when you go out on a ship, or you go out on a boat, these waves don't affect the bottom pressure. The only thing that changes the pressure is tides. So, you have a natural signal there that you can track. As long as it's tracking, you know everything's working right. You can see the tides. Then, along comes a tsunami, and it changes the bottom pressure, and there are two ways to detect a tsunami. We set these sensors at a threshold. If it exceeds the three-centimeter threshold in one minute, it automatically starts sending back data. More commonly, we call it up on demand, and tell it to wake up, start measuring at a higher frequency. Normally, to measure the tides, we measure once every fifteen minutes, but during the tsunami, we measure once every second. Then, those data are sent back to the warning center, and they can see the tsunami as its arriving and get the tsunami signal. These data can be put into a computer model, and the model then advances that wave to the coastline and into the flooding zone. That's why it's so critical to have this, for two reasons – one, it's a clean signal. Two, it's an early signal. So, you get the forecast. You want the forecast because it takes hours to evacuate people. You can't do it instantaneously. Like I said before, one of the motivations for doing it was to eliminate false alarms. So, the warning centers would usually query the buoy. If the tsunami that came over a DART was one centimeter - not big enough to trigger the threshold, then they could say with certainty that it's not going to affect anybody. Then, in 2011, the tsunami signal was over one hundred centimeters. That's when we knew we had a huge tsunami and it was going to flood many places. So, we ran all the models in advance, had them in the place. That's the other thing that, during this ten-year evolution – we put the flooding models in place. They were all tested and had been verified for 40 US coastal communities. They worked as expected with about eighty, eighty-five percent accuracy. In some cases, ninety percent. When we started this project, our estimates were – they would be sixty percent accurate. So, the system that Gaylord Miller and the original tsunami research group had identified was really the key to make flooding forecasts. My contribution was to apply the engineering effort to make it work.

MG: I read in [2011] there was the Kahului tsunami, and there was a successful evacuation because of the long lead time.

EB: Yes.

MG: What are we missing up to this point? What else about your career haven't I asked you about?

EB: I think we covered almost everything. In summary, and I said this when I got a couple of awards, it's been a privilege to work for an organization that its whole emphasis is on providing the public with day-to-day information that guides their lives. It could be – is it going to rain? Do I have to evacuate? Is the air pure enough? So I felt like I've, by chance, by luck – you never know what percentage of success is luck and how much of it is – "chance favors the prepared mind," I guess, is the best quote I can come with because you never know when something's going to happen. But if you're prepared, you can then take advantage of it. I think that's the real value of NOAA to the nation is that they sustain these long-term programs of studying the environment in a way that is solid science, but it's solid science for the sake of society's interests, the U.S.'s interests. It's not just willy-nilly science. It's science that's focused, and it's applied to the problems that NOAA's been assigned to address. I think

NOAA's done an admirable job. All the NOAA leaders that have come and gone, that's the one thread through all of them, is they always – when they walk in the door, they may have their doubts about government service. This was particularly true when Ronald Reagan was elected – "Oh, you guys are a bunch of lazy civil servants." I think when they leave NOAA, they leave with a very good image of the organization and its value to the nation.

MG: A few more things just popped into my head that I wanted to ask you about. Can you tell me about the non-tsunami-related work you've done at PMEL? We haven't talked about that at all. I know you worked on El Nino, underwater volcanos, things like that.

