Nevada Test Site Oral History Project
University of Nevada, Las Vegas

Interview with Raymond Harbert

February 18, 2005
Las Vegas, Nevada

Interview Conducted By
Mary Palevsky

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Mary Palevsky: *All right, so let's begin with some of your background.*

Raymond Harbert: My name is Raymond Chester Harbert. I was born in Los Angeles [California] on September 30, 1922. I was raised in the West Los Angeles area out by UCLA [University of California, Los Angeles]. I was drawn towards an engineer early in my life. I was raised during the Depression and so things were tough to come by. And I was a Boy Scout, and part of being a Boy Scout, on Memorial Day we would show people to the graves of their loved ones in the cemetery at the cemetery there in **[00:00:56]** Sawtelle California, the veterans' cemetery. And one year when I was there, I was drawing a map on the territory I was supposed to take people to, and a veteran came and looked over my shoulder and he said, My, you're going to be an engineer. And that stuck with me. And ultimately I decided I wanted to be an engineer. My father was an electrical contractor in Los Angeles and he was considered to be one of the better ones, and he did most of the movie stars' homes there in the Los Angeles Westwood-Bel Air area. And as I grew up I worked as an electrician. He never gave me the fancy jobs. He always gave me the dirty jobs. He thought that's a better way to it.

I went to University High School in Los Angeles and I graduated from there in January of 1941. And the rumblings of war was coming along and my dad convinced me to volunteer for the draft so I could get the draft over with and then go on with my life. I was expecting one year. I ended up spending four years, seven months, thirteen days, and eight hours in the service. And I was in combat in Italy during World War II. I was at Anzio and first troops in Rome, first troops that went to the Vatican and had an audience with the pope. And I was in Task Force

Howze, which cut Italy in two right at the end of the war. And we almost caught [Benito] Mussolini at Lake Como. The partisans got him in the town of Dungo and history records what happened.

When I got back from the service, we had the GI Bill of Rights. And my father wanted me to come into the contracting business with him. And I felt I could do more and I decided to go to college. I wanted to be an engineer. And I enrolled under the GI Bill of Rights at University of Santa Clara in Santa Clara, California and went through their engineering program. I graduated from there in 1951, and in 1954 I passed my state bar as a professional engineer and then my register engineer in the State of California.

I went to work initially for my father, and father and sons don't always get along. So I went into the engineering design field and I ended up working for Holmes and Narver on Figueroa Street in Los Angeles. When I first went there, you had to get a Q-clearance to work on any of the AEC [Atomic Energy Commission] programs, and so the first work I did was design the lighting for the airstrip on Kwajalein because that was not classified. And as soon as my **[00:05:00]** clearance came through, I was allowed to move upstairs and I was responsible for the design of the electrical systems for all of the test facilities at Bikini and Enewetak during the [Operation] Castle series in the Pacific which was to take place in 1954.

And after we had completed the design, my boss Henry Dietz came to me and said they needed an electrical engineer out in the Pacific for plan interpretation and problem-solving, and would [I] consider going out there. I discussed this with my family and I took the assignment and proceeded to the Pacific.

When you say "your family," were you married at this point?

Yes.

And did you have children also?

Yes. And we made an arrangement. When you were on the islands, you got five dollars a week allowance out there and the rest of it went home to take care of your family. And you worked under a bonus program, and that was important. It was also important to assume more responsibility.

The flight in, we flew commercially from Los Angeles to Hawaii on Pan American. And from Hawaii, we went to Hickam Air Force Base. And at Hickam Air Force Base, we got on a military aircraft that flew us into Kwajalein Atoll in the South Pacific in the [Republic of the] Marshall Islands. The flight took about thirteen hours down there. And we landed in a rainstorm. There was the wife of a sailor who was stationed on Kwajalein on board. She had her two children with her. She was going down there to be with her husband. And it was her first flight, first time she had ever flown in an aircraft. And she and the kids were scared to death, and when we got in the heavy rain squalls, the plane bounced around and she was taking bucket to bucket to the kids, and I was trying to help her. And we landed there that morning after the thirteen-hour flight.

All of the flights into the test facility, into the [Pacific] test site, had to be flown by pilots who had Q-clearances. So we changed planes there. We stayed at the terminal, I guess, a couple hours and then we boarded the plane. We flew from there into Enewetak and were processed on board there at the Enewetak Island of the Enewetak Atoll. We then took a LCM [landing craft mechanical] to island code-name Elmer, which was a base camp for all of the civilian operations and the test personnel.

I was there for about three weeks. It was interesting. I did have an opportunity to visit a neighbor island called Japtan and on Japtan there was wreckage of the *S.S. Nickajack Trail*. It

was a cargo ship, Liberty ship. It was built in World War II and it had tried to enter the lagoon and apparently there was a dispute between the captain [and] the sea master of the island and he told them to turn around, they couldn't enter, and then trying to make the maneuver, he grounded out on the island of Japtan, and the wreckage has gradually disintegrated. One of the interesting things while I was **[00:10:00]** on the island, it was completely forested with palm trees and tropical vegetation, was there was one of these dragon lizards on there. We saw it. It scared the hell out of me. But other than that—

A Komodo Dragon?

Komodo Dragon, yes. Oh yes, it was a big one. So long. But that was one of the experiences there.

After I'd been there for about three weeks, I was informed that the resident engineer at Bikini would be going back on leave because his wife was sick, and they asked me if I would go up to Bikini and serve as resident engineer at Bikini until his return. I went up there on the first of October of 1953 and assumed his responsibility. As it turned out, he never came back, and so I ended up being promoted to resident engineer and served as that through the test series until I had to leave the Pacific because of the radiation.

OK, I have a question here. The electrical engineering that you're doing had to do with the buildings at Holmes and Narver?

There were three electrical engineers in Los Angeles. One was in charge of the design of the test facilities, the internal and external. Another was responsible for the power generation and the distribution of power around the islands. The third was responsible for the communication cables. So my expertise was all of the—and the design activity I was involved in was all of the

electrical installations in every test facility, whether it be a camera bunker or an instrument bunker or a ground zero, that was my responsibility.

So I'm trying to get clear that it wasn't the electrical engineering on the devices themselves. It was the facilities.

No, it was facilities, strictly facility design. In my entire career, I never got directly involved in devices. Only going up, providing power to the devices, and power to the instrumentation and the camera bunkers and all of that. And that was the extension of my professional training, and that's what I figured I was trained for. I found out in later years that I was a better project manager than I was an electrical engineer, and that's where my career ultimately headed. But this was the first step towards project engineering. Total project responsibility.

