Frederick E. Crory

23 October 2002

Brian Shoemaker

Interviewer

(Begin Tape 1 – Side A)

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BS: *This is an oral interview with Mr. Frederick Crory, taken as part of the Polar Oral History Project of the American Polar Society and the Byrd Polar Research Center of the Ohio State University on a grant provided by the National Science Foundation. The interview was conducted by Brian Shoemaker at Mr. Crory's home in Hanover, New Hampshire, on the 23rd of October, 2002.*

Fred, it's great being here at your home. I appreciate the invitation to come here and as you know this is an oral interview with you and we're interested in people who go to the Ice and basically, why you went – your background, your expertise that took you there and motivation that got you there, your work, and the people that you associated with and where you were, etc. So, it's your interview. I'll ask you pregnant questions along the way, and dates and such. And I think we'll have a good time.

FC: Well, I welcome this opportunity to speak with you, Brian, and to kind of reminisce about the years and different places and different projects. My background is one of a son of a farmer. I was born and raised in a little small town in Massachusetts, some 27 miles from Boston. It was a small population of about 400 people, agricultural town, and I was one of five children. I was a second son. My father's family was Irish. My mother's family were Norwegian, so I've always kind of thought I had a little Celtic blood in my veins. I always had an interest in exploration in the North, as you will probably recognize when I talk about where I've been. There is a connection with the North throughout my life in different places around the North.

Now, I should preface this by saying that I'm unlike some of the people at CRELL that have been involved in ice work. My work has been primarily with permafrost - shoreline activities, although there have been some off-shore operations, but primarily frozen ground. And my work has been with few exceptions, primarly in the North as opposed to Antarctica.

BS: *Were you associated with Link Washburn?*

FC: I know who Link is and met him several times. But, I grew up in a small town with a very large farm that catered to chickens. It was a great inspiration to me because I soon learned that I did not want to be a farmer and take care of chickens for the rest of my life, even though my father was quite content with it. It was an inspiration to go on to do other things.

Now, like most people in life, what you dream about doing or think about doing doesn't necessarily happen the way it always was supposed to. My early childhood was influenced by World War II, and the threat of being drafted or going into the service and to that end, I grew up making model airplanes and loved flying. I also had an historical bent which I'll criss-cross back and forth to. I originally, during the war, changed my age from 1928 to 1926, and enlisted in the Massachusetts State Guard at the age of 15. I served in the Guard for two years, rose to the rank of Corporal, and used that as a stepping stone later on when I went to the Marines upon graduation from high school.

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BS: *So, you'd been in for two years by the time you graduated?*

FC: Yes, but it's like National Guard activities during the week. But, by the time I got in, the war was over. Well, not quite legally over. There were still six more months to it, but I was offered the opportunity of going into pilot training when I first finished boot camp. And I took all the tests and they said I had my choice of 52 colleges around the country and by the time they added up all the years of commitment of going to school and flying, it amounted to nine years and nine years seemed awful long at that time. So, I turned it down and continued to go to engineering school within the Marine Corps. I have maintained contact with the Marine Corps Engineers ever since that time.

BS: *Were you Reserve?*

FC: No, I was regular.

BS: *No, I mean after you got out.*

FC: Well, let me get to that. I went to the Pacific and served in Guam and went on to Japan and other places in the Pacific. And when I couldn't stay on Guam with my younger brother who had enlisted in the Marines, I elected not to get trapped in Hawaii, and I elected to get out on my regular enlistment time and join the Marine Corps Reserve at that point just in case. But, the idea was that I had the GI Bill available to me to go to college and particularly to pursue engineering. And so, with that in mind, I came out and since I had not taken any college preparatory courses when I was in high school, I elected to go to a private academy in Groton, Massachusetts, Lawrence Academy, to have a refresher course before going to college.

I went one year to the Prep School and upon graduation from that, the Korean War broke out and I was recalled to active duty, actually ended up serving a year and a day. When President Truman issued an executive order that anybody whose GI Bill had been interrupted was permitted to be released from service and to go back to school, I instantly elected to take and arrived at the UMass campus

24 hours after being released from duty to register at the School of Engineering at the University of Massachusetts in Amherst, Massachusetts. I pursued Civil Engineering there at UMass for four years and graduated in June, of 1955.

It was during my senior year at UMass that I took a great interest in soil mechanics and foundation studies – highways and other courses like that. And the instructor that I had in soil mechanics had, the previous summer, gone to Greenland, and was the party surveyor for some sites up on the Ice Cap. And he came back with a movie and explained to us what they were doing up there and it sounded like very interesting work. And the office that had hired him was the Arctic Construction and Frost Effects Lab in Boston, Massachusetts.

BS: *I've never heard of that. Arctic Construction . . .*

(100)

FC: Arctic Construction and Frost Effects Lab. And this was a Corps of Engineers group that worked within the New England Division of the Corps of Engineers. And they were primarily involved, during World War II, in the construction of airfields and took over the previous work that had been done in Alaska on constructing barracks and airfields and roads and everything else up there. So, this group inherited all of that work and continued to research and be involved in military construction in the North for the federal government – both the Army and the Air Force.

It was through my interest in the work of this group that I wrote to the office to inquire if they had any openings available and sure enough, after going down for an interview in Boston, I was hired and went to work a week after graduating for the Arctic Construction and Frost Effects Lab in Boston.

BS: *I'm going to ask you a pregnant question here. Do you know the name of the professor that showed you that movie?*

FC: Yes, Karl Hendricksen. He recently died, about a year or two ago.

BS: *OK, Great.*

FC: And it was the time when the DEW-line was being originally conceived and some of it had already been experimented on with the new little sites to see how the radar would work up in the North. And it was places like Skull Cliff and Barter Island that were the prototypes that were under construction.

BS: *What year was that that you graduated?*

FC: 1955. Now, the interest was in pilings to support the facilities and the towers. And I did a cold room study on the preparation of the hole and whether there was any point bearing on the bottom of the piles and determined that the potential bearing at the bottom of the pile or the point was not consistent with the frozen adhering soil around the length of the pile. That the ad-freeze, if you will, would break before the point was mobilized to contribute any significant contribution to the total capacity of the pile, so we discounted the bottom of the piles as helping in that matter and concentrated only in the frozen ad-freeze strength of the permafrost to the piling itself.

BS: *Ad-freeze is . . . ?*

FC: That's when something freezes to something. And, in this case, it's mud that's put back into the hole to eventually re-freeze again because of the surrounding permafrost and it grips the pile. And it offers the capacity to load the pile and it's transferred to the ground by this adhering or ad-freezing frozen soil around the pile itself.

BS: *And that's a function of the weight you're going to put on the other end of the pile.*

FC: And the soil and the temperature of the soil that surrounds the colder, the stronger the bond is to hold up the load. And that got on to more research later on because it made a difference whether the pile was creosoted or was an untreated timber. Whether it was a pipe pile, it had a milk coat of varnish on it, or if it was painted.

(150)

So, it opened up a whole Pandora's Box of other studies as to what is controlling the capacity of the pile, not just the ground, but the pile itself may have . . . and we showed that it did have an influence on the capacity of the pile to hold up loads.

Now, some of the loads, particularly wind loads, became cricital on towers because the early radars were rotating antennas and there tends to be an oscillating load rather than a static load. And you couldn’t have the antenna deflecting or otherwise moving or the tower move in the wind or anything like that or else the signal would be distorted. So, it became a very interesting exercise in designing towers so that just the rotating weight of the radar itself wouldn’t influence the signal.