EB: Yes. Well, I think this falls under the category of leadership. When I became lab director, the head of NOAA Research at that time was Ned Ostenso. He had been nurturing a program about studying underwater volcanos because, as a geophysicist, he understood one of the big mysteries of the ocean was why didn't they continue to get saltier because all the rivers keep pouring salt into the ocean. There had to be some kind of recycling going on internally to the oceans to keep the salinity almost constant. So, his question was "Where is the recycling taking place?" Under Ned's leadership, Alex Malahoff, a very famous scientist, discovered these underwater volcanoes and all the life that they had around them. It was fascinating. But what Ned wanted to do was shift this from an academic curiosity effort to a long-term ocean program that could determine exactly how much influence underwater volcanoes had on the ocean. I was a young buck at that time. He said, "Eddie, I think you're the guy to take this over." He gave me the whole program and the money. I went through a very grueling process of extracting it from the existing program that had thirty-five projects of no more than fifty-thousand dollars apiece. I had to tell those thirty-five academic PIs that it's over. Of course, my popularity went down the drain. I concentrated the activity in a small group of scientists who could focus on this problem. I had the ship time. I had the technology. I had the best people in the world to do the research. I said, "We don't need to do some sandbox research. We need concentrated, long term research." So that's what we did. Using tsunami technology, PMEL scientists put a pressure sensor on top of a volcano crater – underwater crater, and they monitored it, and this sensor, just before an eruption, rose six centimeters. During the eruption the crater floor fell, which is when the recycling of ocean water is maximum, one of the sensors actually covered up with lava. So, what we were doing was using – I was trying to take the engineering infrastructure and apply it to different problems. Then, when we came up with this two-way communication for DART, we realized we could use that on the underwater volcano problem to tell us when an eruption is going to take place. Here we had two different sciences using the same technology for different applications. If I hadn't been at the helm, these two worlds would have never met. Our contribution to this was we knew so little about the planet, and this is the first long-term sustained program to actually evaluate the recycling of an underwater volcanoe. It's called Axial Seamount. Because of PMEL's pioneering work, now there's an underwater cable that goes from the Oregon coast out to this volcano. The cabled observatory is constantly monitoring the volcano. So, our pioneering research led to more monitoring of this one volcano. So, we know a lot about that, and we hope that carries over to understanding this whole process of recycling the ocean. The El Nino story is quite interesting because when I first got to the lab, and we were trying to pull ourselves up by the bootstraps, we asked ourselves, "What are we good at?" What we're good at is ocean observations using buoys. There are two ways to collect information from the ocean. You could take a ship, which costs a lot of money per day. I think it's up to

forty-thousand dollars a day. Or, you can take a ship out and deploy a buoy, and it constantly records the information. In most cases, you can send data back by satellite. Buoys replace the ship for monitoring the oceans – a very, very cost-effective way to do it, but it takes a lot of skill to do this. Like I said, most organizations had data return rates of sixty percent. We were up in the ninety percent data return rates. That's because we focused a lot of energy and money and resources and talent on engineering. The El Nino problem – in 1983, there was this huge El Nino, and it caused all kinds of global climatological havoc. It became a very scientifically focused problem. A lot of modeling was done. Every model said the same thing – we need to have information from the ocean in quickly; like the tsunami problem, only, it's weeks, months. So, the latency problem wasn't such a big deal. It was just a matter of collecting enough data. A lot of people start thinking about – keeping buoys on the equator is very difficult because there's an ocean current that goes over the ocean surface at the equator, but there's a current that goes underneath it in the opposite direction, so you have this huge sheer. Hugh Milburn, our chief engineer, had come up with a solution to overcome the sheer, and that was to put little fairings on the mooring line. They're like wings on an airplane; they reduce the drag, and you can keep the buoy in the water without it drifting away. PMEL was the only group that could make it work in the world. Everybody was getting really excited about this because this was one climate product that NOAA could put out an El Nino forecast. So, we got lots of support from NOAA, got lots of support from the academics. But at that time, the culture in oceanography was, "I collected the data. It's mine. I'm not going to share with anybody until I publish it." Well, that couldn't work in this particular model. So PMEL had a scientist by the name of Stan Hayes, who embraced the concept of, "We'll put the buoys out, and we'll share the data with everybody as we collect it." Then we got the support of academics because of this shift. Stan Hayes made it happen. I supported him. I went out and did the necessary marketing with Congress and all the other people. But NOAA was behind this thing. It's sort of like the tsunami problem. They all got behind this and made it happen. We put the buoys out there, collected the data. The European Centre for Medium-Range [Weather] Forecasting improved their forecast by fifteen percent. The head of the European Center for Medium-Range [Weather] Forecasting came out and visited me, and said, "You got to keep this thing going. You got to keep this thing going." But it was the first large-scale oceanographic array ever deployed. I attribute it to Stan Hayes's ability to share his data that enabled the whole world to embrace it. You got to remember one thing that nobody appreciates what you've really done by sharing data. By sharing the data with the whole world, look at how fast you advance the technology of El Nino forecasting. There could be a genius in India or Afghanistan or who-knows-where, in Germany, who sees this data in a different light than somebody might see it here. Suddenly, you've got the whole world focused on a problem that's relevant to your culture, your country. What a bargain. What a bargain. So, when I started telling senators and representatives this story, they said, "Yes, yes. Let's keep doing this. Let's keep doing this." This is one way to be a global citizen, but it's not purely altruistic. The US gets benefit from it, but we also enhance the knowledge base of the whole world. That's the El Nino story. I told that over and over again to people because, in the academic world, this is still a very major problem, sharing data. They collected it. They raised the money. "It's mine." "Well, wait, didn't you use taxpayer dollars?" "Doesn't matter."