And so when I went up to Bikini—at Enewetak we had metal barracks on Elmer. But on Bikini, we lived in eight-man what are called squad tents. So when I got there—and each island group, on Bikini the main camp was a complex called Tare. There was a camp and main command and control center on Nan which was Eneu. There was nothing else on the island itself. Then there was the Fox-George Complex in which there was a camp on George. And then there was a camp on Charlie, along with Ground Zero for the Bravo event and photo and instruments.

Now these are all code names for islands?

These are code names. There are twenty-eight islands, as I recall, twenty-eight islands, and they were all given code names, although they had native names from the Micronesians, they named them all. But we had set up—and it was alphabetically, so there was Able, Baker, Charlie, Dog, **[00:15:00]** Easy, Fox, George, and they used the phonetic alphabet, basically, and it was a phonetic alphabet that was used at that time.

And so the main camp was on Tare. And each of these camps were self-sufficient. We had entertainment on them, they had movies, we had a mess hall, we had a recreation area where the—get your beer and drinks and everything. It was referred to as the Snake Pit. We were allowed to buy a bottle of alcohol, very reasonable, we didn't pay tax on it, Scotch or bourbon or whatever, and so we had those in our tents. The tent I was in, because I was considered part of management there, was an eight-man tent but the tent was divided into two parts. There were four beds in the back half of it. In the front was a recreation area where we had a table and a refrigerator and some reading material and that sort of thing. In the mess hall, because we did have a caste system. I was fortunate, I was in the upper class. There were eight managers there, the resident manager, myself, the operations, and marine operations electrical, mechanical, structural, those sort of things, there were eight of us. We had a separate table and we were served by waiters, and we had the best food in the Pacific. Holmes and Narver was noted for it, regardless of what your rank was, but we got, as part of the caste system; we had our own separate area, separate table, that was reserved for us. And it made life reasonably pleasant.

Were all eight of you—this is all Holmes and Narver employees?

All Holmes and Narver employees, yes. And there was a separate table for the AEC and the scientists. And their lead people got the same type of treatment that we got.

Do you think that the caste system, as you call it, is related to a military—a sense from the military? I'm curious about that.

I think part of it did because in World War II, I was an enlisted man and I couldn't deal with the nurses who were lieutenants, although I did date one. And part of it, if there were arguments between the supervisor and the workers, they wanted to keep that separate. They wanted to keep them minimized. So we kept somewhat to ourselves, or we were forced to be kept by ourselves.

The Snake Pit, the guys'd get drunk down there because when they were through work, they had nothing else to do. You're on an island that the highest spot on the island's eight foot above the ocean. And so they needed some way to let off steam. And we did not go down to the Snake Pit. We drank in our tents and things like that.

There was a military detachment there on Bikini and it provided the aircraft for us. There was both observation aircraft and helicopters, H-19s. Plus we had our own if you want to call it a fleet, our own water system made up primarily of LCMs, landing craft mechanical, and that was the way we got around the islands.

In some cases, we had to mix concrete on one island, put it in a concrete mixer, take it over to another island, and dump it that way because we stockpiled in one area. We had to pour some **[00:20:00]** unique concrete out there for radiation shielding which was called limonite. Normal concrete runs 150 pounds per cubic foot. The limonite ore that we were pouring was dense, 310 pounds. So you had to treat it completely different. You couldn't treat it the same way. In our mixers, we could only mix a quarter of a yard instead of the full yard in mixers because of the excess weight. The equipment couldn't handle it. We also had to cure it differently because it had a high heat of hydration as it cured, and so we put a sprinkler system up over it and put gunny sacks over it after we'd poured that type concrete, to let it cure over an extended period of time. We did that on Bikini. On Enewetak they did not do that and what happened was the limonite began to spall. You'd hear an explosion and a chunk of concrete would pop off the wall. So we devised our own. When you're out in the field, one of the things you learn as an engineer is to make the best of what you've got, but it make it work and make it right. And so that's basically what we did.

We had a movie theater there. Of course, we looked for mail call. We had a small first-aid station there. There was a doctor's station there. We could get dental help if we needed it. We were pretty self-sufficient.

It was really a relaxed life but we were faced with a schedule. The first shot was scheduled for March of 1954, so all of the facilities had to be constructed, completed, tested, and ready for the detonation and ready for the scientists when they came in, because the scientists were not there early on. It was purely construction and support people.

As I indicated before, we commuted between islands by helicopter or by LCMs. I had some unique experience on the helicopters. We were going to an island called Love, if you can imagine, that's for "L," Love, and we started to land on the lee side of the island. When the breeze, the current wind, dropped because it was sheltered by trees, the helicopter fell into the water and the wheels on the bottom of the pontoons hooked onto the underwater cable. And the pilot got us loose from that, and then we got up about ten feet above the water and he raced to the end of the island where he could get back into the wind stream and get up. But it was rather scary.

Another time when I went into Nan, I'd just gotten out of the helicopter and was walking over to the Jeep to go to the camp, and the helicopter took off and a shear pin broke and the helicopter came crashing down. No one was hurt but thank God I was out of the way when it came down.

I had another interesting experience. I was flying between Charlie and Fox-George Complex and I was sitting next to the door. The doors were open on the helicopter. It was an H-19. And as I looked down, I saw a huge shark on the reef. And I was telling the man next to me, `Look at the huge shark down there.` And because of the noise, he couldn't hear me. Well,

[00:25:00] I tried to show him by spreading my arms apart. Unfortunately, I had a plan which was a classified plan in my left hand. And as I showed him how big the shark was, the slipstream caught the plan and it's lost. I spent hours explaining to the FBI [Federal Bureau of Investigation] how I lost a classified document. No one would believe I lost it trying to describe how big a shark was.

That's an interesting story, but let me understand this. Once you lost the classified document, you have to report it. How does the FBI come in? How does that process work?

I had to fill out a form because the classified document was a ground zero document and it has a number on it, so now it becomes missing. You have accountability for it. So I had to report it through the system to the AEC. The AEC's agent for that was an FBI agent. He came in and interviewed me for about three or four hours on how I lost the document. And at first he wouldn't believe me, and finally he decided it was true and he laughed about it.

What was it like for you to be questioned like that?

