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Interviewers: Taylor Krabiel

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Abstract: The oral history of Captain Carl Fisher, Ph.D., conducted on June 20, 2020, chronicles his extensive career with the NOAA Corps, ESSA Corps, and the Coast and Geodetic Survey Corps, beginning in 1965. Fisher recounts his early training in hydrography and nautical skills, highlighting the rigorous standards and the high caliber of officers recruited during the Vietnam War. He provides detailed insights into his assignments, including hydrographic surveys, oceanographic research, and navigation system developments, such as the transition from celestial navigation to advanced electronic systems like LORAN-C and GPS. Fisher's narrative covers significant projects, including mapping the Gulf Stream and participating in the pioneering study of seafloor spreading, which contributed to the acceptance of plate tectonics. He also describes his role in historical events and scientific advancements, such as developing the first ocean service centers and contributing to NOAA's vertical datum improvements. The interview captures Fisher's experiences with various vessels, his involvement in key oceanographic discoveries, and his interactions with notable figures like Vice President Hubert Humphrey. Additionally, he reflects on the cultural and operational shifts within NOAA, emphasizing the importance of technological advancements in navigation and survey accuracy. This oral history provides a comprehensive overview of Fisher's contributions to marine science and NOAA, illustrating the evolution of oceanographic research and hydrographic surveying over several decades. It serves as a valuable resource for understanding the historical context and technological progress in marine and atmospheric sciences.

Taylor Krabiel: The following is an interview with Capt. Carl Fisher, PhD., retired NOAA Corps, ESSA Corps, and Coast and Geodetic Survey Corps. The interview was conducted at Carl Fisher's house on June 20, 2020, by Taylor Krabiel. So, if you wanted to first introduce yourself.

Carl Fisher: Oh, sure. I'm Captain Carl W. Fisher, Ph.D. I came into a predecessor of the NOAA Corps, the Coast and Geodetic Survey, in June of 1965. The training class back then was held at the Atlantic Marine Center [in] Norfolk. They actually had a new building built there, and we had a good portion of it for the training. Our training class was seventeen of us. This was just as ESSA was being formed. So, they were bringing in a lot of new officers. It turned out there were three training classes a year, so you can see how the Corps was expanding. When I came in, the size of the Corps was 182 officers, and it eventually expanded to about 350. When we were brought in, we were brought in as Coast and Geodetic Survey deck officers, not ensigns. We didn't become an ensign until the training class was finished. I guess part of the logic is that two [in] my training class did not become ensigns. They found that one officer was color-blind – hadn't been picked up on – and the other officer, actually, did get commissioned, but later, he was gotten rid of because he was involved in a political shenanigan out in San Francisco wearing his uniform. They actually removed him, which was a shame because he was a brilliant officer. In fact, many of the officers were quite brilliant. Because of the Vietnam War, there were so many college graduates that wanted to get into the Coast Survey and eventually ESSA, and so they had their choice of who they wanted. So, I think the one that got put out of the Corps was a physicist. I remember he used to, just for the pleasure of it, do differential equations when doodling. So, the training class was very interesting. We had two officers, Captain McCaffrey, who later was a commanding officer of mine and a lieutenant commander. The training class was mainly to teach us hydrography. Most of the Corps, up to that time, had been civil engineers. They were not really noted ship handlers. They really had no requirement from the Coast Guard to meet the requirements of licenses, rules of the road, radar certification – things like that. I learned how to do hydrography, but Captain McCaffrey actually ended up having me teaching a lot of the nautical part to my classmates. It was a unique training class, I think, in that we still have get-togethers where there's probably at least twelve of us still in contact, and four of us made it all the way through our careers up to thirty years. In fact, I'll explain later that all four of us commanded ships at the same time at the end of our careers. But anyhow, I want to talk a little bit about the hydrography training. They basically taught us launch and skiff hydrography at the Marine Center. We were given a survey area to do just across the river in Portsmouth. So, most of it was skiff hydrography. But the techniques used were pretty much the same techniques that have been developed in the 1700s and 1800s. About the only difference was that we were using motorized survey boats by then and had an electronic fathometer rather than just lead line, even though we did do a lot of lead line work. I want to tell you a little bit about what it was we did if you can look at what I have here. This is a three-arm protractor, which was one of the main tools of our trade because we got our position for the boat using sextants. They were held horizontally, and you measured the angle between targets on shore. So, what we have with the three-arm protractor is the fixed arm in the middle. You see the line that goes through the target on the shore, which would be plotted on your boat sheet. We had to make up our own boat sheets for the survey work. This was a cloth-backed paper sheet, so it'd be weatherproof, so you could carry out in open boats and all that. We would have to put on the graticule, the grid, for latitude [and] longitude. We would go to a survey area where, typically, the signals we're going

to build were actually built where the bronze disk had been put beforehand. So we would go and find those bronze disks, and we would build different shaped signals and different colors. So, we typically use cloths of four different colors: international orange, a brilliant yellow, a white where there's a real dark background, and a black where there was a real light background. So we would build these targets. Sometimes, a major survey would be over a hundred targets being built out of two-by-fours. And also, we sail with a whole cargo of lumber and all that. It was a very enjoyable part of the survey, building these towers. Later, I learned how to build a special thirty-foot tower for ship hydro way offshore. But as I say, the center arm of the three-arm protractor is fixed, and that's the zero of an angle. Then you have the left arm is movable. The left-angle man would be the more senior officer taking the position, and he would pick the targets that would be used, and he would tell the right-angle man, who is learning, what they would be shooting. Now, in an open boat survey or even a launch, they had what they called a sounding clock, which was a battery-operated clock with a bell operating that would give you one ring to let you know that it would be coming up for a fix. That way, the angle man could start getting their sextants read for the horizontal angle. Then, the second bell would be on the mark. So, usually, a helmsman or the OIC [officer in charge] would yell out, "On the next." And then, when the second bell rang, they would say, "Mark it." And they would take the fix. If they blew it, they would say so right away, and then they would go on the next. If they kept blowing it, you'd have to turn around and start over again. Anyhow, typically, a survey launch was a six-person operation. You had the officer in charge, who is usually down below with a plotting table, a three-arm protractor, and a sounding clock. The angle men would usually be up on the bow. Working in Puerto Rico, they'd be out in the sun. It was kind of an enjoyable thing to do. The sounding clock had intervals. You might take a fix every three minutes – that was a little soon – or every five, which is typical. Then, under certain conditions, they might even go longer. I think they went up to ten minutes. In addition, you had a fathometer operator, which was a crewman – survey tech. Typically, they would survey in feet and shallow water, and then beyond a certain depth, they would change it over to fathoms. They would have another survey tech that would be a record keeper, and with a sounding volume, he would be writing in there the record, which nothing ever got erased. If something was mistaken or whatever, it would be crossed out and corrected. Then, you had a helmsman. The helmsmen were really unique because the first survey that I did in Puerto Rico, we had no electronic control. We ran the lines onshore and offshore roughly a hundred meters apart, like mowing the lawn. But the helmsman would actually pick up natural ranges. He would pick up a range, which might be lining up a cactus with a tree or a rock with something or whatever it was, and then guessing how far over to move at the end of line. He would guess to be about a hundred meters, and it came out pretty good, except the commanding officer, when I turned in my work at the end of the day, would look and see where we'd left too big a gap, and he would order me to go back and fill in that gap. So it didn't always work out perfectly, and sometimes it looked like spaghetti, but that was how it was done. Targets back then were given three-letter alphabetic names. I have a sample that I'll show where I use “mom,” “dad,” and “son.” We actually got a directive sent to us that in no way we'll read or pick three-letter names that would lead to some kind of a lewd statement when you strung them together. When we went to automated hydro, we just went to three-digit numbers for each of the stations. One of the pages that follows the three-arm protractor shows how they would be picked: the center object and then the left angle, and the right angle. When you went further offshore, you would actually move to other targets so that you weren't shooting too shallow an angle, so you could actually widen out to targets [on] the right and left. The left-