MG: And I know you wrote a paper on arctic contaminants. Was that another focus of your work?

EB: There's tsunami. There are underwater volcanoes. There's El Nino. The fourth one is fisheries oceanography. That was, in large part, due to Bill Aron and myself and my twelve-year-old kid crabbing experience. What I took away from this is because we're a federal lab, you have to pay attention to federal interests, U.S. interest. U.S. interest in fisheries is quite large. The pollack industry in Alaska is a billion-dollar industry. It was economically important to the nation. How could we say no? This was something we were supposed to do. That included the Bering Sea, so that's part of the Arctic. The Bering Sea research we did was, of course, before the ice started retreating from the warming of the planet. We had some of the baseline environmental studies. Those baseline studies PMEL had done for the Minerals Management Service agency back in the early '70s was due to their issuing permits for oil drilling in the Bering Sea. We had those baseline studies done. When PMEL went back in the '80s, we could compare the baseline with those recent data. So, we had done the research, and we had done the baseline studies, and we had the datasets in an easy-to-use format, again, like the El Nino. Here's the data. We can make scientific advances on the data. So, the fisheries oceanography was trying to see what changes were happening in the environment while fisheries research was measuring the changes in the marine animals. There are all kinds of time scales. I didn't realize this, but pollack eggs will float up to the surface, and in the Bering Sea, they're frozen in the ice. Then they drift somewhere else, and they hatch in the nutrient rich, ice melt waters. One biologist told me they're the dandelions of the sea; they go everywhere because they have this feature about their reproduction cycle that enhances survivability. The fecundity of these pollack females is enormous. One female has ten thousand eggs and she hopes two will survive. In certain years, like my hurricane/crab example, a hundred survive, and then you've got this huge population spike. But fisheries, what they wanted to do was make sure that we didn't overfish so that the boom supplied enough stock to sustain it. So, I found this to be a fascinating problem. The fact that we could contribute something to it was the big bonus, and we were working with a NOAA partner. That was a large part of both our economy and our lifestyle of eating food. I love seafood. Everybody does. Anyway, I got to work on these things. The underwater volcano was more academic. But the El Nino, fisheries and tsunamis were all very practical economic applications. Someday, the underwater volcano research will pay off big time. I just don't know how it's going to unfold, but it's a global system, and it's got to be a very important part of the cycling of the oceans. It could be that it's a lot more important than we ever thought.

MG: You're echoing the message of your grade-school science teacher, that that's the next area to look into.

EB: Yes. Well, I think sea-level rise is the challenge now. My nephew's son is in sixth grade in a school in Pensacola, Florida. I did a Skype lecture with them. They asked me what the most critical issue was today. I said, "Sea-level rise. You guys are going to have to figure out a way to deal with it." For tsunamis, it just makes it more acute because now flooding is going to be more frequent. What used to be a one-in-ten-year tsunami will be one in a year. What used to be one in a hundred years will be once every ten years. It's the same thing with hurricanes. So, if you think of all the hazards on the coastline you have with coastal problems, they're all going to be exacerbated with sea-level rise. So, are we prepared? No, no. I mean, the ports. Go look at any port. You'll see all their facilities are two feet above high tide. It's the most challenging thing we have. The National Ocean Service is doing a good job of tracking that.