But, anyway, I started with that and also was doing a study on frost heaving with a nuclear meter that had just been developed that had been primarily used in the States for looking for the migration of moisture on their airfields, particularly pavements. We adapted the unit that we borrowed from the Ohio River Division and I took that to Alaska in the summer and fall of 1955, to monitor the ground as it froze to see where the moisture was going and whether it contributed to frost heaving of the ground.

When the moisture in the ground starts to freeze, it expands. It also attracts at deeper depths, some more moisture to come to this freezing front, so it produces large ice windows or significant sizes, bigger than the moisture volume that was there. And anything that’s on the surface or adhered to like a piling or a foundation will be physically lifted by this frost action. And this can amount to many tons of force to push up a building or a footing under a building or a runway or anything like that in a road.

And it typically does not do it evenly. So, you get this washboarding effect or buckling effect and then, of course, in the spring when the ice in the ground thaws out, it turns to mud and it looses its capacity much less than what it was originally in the compacted state. And so you have this loss of bearing capacity in settlement that occurs with that. And the thawing and the settlement also doesn't occur uniformly. It'll settle more on the south side than it does on the North side and so you get a wracking of the building or pavement or whatever else it is.

BS: *A good explanation.*

FC: It's a very common thing to New Englanders and it's why we grow rocks in our pastures and fields around here, because the rocks are being annully pushed upward and out of the ground and they end up on the surface and the farmers had to harvest all these rocks to get them out of the way to put crops in. And that's why New England has such a profusion of stone walls from all the frost heave stones that were pushed up over centuries.

(200)

BS: *Now you say you did these studies. This was in the lab in Boston?*

FC: The pile studies were in the lab in Boston. We had large cold rooms and a testing machine and all the rest of the equipment down there. The nuclear meter, I did do a very brief cold room study to make sure the equipment would work at these temperatures, particularly the Geiger counter and all the rest of it and got the system down as to how I would install them in the field. And then took it up to Fairbanks, Alaska - we had a field station there outside of town - and installed these thin-walled aluminum tubes that we would put these nuclear probes down into the ground to different depths and then we would lower the nuclear probe down into the tubing and held it in place with a clamp and would monitor the readings at 6” intervals down to 10’ or something on that order. And then we would do it again two days later, two days later, and then just keep watching as the frost continued to penetrate in at the ground. It’s a combination of laboratory cold room work and field work up in Alaska and particularly in Fairbanks.

It was this introduction to the field station that we maintained there through the Arctic Construction and Frost Effects Lab that I got very interested in Alaska and the work in Alaska, liking field work, as opposed to . . . I didn’t hate our lab work, but I liked the field work and all the different things that I saw going on in Alaska. So, at that time, the soils engineer that had been assigned to the field station was due to rotate. The normal tour of duty up there was two years, so he was planning on coming back and working in the office in Boston, so I volunteered to do two years in Fairbanks. And so I was married at the time with my oldest boy, so we packed up and we moved to Fairbanks and lived right there at the field station in a little small bungalow. There were two houses there connected with a station.

BS: *What year was this?*

FC: In 1956, we went up there. And I met several friends who worked for the IGY up there, one of which was a classmate of my wife who also graduated from UMass. But, when I arrived in Alaska, it was primarily to not only continue the nuclear studies, but to get involved in a whole range of other projects – testing pilings that had been put in. We were removing ground temperature sensors that had been installed all around Alaska ten years earlier to take soil samples to find out what the conditions were at the end of the period. To remove all these very sensitive temperature sensors that the FAA people had monitored for us over the years and to move all our equipment back to Fairbanks again. So, within my first year in Fairbanks, I did get to travel around Alaska and primarily into the Northern area to Point Barrow and all the other areas along the coast wherever there was an air field.

(250)

BS: *In Alaska.*

FC: In Alaska, and operated on just a whole host of projects that were going on at the time. Now, in 1955, when I first came up there, they were just beginning to do the ground work for the construction for the AC&W, Aircraft Control and Warning

Stations, which were the second line of radar defense installations across Alaska. And they stretch from the coast all the way across into Canada. And the interest there was in Arctic construction and primarily the installation of the pilings to support these very large structures off the permafrost. And we went around to various stations, the critical stations, and actually had representatives at the stations. We did pile load testing to find out how much they would support and what the deflections were under different loads. Refrigeration of pilings to get them in and get them frozen as quickly as possible so they could be loaded. Snow drifting, thermal studies . . . we attached thermal couplers to selected pilings to monitor the switchbox so we could monitor the temperatures in the ground underneath the facility. We established vertical movement points to make sure that they indeed were stable and they weren't settling or heaving or anything else. And those were long-term studies and typically we did them once a month, originally, and then it dropped back to every three months, and then finally at six month intervals, we took readings at all these stations. And it was a lot of traveling and a lot of cold work to survey and take these readings at these remote locations.

It was a very interesting two years – what I signed for – but, I stayed on for another year, so I stayed there for three years without ever coming back to the States.

BS: *1955-58?*

FC: 1956-59. I went there the first time in '55, and then I went with my family in '56. And I came back in the spring of '59. Now, when I came back, I was offered the opportunity of taking over the pile testing program that CRELL had, or that Arctic Construction had at that time. We were ready to merge to form CRELL at that point, and we were waiting for this laboratory up here to be finished. And we started on that and while I had been in Alaska, we installed a large array of different piles and types of timber and creosoted timber and steel and driven piles and the like.

(300)

We got involved in a joint project with the highway department for driven piles for bridges and we monitored the installation of the driving of the H piles into the permafrost and equipped them with therma couplers and vertical movement points and monitored those over the years.

BS: *So, you were over in Boston with Arctic Construction and looking to combine with CRELL.*

FC: Yes, the Arctic Construction and Frost Effects Lab merged with the Snow Ice Permafrost Research Establishment, SIPRE as we called it, from Willmette, Illinois, to consolidate into one facility in the new laboratory as such. It would deal with snow and ice and frozen ground. So, this is how CRELL came to be, by merging those two units - ACFEL and SIPRE. And the final merger occurred during the summer of 1961, and everybody transferred here in the fall, November of 1961. I was ready to move in on Day 1 to move CRELL over here when they opened the door.

BS: *They merged in 1961?*

FC: They merged in 1961, and that was the beginning and everybody was to be here and transferred here by November of 1961.

BS: *I'm very familiar with CRELL and the work CRELL has done, but the Arctic Lab – now the acronym for that was ACFEL?*

FC: And we really didn't change our scope of work. We were still doing a lot of military construction work and research for the Corps of Engineers which had it's use in military construction for the Army and the Air Force, primarily. And there had been a steady sequence of military construction going on in Alaska and in some cases, in Canada, and it just gave us a bigger opportunity and a bigger base to operate on. We maintained the field station in Fairbanks, to continue field studies and a base of operation in Alaska, but with the SIPRE people coming here, there was more of an interaction with those that were working in ice, primarily at that time there was a lot of the construction going on at Thule, Greenland, and off-shore ice projects. So that it became more and more ice related with that group. I still retained my prime interest in frozen ground.

BS: *Who was the Director when it was formed?*

FC: Keith Boyd was the first director.