angle man would yell down to the recorder which targets they were using, and then they would yell down the angle degrees, minutes, and seconds for the ones that followed. Now, an interesting thing about this is something we were taught over and over. Now, one thing I forgot to mention. I don't know if you've ever seen an old hydro manual. I looked for mine. I couldn't find it. I'm sure you'd have access to one, but I may be able to find mine. But it gives all this information. But the worst thing to do if you were doing a survey was to shoot what they called a swinger. Now, did you do the survey on the ship when it did the survey of Ponce, Puerto Rico, and worked out of Arroyo?

Taylor Krabiel: We were down in the – yeah, we pulled into Ponce a few times. We were down at Guayanilla.

Carl Fisher: Guayanilla, okay. Well, in Arroyo, about a mile to the west of there was a cove. Out beyond the cove, offshore, as I show in the drawing, was a reef. It really needed to be walked and positions taken. So, I was the ops officer at the time, and I assigned this officer and a couple of survey techs to go out and do this. So they went out and did it, and you could see that the cove – beyond where it is, you could see the reef at the bottom. What happened is the targets you were shooting were basically on a circle that you were on the backside of it. Then, any angle you took could put you anywhere. So, I've drawn in there to show in both the black and the red how you really did not have a determinant position. It could move anywhere around because it would be in a circle. Well, the officer came back at the end of the workday, and I went to check his work and spotted that it was what they call a swinger, and it all had to be crossed out and sent back to do it again. You could see mathematically what happened. So, I've showed there with X's that the way to solve that problem is we actually had to build signals further inland or go further to the right and left so that you would not be on that same arc. But that was what was called a swinger.

Taylor Krabiel: So, that's what that giant circle is, right?

Carl Fisher: Yeah, the giant circle is what the problem is, and you can see how the cove kind of mimics it, and then you could see between the two different sets of angles – oh, I forgot to mention also, on the left one that, in addition to the right and left angle, that if you were locating a buoy or something important, you would do what they call a check angle. Usually, the left angle man, after he shot the left angle, would very quickly go to another left target, to the center target, and take that angle too. So, you actually ended up having three angles determining position because, with a buoy or whatever, you didn't have, the forward motion of the vessel, the course, and the distance between to also verify that it was a valid fix. It was what they call a detached position that you had to do, so they all had to have check angles. The interesting thing about the survey is that you plotted the positions during the day. You didn't plot any depths. At the end of the day, you went back to the ship, you scan the fathograms to get the depths, you had a predicted tide corrector, which was just basically from the prediction tables, and that we get you in the ballpark. They would use real tides later when they check the survey. Between the fixes, they would use what they called ten-point dividers. What happened there is you would put the point – the first point and the eleventh point on the positions that you had checked and plotted. You'd prick them and ink them. And then, in pencil, you would go ahead and put the soundings in between. So, they would have like ten soundings in between each fix or nine

soundings between each fix. That would be how you would do your survey. Later, you would then contour the results, and it would tell you whether you needed to do further work or whether there was any feature. If you had the hint of a feature, you would have to go back and develop it. So that was the work we did. Well, what happened in Puerto Rico – it was so difficult trying to do these surveys without any form of control that finally, with the help of an officer that really could survey, he came down, we went out, and we put in two Radist towers. They gave us steering arcs so that we could do a new type of survey. It was the angles from the sextant, but the steering came from watching the Radist needle so that helmsmen could drive parallel lines. But we couldn't use Radist to tell where we were because of the shape of the coast. We couldn't put in an array of stations that would do it. Back then, we had Radist, and then eventually, they came up with microwave Motorola Mini-Ranger. With that, we could then finally go to a semi-automated hydrography where we could get a position. Sometimes, we still couldn't use the combination to get us a fix, so we had to do something called range-azimuth, where we would put an officer on a mark onshore to turn angles with theodolite, and the distances would come from the Mini-Ranger. At the end of our training class, we had a big celebration. The survey launch was an old, wooden survey launch, and we were allowed to take it from the base in Norfolk up to Williamsburg, Virginia, on the James River – near the James River – and stay overnight in Williamsburg. That was the big deal. Mentioning the launch, these wooden launches were slow. By the time I went to my second vessel, we had fiberglass launches, but they were notorious for engine complications. So we were cursed – I guess my first three ships I was on – with bad launches having difficulty. They eventually went to the Jensen aluminum launch, and they were much better. Engines and all were definitely much better. We didn't lose a lot of productivity there, but the generators – they put 3kW generators in them to run the computers, the PDP-8 computers that we had. The computer kept failing, so we had to keep rebooting throughout the survey. It wasn't until I finally ended up on my last ship, the *Rainier*, that we ended up with dependable boats and dependable generators. Now, at the end of the class, we all went to Washington, DC, up to Rockville, Maryland. The agency was just becoming ESSA. So, we became ensigns in ESSA. We met the administrator of ESSA, Dr. [Robert] White. He created it and was head of it for five years as ESSA and then it became NOAA. Well, it was interesting because when I went through the receiving line and talked with him, he was asking each one of us what our degree background was. So, when I got to him, I said that I have a degree in meteorology and oceanography. He looked at me with a smile, and he said, "Oh, that's perfect for ESSA." He said, "That's what ESSA is, weather service and charting." So, I got to meet him. When I went to my first vessel, almost all the ships had been in World War II. They were all being replaced because we had enough money for new vessels. So, I'll mention the old ones. The first vessel to go was the *Hydrographer*. She had worked in the Gulf of Mexico most of the time and corroded a lot. The captain brought her along with a crew up to Norfolk, and they were afraid the whole trip that the hull plating would rupture. He was worried about it sinking, so he basically stopped in every port along the way. The vessel that I first served on was called the *Explorer*. She was one of two sister ships – the *Explorer* and *Pathfinder*. About 270 feet long, very deep hull, so she rode good. That was good because the first project I went on, rather than going out to survey, which she had been doing, they came up with some major oceanographic surveys. So, ESSA was becoming oceanographic research. So, we were assigned to map the Gulf Stream. We had interesting equipment put on the stern called a VFIN. It was about ten-foot wide. It was a depressor that would depress a thermistor down to two hundred meters approximately. The core of the Gulf Stream was defined as fifteen degrees