MG: I also wanted to ask you about your experience as a professor. You taught college for a little bit.

EB: Not really. I shouldn't say anything about that. I was an honorary professor. That's the way I would call it. They call it adjunct. I gave a few lectures. I never felt like a NOAA scientist should be teaching and competing with other university professors. After all, that's their job. NOAA can come in and give guest lectures. When I got to the lab, there were several scientists who were teaching classes, and I said, "How does the university feel about that?" You talk to a university administrator, and he says, "Well, that's free labor." You talk to the other university professors; they say, "That's competition." I said, "I don't think being a competitor is healthy for a research lab." So, I changed the policy and practice. You can't teach classes. You can give invited lectures. They didn't like that. But I said, "You're creating a problem. If you want to be a university professor, quit and go be a university professor. But you're a NOAA scientist. NOAA scientists have a task to do.

MG: You've been recognized for your great work, and its too many awards to mention here, but are there any that stand out to you as particularly meaningful?

EB: Well, like I said many times, I've had a blessed career. Timing on things – just incredible. Having mentors of the quality that I've been fortunate to encounter has shaped my culture, my career, my character. I think that the best honor I've had was when I retired, several scientists wrote me comments and thanked me for my work. A common thread between all these comments was I was fair. I was fair. So, I think the awards are a manifestation of being a person who subscribes to the win-win philosophy and tries to be fair. Being selected for the Presidential Rank Awards from three different Presidents - Clinton, Bush and Obama is my personal favorite. Another is the one from Japan I received in 2016. I think having another country recognize your contributions is very special, especially a country like Japan, which has a much bigger tsunami problem than we have. When I went to accept it, it was a very formal ceremony. It was huge. I wasn't prepared for that at all.

MG: Was that the Hamaguchi Award for Enhancement of Tsunami Resilience?

EB: Yes. But the Service to America award was a kick. Because the sponsors to the Partnership to America award include corporations, it turns out that the sponsor for my award, which was the homeland security award, was Dupont. During the award ceremony, at the dinner table, I was allowed to sit next to the chief executive officer of Dupont. We chatted for a little while. It was the first time I ever sat next to a CEO of any major company. What a delight that was. I think probably just meeting him and talking to him – then he inspired me. As we were waiting for each person to make a few comments, he said, "Say something about safety." I said, "Okay." He said, "Dupont's all about safety." I said, "Okay." So, I went up on the stage, and I said, "Okay, everybody. I have one key message, and that is, "When you visit a beach, if you feel the earth shake, see the water recede, or if it's at night and you hear a loud roar, those are natural signals that a tsunami is present. So, run to high ground." I had the audience repeat it. That was a showstopper. They loved it. They loved it. The CEO of Dupont said, "Thank you. That's what Dupont is all about."

MG: Yes, I have to say you're a great speaker. I watched a number of your talks on YouTube. I was really impressed.

EB: Thank you.

MG: You're a good storyteller.

EB: I just watched it, too. I said, "That guy's good." [laughter]

MG: [laughter] Now tell me about your life outside of NOAA. Tell me a little about your grandkids.