BS: *Was he a Colonel?*

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FC: No, he was a civilian. He worked first for some road administration back in the war, and he worked on Alaska highways and some of the airfield work in Alaska. So, he was Alaska oriented *per se* for the highway administration and came to us and took over as the first director and I think he had been, originally, at SIPRE before he came to CRELL. The guy in charge of our laboratory in Arctic Construction and Frost Effects Lab was a man named Kenneth Linnell, who, in fact, lived just three houses down from me here. And his second-in-command was Ed Lobaz, who lives two houses down from me. Both of them are now dead, but they were the leaders in the Arctic Construction and Frost Effects Lab.

I should mention one other name, James Keeley who was second-in-command of the Arctic Construction and Frost Effects Lab, who had been a Navy officer in the Seabees. And he and I got along famously because we both shared kind of a military Seabee can-do, we'll-make-it-work aspect to our field work. So, we were always thinking in terms of projects and how to accomplish them in remote areas, which stayed with me throughout my career at CRELL – to organize and figure out how to do something and then how to actually accomplish it in the field and get the equipment, or whatever equipment we needed and get it there and out of there and get it to work. So, it was a nice mix of military construction with former military people to get things done.

BS: *Plus some pretty good research, it sounds like.*

FC: Yes, and it was *very* interesting. And I must add here that I found from the very first day that I started to work for the ACFEL and eventually with all of my career at the Corps of Engineers, that I found it very interesting to the point that I had no interest in going anywhere else in private industry or anything like that. I was very content with being a research civil engineer and working in the North and doing this type of research. And that was my official designation was a research civil engineer.

(400)

But, when I came back and took over the foundations group, I got involved in several other projects along the way, but the major interest at that time was military construction. We thought we had pretty much all of the answers. The military construction in Alaska was dropping off. The facilities had been built and were operating, and we were still monitoring to learn what might happen with time, but the amount of dollars to continue at the level that we had been doing started to drop off and it was ironic that about the time that we had finished testing all the piles and wondered, other than putting reports together, what we would be doing next, low and behold, then the trans-Alaska pipeline came along. And it came in different stages. It would start with a flurry and then there would be a legal challenge and an environmental impact statement had to be filed and that took years. And in the meantime, we had an opportunity to start working with the US Geological Survey, who were the prime people on the corridor - permafrost along the corridor.

BS: *When you say "the corridor" . . . ?*

FC: The pipeline corridor where the proposed pipeline was going to be built. And then, to begin the dialogue as to how it was to be built and particularly the permafrost aspect with the hot oil pipeline. And then the inevitable selection of piling to elevate the pipeline above the frozen ground – the permanently frozen ground. And so, we started getting involved in looking at the sight and going along with the drill rigs, trying to sample along the 800 miles and we spent a lot of time with the crews that were working for Alyeska, the owners of the pipeline, to determine what was there at different places and where their critical or dangerous places would be. And we went on for years with that and then we got involved in their design criteria for what they called the vertical support members, which was just a legal dodge for not calling them piles because another union would be involved in putting a pile in the ground, so they called them vertical support members. And it was then kept within the steel workers who actually did the cross members that held up the pipeline.

(450)

Then, it got into equipment for putting in the piles and the like and one must remember that it ended up that half the pipeline – 400 miles of it – was supported above ground, and there were 80,000 piles used on that trans-Alaska pipeline. So, our little investment in 100 piles to start getting the design criteria put together was really utilized in the development of the criteria for different types of piles in different conditions and the like, so it really paid off in that sense.

Now, it seems that the same thing always seems to occur, I guess, but about the time that the oil started to flow in the pipeline and we had monitoring places for temperature and vertical movement in selected all along the 800 miles of the Northern half of it, but because of our interface with the geological survey, they were already starting to step out ahead of the oil development on the North slope and start looking for more oil reserves that could be tapped eventually potentially when the oil from Prudhoe Bay started to drop off.

So, we got involved in exploring for oil in different places in Alaska, and the Geological Survey wanted to put in very deep holes to explore the geology and look for oil and gas. To do that, the drill rig had to be on site for at least a year and typically, it might run as much as two years. But, accessible at all times to outside transportation, primarily air by C-130s. They would not drill if they did not have access by aircraft. The drillers would just shut down because it was too dangerous.

If we had a blow-out, there would be no way of bringing in something. And so they wanted to construct the deep well sites, what they called "all season airstrips" and these were gravel strips, one mile long to accommodate the Hercules C-130s, in which a complete drill rig could be disassembled and flown in initially or, as in the case of an extra drill, to relieve the pressure on a blow-out. And then, of course, after all the drilling was done, they could fly the camp and the drill all out on C-130s and not go across country, at least in the summertime.

(500)

Now, a lot of the equipment was brought in on special sleds or vehicles in the winter over the snow. But, it was the beginning of an era in which trafficking on the tundra was a no-no. No trails and bulldozing or anything like that that had occurred during World War II, when the Navy and the rest of the oil companies that were contractors would drive across the tundra and left things. So, I had an opportunity during that USGS work to see the effects of prior traffic and sled trains on the tundra, and fuel depots and barrels left there at the drill sites and their conditions, which I eventually came back to again later. But, I had a real introduction to them when I was working with the USGS. Even though I'm still working at CRELL, we did a lot of direct work with the USGS on these deep well sites.

Now, there were three of these deep wells at Inagauk, Tunalik, and Lisburne that required the all-season strips. Now, to accommodate these strips, we used a novel technique of insulating the ground and then putting a very thin overlay of gravel on the insulation. During the wintertime, you capture the cold in the ground and then throughout the summer, to retain the thawing only above the insulation, and it never penetrated into the sub-grade permanently frozen ground. And these worked very well. They were expensive, but it was the only option that we knew of to actually build a temporary air strip where particularly there was very limited gravel. I think it was some 30 miles to haul the gravel and for the first site at Inagauk, over a winter road and over lakes from a tributary of the Colville River. (550)

And the Tunalik site didn't have as good a gravel – it was small sized particles – but, there was an old beach ridge that was robbed, mined, for getting the gravel to cap over the top of the insulation and leveled underneath the insulation. Lisburne had a local source and that wasn't a problem at that one. That was the third one. And all three wells were drilled to their target depth and I won't get into the geology and all of that.

BS: *Do you remember the depth?*

FC: I think it was a mile. 5000 feet. And then there were smaller wells that were drilled in the winter. Sometimes the drill rig was left on site for the following winter to be moved to the next site. So, there were deep wells and there were shallow wells. The shallow wells didn't require an all-season gravel runway.

BS: *Because you used the frozen ground, frozen lake, in winter?*

FC: Or we made it on land by packing the snow down. And the operation was to be completely done before spring. And many of those wells, the rigs worked right up until spring, and then they just shut down and waited until the following winter when they were then hauled across-country to another site.

BS: *Were you involved with the well that we drilled in the Barrow zone?*

FC: No. There were some wells put in there later on, but I didn't get involved in that because there was no airstrips involved. The interest there in our drilling program was to augment the supply of gas for the lab and for the city of Barrow, and as far as I know, that's still going on and they're providing gas for that. But, I guess it was more for producing gas than it was for exploration. They knew it was there. It was just a matter of tapping it to supply it for the Lab. Otherwise you went into a problem of how do you heat the city of Barrow, and the Lab?

(600)

BS: *You hit the nail on the head. Let me tell you what happened there.*

(End of Tape 1 – Side A)

(Begin Tape 1 – Side B)

(000)

BS: *OK, you were going to tell me about this peak that you did.*

FC: Oh, at the Lisburne site, without NAVAIDS to fly there, you typically are flying along the foothills on the north side of the Brooks Range and down. It's very difficult to pick out where the drill site is because it was nestled in the hills and so, you would fly around typically for 10 or 15 minutes looking for landmarks and the one landmark that we always seemed to locate first was this one distinctive pyramid shaped hill.