Celsius at two hundred meters. So we were to steam with this, and we would cut back and forth across this fifteen-degree isotherm. Quite often, this thermistor would fail. One time, we actually lost the VFIN entirely; it broke right off. So we had to use what they call mechanical bathythermographs, BTs. This was a brass instrument developed for anti-submarine warfare in World War II. The inventor was Athelstan Spilhaus. He actually was an advisor and worked for ESSA when I worked there. So, I actually got to know him somewhat. The BT had a glass slide in it that – first, it was smoke coated but then later gold coated. As the bathythermograph went down in the water because it was heavy – it was about three feet long and had a heavy brass nose. As it sank, a stylus would move across this slide making a trace. When it came back up, he put the slide in a reader and you could read it. And then, I would call up the bridge. Well, because of my oceanographic background, I ended up doing quite a bit of this. I think we did an estimated about three thousand of these casts. We had a special winch back on the stern, and we put it over the side and let it freefall. Later, they came out with an expendable bathythermograph XBT, and this had a thin wire that, in a bad wind, would tend to get wrapped all around the ship's superstructure and all that. On the *Explorer*, an interesting thing happened to me. A ship like that would normally have about fifteen officers as a very large complement of officers. There was about fifty in the crew. The captain and XO [executive officer] were civil engineers. Most of my fellow officers were, too. I was the only one from the Maritime College. The captain invited me up to his cabin the second or third day I was on board, talked to me about my education, and said, "I'd like you to be the navigator." I said, "Well, that's the fourth-ranking officer on the ship." He said, "Well, we got to do a lot of work by celestial navigation." We only had what they call Loran A, which was good during the day, [but] went bad at night. It was only good for about a hundred miles offshore, and he said the whole survey has to be pinned down with star fixes, sun lines, etc. So, he said, "Are you any good at it?" It turned out that I was very good at it. So, I did not stand regular watches. I was the navigator. They would get me up early, and I would go out to take fixes morning, night, and during the day, especially at noontime because you'd get your best fix at Local Apparent Noon. It's interesting that this survey was put into the archives with the celestial navigation by Ensign Fisher. We used a technique that went back for centuries of throwing over what they called drift bottles. These were a bottle [that] had the symbol of the agency on them, had a cork in the top, and inside it was a form. The form would tell people who would find them to fill it out and mail it back to an address in Washington, D.C. And from that, they would get a general idea of where the current flowed. Well, since we were doing the Gulf Stream, they had us throwing over some of these bottles. So, I got one here. I don't have the original card, but I did, fortunately, copy one before they all got used up. But it's got a beautiful symbol of the old Coast and Geodetic Survey, and it's got the card inside with writing and everything from Japanese to English in the bottle. People would find this on the beach. Say if you threw one of these bottles offshore of Virginia here, it might, in a matter of anywhere from months to years, end up on a beach in Ireland, France, [or] Spain. They've even found them from the Canary Islands and in the Caribbean because they know that the current flows in a clockwise circle going up the Gulf Stream and across the Atlantic and then flowing southward down along Ireland, England, etc., and then back to the west again down in the trade winds. So, then you've got a circulation like this in the Pacific with the Japanese current. Of course, this is archaic; they no longer do this anymore, but I got one of these bottles to give as a souvenir. Now, the other thing that happened with this survey is, in addition to knowing where the Gulf Stream was going, we learned about the warm eddies and cold eddies that are shed from the stream. But we had overflights by special NASA planes.

They had a sensor in them that was later put onto a satellite. They were mapping where the outcropping is at the surface, and it turns out that that's not directly over the fifteen degrees Celsius that we're seeing below. So, in some way, they determined how to use the satellite measurements later to reproduce what we were getting with the ship. These were very difficult cruises. We went through two hurricanes that I remember and winter storms. We were actually at sea when the cruise ship, the *Da Vinci*, got stove in, they claim, by a rogue wave, but it was as we were in forty-to-fifty-foot seas at the time, and it could've been a hurricane. We were thirty miles away, and we could not go to their rescue. In addition to the VFIN with that ship and with a couple later ones, we towed what they called a magnetometer. This was a long electric cable that had a sensor on the end that would get you the magnetic field of the sea bottom that you were going over. I found out when I went to grad school at Oregon State that a brilliant scientist had put this all together and determined that it was proof of seafloor spreading. The molten lava comes up at the Mid-Atlantic Ridge, and then the seafloor spreads east and west from there at centimeters per century. You've got a mountain ridge there. The seafloor goes to the east coast of the USA, and then it dives down below the continent. So, you have what they call a subduction zone. This magnetometer was interesting to bring in because after having it out there for quite a while, quite often we'd bring it in – it was made of PVC – and we would find shark's teeth in it. I remember one time the sensor was gone: it'd been bitten right off. So, it must've been a pretty big shark that took it. But that was the history of seafloor spreading. There have been scientists who have looked at the shape of the continents out at the continental shelf edge, and they have seen how they could have fit together. So, as we were just talking – a Professor [Alfred] Wegener and a Dr. [Eduard] Seuss had both done this. I'd gone to American Geophysical Union meetings in 1966, say, in Washington, DC, and you almost had open fistfights, battles of those that believed in it and those that were against it. But that was the excitement of it. After this proof came out, it basically ended. No more. So, I felt like I was involved in one of the first major oceanographic discoveries of all time.

Taylor Krabiel: So, what you're saying is you were around when we went from – can't remember the old theory, the old geologic theory, right? You're around from that transition from the old geologic theory of how the earth formed to this idea of plate tectonics.

Carl Fisher: It turned out that when I went to grad school at Oregon State, my geology professor there – marine geology – became the administrator of NOAA later when I was operations officer at the Marine Center. I learned a lot from him about this. He was lecturing on it, so I actually understood it better. But that's the end of my *Explorer* work. Well, I also started to talk about the World War II vessels. So, the *Explorer*, right after we finished the Gulf Stream project, was laid up and became a school ship up in Washington DC for local city children who didn't go underway, but they could go aboard it and had classes on board. The sister ship, the *Pathfinder*, was laid up out in Seattle. Then we had a ship called *The Surveyor*, a steam vessel, and for some reason, they kept her around my whole career. She was still in service in 1990. Being a steam engine, she was archaic compared to all the new ships that were diesel. Then, we had smaller vessels. We had a vessel called the *Marmer*, which was an ocean-going tugboat that was made into an oceanographic vessel and carried current meters. Then we had two wire drag vessels called the *Wainwright* and *Hilgard* that eventually got replaced, and they started getting the new vessels. By the time I went to my second ship, I went on a new ship called the *Mount Mitchell*. It was 270-some feet long and one of three sister ships; the two sister ships were the *Fairweather*