Horrible. A grilling. Because in those days, classified document, it was something that you just didn't—you start out under your Q-clearance and everything, you couldn't write anything home to anyone about what you were doing, other than it was construction, or eating, or you went fishing, or whatever you did. But security was an all-consuming attitude. Of course, we were in the middle of the Cold War and you couldn't expect anything else. But that's what happened.

One time I was up in the helicopter and the pilot, the major, we had become bosom buddies out there, and I was the only one in the cabin. And so he decided he was going to give me a thrill and he put the plane into counter-rotary, which drives the helicopter down. And then he did what he called "rocking the baby." The helicopter kept going back and forth. So they had their fun with me and that was it.

While we're talking about the air, there was another incident that occurred. One of the projects was designed to determine the fallout pattern and the particle size of the first shot. And we had built concrete blocks as anchors and tied them to a buoy and then a raft was attached to that. And it was in a checkerboard pattern across Bikini lagoon. And a large storm came up and all of a sudden, through the passage between the islands, we saw our rafts going out, along with some buoys. So this major and myself went up in a observation plane and we went over the lagoon, trying to plot the ones that we had lost so we could replace them. As a result of that, he was flying a lot of figure-eights. I got sick. Only time I've ever been airsick in my life, but I got sick. But we did record them and replace them for the experiment.

Let me ask you how that works a little bit. You've got this checkerboard of buoys. How does that help detect the radiation?

Well, what you had was a concrete anchor and it came up to a buoy, the buoy basically being a float. Then you had a rubber raft or a cork raft attached to that, and you had a collector **[00:30:00]** on that raft, so that when the device went off and you started getting fallout from the mushroom cloud, you would get a collection of different amount[s] in different areas, so you could then take and plot the pattern of the fallout across the lagoon. Does that—?

Yes. And you said rubber or what kind of raft?

I'm not sure. It was either a rubber raft or it had a cork.

Cork. I didn't understand what you said there. Cork.

Yeah, cork. It was a life raft.

All right. And so the debris would literally fall on that thing and then it would measure it.

Yeah, it would fall. It'd be essentially stationary. And they would go in and then collect it and record the amount of radiation collected on that raft.

So the wind had blown these rafts away from their concrete anchors, is that right?

Broke them loose, so they were no longer attached to the mooring.

Got it. OK. And just for the record, do you recall this major's name that was your friend?

No, I don't. He was a good buddy. We drank together and all the other things. In fact, he shaved a couple people's heads and put helicopter pads on them, but he was drunk. But you developed a camaraderie out there which is extremely unique. You're living in a very limited space. So I really couldn't—

On one of the flights, we flew over the [USS] *Saratoga*. The *Saratoga* was sunk in the Able shot or Baker shot in 1946. You could still see oil coming up from that in 1953 and '54, from the wreckage. Around the conning towers, when the tide was a little low, you could see the top of the conning towers, even though they were below the surface. And as such, this one time I was flying over there and there was three or four sharks just swimming around them.

One other interesting experience I had while I was there dealt with the Navy. We were going to use barges for the latter shots. The first shots were in cabs on various islands, one on Charlie and one on Tare, and then the rest were all barges off Fox and Dog. The Navy had to locate the coral heads within the lagoon. They provided that service to the AEC. When they came out, the two ships that came out were the [USS] *Chief* and the [USS] *Competent*, were the names of them. And the captain of the *Chief*, which the other ship referred to, they were minesweepers, referred to them as the *Incompetent*, so the *Competent* and the *Incompetent*, but that was a little joke. But I went out and spent two days with them while they were sweeping and recording the coral heads. And they did that by tying a line between the two ships and they would go along and when it would hit a coral head, it would break the line and they would record

that location. It was really a novel experience. I was the only one of the contractors that they had out there, and I ate at the captain's table and all the other good things. It was quite an experience.

And what was your reason for being there? Do you have certain duties or you were helping them—?

My duties? Just to observe the mapping of the coral heads because that was important. We had to **[00:35:00]** prepare a map which would allow a tug to bring in the barge for anchoring. We didn't want them to get hung up on these coral heads, so the whole atoll had to be swept. We had to find out where they were, particularly in the areas where we had planned mooring of the barges.

OK. Thanks. That explains it perfectly.

OK. There were a lot of different type of structures. We had camera bunkers and we had instrument bunkers and we had ground zeros cabs and we also had line-of-sight pipelines. And one experience that I had which was interesting, on the Charlie Complex there was a pipeline seventy-five-hundred feet long and I think it was twelve pipes or eight pipes, I'm not sure, and I believe their diameter was eight-inch diameter. And they were line-of-sight pipes. And a mile-and-a-half curvature of the Earth comes into play. And so when we aligned it, finished surveying an alignment, it did not show a complete circle, and there was something wrong with it. We tried to figure out what was wrong. There was a scientist by the name of Stirling Colgate from Lawrence Radiation Lab [LRL]. He's related to the Colgate millions. But he was there and he was apparently one of their top scientists. He postulated that the reason that we were getting the readings we got—because the way you measured it was put a radioactive source at one end and a recorder at the other—he said there was probably a magnetic field somewheres along that line which was distorting it. I couldn't really buy into that, so I got my head of surveying and we went over and we went through the calculations again, and what we found out was that yes, it

was set up in a sinusoidal fashion wave because we had only adjusted to the midpoint of the pipe. We'd not adjusted the entire length, made the adjustment. So we went through and recalculated the alignment, resurveyed it, the next test. But it was interesting. Sterling swore that it was a magnetic field which was screwing it up but it really wasn't. It was an engineering error.

So you had allowed for the curvature for the first half?

They took to midpoint, so they corrected for midpoint but they didn't go back and then correct between midpoint and start and here. You got to take that correction and use—the delta's all the way along. We didn't use the delta. They used the one correction. And so we got a bow and a bow.

That's interesting.

And that brings us up to the time that—oh, one other thing that was interesting as part of the early construction is the island of Bikini itself. The atoll had been used for the Able-Baker shots in 1946. And we went over to the island of Bikini and we found on that island that there was still several hundred barrels of oil. There was construction equipment. We were able to salvage all of that and use it as part of our activity. Also on Bikini was where the major inhabitants lived. It **[00:40:00]** was their primary island on the atoll. Their graves there for their people were—because you have coral below the surface, they could only dig down so far—and what they did was build mounds over them, and the mounds were supported on the outside by Coke bottles that had floated over the years there; and they used those, and they put the headstones beyond that. There was also an obelisk on the island. It was put there in memory of a Japanese pilot that had gone down during a maneuver prior to World War II, and it was close to the camp there.