Several years later, after we had finished the runway at Lisburne, my very good friend, Dr. Reuben Katchadorian from Mineral Park, California of the USGS, died and after working with Reub for something on the order of 20 years on different projects, I submitted a name for that peak to the Board of the Geological Survey to have his name put on the peak and it was accepted and it is so named now and I assume that it's now on more recent publications of the map. It didn't qualify as a mountain because it wasn't high enough and there were other restrictions on what you can call it. But, in any event, I called it Reuben's Peak, because it was the peak of his career to work on those well sites and the like. So, I thought it was aptly named and I have a certificate from the Place Names indicating that it is, indeed, a recognized peak on maps for Reuben Katchadorian.

We typically named things unofficially so that we could refer to different places or where a tundra fire was started by a lightning bolt down on the Carbon

Creek area. We operated in an out of Umiat and we had certain names for trails and hills or well sites. We actually called a lot of things in Alaska.

Now, the projects I dwelt on primarily here is different field work. There were a lot of other projects and there were, of course, papers to be written, permafrost conferences to go to, and in 1973, for instance, we went to Siberia and looked at the conditions over there in their permafrost and their research facilities. The first permafrost conference had been held in Purdue in 1963, ten years earlier, and so we had an opportunity and eventually, I was involved in another group that President Nixon had designated to interface with the Soviets on permafrost related problems and I ended up making three trips to the Soviet Union, including coming back from one of those trips, I had my first opportunity to go to Norway. And on a week-end, I finally found my family homestead there and was the first of my grandfather's family to ever come back to Norway since he had left there in the 1800s. And it was fun and gave me a chance to see Norway, as well.

(50)

I also started working on different projects, primarily radar, in Greenland, at that time.

BS: *You went to Greenland?*

FC: Yeah.

BS: *Where?*

FC: At Thule, up on the radar site outside of the base to upgrade the facilities there from their original work back in the ‘50s and ‘60s – the refrigerated foundations there.

BS: *What year was this?*

FC: I would guess around ’75 or ’78 – somewheres in that group.

BS: *OK.*

FC: The first time, at least.

BS: *You made a number of trips, then?*

FC: Yes.

BS: *Were you involved with building the BMEWS?*

FC: Yes, the one in Alaska. And that was one of the easy facilities to get to for us because it was just outside of Fairbanks. We were also involved in that BMEWS at Thule as well. But, some of the facilities like in more recent times – 10 or 12 years ago – I was involved in the up-grade of the DEW-line to convert it to the North Warning System, so called, and to find new sites with a new deployment of automatic equipment as opposed to being manned stations. We started first in Alaska, looking for new sites to put these new facilities in that were primarily closer together and capable of detecting low-flying Cruise-type missiles as opposed to the former interest in bombers – high-flying bombers. So, it was a different deployment criteria, but the stickler was doing it automatically and remotely as opposed to having manned stations. And then we started with sites in Alaska, and then eventually it extended into Canada and then down the east coast of Canada and included Greenland. And this work went on for two or three years, primarily summer site surveys. The ones in Canada were a joint exercise with Canadian forces.

BS: *Did you visit all these sites?*

FC: Not all of them, no. We broke into three teams for our big effort. The ones in Alaska, I visited all of them.

BS: *They were up on the North Slope?*

FC: All on the coast. And this is why I always have maintained an interest in the ice off-shore because it blinks on the radar if there is a ridge attached to a pier, it will start to blink at the radar and send a false signal and so we were interested in ice ridges as such off of Alaska and large icebergs off the east coast of Canada.

BS: *Where? Baffin Island?*

FC: Baffin Island.

BS: *You visited those?*

FC: Yes.

BS: *How many sites have you visited? Do you know?*

FC: About 15, I'd guess, out of the 30-35 sites that we went to.

BS: *And you did the soil studies for all of these?*

FC: I was the Project Manager on the surveys – organized the teams, trained the teams, got their transportation, all their supplies laid out, itineraries and schedules.

BS: *This is for construction or testing ?*

FC: This is just for the surveys to actually find the sites.

(100)

BS: *What were the criteria for picking the sites?*

FC: Primarily it was the visibility of the radar, whether there was an obstruction in the way. How far it could go and then what it's neighbor station would see so they would overlap.

BS: *So, you got involved with radar, then.*

FC: Yeah, and doing depth studies of masking of terraine by using maps and we developed a technique of analyzing topomaps to define what the radar would see or not see and which was a better site.

BS: *So, your team picked all the sites.*

FC: Yep.

BS: *For the – what do you call the system?*

FC: The system was called the North Warning System – strictly radar which was an upgrade of radar types compared to the DEW-line. But, there were no people there and no weapons there. No sending up missiles to knock down missiles – that sort of thing. It was simply to detect them.

BS: *Did you build them or did you have a contractor do them?*

FC: Contractors.

BS: *Did you supervise the contractor?*

FC: No.

BS: *Not CRELL's job*.

FC: We were just involved in the siting of them.

BS: *They must have had problems so they'd call you back here and there.*

FC: Well, the program changed with time, too. Some of them were built and others were not built. The DEW-line was enhanced and maintained and kept going as opposed to building a new North Warning System in some sectors.

The other problem was how to physically go there and service them and they ended up using helicopters to put an elevated landing pad over an open grillage so the snow would fall down through the grillage, because there was nobody there to shovel snow. But, there was a lot of talk about building airstrips, certain ones at least. There was even talk of using a dirigible to service them which I fought every day to discourage. But in any event, it was a lot of meetings, it was working with different people. We did all kinds of surveys with equipment on site looking for the resistivity of the rock or permafrost because grounding was a major problem. We had a radar officer with us and he and an assistant with a theadolite mapped the entire horizon to confirm what the radar would see or not see. And we also took one of those panoramic special cameras that we had purchased that would take a photograph of 360 degrees from a tripod and that was utilized by the radar officer to confirm that his readings matched with certain peaks and certain directions and stuff like that. Access – is there a beach available. How are we going to get supplies in here. And actually, then compiled a complete report on the site and constructability and problems – whatever it was. Or, if there were no problems, which was rare, but to go physically around the site and then report what we found to the joint US-Canadian team that made decisions on what was to be built or not built or which one would go first.

BS: *What year block of time frame was this?*

(150)

FC: This was in the ‘80s and into the ‘90s. In ’90, I went back into Canada and went to one of the kind of awkward sites. I wouldn’t say that it was that difficult, but it was a former DEW-line site that had burned. It had been completely destroyed. And we went back in there to see one of these Northern Warning Sites up and running. That was an interesting one on the Labrador coast at a place called Sagalak. Interesting from an aviator’s standpoint was that during World War II, a US bomber crashed exactly where they later built a runway to accommodate it. And the poor guys froze and died of lack of food. So, I’ve always had a kind of historical bent for each of the teams that were on and off warning. I prepared a historical thing and had two reasons – one, to alert them if they saw certain things, not to touch them, because in Canada you're not supposed to disturb an archeaological site. And secondly, was that they would recognize what they were seeing as an archaeological site so that again, they didn't touch it or disturb it, nor take anything and bring it back. And so, I prepared the three notes for each of the teams on what they might find in their sectors and sure enough, there were a number of things that we located and sent back to Canadian officials that we had seen this and seen that.