and the *Rainier*. They were of the mountain class. Mount Mitchell is the tallest mountain east of the Mississippi River, near Asheville, North Carolina. Mount Fairweather is now called Denali, its Indian name. The *Rainier* was in Seattle, which I later commanded. When I was just leaving the *Explorer*, they contacted me and said, "Would you like to go to grad school next year?" I'm amazed because this is my first ship. I'd only been in ESSA a year and a half. I said, "Yeah, I'd be interested in going in oceanography." So, they said, "Well, you figure out which college and get accepted in September. In the meantime, we'll come up with a temporary assignment." I finished up with the *Explorer* and went to Washington, DC. I first was assigned to be an aide to Dr. White, the administrator of ESSA. He sent me over to Capital Hill to listen to congressional discussions. I was then assigned as staff to a presidential commission on oceans and engineering that was created to do a study and make recommendations that included creating the Stratton Report. Dr. White said, "Well, I'm going to send you on over to that because they need help." So, I was sent over. I shared an office with Lieutenant Don Walsh of the Navy. He just came back from diving on the bathyscaphe *Trieste* to the bottom of the Marianas Trench. So, he had dove over seven miles deep in the ocean, a very interesting time to be with him. Basically, we worked for Vice President Hubert Humphrey. We had an office building just on Connecticut Avenue, and I was quite often sent to the White House with information for the vice president or even from his office in the Old Executive Office Building to the White House through the tunnels that run between the two buildings. I would take over documents and things like that. I thought Vice President Humphrey was a wonderful man. President Johnson was a bit more crude, but he was all right. So, come September of 1967, my wife, Kay, and I got married here in Virginia Beach. We drove to Corvallis, Oregon, to Oregon State University, where I earned my master's degree in physical oceanography. After graduation, they contacted me and said, "We'd like you to go to this estuarine vessel." I finished my master's degree at Oregon State and went to the *Ferrel*, which had replaced the *Marmer*. She was a petroleum industry-type boat – very shallow draft, but had a bow thruster, very maneuverable. We went off to Penobscot Bay, Maine, to do an oceanographic project of currents and tide measurements. We operated all the way from the ocean mouth up to Bangor, Maine. I was the XO on the *Ferrel*. I was on her for a year and a half. And then, I had the opportunity to go to another ship right away. I wanted to be on a hydrographic vessel, and they needed a future operations officer on the vessel, the *Mount Mitchell*. So, I went there as a junior officer directly from the *Ferrel*, and we sailed right away for Puerto Rico. We surveyed in Puerto Rico for two years, and that's where I did my first survey. I was the OIC of the launch, and I completed that survey at Arroyo. And then the ops officer left, and I became the ops officer for the rest of the survey. When we finished Puerto Rico, we went back to the US, and then we surveyed along the coast of South Carolina. We surveyed south of Charleston Harbor. That was a very interesting survey for two reasons. One, our ship hydrography crossed the Gulf Stream, and I ended up having to develop a technique to determine sound-in seawater corrections for the change due to the Gulf Stream. Also, I found out that quite often, we were using the two different transducers on the ship. One was directly below the antenna midships, and that was okay. But the other at the stern that we used in bad weather was displaced from the antenna by a hundred feet – or more than that – and that required a correction. I actually had to get together with an officer up in Washington who corrected for that antenna displacement. I also ended up drawing a line across the sheet for where the Gulf Stream was and had a different temperature corrector for each side. We actually got the temperature correction with Nansen bottle casts with reversing thermometers. So, we would put them over the side. So, on one side of the Gulf Stream was the Sargasso Sea, and we had a

correction there because it was much warmer. Then, on the other side was the colder water where we're getting the coastal flow inside the Gulf Stream. It was a very interesting time, and it was a transition from the old type of hydro to modern automated hydrography. We were still doing visual hydro, and the captain said he needed to have towers built onshore big enough to do a horizontal sextant fix from five, six miles offshore. I had an old-timer on the ship that had been involved in building the big towers that they'd used years ago. He taught me to build thirty-foot towers. It was a special island that one had to be built on – oh, I forget the name, the island. But anyways, we went to a lumber yard and bought two-by-fours, but he had half of them ripped diagonally so that they were triangle shape. They were sixteen feet long. We went to the site, and we built the first lower sixteen-foot four-sided tower. We buried pieces of two-by-four in the ground, used a bolt to connect one side of the four-sided tripod or tower – I keep calling them tripods, sorry. But anyhow, they were bolted so that they would flip. You could flip the tower up. Then, the second story of the tower was lighter because the two-by-fours were ripped in half. We brought it up to the point with a ripped two-by-fours, and we dressed it with a signal cloth while lying on its side. Then, we used a Jack pole, which is a special pole that goes over your line that's going to pull the tower up. The line goes up at an angle and then back down to the rear bumper of our ship's vehicle that we had out on the beach. We then pulled it up vertical, bolted its back legs. So, all four legs were bolted to anchors in the ground, and it was thirty feet tall. We built two of these and used a lighthouse at as our additional target. Those were our targets for calibrating offshore. The rest of the survey was done by Radist, which gave us our positions. I finished up on the *Mount Mitchell*. They had me go to be on another presidential commission, and this was the National Advisory Commission on Oceans and Atmosphere. [Richard] Nixon was president then. I did not work in the White House, but we were making recommendations to create different parts of NOAA. NOAA would become an agency in 1970. Anyway, I worked on that for a while. Got to see some of the things going on with the White House and the controversy over Nixon's presidency and all. Lo and behold, I was just taking my lieutenant commander exam, which was to plan a hydrographic survey of Cook Inlet, and they would have a senior officer evaluate it, and also an oceanographic exam, which Captain Swanson evaluated. I got promoted in about a little over six years, and went to Washington to be the director of the Oceanography Division of the newly formed National Ocean Survey. So, anyhow, this was quite a coup because they'd never had just a lieutenant commander, become the division chief. I was in charge of all the tide gauging, the producing of the prediction tables, and the current meter measuring. We had a vessel, the *Ferrel*, doing our projects. While I was chief of that division, they brought in parts of the Corps of Engineers to be part of NOAA. They took the lake survey center, putting the water level gauges on all the Great Lakes in NOAA, and also doing hydrographic surveys in the Great Lakes. So, I brought those people from Detroit to Washington DC. Part of them came to Norfolk to be part of the tides and water level teams that went to the stations and checked them regularly and rebuilt them and all that. Another thing that happened is it was right during that time, Nixon resigned as president, so I remember that day very clearly. I worked in the oceanographic division for quite a while for Captain Munson, and he came down to Norfolk, became admiral here, and then he had me come down to be captain of the *Peirce*, P-E-I-R-C-E. People thought it was "Pierce," but it wasn't. Named after a famous mathematician. We did a number of surveys, what they called item investigations. There were so many reported wrecks put on charts that they were beginning to really clutter up the charts. So, I was assigned to go to the sites of these wrecks with reports that would be put in by the power squadron, etc., and search for them. We started out working in Palm Beach, Florida, and worked our way south,