I visited another island that we called [the]codename I think it was Uncle or William, I'm not sure which one, but we found on that island a downed Japanese aircraft that had crash-landed there. It was deep in the forest.

But that pretty much tells you what life was like and what it was like getting ready for the shots.

In preparation for the first shot, which was Bravo, we tried to remove as much salvageable equipment as we could from the island. We would take it down to the loading area, move it down there, and they'd bring in an LST [landing ship, tank]. We'd load it on board the LST. There was one LST that came in. I don't recall the name or the number on it. It had a new captain assigned to it in San Diego [California] before it left, went to Pearl Harbor and loaded up there, and then came out. When it came into Enewetak, the captain was at the helm and it hit a pier there and knocked off a chunk of the pier. He then came up to Bikini and beached at Tare so we could load all this heavy equipment on it. When he got ready to back off—what they do is they drop an anchor as they come in and then they pull on the anchor to pull them off. He couldn't get off because he'd come in hard and we'd loaded him. So we're getting ready for the shot and he can't get off. And this goes on. They lowered the loading ramp and they got bulldozers pushing on it. We got tugs alongside of it, trying to work it from both sides. Couldn't get it loose. About that time, the command ship was I believe the [USS] *Estes*, or the [USS] *Curtiss*, I'm not sure—The admiral in charge of doing [Joint] Task Force Seven, which was the name of the support operation, sends in the message, blinking light thing, "Captain, you will be off by 1000 hours tomorrow period. Signed, the Admiral." And so we got everything we could. We got three bulldozers, we got some LCMs alongside of it with lines on it to rock it, and they

had a tug out there hooked up to it. And it got off. But I imagine that was the end of that captain's career.

Amazing. That's an interesting story.

[00:45:00] As we got ready for the shot, the camps were evacuated. We were told that we would be able to come back in after the shot was over. Bravo shot was originally forecast to be between three to five megatons. It was an experimental thermonuclear device. So we evacuated the camp. And the people who were scheduled to come back, anyone who was surplus was sent back to Enewetak. Those of us who were involved in the recovery operation and everything were aboard the [USS] *Ainsworth*.

Can I ask you a question here before you go on with that story? Do you recall any of your anticipation? What were your thoughts about—?

Looking forward to a great adventure. Something I'd heard about. I'd heard about the Trinity shot, heard a little bit about what went on at Nevada, particular the Cannon shot out here. But it was anticipation. I'm going to be part of a great experiment. I'm part of the Cold War. I'm helping my country. I'm devoted to what I'm doing. And fortunately I was playing a key role in it. I was not just an observer. And as such, on board the *Ainsworth*, I got special treatment. I got a cabin to myself and all the other things that VIPs get. And I hate being a VIP. I don't like it but I have to admit I enjoyed it.

We went to sea and we stood forty miles off the ground zero. There was one station, Station 70, the command and control center on Nan, that was occupied by scientists, people from EGG [EG&G, Edgerton, Germeshausen, and Grier] and Lawrence Radiation Lab and a few Los Alamos scientists there, and Sandia. They were buttoned up. Station 70 was the command post. That's where all the timing equipment was, some of the recording, there was a tower out there to

record some stuff off that. They were the only ones left on the island. The rest of us were either evacuated to Enewetak or on board the *Ainsworth*, the *Estes*, or the *Curtiss*. And I was on board the *Ainsworth*.

They woke us up early in the morning because the shots there occurred just before dawn, and that was because there was minimum distortion caused by thermal waves and everything else, and aided in the photography. As I said, we were standing off about forty miles. I was on the bridge. There were a couple Livermore scientists and a Los Alamos scientist standing next to me. They were broadcasting the countdown over the loudspeaker system. We had protective eyeglasses which, prior to the shot, we were told to put in place. They then started hearing the countdown, ten, nine, eight, seven, six, five, four, three, two, one, and then the whole sky lit up. *Huge*. It was tremendous. It was awe-inspiring. We were told to keep our glasses on until they told us we could take them off, and you could see in the light from the explosion the churning of **[00:50:00]** the cloud as it rose in its mushroom shape. It just boiled. It just rolled.

When we were allowed to take off our glasses, we looked up and saw the huge cloud over the island, and I looked at the cloud and the scientists next to me were observing it and we saw oranges and violets and pinks, radiation occurring in it. Saw lightning within the cloud. His comment to me, which still rings in my ear, is, `My God, we got an over-yield.` The original test was forecast at three to five. First numbers that came out, they said it was seventeen megaton. I think the final ruling was fifteen megaton. But it was the largest nuclear explosion ever conducted by the United States.

As the cloud began to lose its mushroom shape, the sky became overcast and pretty soon the sun was blocked out. Although we saw the sun begin to rise, the sun was blocked out. It was a heavy overcast. We began to wander around the ship. We got a report that the men in Station

70 on Nan were experiencing radiation, and so they flew two helicopters in from the *USS Bairoko* (CVE 115) and the men left the bunker, got into Jeeps, went down to the helicopter pad, got on the helicopters, flew back. They were processed through RADSAFE [radiological safety], took showers and everything. Little while later, a RADSAFE monitor walked by the helicopters and his Geiger counter went wild. The wheels of the helicopter had picked up radiation. That was the first sign we were in trouble. We began to experience fallout on the *Ainsworth*. We were told to go below deck and they were going to seal it up.

What was it like when you say "experience fallout"? Did you see something or—?

No. The monitors picked it up. You couldn't see it. We went below deck and they buttoned up. There's no air conditioning; it was shut down. We ended up in our skivvies. They turned sprinklers on. They had a sprinkler system on the deck of the ship. Turned them on. And the fleet in essence ran. We were at sea I'd say about twenty-four hours before we landed at Enewetak.

Soon as we got to Enewetak, we started planning on how we were going to go back to Bikini. And so a select crew went back. We took part of the fleet back.

An aside was there was a Japanese ship called the *Fortunate Dragon* which had been fishing for tuna some forty, fifty miles off Bikini. The reports I've read indicate several of the sailors on that died. Others were marred for life.

We began the planning. I was assigned as part of the crew to go back. My assignment when we got back was to recover everything we could, all the personal gear from the islands. I **[00:55:00]** brought with me a crew of dishwashers and waiters and busboys. They were the ones that were going to help me with that task. About two days later, the fleet sailed back to Bikini lagoon. We anchored in Bikini lagoon. We'd brought with us a RADSAFE barge which we moored adjacent to the *Ainsworth*, and it was there that we would get ready to go on shore, and

when we came back from going on shore, we would shower, take off our booties. The only protective equipment we had was booties. We had no masks. The Atomic Energy Commission at that time really did not realize the problems, although we'd lived in some background radiation all the time. They said your system would just absorb it and you would mutate through it without any problem.