BS: *You sent a note back.*

FC: A formal letter.

BS: *Photographs.*

FC: Yep.

BS: *You didn't keep a book of those, did you?*

FC: No, I didn't. But, you'd be surprised even just on the North coast of Alaska to the east of Barter Island, we found a couple of graves marked by a plank with their name on them and it's not marked on maps or anything like that, but we had stopped there to use the benchmark that was part of the Shoran system there, and so we found the graves and marked them on the map and let people know that there are some people that died here along the coast and they were apparently seamen. They were English names as opposed to Indian names.

BS: *Did you find any of the Eskimo navigation cairn-type things?*

FC: Yeah, we were known to put them up, too. In fact, I won't name who he was, but he had a sense of humor that he would always erect a certain circle of a certain diameter out of stones and leave the North stone missing. And then he'd sit back and chuckle and say, "Now some day, someone will come along and see that ring of stones and wonder how they figured out where North was." But, we were always looking at things and typically, you found cairns, or rock cairns near the very peak of the hills or wherever it was, and sure enough, you'd find a tin can or the like in the cairn and there would be notes of who was there before you.

In fact, normally operating like on the North Slope, we would be flying in helicopters in the fog and this one pilot – I usually was the navigator – and he would turn and take the left fork of every tributary as opposed to the right fork. Don't ask me why, but we ended up coming out into the Uona Valley, not knowing where we were other than that it was a valley, but we didn't know what the river was or where we were.

(200)

BS: *Now this was where? Northwest Territory?*

FC: No, no, this was in Alaska, maybe 100-200 miles south of Barrow. In those rolling hills there where there's no features, no big mountains, no anything – just rolling hills. And they had a well site there, so we were really quite lost and there's no NAVAIDS to tune in to to find out where's Barrow from here. So, you just looked for the tallest peak around, flew over to that and sat down and walked right up to the benchmark, read the name on the benchmark and I distinctly remember it was Thunder, and sure enough, we looked on our maps and we were one map over from where we thought we were. But, there in the Northwest corner of that map was benchmark Thunder, so we knew exactly where we were. Then we flew out from there. So, after that, I was a firm believer in finding yourself by benchmarks if you get lost in an helicopter. Just stop and look around for a benchmark.

And typically, along the coast, everywhere, you would spot the old batteries that they used back in the first advent of helicopters for surveying in the mid'50s, early '50s in Alaska. They left these big lead cell batteries there to run the lights, typically because the light was running when they went off to the next benchmark. And so, they just left it back at this old one. So you'd look for those batteries and then you'd find, within a few feet, where the benchmark was and you could relocate yourself and of course, in many cases for site reconnaisance work, we were using benchmarks. And it works fine. It's the same way. We didn't carry batteries and lights with us, but we used mirrors on benchmarks and we could see a mirror flash of a little small 4 x 6 mirror for 6 or 8 miles if the sun was really out bright. And that worked slick for survey work. You could spot a guy way out on a benchmark some place out on the coast. And we would look for things like that and kind of observe the flora and fauna and watch out for bears and keep track of weather for flying purposes. ‘Do we go this morning or shall we wait until 9 o’clock?’ and if you operate out of Longley, which is about half way between Barrow and Prudhoe Bay, there was an operational camp for the oil exploration program, the National Petroleum Reserve, you knew that by 5 o’clock, the fog would come in and you would have one heck of a time getting into Longley in time for supper. If you came earlier by maybe even half an hour, you could make it. But, if you didn’t and you typically were coming in after a long day in the field, you would try to orient yourself on old trails that led to Longley and then come in on Longley at like 100 feet and go in about 100 feet per minute. I mean it was very slow to inch through the fog and then all of a sudden, the radar and the hangars and the light would show up in front of you – wham!

(250)

But, it was very dangerous to fly there in the morning and in the early evening. Later in the evening, it would just kind of get too cold and it would dissipate again. But, Barrow was the same at times. You’d get that fog in the early morning and then you’d wait before you’d start off. Most of our helicopter operations were with bare skids. Sometimes we did have floats, but the helicopter pilots were under orders not to fly out over water unless they did have floats on. So, they would skirt ponds or big lakes. We would navigate to avoid going out over the water because we were so low, that had we had trouble, there was no way we could reach the shore.

BS: *Whose helicopters were these?*

FC: We had almost a different helicopter every summer.

BS: *Different contractor.*

FC: Different contractor. We were under contract to the Oil Exploration Program. And for a number of years, we had set up a system whereby we would move into Northern Alaska, in the end of June, so we would have the helicopters over the 4th of July weekend when all the rest of the people had vacated Alaska for the holidays. That was our week or ten days that we could get them at no cost and we would operate with the helicopters – go everywhere hell bent for leather to get all our work done in that time frame. So, I spent a lot of 4th of July holidays in Alaska.

Now, I mentioned earlier that I did have an interest in flying and I still enjoy flying and flew in everything from Beavers to Twin Otters to two other fixed wings as well as the helicopters of different sizes and types. But, I only had one real accident. We lost power coming through the Brooks Range and we crashed next to the highway.

BS: *How'd you crash. Did you put it down?*

FC: Yeah.

BS: *Auto-rotated?*

FC: We were auto-rotating down to get there and there had been a snow storm that we had gone through just prior to that and then all of a sudden visibility changed and we could see where we were and how to get back toward the haul road. And the problem was the wind was completely 180 degrees from what we had been experiencing in the Brooks Range, so we came in with a tail wind and we were going downhill on the road. And so he crashed so hard that the rotor blades slammed and bent down and cut off the tail of the helicopter. And we were leaking fuel, but it didn't catch on fire and nobody got hurt.

BS: *That's right in the Brooks Range, huh?*

FC: Yeah.

BS: *What kind of helicopter? Do you remember?*

(300)

FC: No, 205 or 206. But, it kind of changed our day, I'll tell you.

BS: *Did you get out and set up survival camp?*

FC: No, we weren't that far from the road and a trailer truck came along and said, "I saw you," because we had been on his back up on the top of the hill. You couldn't see as we came through the Brooks Range because of the snow storm. So, what we did was to hover right over the top of the trailer truck and let him show us the way right through the pass and then once we got over the pass, we could see again and we broke loose from him and flew down into the pass and that's when the engine quit.

BS: *No one hurt?*

FC: No. Nobody got hurt.

BS: *Good pilot, sounds like.*

FC: He had been a helicopter pilot in Viet Nam and had been a test pilot when they repaired helicopters over there. He took them up and put them through the paces before they went back into normal service again. And he was qualified not only as a pilot but as a mechanic as well. And earlier, he had done some major work on our helicopter because it was leaking hydraulic fluid when we had been down at Wainwright. When we got up to Barrow, he worked all night to repair the thing and fix it up, so he was very adept at not only flying, but we'd been flying together for about two weeks at that point.

BS: *Remember his name?*

FC: No, I don't. I have all the reports on it, however, because there was a law suit over the company that had rebuilt the engine. So, they wanted to know all the details of the last two weeks when we were flying around.

BS: *Mechanical failure? I mean mechanical error in repairing?*

FC: That's what they said it was.

BS: *Most things like that are human error. Pilot error.*

FC: It was like a bearing that was shaving off like steel wool parts that were clogging the fuel filter. And that's what they found and that was why they were after the company that had rebuilt the engine. I don't know how it was resolved. I didn't have to testify. I had to only go to West Lebanon and have a court reporter record all the details of it.