doing all the wrecks all the way down to Key West. It was very interesting work – a lot of diving. We would check wherever there was a wreck, dive down, and the divers would do sketches of what was left. If there was nothing or if we found a record that it had been removed, we would send that in. It takes almost an act of Congress to get a wreck symbol taken off a chart. Quite often, put "ED" next to the wreck symbol, "Existence Doubtful." So, that was the best we could do. In addition, we surveyed – I surveyed the entrance to Chesapeake Bay. They had a theory that the Chesapeake Bay bridge tunnel with all the abutments causes a lot of deposition and erosion. So they needed that resurveyed. Then, we were sent up and surveyed the entrance to Delaware Bay. We worked out of the Coast Guard base at Mayport, and it was very interesting work. Probably, the most interesting thing is we found a location in our survey area where the Army dumped a lot of munitions. I don't know, maybe World War I or World War II. It had been reported to me by clam boats operators that they had brought up hand grenades. They had hand grenade in the things that would clean off the clams and all. So, it was a very good thing. After I'd been on the *Peirce*. Admiral Munson invited me ashore at the Marine Center to be the operations officer, which was a wonderful time. I think probably one of the highlights of it, or two of them, is one, we had the sailing training vessel from Norway, the *The Christian Radich*. It came to Norfolk, but the city had no development at the waterfront to put it. So, they asked if it could be tied up at the Marine Center and open up for tours. We did that. We had like three thousand people a day come to tour it. Then, they developed the waterfront. Now, we got the modern waterfront at Norfolk for the tall ships. So, it was the first tall ship to call at Norfolk. The other thing that happened is they had Jacques Cousteau come to Norfolk. They didn't have a place for him, so they asked if he could tie up for six months at the Marine Center. As operations officer, I was responsible for taking care of every one of his needs. Very interesting time. He was on the *Calypso*, a converted U.S. minesweeper. Very nice. They even had a tank aboard for wine. They served wine with their meals. It was enjoyable to dine over there. The biggest problem is they had a helicopter, a lttle small one, that would take off and fly around the neighborhood, and I'd get complaints. "What's this helicopter doing flying all over, so close?" While I was at the Marine Center, a classmate of mine from Oregon State – when I got my master's degree, he got his doctorate and had become a professor at ODU [Old Dominion University]. So, he talked me into taking graduate classes and beginning to work on my doctorate. The NOAA Commissioned Corps decided that they would back me for getting my doctorate. So, I left AMC and went to ODU, where I did all my studies. I decided on a topic [which] was the circulation of Chesapeake Bay. A famous oceanographer who worked for me up in Washington named Steacy Hicks had done a research paper, a very limited one, on what the tide looks like going into the bay. But he based it only on tide observations of high water and low water. Since the tide is a composite of many different frequencies, it wasn't very clearly established, and he had recommended to me that once we started doing this *Ferrel* project, where we got a lot of data of long enough duration to analyze for separate frequencies, that I go ahead and do it based upon – M2 is the semidiurnal tidal frequency and K1 [is] the solar frequency. We did a three-year project with the *Ferrel* with a lot of tide gauges and a lot of current stations. Prior to this, we'd done a lot of tide stations, especially in the tributaries, to build the Corp of Engineer model of Chesapeake Bay. I went ahead and did my doctorate. I went to Washington DC for a year doing analysis myself, running computer programs where I found out these frequencies and plotted them up. I did a dissertation based on this. Found that the tide was very distinct. M2 in Chesapeake Bay, because of its length and its width, has two actual cells each the wavelength of M2. K1 is just about equal to

one wavelength. So, I have one cell showing that it clearly fits in Chesapeake Bay. But it's all kind of moved over to the westward. To determine the cause of that, I worked with a model that shows the effect of friction on the tide. Now, because of Coriolis force, the tide is higher on the east side of Chesapeake Bay than it is on the west side. This is because of the rotation of the earth. But then, because of the friction effect on the wave going up and reflecting back, it caused the whole amphidromic system to move to the west such that the center of the amphidromic system, where the tidal change would be zero, is actually displaced right onto land. So, you only have the eastern half of the cell shown. I got done with my doctorate and I got my degree, and I went to Washington DC again to work with the program to create ocean service centers. While I was there, a fellow that I'd worked with in the currents section and I went together and did a technical publication. The only one of its kind ever produced. It shows all this information, how it's done. But with the current information, we show how the current rotates, and the current sometimes goes around clockwise. Sometimes, it goes around counterclockwise. It's affected by bottom friction. But you can see in this publication what the currents are throughout the bay. I saw this similar going up the inside passage with the *Rainier* when I became captain as we went through places where you could see the current at the surface as whirlpools. Whereas sometimes it'd be spinning to the right, and sometimes spinning to the left. And sometimes the water just boiled right up at you because of the effect of the bottom. So, I finished this ocean service center program, which later got kind of canceled. We had a center out at Seattle. I got selected to be the captain of the *Rainier*. This was 1986, summertime, I drove out to Seattle. A prior captain who had the experience going up and down the Inside Passage. [He] went with me to Alaska to give me experience going up there, going through Ketchikan, up through the Wrangell Narrows, a very difficult passage. We went up to Admiralty Island, which has an inlet inside of it and began surveying where he had been working. He flew back to Seattle to work at the Marine Center. We worked there the rest of the year, went back to Seattle in November, and then the next season, we went up and worked around Admiralty Island again. Then went over to the Aleutian Islands and worked out of Dutch Harbor, very famous during World War II. We worked a schedule – out of twenty-one days, we were eighteen days up in Bristol Bay and three days in Dutch Harbor, where we could buy supplies and all that. Now, because we were the *Rainier*, we had kind of a special situation. We were allowed to buy Rainier beer, and I could lock it up and have hundreds of cases of it. During this eighteen-day working period, about halfway through, we would have a cookout, usually on one of the islands. We would have a beer party and do a cookout. We were surveying an area that had never been surveyed before. I'd never been given a blank chart before, but it had a few lines on it that had been reconnaissance, but other than that, it was blank. So, we had to actually sneak in with our launches ahead of us to find anything that's a danger. And we actually went in and out of our work area on a LORAN-C rate. One time, we were going in, and I had a junior officer on watch. He had gotten off track. All at once, the bottom started coming up quickly. I immediately took over and saw which way the rates were going, did a hard left turn, and the depths went back down again. I went back to the area, and my divers dove; they found a rock coming up from the bottom, about forty-foot elevation within fifteen feet of the surface at that stage of the tide. Eventually, we got to survey that area. We were working our way down to it, so we got it surveyed and found out. But I remember the feeling I had seeing that bottom come up like it did. I finished up on the *Rainier* and came back east again. They didn't really have an assignment for me. They left me [on] my own to go find what I'd like to do. The civilian that I'd worked for previously had started a new program where he was trying to improve the data centers. He ended up being in charge of the