We began immediately with the recovery of equipment. I went into Tare and the Tare Complex, into Nan where Bunker [Station] 70 was, into George-Fox [Fox-George], Dog Complex, and recovered all that. It took about three weeks to do it. We would get up in the morning and I'd get the guys together and we would go down as a group. We'd get ready, put on our booties, get into the LCMs, and go across the lagoon and go to the island.

One of the aside stories is that on Tare, two of the foremen, one, his name was Black, I forget the other—Black was mechanical foreman and the other was the electrical foreman—had gone in and of course the food that was left there was all rotting, and we had these 575-foot reefers [refrigerators] on there. And they were jokesters and they found some rolled roasts and they found a pair of Levis and some boots. And they took and put the rolled roasts up the legs of the pants and put a boot on the end of it and laid it in the opening to one of these reefers. And then one got Crenshaw, who was the construction superintendent, and brought him over to the area and they said, `Oh, my God, we left somebody on shore.` He damn near had a heart attack. But they were practical jokers. To them it was funny as hell.

What's a reefer?

Refrigerator.

Oh, refrigerator. So you had these big refrigerators and then—

Yeah, so they just had him sticking out and they had these rolled roasts, so you had all the blood and all the stuff there and it was rotting by that time. See, we'd lost all power on the islands. And—go ahead.

The islands that you're on, are you seeing effects of the blast where you are, or are you just dealing with the fact that—?

On the *Ainsworth*, after we saw the fireball, the next thing we were alerted to was the shock wave. And they had a countdown for the shock wave in telling us when it was going to hit. You could see it coming towards you because it's a pressure wave and it was pushing the water down, **[01:00:00]** so it came across as a shadow across the water. When it got to the ship, I was wearing a baseball cap. The shock wave forty miles away was strong enough that it knocked the hat off my head and went over the fantail. You could use the word "awesome," you could use the word "scary," you could use the word "magnificent." Any of them would describe what happened. The thing in the background of your mind is what if one of these things went over the top of someone? And we know it happened in Nagasaki and Hiroshima. It is *awesome*. There is *no way* that you can adequately describe that feeling. The tests out at Nevada Test Site [NTS] are *nothing* compared to this. On Enewetak, which was I believe 180 miles away, they could see it, the sky light up. There's reports on what they saw and pictures of what they saw. It was *awesome*. It changed the *environment* for days. It was just something, you could say it was marvelous to behold or you could say it was scary to behold. Both adjectives would be true. It was an experience of a lifetime to me. I saw many subsequent shots at Nevada and also in the Pacific, but that first exposure, and to the largest shot the United States had ever fired, you know. I've played a role in history. This was one of them. I was involved in the Cuban missile crisis as

part of my career. I put Atlas missiles on ready because of the Cuban missile [crisis], but *nothing* will ever impress me more than that few moments on the *Ainsworth*.

Can we take a break now?

Yes.

OK.

[01:02:55] End Track 2, Disc 1.

[00:00:00] Begin Track 2, Disc 2.

We were talking about the recovery activities at Bikini after we returned to the atoll and we anchored and I was put in charge of the recovery of personal gear and salvageable gear from the various islands.

One thing that might be of interest is life on the *Ainsworth* while we were there. I spent about six weeks on there before I had to leave the Pacific. Again, the caste system came into play and we ate pretty damn well on board the ship. But a lot of it was idle time and we would play cards or chess or one of the other games, passing away the time, waiting for more activities to occur.

But the experience in the island, going back into the islands, it was quite extensive. What we would do is we would leave the ship via the RADSAFE barge and put on booties and put on our film badges and board an LCM and go across the lagoon. Sometimes the seas were pretty rough and you'd try to shelter yourself a little bit, and if you sheltered yourself in the wrong place, the exhaust from the engines would damn near choke you, but that was just part of going to and from work.

When we got to each island, we would look for the salvageable material. But first one of the problems that faced us was that the plan had been for everybody to return to the islands and

resume life as it was. That meant that food was prepared in the mess hall and the refrigerators had meat and everything else stored in them. And when we got there, the power was all gone. The power was knocked out. We had to reestablish the power. The refrigerators—we actually had to pick the refrigerators up, carry them to the ocean, and open up the doors and drop all that food out and hope the fish would enjoy it. We had a store on each of the islands. They had watches and cameras and a lot of other things that were of value, so we had to collect those and secure them so they were not stolen because they were of value and they were essentially government property. We handled that separately. When we would go into a tent and find someone's personal gear, we would take and put it in an aluminum locker that they had. We would identify the location, the tent that we found it in, and we would put a seal on it so no one could break into it, trying to maintain it so people could get their personal gear back. We would collect enough of this so we could bring in a landing craft and load up the landing craft, and that would then take it on down to Enewetak, where a lot of the people still were and were waiting for their gear to show up.

We started initially on Tare, where the biggest camp was, then we went to Nan, did the same thing there, went to George-Fox and did the same thing there. Charlie Camp had been completely evacuated because we knew it would not survive the detonation.

The preliminary information we had on the crater from the Bravo shot was that it was a **[00:05:00]** mile-and-a-half across and 225 feet deep. And that was measured with sonar, but that was the original survey data we made on it.

We'd come back every night, shower, take off our booties, go up and have dinner, and plan for the activities for the next day. There were no such things as Saturdays or Sundays. Every

day was a work day there. Sometimes you'd have to wait. In preparation for the next shot, which was the Romeo shot, I was assigned to the *Bairoko* (CVE 115)—

Before you move on to that, though, I have a couple of questions about the recovery. Are there any concerns about the things you're salvaging and their radioactivity?

Radioactivity? No. You've got to remember, this is 1954. When we first went out there, the education program regarding radiation was basically that your system would assimilate it and that there wasn't anything to worry about. They did have limits on the amount of radiation that you could absorb before you would have to leave. That number was 3.9 Roentgens, or 3900 milliroentgens, per quarter. Since then, that number has changed. It's been drastically reduced. But that was the standards that we worked under at that time. I never got swabbed. I never got nasal or a throat swab. Even though on the islands, the islands were dusty and we had Jeeps that we rode around the islands there while we were recovering equipment. I'm sure that some of the workers with me—and I know one of them died of cancer early on, probably more—I'm just aware of one of them.