BS: *In all of these accidents, they blame the pilot, blame the mechanic, blame the manufacturer.*

FC: We were looking at some sites along the Canadian border and we had been up on a ridge and there was no way we could get the helicopter off the ridge because the wind would turn the rotor. We couldn't get it started without the rotor cutting the tail off. And so that's the same pilot. He said, "Now stand up front and hold the blade down until I can get enough power to take it out of your hand and then you get out of the way." And sure enough, he got that rotor blade to start rotating with the right tilt on it so he could keep it off the tail and then I snuck under the blade and got back in the helicopter and away we went. But, he knew how to do it.

(350)

BS: *Sounds like a good guy. Good pilot.*

FC: I've always enjoyed people and working with pilots, you spend two or three weeks with a pilot and you get pretty familiar with them after a while.

BS: *Sounds like your two big major projects throughout your career were one, the pipeline and the engineering to support it and the other was the Northern Warning System - the foundations for the whole thing. I do have a question. How'd you get power to these remote sites? Generator going by itself? Not you, but when you leave them to be automated, what powers the radar?*

FC: Some of the new radars were to be nuclear fuel.

BS: *When we went to war or all the time?*

FC: All the time.

BS: *Did they use nuclear fuel or nuclear generators?*

FC: I don't know what they finally elected? Because some of the stations were not to be. They were fuel cells as opposed to nuclear fuel.

BS: *Fuel cell being . . . ?*

FC: Fuel that's converted directly without a big generator working to do it. The problem there is that they couldn't run something without somebody being there to tweek it, check it or anything else.

BS: *That's why they had to upgrade some of the DEW-line sites.*

FC: Well, they had 6 or 8 or 10 people there - most of those sites. They had downgraded the number of people, but still the equipment had to be maintained. You had to bring in water and even because you have people, you've got another logistics problem. You've got to bring in fuel and water, and you've got to haul people in and out on a rotating basis.

BS: *And emergency basis.*

FC: And emergency basis. And then because you're there, people also come to you for aid. Time and time again, when we were on the Labrador coast, the minute we would land, a native would come out of nowhere and say, "We have to get to Maine, or Cartwright or something. Can you fly my mother there?"

BS: *Pregnant.*

FC: Or whatever the problem was. It was always something going on.

BS: *So, this sounds like pretty big projects. What's the status of the new sites now. Is there any DEW-line anymore? I know there's BMEWS.*

FC: There are still operating DEW-line stations. I think they're all under the umbrella of North Warning now, as opposed to DEW-line. That office is dissolved. Some of the North Warning sites have been constructed. I think, for the most part, the full deployment, and I don't want to get into classified stuff here, but the full deployment will probably never be built.

(400)

It will rely upon satellites for detecting things as opposed to ground based stations. But, certainly the threat from over the Pole has changed. There's a lot of that same technology that gets transferred around the globe. I worked on missile silos in North Dakota, in Florida, and outside of San Francisco bay - different places around the country, and it's all because we have the interface with one of the prototypes and they want to know – it's an operational requirement – if they want to button up for a real problem, they have to dump all the heat into the ground. So, you need to know what the ground temperature is, it's conductivity and how much of that heat can be dumped for how long. So, again, we would go to the strangest places to measure ground temperatures. Now, you'd say why doesn't other agencies have the ability to do it? They could get this ability and we'd be glad to show them how to do it, but it's easier to just call us up on the phone and say, can you make up an assembly, so many hundred feet long and put it into this drill hole because we have a drill crew there drilling a hole right now and tell us what the ground temperature is at that location and different depths. And then we would do lab testing on the conductivity, the specific heat of the soil or bedrock at the site, conductivity testing equipment.

Again, that's cold room related. So, we would provide a service to these other agencies all the time and it also meant you flew to Huntsville and attended the meeting and resolved how it was going to be built and where and how. We put in a similated missile silo at CRELL here years ago to find out what temperatures and humidity conditions would be inside a silo in a cold area and how the cover could be quickly released for the missile to fire up through the cover, if you had a snow melting system on there.

(450)

The problem was if under these foam domes, the missile couldn't just go right through it if it was covered with snow and ice. And so they had different methods of constantly removing the snow and ice off of it. And this ranged from manually doing it to different electrical heat sources to keep it off. And we had TV cameras inside the silo to look at condensation on the inside of the walls of the silos. Just little projects like the same things that CRELL is now doing all the time for space shuttles and everything else with cryogenic fuels and the like. It's the same type of providing assistance or knowing how to come up with the numbers that somebody needs.

BS: *So, you learned all these techniques up in the Arctic and then they were applied to lower latitudes.*

FC: Yeah. In the same way I mentioned earlier about being in the Marine Corps Engineers and the Marine Corps engineers came to us to employ these landing mat runways – these quick expeditionary airfields. And so we went out and also got involved in expedient helicopter pads for the Harriers where they land vertically and take off. And we came up with a system of anchoring them to the ground and went out to Camp McCoy, Wisconsin, verified that the way we were anchoring was adequate and it was within their limits for the forces on the mat and they landed Harriers on, and then we took them over to Northern Norway and we operated over there with US and Norwegian forces in the winter exercises.

BS: *In the Arctic.*

FC: Very Northern. We would take that to the North with the forces up there. Confirm that everything that we had developed would indeed work and if there were any problems, we'd solve it right then and there in the field. And then the Navy developed what they called a fleet hospital. It was all the new tentage that could be packed in ISO containers and shipped around the world with the exception of medicine which had a certain shelf life to it.

(500)

The tentage and beds and all the rest of the fixed equipment could be boxed and then shipped by container ships anywhere. They shipped us from California components of one of these big hospitals to our backyard at CRELL. So, we deployed the mock-up of the hospital and tested it under winter conditions. We told them what the problems were and what the higher maintenance was, what the water problems were, snow problems were on it. What equipment didn't work. The instructions were wrong or they were vague or something else. All the shortcomings of it.

BS: *Tell me what facilities you had at CRELL.*

FC: Well, you're going to get a tour this afternoon, from what I understand, so you will see things – of course it's changed. Every year we've added something over there – new frost effects lab, and ice engineering has expanded. Like when I first came here, there wasn't a big warehouse down back. It was a big kind of equipment parking lot, gravel, and we could do anything we wanted in there. Try this out or different little things, like put in the missile silo in the dead of winter. That's just because it worked out that way. So, we had a big barbeque with charcoal on the gravel pad and let it burn overnight and the next morning it was steaming and we had frost and the contractor just went in and dug a big hole for us and he was amazed that the ground wasn't frozen. He said, "I don't think I can touch it with my backhoe, because there's too much frost in the ground." There was no frost in the ground when he got there with his backhoe. It cost a couple hundred dollars for charcoal, but it sure worked. So, these are little tricks of the trade that you pick up along the way.

(550)

It's like we had a test in Alaska that we went to put in pilings and get some frozen back for a test in the latter part of the summer or early fall. Well, that's the time of the year when the ground temperatures are at their warmest and so, we just went downtown and bought some blocks of dry ice and popped them down the pipe piles and chilled that thing and in 24 hours, we were loading it up because it was frozen solid. So, little practical things that you can do in the field as opposed to saying, I can't do it at this time of the year. You figure out a way to make it work. And it's always been a challenge like that. Typically, after you've been flying around to different places in Alaska – I've been on the Alaska railroad from one end to the other with the railroad people looking at their soil and rock and their operating problems. You just see so much of Alaska and you meet so many people and typically they share experiences and the like up there, it's been fascinating, I found. I couldn't have asked for a better job, better people to work for or with.