three national data centers we have in the US: the Meteorological Data Center in Asheville, North Carolina; the Oceanographic Data Center in Washington; and the Geophysical Data Center in Boulder, Colorado. There are similar data centers elsewhere. Three of them in what used to be the Soviet Republic and three in China, and we work closely with them. Anyhow, we developed these data centers, improved them, and then started a program to locate the "Centers of Data," a term that I developed. Other agencies have different type of data. These would all be supported financially, and they called it a treasure trove of data. It's unique data that researchers can use. After doing that and getting that program started, I was able to come down to what used to be called the Atlantic Marine Center and be the deputy director. The director was Admiral Freddie Jeffries, who had been a classmate of mine, and he specifically requested me to come down and do it. Then, when he retired, I became acting director until I retired. I have a story about Dutch Harbor. When we went into Dutch Harbor one time. We had a Soviet fish processing vessel there. Under the Magnuson Act, American trawlers were able to catch netloads of fish and then take the actual net still in the water over to these processing vessels where the Soviets would bring them aboard, empty them, filet the fish, and freeze them, and then give the nets back to the trawlers. That's how the fishermen were working. So, these trawlers were getting a lot of fish, and there were probably maybe two hundred people aboard, a good portion of them female. When we pulled into Dutch Harbor, we usually had free dockage at a pier that had a warehouse, and this Soviet fish processing vessel was already there. We were coming in for the Fourth of July weekend. We ended up docked bow to bow with them. I noticed that after about a day – it wasn't the Fourth yet – I had Soviets over on the ship playing checkers and chess down in the crew's mess, and our quartermasters were talking with them and all. The next thing, I had a visit from the Soviets. The first mate could speak English, and he was zampolit, which is a political officer. The captain couldn't speak English, but he was a really good guy. They had made plans with the mayor of Unalaska, which includes Dutch Harbor – the city is actually Unalaska – to have a Fourth of July party. Since it didn't get dark until about midnight, we wouldn't have fireworks until then. So, they asked if I would go in on it with them, and we made a bargain that I would break out the Rainier beer. We got the use of the warehouse. They cleaned it out. The mayor of Unalaska actually was a fairly young fellow [who] had a salvage operation where he was getting rid of World War II vessels and buildings and all that. He had a rock band with a young lady who was with the local TV station, an Aleut native, that really could sing. We had it set up for a dance. The people of Unalaska provided elk and bear meat and all kinds of stuff, and the Russians gave us homemade bread and borsch. We were all set up. It was a beautiful layout. The first mate kept saying to me – he would come visit, and we became really good friends. He would say, "We got to have volleyball. Got to have volleyball." And I said, "Okay." Eventually, we did. Well, I didn't realize he practically was an Olympic volleyball player. This guy spiked from the back line, I tell you. Anyway, so we had the volleyball going on, and we had the band playing and all that, and they had a – I'll tell a personal story – is they had a doctor on board the vessel, and she was a middle-aged blonde-haired lady, had a most beautiful black leather topcoat which is what I remember about her. But anyway, I was standing there with the first mate who would translate for the captain and me. He had children about the same age as mine. She came over and asked me to dance. I thought I should, and I went out and danced with her. Because of the weather, she was wearing a topcoat. I had on a coat and all that. It was cold. So, we danced. When we went back, all of a sudden, there was a line of the women from the Russian boat lined up. Now, at first, they stayed aboard the boat. We didn't see them much. But I had some wonderful female crewmembers, especially

a third cook. She changed the whole wardroom in that she made vegetarian meals, vegetarian walnut burgers, and all that. Next thing I knew, that's all they were ordering in the wardroom. But she had seen that these women weren't coming over even though the men were on the ship all the time. She went to the ship store that we had supplied with all the types of things that the women crew members would like to buy, and she bought a whole bunch of stuff and took it over there to give to them. She got them kind of bolder so that they would visit us. The next thing I knew, here they come, and they're lined up. So, I'm dancing with them, and I'm thinking, "Jeez, I hope my female crew members will come." The next thing I knew, the first mate was out there dancing with them. The captain, I don't think he ever really got out. But it was really neat. Well, we had a good party. I finally ended up having to break out more of the Rainier beer, but the bread and borscht, and everything was great. Well, next morning, the Soviet vessel was to get underway. About 0700, the quartermaster calls down and said, "The first mate's here, and he's missing a crew member." He thinks that he has come over to request asylum. I said, "No, he hasn't done that. To my knowledge, he's not aboard." I got my XO, and we did a walk-through of our vessel, and everybody said, "No. No, he's not here." Well, I guess by about 0900, they did find him. He was down in the women's quarters on the Soviet vessel. He got drunk and ended up sleeping down there with them. So, he was in trouble. But I had pulled out the regulations. The thing on asylum was really scary because the Coast Guard had screwed up real bad when a Russian had asked to give asylum, and they had given him back to the Soviet ship. I didn't want that to happen. But that was a real experience. The other thing that I thought was really interesting is while we were planning the party, the first mate wanted me to do something, and I said, "No, I got to go in town and get a haircut." Our fellow that cut hair on the ship was not aboard. He said, "Oh, no, no, I got a guy. I got a guy onboard the Soviet ship. He will cut your hair. He will cut your hair." I said, "Okay." We're trying to get along good with them. Well, they called down from the bridge, and they said, "Captain, there is this Soviet crew member. He's here to cut your hair." So we set up a chair in the office, and I meet him at the door. He smiles, and he's got chrome teeth. All I could think of was Jaws from James Bond. He's from Azerbaijan, an Azerbaijani. Apparently, they use chrome instead of gold or whatever for their teeth. He had almost all false teeth, but they were chrome. Well, he pulled out a pair of paper shears to start to cut my hair, and they were pulling and all that. Well, luckily, since I had a beard and mustache, I went in and got my barber shears. I brought them out, and I said, "Please use these." Well, when he got done – and he gave me a good haircut – I tried to pay him. He wouldn't allow that. So, I gave him the shears. Oh, he just thought that was wonderful. I think that with the haircuts that he gave from thereon, I think the crew loved it, too. [laughter] I'd like to tell you a little bit about the cartoon of the Surveying Eagle, or, as we used to call it, the Survey Buzzard, that was drawn by Walt Disney Studios and requested by the Boston field office of the Old Coast and Geodetic Survey. This is very similar to what they put on the aircraft and vessels during World War II. In the 1940s, the Boston field office wrote to Walt Disney Studios and asked for something that would somehow indicate what hydrography was like. So, Walt Disney Studios came up with this really neat cartoon that's been used in many different ways on buttons and T-shirts and things like that. But when I was working in Washington DC, this old-timer who had been in the Coast Survey, even during World War II came to me just before he retired, and he said, "I have this picture drawn by Walt Disney and these letters. I'd like to give them to someone so they won't be lost." I eventually gave them to the museum that was created with the 200th anniversary of the Coast Survey. Anyway, I have an excerpt here that I would just read into this thing that says, "The Disney Coast and Geodetic Survey Eagle. Walt Disney