The whole attitude towards radiation has changed. In retrospect over the entire program—and I probably shouldn't put it in this early, but I will—is a concern with nuclear weaponry and peaceful use of nuclear energy and power generation. I feel that we are in the nuclear age, that we should embrace it but control it. I think the nation made a major mistake in abandoning nuclear power generation. They should have accelerated their efforts on risk analysis and some of the other activities, evaluation redundancy within plants to make them safe. But as Dr. [Robert] Brownlee of Los Alamos Scientific Lab told me one time on Johnston Island, he said we're going to run out of oil, and when we run out of oil, what are we going to do? You can't carry big solar reflectors around with you over your head all the time. We're going to have

to look at alternate sources. My personal feeling is our nation has not done enough in this area. That's my personal opinion. I put it in at this point time.

It's fine, because that's how the brain works. You're going to jump back and forth through time. That's fine, and thank you for that.

But back to the recovery, then, you're not worried about the equipment being contaminated or those kinds of things.

No. No. And we salvaged equipment like generators and distillation units because we had to distill all of our water out there. There wasn't any natural resources, not for the large crew we had.

[00:10:00] The operation was a combination. It was called Joint Task Force Seven, and they had Joint Task Force 7.1, 2, 3, 4, 5, 6, 7. And the support activities, I think, was 7.6, which we were assigned to. There was an admiral assigned to it who was the Joint Task Force commander. And we basically, when we went into the firing mode, went into a military mode where the scientists and support activities were secondary to the military control of it, because they were military tests. And that was the hierarchy that existed.

Now the people that worked under you when you went out for the recovery, were they military? Were they Holmes and Narver?

They were Holmes and Narver cooks and bottle washers, manual laborers, because we were picking things up, moving them with cranes and onto trailers, loading up trailers so the trailers could be pulled onto LSTs. But everything that was recoverable and reusable was one item. The other was the responsibility of personal gear. Now priority was given to personal gear because there were people on Enewetak that were waiting for it to arrive. It was their everything, their

clothes, everything. So that was our first priority. The second priority was reusable equipment such as generators, distillation units, switch gear, anything that made sense.

Was there any visible damage to any of these things in that area?

Most of the stuff was salvageable. Tare was I think about roughly eighteen miles from ground zero. The tent that I lived in—I had left my gear there and I had a cot, and a lot of us wore what are called G-togs, which are a thong, rubber sandal, and I had a pair of those under my cot. When I went back to where my tent was, the only thing that was on the concrete slab there was my G-togs. The cot, my clothing locker, the tent, everything was gone.

One of the engineers from Los Angeles wanted to run an experiment. We had a plywood mess hall there on Tare, and he wanted to find out how much the wall would move in the explosion. So what he did inside the mess hall [was] he set up an arm with a marker on it so he would record how far that would move. The wall wasn't there when we got back in. But it was, you know, just a little personal experiment. Didn't work. Incidentally, our offices on Tare were wooden buildings, not prefabricated as they were down on Enewetak, but they were wood frame buildings with plywood siding.

I think we recovered about 98 percent of the personal gear, the figure I was given at the end of it. I think there were a few things lost but not too many of them. The biggest problems were on George, which was the closest. There was a camera bunker on George. There was a lot of damage over there. Tare was further away. Nan was even further away. There wasn't any real damage. There was a tidal wave, though, that came over the bunker at Nan, Station 70. I'm **[00:15:00]** trying to think of anything else in that respect. That was about it.

We started to get ready for the next shot, which was Romeo, and on the Romeo shot they asked me to go over to the *Bairoko*. One of the things that we had to do after a shot is go in and

service the generators at the test facility in preparation for the next. We'd have to fuel them and make sure that there's no damage. And so they put me in charge of the electricians and the mechanics that were going in to check those out. They assigned me a bunk on the *Bairoko*. There were about I think eight Holmes and Narver employees on board. This is a helicopter aircraft carrier. I was assigned a bunk, it was about the fourth or fifth one up alongside the smokestack, and it was pretty hot back there.

When we were getting ready for the shot, they would have the pre-shot briefing in what's called the pilots' ready room. This was where the helicopter pilots would gather and it's air conditioned and they had chalkboards there and they had a group of scientists there so they could discuss what was going on and be prepared for the operation. All of the major activity was still going on on the *Curtiss* and the *Estes.* The first night of the scheduled shot on Romeo, we had the briefing in the ready room. I went up there. I was in shorts. You got to realize we're pretty close to the equator, 11 degrees north latitude. They had nice chairs there in the ready room, great, you can lean them back a little bit and you can rest. So about ten o'clock, I guess, they called the shot off. It was postponed. They were going to try it again the next day. And it was postponed because of weather. I thought I was going to be smart. Instead of going down to that hot, stuffy bunk bed I had, I was going to sit there in that ready room where they had that nice air conditioning. I was nice and comfortable and everything. About two o'clock I woke up and I was shivering. Everybody had left and gone. The pilots had nice quarters which I didn't have, but they'd gone back to their quarters so I was the only one in there. And the air conditioning on those are set for a lot of people to be in the room. Well, I was the only one, and it really cooled it down. Talk about getting frostbite on the equator, I almost got frostbite.

That's a great story.

But I did observe the Romeo shot, which was the first event where the device was on a moored barge. The Romeo shot was interesting. Actually the device was called Morgenstern. It was the third in the series, on the end of Tare and it was supposed to be a pretty good sized nuclear device. We again were about forty miles off the coast when the shot went off and it hardly lit up the sky. My understanding is that it only yielded the primary, which was measured at about 110 Kt [kiloton]. And with that, that test was rolled up. That concept was filed away as wrong, baby, wrong.

Interesting.

And so the next shot, which was—I forget the name of it.

I can look it up. You keep talking and I'm going to tell you.

The next shot I observed also from the *Bairoko* and it was pretty and it—

It says Union.

Union, yes. It's yield was about thirteen megatons. It was on a barge.

[00:20:00] *Let's see, Union was 6.9, and then Yankee was thirteen.*

Yes. It was a barge shot. We anchored the barge off Dog, Dog-Fox, and used the photo bunkers there and the instrumentation there in support of that. It was about this time that I was notified that I had absorbed 4.85 Roentgens, which exceed the limit—3.9 Roentgens in a 13 week period—and I was told I would have to leave the islands. I couldn't even stay on Enewetak. I had to leave the Pacific test site.

What were your thoughts about that?