BS: *At CRELL.*

FC: At CRELL.

BS: *When did you retire?*

FC: Actually, I retired in 1990, but then I continued to work for four or five years after that.

BS: *You mean as a consultant?*

FC: Yeah. Then I worked four or five years and then physically completely retired.

(End of Tape 1 – Side B)

(Begin Tape 2 – Side A)

(000)

BS: *This is the second tape of the Fred Crory interview series. I'd like to just ask* *you some basic questions. I've got a leading question – I went to a seminar at Point Barrow that the natives threw for the 50th anniversary and they invited a lot of researchers back there, all of whom paraded up, one after another and said, "I'm so glad I had the natives here. They did two things – they gave me scientific insight and they saved my life." How about you on the scientific engineering insight from these guys? My experience was that they knew a lot and they came from generations of experience.*

FC: I didn't have a lot of interface with Barrow natives as workers with me. Now, there were a number of other people at CRELL that operated for many years out of the Arctic Research Lab with Weasels and they used all kinds of support people there, but my interface was with natives that were working in the petroleum reserves or that were shuttled back and forth working on the pipeline, but they were very small in number and diffused into the other work party. Most of the drill sites were people from all walks of life from Texas and Oklahoma and every place else as drillers and their crew that came with them. So, there weren't a lot of natives. Now, they did have native laborers that ran equipment and stuff like that in the airport and everything, or airstrips. I didn't operate on the ice or in camps with the natives. I got stuck at Point Lay, off-shore, where the old village used to be where the school house is. In the fall of 1956, with the guy from the weather bureau that was there with me. We were marooned in the school house. The pilot had crashed and we had no radio, so we didn't know where he had gone to, but we were there for about 10 days with no word and he didn't come back. And, of course, he had to be taken to the hospital into Fairbanks and get another aircraft and fly it all the way back up there. But, sitting there, I can still recall, the guy from the weather bureau listening to his little portable radio for *The Tundra Times* where they talk to the natives in the outlying regions and he was listening to the radio and as far as I know, he was the first guy to figure out that the Russians had put a Sputnik up. He said that's an illegal broadcast. They broadcast every 90 minutes. There must be something circling the globe. And sure enough, that's exactly what it was and by the time we got to Barrow, Barrow got the credit for finding Sputnik and discovering that the Russians had done it.

BS: *There are at least 200 people who have gotten the credit for it.*

FC: Well, they were the ones that were crashing the big news when we got there.

BS: *The Russians, at the meetings in Paris before IGY, said they were going to put up the first orbiting satellite and they said it at just about every meeting, and they did it on schedule. James Van Allen who, of course, put up the first US scientific orbiting package – it was his – was on an icebreaker just North of the Antarctic circle and the radioman on the Glacier where he was – he was firing rockets from the Glacier – discovered it. And Van Allen said, "Oh." He'd been talking to them, he knew the Russians said they were going to do it."That's it! They did it." It was* *part of the IGY. It was a surprise to most nations. I don't think anybody believed it. So, you were at Point Lay, huh?*

(50)

FC: I thought I'd give you this copy of construction guidelines. It was one of the last big projects that I did at CRELL. Primarily because it was a chance to transfer all the technology in the oil exploration programs that had been going on and to reflect on tundra impacts because that's a sensitive issue these days and trying to allow any exploration over in the Arctic National Wildlife Refuge, and all that. I think you might find some pictures of different places of interest in there. The ability to operate in Northern Alaska. That was an off-shoot by the minerals management based on my previous work for the USGS in the Pet-4 work. So, it gave me a chance to 1) utilize all the photographs that I had of all the trails and drill sites and construction in the winter time that had been going on, and the latest equipment as opposed to just bulldozers and sleds that used to still hang around Barrow and that you could probably still find up there. But, it was a fun report to put together.

Every year or so there's renewed interest in more exploration work and how to do it. And the different agencies – the Bureau of Land Management or the State – how to move out to another oil field or area to explore up there. How to do it and more from the federal agencies who try to figure out how to control them, put out stipulations that you can't do this, you can't do that to protect the tundra or whatever. It was fun to put together.

BS: *Thank you for this. We'll make it part of your file. It's called Construction Guide for Oil and Gas Exploration in Northern Alaska by Fred Crory. I guess you're the editor, writer?*

FC: I was the sole author.

BS: *Author of a very interesting looking manual on Northern Arctic landscapes and the effects of good and bad management, I guess you could say.*

FC: Well, it's based on what had happened before and why it happened and then how to avoid it in the future. I've always had an interest in archaeology and historical things and the fauna and flowers and I can tell you there's places up there we call "God's Little Acre," where I've seen more wildflowers in one little square mile up there than anywhere – it's just fantastic! But, I'm always looking for things like that.

But, it's amazing . . . at the break here a few minutes ago, I was reflecting that I've missed a lot of things that I didn't mention. In 1966, I was given an award to go to graduate school and it was the first program that they called long-term training and I went to Harvard and received a Master's degree in 1967.

BS: *In engineering?*

FC: Yes.

BS: *Civil engineering?*

FC: They call it MS and it's the College of Applied Sciences - it's in engineering, but they don't have the big departments down there in engineering. The main professor that was at Harvard was Arthur Casagrande. He had been a consultant to our office for years, so when given the opportunity, I said I'd like to go to Harvard and study under him, which I did do.

BS: *He was your thesis adviser?*

FC: He was the prime mover for the whole thing. He had been a consultant to ACFEL before even CRELL was formed and he and Ken Woods from Purdue were our major – well, two out of three of the major consultants that we had to our entire research program. And every year we gave a two or three day seminar on them and they met with people from Washington who came up to review exactly what we were doing, what we were getting for results and to steer our research for the next year as to whether we needed to do more of this and less of that, or try something different. And they kept track of exactly what we were doing and gave us, every year, good advice on what we should be doing and where, and our resources. How much money we needed. More or less, or adequate. It was to give feedback primarily to the officials from Washington that were overseeing our research program because it was heavily funded by the military construction program under the Corps of Engineers.

BS: *So, the Corps of Engineers – you've belonged to them ever since ACFEL was formed.*

FC: Basically, you could say that.There was a brief period where there was a reorganization and we were, as a whole unit, transferred to the Army Material Command for a couple of years. It was a dream of somebody in Washington, that we needed to be into terrestrial sciences, all the sciences, in the desert and you name it, everywhere in the world, as opposed to polar regions. And that only lasted a couple of years.

BS: *Was this desert and alpine research guys from World War II?*

FC: Everything, to consolidate other testing that was being done in the labs. It never really flew. It was fine. We went back . . . as I understand it, the Corps of Engineers at the time said, "Wait a minute. Are we going to do the polar regions engineering and research or aren't we, because if we're not going to do it, we're going to pull CRELL back into the Corps again." And that's exactly what happened, because they were trying to pull us in another direction and the Corps said, "No, we'll dissolve this agreement and transfer them back into the Corps of Engineers again" and we stayed with the Corps ever since. It was a brief period I think in the late '60s, or early '70s, when we were pulled into the Army Materiel Command, but only for a couple of years.

BS: *You're still somewhat attached to CRELL.*

FC: Oh, it's right around the corner. I go to all the retirement parties. Well, not all of them.