Productions of Burbank, California, created the 'hydrographic surveying eagle' for the US Coast and Geodetic Survey in 1943. Personnel at the C&GS Boston Field Station requested Walt Disney Productions design an appropriate insignia for the field service of the US Coast and Geodetic Survey." I have an asterisk that said, "Correspondence between the Boston Field Office and Walt Disney Productions and the director of the US Coast and Geodetic Survey are property of Mr. George E. Moore, then nautical engineering aide of the Boston Field Station. Copies were shown to LCDR Carl W. Fisher in 1975. Quoted excerpts were taken directly from the correspondence at the time, and then the original picture and the correspondence were provided for the 200th-year museum preparation for the history of the Coast Survey." Continuing on with it, "On May 26, 1943, Walt Disney Productions responded as follows: 'Walt Disney is happy to present this insignia to the field service of the Coast and Geodetic Survey for unrestricted use within your group.' This insignia was presented to Admiral Colbert, director of the Coast and Geodetic Survey, for his approval. In June 1944, the Boston Field Office was informed by the director's office 'several members of the bureau are interested in obtaining copies of the insignia. This office is willing to reproduce the design.'" I had it put on T-shirts when I was an officer in the Washington area, and Tom Orlowski at the Atlantic Marine Center had it put on buttons. It's a very famous picture. I hope it'll be used again. I'm going to talk a little bit about navigation systems and positioning systems. As I mentioned earlier, when I started out, the system of horizontal sextant angles had been used as early as – I've read – in the 1700s. It was used during the Napoleonic Wars. By the time I came into the Corps, the Coast Guard had come up with a LORAN-A, which was a system of putting electronic signals on top of a pedestal electronically. But it was only good out to about a hundred miles, and it went to pieces at sunrise and sunset. While I was on the *Explorer*, they came out with the first unit of LORAN-C. It was a huge, huge cabinet. It had five steps to get a position, and it was nothing like the modern LORAN-C. We had to put the rates on the charts by hand from an almanac. They did not have them printed on the charts as yet. It was much better, but in the meantime, the captain had me doing the celestial navigation with the star sights, and the sun sights so that the Gulfstream positioning, for the most part, was done by celestial navigation. When I went to the *Mount Mitchell*, we had LORAN-C. It was very handy. We did track lines between Norfolk and Puerto Rico, but also we used a system called Omega. Omega had been prepared for the military. It was a system of eight stations worldwide. It was electronic. Had lanes, much like all systems, and the lanes were eight miles per lane. When you did a track line to Puerto Rico, you went out and circled the Chesapeake light tower, got a fix there, and then you went on your way, did a deep-water survey, and towed a magnetometer. Well, the problem is that in a lightning storm, the Omega receiver would lose lane count, and the only way of correcting it at the time was go all the way to Puerto Rico, get a land tie, and then try to bring the correction back. But if you had two storms and lost lane count, you just couldn't use it. So, we had a storm. The captain was tearing his hair out. He said, "Oh, this is terrible." I said to the captain, "I get a fix from the stars better than eight miles, probably as good as three-mile accuracy." I said, "I'll get you a fix tomorrow at noon, and we'll have no problem." So, I went ahead and did it. The hundredths were okay. We just had to have the right lane, and we went on to Puerto Rico. The captain was so happy, and he said to me, "You've got to write a paper on this. Nobody knows how to do it." And I said, "They don't know how to do a celestial fix? What's happened?" Well, now they don't even know how to do any of it. But this was how we corrected it. I did do a paper – put out instructions on how to correct Omega. Well, then they had LORAN-C. The next thing to happen is while I was captain of the *Peirce*, working up in Lake

Huron, the Coast Guard wanted to put LORAN-C on the Great Lakes charts, but they didn't know about the propagation over freshwater. Well, since I had a positioning system set up on Lake Huron for surveying, they had two people from the Coast Guard come on board with their equipment to track LORAN-C over freshwater and determine whether it could be usable. They proved that there was very little correction that it was okay to use over freshwater also. So we had LORAN-C. We used LORAN-C up in the Aleutian Islands and all, but eventually, they came up with GPS. While I was head of oceanography in NOS, they came up with the concept of putting up the GPS satellites for geodetic work, but they also wanted to use it for tides. So, I was assigned to the study group that actually planned the actual outlay of putting the satellites up and doing GPS. Now, one other thing that happened at that time is the US Geological Survey was putting out quad sheets, and the shoreline was shown as Mean Sea Level 1929. Well, Mean Sea Level 1929 was created way back when they had about twenty tide stations. They actually determined the datum for Mean Sea Level and then worked it in through leveling nets – this is geodetic leveling – to the center of the US and back out with the corrections and then called that Mean Sea Level 1929. Well, the problem with the Mean Sea Level line on the chart is that after a few years, due to land subsidence and sea-level rise, it's no longer any good. So, you have to have a vertical datum. Well, we tried to tell the USGS, "Please don't put this on your quad sheets. It's no longer valid." They formed a committee, I was put it, and we came up with a term called National Geographic Vertical Datum. I think it was 1980 or something like that. There are new ones since then. But they now have the vertical datum tied in with GPS. But The problem with the Mean Sea Level 1929 on the quad sheets is surveyors would use it to put a stormwater runoff line out into the ocean because the Mean Sea Level was wrong, the water would flow the wrong way. It would flow right back on land. So, they had to stop using Mean Sea Level 1929. Now, as I say, with GPS, at first, they did not use the vertical coordinate of GPS. We still had to do a correction for soundings for tides using tide data. Ships had to run temporary tide gauges during surveys in addition to the primary network of tide gauges. Quite often, the tide gauges did not run well. They didn't have experience using them, or the equipment didn't operate properly. The hydrographic surveys would come in with bad tide data. The survey was done with predicted data, but that wasn't good for accuracy. You had to use the actual tide data at the end with a calculation of what low water was. Going to GPS solves that problem because you no longer have to use predicted tide observations. They actually look at the vertical component that is obtained with GPS, and it'll give you the tides. We're going to talk a little bit about Navassa Island, which is a small Caribbean Island south of Cuba. In the late '70s, early '80s, the Navy asked NOAA to survey this island for military purposes, to survey around it. The island is very flat, pockmarked a lot, and used to be used for mining guano, a lot of bird manure on it. No natural harbor, just a cleft in the rock that they used to bring a boat, hold it in position. Anyway, the Coast Guard had a light on it. NOS agreed to do it. I was chief of operations at the Marine Center, and we had to put on horizontal control on the island. This was before GPS. So, I sent my civilian surveyor and officer down to Navassa Island, where they stayed on the island and put in control. The *Peirce* was sent down there to do the survey. Well, the depth dropped off very rapidly from the shore of the island. It was a cliff. What happened is the ship surveyed lines in and out to the island using a deep-water echosounder, and then they would reach an area where it came up rapidly and started using their shallow-water echosounder. But there was a transition zone in between that they defined very poorly. There was a band around the island that was lacking sounding data. Well, the head of processing at the Atlantic Marine Center had contacted the director and told him that he had received this survey from the