You know, there's nothing like the islands in the Pacific—when I went there the palms trees and the palmettos and all the other things; and the recreation part of it, we went snorkeling, fishing.

There was langouste on the reef and we would get fresh langouste once in a while. And it was great.

There was one incident which was interesting on—I guess it wasn't on Bikini, it was on Enewetak. They had seen a large black sea bass out there and they wanted to find out whether they could catch it or not. So they took a Navy buoy out there and put a sizeable rope on it and they made a hook with a barb on it and put a ten-pound roast on it and put it out about three-quarters of a mile off the island. And a couple days later, they saw it bobbing. So they took an LCM out there and hooked it up to the buoy and brought it in. And when they got the buoy on shore, they hooked it up to a CAT and the CAT pulled the whole thing up. Here was this—I think that it weighed 580 pound[s]—black sea bass. Just *huge*. Huge.

But it was an experience. You're in what had been a tropical paradise. One of the interesting things I heard later on when they were talking about resettling Enewetak and Bikini. The natives there viewed Bikini as a world unto itself prior to the arrival of the Germans. There's three major racial groups in the Pacific, Micronesian, Melanesian, and Polynesian. And these are the Micronesian. Micronesian means "small islands." Melanesians mean "black islands." And Polynesians mean "many islands." But they viewed this as their entire world. And I often have wondered how they felt about being removed from their island and having their world essentially destroyed. They had been removed at the time of the Able-Baker shots in 1946. Later in my career, I participated in some of the attempts to return them to their island, and that was gratifying.

I went back there on [Operation] Hardtack [I], to Bikini. And while I was there we had had to, as a result of the shot on Bikini, the Bravo shot, they had realized that the heavy fallout had caused the islands of Rongelap and Rongerik to no longer be inhabitable, and they sent a

destroyer from our flotilla to those islands and evacuated them. When I returned for Hardtack, **[00:25:00]** we sent a crew back over to see the damage, and I have some pictures of that and I've since donated that to the [Atomic Testing] museum. But there was a pig still alive on there, and it was difficult capturing him. He was a wild pig now. It'd been a couple years. But he had managed to survive. And we captured the pig and that pig was sent back to the scientific labs in Washington, D.C. and they performed some experiments on him. But quite a few of those natives ended up at Walter Reed Hospital [Army Medical Center] with thyroid cancer, and several of them, I don't know how many, died as a result of their exposure to that one device. And they were 180 miles away. So you know you're not dealing with toys. Although some people have written a book called *The Firecracker Boys*, they were not toys. They were an entry thing, engineering development of the human race, as we learn more and more about both inner and outer space. I've dealt with inner space in Project Mohole and outer space with the Atlas missile program. But this is just as much a scientific endeavor as any of those.

An interesting thing on my return from the Pacific, I flew again from Enewetak into Kwajalein because that's a controlled link there and the pilots have to be cleared. And I flew out with Hyman Rickover, and he was my seatmate on the thirteen-hour flight to Honolulu and I got a chance to spend time with him. And he's one of the people I like to think I've had a chance to meet and converse with and exchange opinions. He's filed away, along with Dr. Edward Teller and Werner von Braun, who I met in the Atlas missile program.

What was that experience like, to be talking to—?

Well, he told me about the problems he had developing the nuclear submarine. You know he's the father of the nuclear navy. And he fought not only the Navy but the bureaucracy in Washington to allow him to proceed with nuclear power. And of course you realize today we

have nuclear-powered aircraft carrier[s] and nuclear-powered submarines. And ironically, when in my later career I worked for General Dynamics, I went aboard a nuclear submarine, the [USS] *Whale.*

And it's an unending circle that you keep passing through. And throughout my career I have encountered people in one form or another. This assignment at Bikini opened up a new vista for me. I did not abandon electrical engineering. I went on to be a chief electrical engineer for J.H. Pomeroy, Inc. But I migrated back to project management and my career—they said at one time that I was one of the top seven project managers in the United States. And I can't guarantee you that but I had friends say that. It makes you feel good about your career.

But I used that experience as I went back to Holmes and Narver. I was unhappy about one thing at Holmes and Narver. I asked our management to get a debriefing from everyone coming out of the Pacific because I felt there were major lessons that we'd learned, not only **[00:30:00]** from management or from those camps but construction in remote areas and dealing in different type of environments, and it was worth capturing for posterity. They chose not to go that route and I think a lot was missed because then you have to relearn those lessons rather than the lessons going into textbooks which are going to educate the next generation of engineers.

Do you have any idea of why that wasn't taken seriously or adopted?

I don't know why. I really don't. I had not had experience in oral history or any of those things. But it just felt to me because it was a huge part of my learning and everything I learned out there [that it] carried on in the future of my career. I can't tell you how many projects something has come up where I've related a tale of what happened out there, of ingenuity where you're in a remote location and you have to use your engineering skills to solve the problem. When I was in college, the head of the school of engineering said an engineer is a person who is trained to do

any task in half the time at half the cost of any normal person. And I have always tried to bring projects in under budget and on schedule; that being your target, and your resources are men and material and equipment. And it's from that point of view, I'm proud to say I'm a project manager. I have got a litany of projects that I've managed. All of them have been successful. But each one presents a different challenge.

So you come back to the Pacific from Holmes and Narver.

They put me back in the same type work I was in. Maybe it was my ego or something. I felt that I was more of a valuable asset now than I was when I went out to the Pacific. And they didn't quite see it that way, or they didn't have a vacancy. Holmes and Narver was a great company to work for, believe me. Don't ever get me wrong. I loved it. I admire Mr. Holmes and Mr. Narver. I admire every manager and officer I worked with in the company. I was back about six months and I had a call from a company called J.H. Pomeroy. They needed a chief electrical engineer at a substantial increase. I had a family to raise and I took the job and I left Holmes and Narver.

It wasn't until a couple years later I got a phone call from Sam Howell who I'd worked with in the Pacific. Holmes and Narver had been given the assignment, taking over from Black and Veitch at Nevada Test Site. Black and Veitch had been doing the engineering management up there. Part of the requirement was that they staff it with experienced people, so Charlie Kelly who had worked with me in the Pacific said, `The only engineer I want is Ray Harbert.` So Sam Howell called me and made me an offer to come up and go to the Nevada Test Site.

Now what was Charlie Kelly's position?