EB: Well, I have to say, none of this would have been possible without Shirley's support. She's the unsung hero in this story and has never been given enough credit. She's the person behind the scene that gives support. How many times did I come home complaining about something, and she just patiently listened and worked me through it? It would not have been possible. None of this would have been possible without her support and confidence in me. She's the one that said, "Well, why don't you become director?" I said, "Why not?" My daughter was an inspiration. Elizabeth was a very active, bright, brave child. Her intelligence qualified her for gifted programs. She was athletically involved in high school varsity sports of volleyball and track. She was brave enough to go snorkeling with me in Hawaii and recently climbed Mt. Rainier. She was in high school when I first got the tsunami awareness program started. She helped me design some logos, some graphics. Believe it or not, she's the one that taught me PowerPoint. Because, at that time, when she was at the University of Washington, she applied for a Bill Gates Foundation internship, and she was selected. Her job was to teach high school principals and high school people how to use PowerPoint. It's a Microsoft project, and so she became skilled at teaching people PowerPoint. She went to one of our tsunami conferences and said, "Dad, you have got to learn PowerPoint. This overhead projector stuff is outdated and ineffective." I was using those old overhead projector slides. I said, "Okay." So, within a day, she got me up to speed. Again, you just have to say – because we lived in Washington State, she went to the University of Washington, got the Bill Gates Foundation internship, and then learned to use a Microsoft product. Now, she's still in the tech part of the world. She's had a very nice career. I had the honor of giving her away during her wedding ceremony. Then, in 2011, her first child was born, our first grandchild. That was a major change. One of the reasons I retired was I wanted to spend some time with the grandchild, and we have. Her second child was born in 2014, so I have two grandchildren. I must say it's a nice balance. I don't have to get up early and commute to work. I get to see the grandkids regularly. It's nice to watch them grow. They do grow fast. People usually ask me about my hobbies. I have such an interest in my work and family that I just feel like – I like to go on hikes in the woods and think about things. I like to do yard work and house maintenance. I like to do things that have applications. I feel like I'm wasting life if I go do something that doesn't produce any results. That's just me. That's probably a workaholic definition. But there IS time to play with the grandkids. My definition of retirement is doing what you want to do, and that's what I'm doing. So, I'm happy.

MG: I have gotten to the end of my questions, but I hate that our conversation is coming to an end. This has been such a treat to talk to you. I've really enjoyed my time. Is there anything I've forgotten to ask you about?

EB: I don't think so. We've covered a whole lot of territory, and things I would have never thought of talking about like the Russian experience and the underwater volcanoes. I wouldn't have pulled those things together, except for your prompting me to think back. Like I said, I feel very fortunate. I've had a life that has been blessed with lots of opportunities and lots of experiences that have made a difference. Whenever we entered the world, I think that's what we want to ask ourselves – can we make a difference? It may be small, but at least it's something concrete, and I can point to it.

MG: I think helping save lives is not small.

EB: Yes, I think it's an honorable way to look at science. We're a rich country, but I fear that we're wasting a lot of talent and money and time on insignificant activities. That's in the earth sciences. I think medical sciences are making major breakthroughs. But we have to overcome this culture in earth sciences that, "It's my data. It's mine. Mine."

MG: Well, I'll end it here. I want to thank you so much for your time.

EB: Yes.

[Tape paused]

MG: You brought up something interesting after we turned the recorder off.

EB: Yes. One aspect of the tsunami business is that because it's an intriguing disaster – because it's quick onset, happens suddenly, people are put in a stressful situation, and they all react differently. Over the years, I've been interacting with many different artists, especially authors of books, who talk about tsunamis. I've tried to educate them so that the information is accurate as opposed to some crazy, wild idea. But after the 2004 Indian Ocean tsunami, you can imagine, interest was everywhere. I got calls from different people about ideas they had about how to deal with tsunamis. Two of the most interesting ideas I heard I'll share with you. One of them was, "Why don't we drop an atomic bomb in the ocean and create a wave that would cancel out the tsunami?" As bizarre as that sounds, that's one of the ideas that came out. Interestingly enough, the next week, I got a call from Wil Mara who was writing a fictional story about an accidental nuclear detonation that generated a tsunami. I said, "Wow, what a coincidence." So, he talked to me about how a nuclear bomb could generate a tsunami and what would it do to an island. He wrote a book, entitled "Wave", and sent me a copy. It was pretty interesting. The tsunami hit Long Beach Island, New Jersey. Then, the second idea was a guy who had this idea about a bladder. You put it across the mouth of your harbor, and it's deflated, but when a tsunami is coming, you pump water into it, and it raises up a wall. Actually, that's a great idea, but it never got any further than that, as far as I know. But this could be a clue to sea-level rise. Maybe bladders along the coastline that you inflate when you need to may be a much better alternative than huge walls or barriers or stuff like that because everybody wants to see the ocean,

everybody wants to interact with the ocean. So, could you come up with a concept that might do that? Those were the two ideas that came about as a result of the 2004 tsunami. Then, over the years, like I said, TV shows, movies would do everything. They would call me and ask me questions. I gave some technical advice. Because I worked for the government, I couldn't get in any contractual arrangements with people, and so I didn't.