ship, and it was not qualified enough to be an actual survey. It would have to be degraded to something else. The director was concerned about this and needed an independent assessment, so he asked me to evaluate it and see if there was any problem. I looked at it. I saw the transition between the deep-water and the shallow water – there wasn't any data in the band. I knew from the hydro manual that if you have an area where the bottom topography is changing rapidly, you are to run slant lines so that your sounder comes up along a slant rather than up straight the cliff face. Well, the *Peirce* had neglected to do this. The survey went to Washington, and they downgraded it to a reconnaissance, so it never was turned over to the Navy as an actual survey. Anyhow, years later, I believe the NOAA Ship *Thomas Jefferson* went down there to make good on this request with their multibeam sounder, and they ran their multibeam around the island, which took care of the fact of the bottom dropping off so rapidly. It showed something that the *Peirce* never even knew. One of the boats that transported guano had actually sunk in the deeper water next to the island. Looking at the results of the survey, you could see the wreck lying on the bottom. One more story. We were sent to Sitka, Alaska, to do a reconnaissance survey where some of the local boats going in and out had reported some pinnacle rocks that were not supposedly charted. We did that. We had a towed side-scan sonar, so we did a limited amount of work there. But one of my junior officers later became the commanding officer of the *Rainier* after I'd retired. He contacted me after they'd done a survey of Sitka Harbor because they did it with multi-beam, which is like a picture of the bottom, showing everything. When I looked at the results – they sent it to me by computer – it was like looking at mountains from above the surface of the water. It was just unbelievable. The other thing interesting that happened was up in Bristol Bay, where we were working in the Walrus Islands. There were two employees there, male and female, and they were engaged. Well, after working there the first year, the female state employee asked me to perform their wedding the next year on that island. I told her that the captain of a NOAA ship didn't really have that authority, but she said, "Oh, you can get it from the judge in Sitka." So, I went to the judge's chambers, and I got the authority to perform the wedding once we were up there in June of 1988, I think it was. We had a wedding ceremony out on the island. I wanted to say a little bit about how the ships have changed since the time I entered the Corps and now, and one of the biggest ways is actual dining. The first ship I was on, we had a wardroom that had its own cooks. We had our own galley. The chief engineer had a rank of commander, and he dined to the right of the XO. The captain had his own dining up in the cabin, had his own cook, and had his own galley. That's now been rebuilt on the *Rainier* so that they don't have a galley there anymore. Anyways, when I went on the ship, they gave us collateral duties. The first collateral duty I was given was wardroom treasurer and was seated at the far end of the table. There were sixteen officers, counting the chief engineer, with the XO sitting at the one end, the forward end, and me sitting on the far other end. I had to bill each of the officers each month for the food, and I had to buy it and stock it or have the cook that worked for the wardroom do that. But we actually dined quite well because our chief engineer, shortly after I got there, got sent to the shipyard to build a new ship called the *Researcher* that became the *Baldrige*. He had a freezer full of a side of beef at his home. He sold it to me, and so we ended up with steaks and all this good food. We would go out, as I say, for just under three weeks each month, tracking the Gulf Stream over halfway to Ireland. We would usually cross the mid-Atlantic, and we would have these really good meals. As I said, we had to plan our own menu. We had served just one entree. They didn't really come out with the union regs until later. Then, the crew's mess was separate. They created a ship's officers' mess that the chief engineer moved to. They had the officers mess eat

out of the same galley as the crew and ship's officers. As the captain, I decided that I would not eat in the wardroom now and then because – especially, when working in Alaska – officers come back, wanting to talk. I didn't want to be there hindering conversation, so I would just have something brought up to the cabin and had my meal up there. So, that's how the mess has changed. Now, on the oceanographic ships, they had the scientists eating in with the officers. On the *Oceanographer* and *Discoverer*, especially, they had real problems with the – scientists didn't want to get cleaned up or even dress up. So quite often, they would try to come in, especially when they were fishing and gutting them. Also, they complained quite often about their seating. So you would have the officers in their uniforms for their meals, and you would have the scientists sitting at the same table complaining. So, we always had friction between the laboratories and the research ships. When I went to the *Ferrel*, because she was a class-four vessel, she was really small. We ate in the same area as the crew, just had a separate table, the forward one. They had the aft one. We had two cooks, and the galley was adjacent to the dining tables, which was a very good arrangement. It worked out quite well. The *Ferrel* actually flipped over, I think, during Hurricane Maria on the coast of Puerto Rico. We had always been warned about her safety. She was shallow draft, seven feet, built for the Gulf of Mexico oil work, and had a restriction that she couldn't go more than a hundred miles offshore. A private investor bought her, took her to Puerto Rico to work, and got wrecked. [RECORDING PAUSED] I decided to come into the Coast and Geodetic Survey because the Coast Survey began recruiting at the Maritime College, and one of the faculty there was a real supporter of the C&GS. I talked to him. Well, I talked with the recruiter. This is back when they had field offices, and they had a field office in Manhattan. So, the captain came up from the field office, and I talked with him my junior year. I decided that with a degree in meteorology and oceanography and all of that – I had a third mate's license, too, but I didn't really want to go into shipping. So, I made a decision: I'd come into the Corps. They took four officers from the year before me that were my upperclassmen. They became good friends when I was in the Corps. Anyway, everything worked out good. I was all lined up to go into the Corps in June of 1965. It was a very interesting period back then because about a year after that, we started seeing the effect of the Vietnam draft on officers coming in. We were bringing in about fifty, sixty officers a year. I guess it was about five years after I had come in the Corps we started bringing in female officers. I really liked it. I liked the oceanography that I started out doing. I liked doing hydrography, and I liked the history of it all. So, I was sure I was going to stay. The other thing is that there were 182 officers in the corps when I came in. I was number one in my class, so I was 183. They eventually increased the corps to almost four hundred officers. Promotions were quite rapid. Lieutenant was three years minimum time, and I was at grad school out at Oregon State and got promoted. There were no zones or anything like that. I just got promoted. And then, while I was on the *Mount Mitchell*, I had to do my promotion exam, which was to design a survey of Cook Inlet. So I did that, and I was promoted to lieutenant commander in a total of six years. I can't remember exactly, but I think I made commander in about eleven years. I made captain in a total of twenty-one years. I love the Corps. You had a lot of history. I had military-type training at the Maritime College I went to. So I liked having the dining-ins and all of that. The most interesting dining-in that I ever attended was at Quebec at the fortress up in Quebec City. I was on my way to survey in the Great Lakes. One of my crew members was injured. I radioed ahead. They made arrangements to take him to the hospital in Quebec City, but they did it through the 22nd Regiment at the fortress there. They called that the *vingt-deux*, which was French for 22nd. They docked me right there in Quebec City Harbor, and I got to know the

colonel from the fortress. He invited me to dine with him, but he told me that they dined formal. I was fortunate. I was attending a meeting in Canada, and I had my dress uniform. So, I put on my dress uniform, hiked up past the Chateau Frontenac, went into the fortress, and sat and dined with them. They dined like we do at a dining-in. The bottle never touched the table – toasts and all that. I found out later that I was the excuse for the event, that I was a guest of honor. They toasted the queen. I sat there thinking, "We tried to take this fortress twice in wars in the past, and here I sit there as a guest of honor."

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

Reviewed by Carl Fisher 3/1/2024
Reviewed by Molly Graham 3/12/2024