BS: *You know all of the people. It's somewhat of a family-type thing?*

FC: I know all the people. We've lived here for 40 years now and a lot of the people that worked at CRELL originally and retired from there all stayed here. They didn't go back to Illinois or the Boston area. They pretty much stayed right here. They'd put down their roots.

BS: *Let me ask you the retrospect question. Would you do it all again?*

FC: At my age, no. But, if I was a younger man.

BS: *As a young man.*

FC: Oh yeah. I'd do it in a heartbeat. It was very interesting and even my wife would tell you the same thing, I think. It was a great adventure. She went to Alaska with me and she went to Siberia with me on the first trip.

(500)

BS: *Where did she live there?She lived in Alaska with you?*

FC: Fairbanks. All my kids have a great affinity for it. My second boy was born in Alaska when it was still a territory, so he takes great pride in telling everybody that he wasn't born in the State of Alaska, it was still a territory. There are a lot of memories, photogoraphs that we have of the places and the same way here. I'm an avid photographer. I like to take pictures.

BS: *Did you take a lot of these?*

FC: Yeah. Almost exclusively. But, I like taking pictures and it kind of drives some people up the wall. I'm more like a tourist when I arrive at a construction site. I like to take pictures of what's going on.

BS: *People?*

FC: People, equipment, flowers, you name it.

BS: *Have you got them all catalogued?*

FC: I did. Over at CRELL, I had a tremendous collection of photographs. I still have a number of them here.

BS: *Are they catalogued over there?*

FC: I think some are. A lot of them aren't.

BS: *How is their archives? Is it a real archive or just a useful library?*

FC: Well, that's a sensitive subject with me. I wanted to archive and save all the documents from the TransAlaska pipeline and all that stuff and I must admit that it was taking up a helluva lot of space in the warehouse in cardboard boxes. And it eventually just got chucked out. It's gone, as far as I know, it's gone. So, a lot of those things have disappeared, we'll say, because I wasn't there to protect them. But some old classic World War II type operations reports and stuff like that, I had another avenue that I could have them stored in a special place where I could keep track of them for me. It was not in a warehouse. And as far as I know, those things are still safeguarded over there. And hopefully, they will remain so. Many of them are reports like we were talking earlier about Marble Point in Antarctica. That was a project that I got involved in because of the airfields in Northern Alaska.

BS: *You never went down there, though.*

FC: No, because the project was never funded, but they wanted us to revisit what had been done and to gear up to see if, in fact, it should be brought forward and how to do it. And so we went through the exercise of looking at what other people had done. We had Wayne Tobiason, for instance, stop by on his way through there to go out and take a look at it and he brought me back some rock samples and soil samples and pictures and a video of the whole thing and we were waiting on the National Science Foundation to give us the green light that they would fund it, which they never did, so it went back in the box again.

BS: *So, you got interested and were prepared to go to Marble Point, Antarctica, to do a feasability study.*

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FC: Yeah, it would be a step up from what they had done before to actually figure out how to build it and not necessarily where to build it. That was limited, but the runway and orientation. I still get the automatic weather dater from Marble Point. It’s put out by Wisconsin, I think it is – the University of Wisconsin. They maintain these little remote wind, precipitation and temperature records. But, it was basically to gear up to see how to build it, and what would be the operational problems and getting ashore with the equipment from the standpoint of off-shore ice and icebreakers or whether we could fly certain things in with C-130s or other means of shuttling from ship to shore.

BS: *What's the fellow's name here that you said just dropped in and brought data back for you?*

FC: From Marble Point?

BS: *The fellow that's right here. You said I should interview him.*

FC: Wayne Tobiason. He was the one that went to Marble Point when he was doing some other work at the Pole. He flew over to Marble Point with a video camera and got that.

BS: *He's an old CRELL guy?*

FC: He started in ACFEL with me.

BS: *He's retired now?*

FC: Yeah, he retired a couple of years ago. He's a little younger than me. Never went into the service and he was a Northeastern student, so he came up as a co-op student to Alaska back in '56-'57 time frame, and I guess he would have graduated from Northeastern like '58-'59, somewhere like that. And then he got bit by the North bug and he stayed with ACFEL.

BS: *Just like you, huh?*

FC: It's a very small fraternity of people. And most people don't even know what you do because you don't talk too much about some of them. I can remember when my second boy was in the first or second grade, one of his teachers asked him, "What does your Daddy do?" and he said, "He's a photographer." As far as he knew, I always brought home pictures to show the kids of different places. So, from his focus, that's what I did – I took photographs, which was all right, too.

But, we're kind of isolated up here from the engineering companies and the Boston Society of Civil Engineers and all these other things that go on. It's changed over the years. We've gotten involved in the American Society of Civil Engineers, but we're still 100 miles away from Boston. We enjoy it that way and we enjoy the atmosphere here. In fact, we're going over to the Montshire Museum which is a new museum that was built here in the last 10-15 years over in Norwich. It used to be right here. But, they're having a reception for Stephenson's daughter here and there are a couple of speakers.

BS: *I know Mrs. Nett. She lives in Washington. That was his former wife. She was a secretary. Well, we're getting astray here. I think we're done. This has been an outstanding interview and it's been a pleasure.*

FC: I don't know if you want to get into after I retired, there were . . .

BS: *Oh, you did some other work. OK.*

FC: You can't just walk away and there are people that will call you up that will ask you for advice or to participate in a research venture and the like. And I think the one notable job that I basically turned down after reviewing what they wanted to do, I told them it wouldn't work. The whole million dollar program was dead in the water before it ever got started because I just said from the beginning that it was no good.

What they wanted to do was to make a quicker, cheaper way of putting in a piling by filling it with water and not soil. Just fill it with water and let it freeze as ice. And I said, "Every bit of information that I've ever had said that ice does not have the bond or strength to a pile that frozen soil does, and accordingly, I don't see any value in running a research program at Prudhoe Bay to prove that ice is weak," so I said, "You can do it if you want, but I'm not going to go up there and run a pile test program to prove that I'm right. You can go prove I'm wrong if you want. But, I don't want to be a part of it." So, they just killed the whole program and fortunately, they never used it because now, with global warming, it's becoming a very interesting phenomena with the ground warming up, thawing out in some places and the like. And it can be disastrous for a pile to fail under holding up a pipeline.

So, for the most part, I like to do projects around town for my family, myself, the neighbors and the like of that. Fix this, paint that, build this, offer advice when needed or when one asks. And I don’t spend as much time at CRELL as I used to when I first retired and part of that is because it’s a no-smoking zone now. The cafeteria is gone now, so there is no real avenue to communicate unless you disturb people when they’re in their offices and the like, so unless it’s a retirement party or some other function going on over there, I pretty much let them do their thing, which is exactly the liberty that I enjoyed all my years over there.

BS: *And that’s where you stand now.*

FC: That’s where I stand now and hopefully that’s where I’ll stay because I am now enjoying retirement and I do a lot of reading that I never seemed to have a chance to do before. I am writing a paper on the boundaries of Hanover, so that’s kind of an historical thing. And I like looking at problems, like we lost a Leer jet here four or five years ago, so I started to research where the heck it went to and got all the controllers to the aircraft tape recordings because the transcript typically avoids any mention of any other traffic that’s in the area. So, I found that that was a missing link and I had to have the actual transcripts that they had. And then I started getting involved in analyzing where they were and where they might have crashed and sure enough one of the guys up here that’s an agent for a tree farm up Dorchester way found the aircraft and solved the problem.

BS: *Good, sounds like some project.*

FC: It was.

(End of Interview)