MG: Were you consulted at all for the Naomi Watts movie [*The Impossible*] about the 2004 Indian Ocean tsunami?

EB: No, but I think that Naomi Watts movie was the best one I've ever seen. I think it captures what a tsunami really feels like. In fact, I show that clip of her being impaled in that tree to give people an idea of why they don't want to be in a tsunami. *The Impossible*, I think, is the name of that movie. She should have won an academy award for that performance.

MG: She's wonderful. There's another movie that you show clips of.

EB: Yes.

MG: *Hereafter?*

EB: *Hereafter*, that's right. You got it. You're good. Yes. I like to show that because in *The Impossible* the water is like it's going to be – opaque, dirty, you can't see anything that is going on. But in order for people to understand what's going on underwater, the clearwater version in the Hereafter is more effective. I use *The Impossible* rarely because it's so severe. It does strike fear in people's hearts. You have balance education versus fear. That's a tough line to define.

MG: You said you have to explain to people why they don't want to be in a tsunami. Do some people think it's not a big deal, and it's just a big wave they can ride?

EB: Yes, yes. Here's the dark side. People make up crazy stories. There was a person in Chile who claimed that he surfed the tsunami into the shoreline. People interviewed him. They actually put this on camera. Then, when I went to Thailand, around the Phuket area, I taught a USAID sponsored tsunami class there. It was a two-week class. Part of our class was a field trip to the hardest-hit areas of Thailand. We must have encountered five people who claimed that they were in the tsunami, washed into the trees, and grabbed hold of palm leaves, and survived. I said, "Yes, right." So, the dark side of this is there's a lot of charlatans out there, trying to exploit the situation and telling outright lies. There's no way anybody could survive a twenty-foot tsunami, crash into a tree, survive, and tell you about it. But that was part of the teaching experience. When this happened, I said, "Oh my god, this guy's lying through his teeth." I said, "Okay. This is a lesson." That evening at dinner, I said to my students, "What do you think about that guy?" Two people said, "Isn't it amazing that he survived?" The rest of them said, "No, he's lying." I clapped. I said, "That's what you're going to encounter in your own country because these were people from India, Indonesia, and Sri Lanka. I said, "You're going to encounter this. You need to see that this is one of the dark sides of the tsunami problem is that people will lie about things that couldn't have happened, but you have to know enough about it to correct it. You have to be able to explain to the media this couldn't have happened. That's

one of the reasons you need to know more about tsunami science." That's a detail that may or may not be of interest. I don't know.

MG: I think it's very interesting. It leads me to ask – you've published quite a bit. Have you ever considered writing a book?

EB: No, but the guy that wrote the book about the nuclear-detonated tsunami asked me if I were ever interested in writing a book, he would help me write it. Maybe I will. Do you think there's enough interest here?

MG: I do.

EB: Okay. I've been too busy, I guess. But now that I've got some time on my hands, maybe so. It's a good idea.

MG: Well, you'll have to let me now.

EB: [laughter] Do you do books?

MG: No, no.

EB: Do you know anybody that does something like this?

MG: No, but I can ask around. I just find the subject matter so interesting that it would make for a great book, and you are such an expert, so you'd make a great author.

EB: Well, I didn't know if you think it's of interest to other people.

MG: I think so.

EB: Well, you've been a very attentive listener. I know I probably went overboard on some things.

MG: No, I think we probably could talk for several more hours, but both our tummies are rumbling, and I want to give you back your day. Thank you so much again.

----------END OF INTERVIEW----------
Reviewed by Molly Graham 5/4/2020
Reviewed by Eddie Bernard 5/15/2020
Reviewed by Molly Graham 5/29/2020