Charlie Kelly was in the Pacific. He was assistant resident manager. You can get into personalities and things. Charlie, to me, is my mentor. Unfortunately, he was an alcoholic, and he's probably what you'd call a binge alcoholic. He could stay away two or three months, but

when he hit the bottle, he hit it and he'd get himself into problems. He was a free speaker. He was extremely literate. His middle name was Wesley, Charles Wesley Kelly, Junior, I believe. **[00:35:00]** And he wanted me up there and I agreed to it. Charlie unfortunately, with all the devils that chased him, ended up on Skid Row as a drunk with a bottle between his legs, dead on Main Street in Los Angeles. It just tears me up to think that that would happen to him. But he was my idol and my mentor. But it was based on his persuasion and desire that I went to Nevada Test Site as resident engineer.

So now you're back with Holmes and Narver, then, is that right?

I went back to Holmes and Narver.

You went back to Holmes and Narver. And he was—

Yes. This was my second tour with them.

OK.

So I went back to Holmes and Narver and my assignment was in Nevada. I left my family in Burbank, California, and for a year I lived on the test site in Mercury, and would go home about every two or three weeks to visit the family. Mercury at that time had developed into a little city all of its own. It had everything you wanted: theater, hospital, own power source, water, great mess hall, great steakhouse. Anybody who's lived out there for a while speaks highly of the steakhouse. We would go in recreationally into Las Vegas, and Las Vegas was about sixty-nine miles in. We'd go in there on a weekend, and some of the guy'd splurge their whole check in one night and have to hitchhike home.

And the operation there was Plumbbob. I went there in 1956. It was conducted in 1957. And the first thing, I had an office there in a wooden barracks. I lived in another wooden barracks which is a two-man room but initially I was the only one there. When tests came along,

Max Smith who was the head of AEC office at that time at what was called NVOO [Nevada Operations Office] bunked with me during the tests, so he had the other bed.

Our first job was to go out and do what we called “as builds”. I would take engineers out and we would mark up the plans to show how test facilities were actually built and send them to Los Angeles. Los Angeles would use those to make design modifications for the next series. The series was to consist of shots from towers and tethered balloons and some of the first underground nuclear testing. LASL [Los Alamos Scientific Laboratory] was drilling some holes, I believe, in Area 3 and 4 and they were putting them down these drill shafts. [Lawrence] Livermore [National Laboratory] was going to use the Rainier tunnel which is in the Rainier Mesa. The balloons were to be tethered, a four-way tether, a vertical tether, and three other winches, each at 120 degrees so they could hold it in position. We improved the road up to Newsmans [News] Nob, or knocked in a road there, and we built a road. And Yucca Lake, there **[00:40:00]** were still the residual of the airplanes that had been there during the tests. The village that had been constructed and the forests were still there. The vehicles, I drove one of the vehicles. We used that as an AEC car until we got a new fleet in.

One of the first early unique experiences I had, non-engineering, I had a crew out in Area 2 as building the photo bunker there. And it was just before Thanksgiving. The photo bunker’s a two-story concrete structure. And they went down into the lower area, beginning to work that, and they found a bobcat in there. And they didn’t know whether the bobcat trapped them or they got trapped; but they maneuvered around and as they’d maneuver around the wall, he’d maneuver around the wall. So they got a rope, and there was a pipe suspended from the ceiling, and they put a noose on it, and they hung it over this pipe, and they maneuvered the wildcat into that loop, and then they yanked the loop and they caught him. Well, UCLA had been doing some

wildlife experiments out there and they had some cages, so they went up and got one of these cages. Well, before they could put him in, he was still wild, and they had a pickaxe, and they took the pickaxe handle and they hit him in the head and knocked him out, put him in the cage, brought him back to Mercury. And this was just before Thanksgiving of 1956. And we had a turkey frame. We put it in there with him. And he gradually came around in his senses, and we kept him as a pet for about two days and then gave him to UCLA and they took him back out and released him into his environment.

There were a lot of things that were interesting, each one, the erecting of the towers. There was one time a tower was being put up—and what you would do is they had a donkey winch down on the ground and it would lift panels up and there would be a steel erection crew up there that would bolt them or rivet them into place, and there were guy wires from it. The operator of the winch let his clutch slip this one time and the panel swung out and hit the tower, and the guys hung on with dear life. The guy realized what he'd done. He shut his winch down, jumped into his truck, and these guys were sliding down the guy wires. They were going to get him. And he may still be running, but he went through that gate there at Mercury ninety miles an hour.

One of the towers, which called for the Diablo shot, was a 700-foot tower out in what's called Area 10. It's on the far north reaches of the test site. It was 700 foot high. I went out there one day to see how the construction was going and I wanted to go to the top, because they were just getting ready. They were topping it off and they were going to put the cab up there. This tower, the base legs were eight-inch solid rounds. Eight-inch solid rounds, and they gradually decreased as it went up. It was a square-shaped tower, not triangular, and it had guys on it. And in order to get to the top, they had rigged up a situation where they had what they called a

bucket, which was a little wooden structure I'd say about three foot by six foot, had a **[00:45:00]** rigging on both ends and a spread bar over the top, and then they had a rope hooked on top of that. That rope went up 700 foot through a shiv up there, which was anchored to a cross I-beam, and then out to a pickup truck. And what you would do—you would get into this bucket and you'd wave at the driver and the driver'd start up the hill and you'd start up the side of the tower, and as you'd go along, because it's cross beams, you'd have to kick off the cross beams. When we got to the top, you're up 700 feet. That is a seventy-story building with an eighteen-inch step from the bucket to the top. That is the longest step I've ever taken in my life.

I should say!.

We had another situation out in Area 3 where we were drilling the large diameter holes for LASL tests. And we put a casing down in the hole. It was a forty-two-inch-diameter hole. And we put a casing down there. And when they drilled the hole, they had drilling fluid in it. And so stupidly they tried to push this casing down and squeeze the fluid out. What they didn't do is displace it by filling up the casing, and when it got close to the bottom, it erupted. I offered to go down, to get a lung on and take some pictures down there to see if we could repair it. My management wouldn't allow me to do it.

One area of interest was in Frenchman's Flat where the Civil Effects Test Group was conducting some experiments. Its assignment was to protect the general population in case of nuclear attack. Some of the structures out there, one was a underground garage. There were three domes designed by AMF. One of them was aluminum and two were screeded concrete domes.

OK, I have to get clarification. AMF is…?

American Machine and Foundry.

And what's screeded concrete?

Well, when you screed you have wet concrete and you push a form around it. That's called screeding. Excuse me for using—

That's OK. I want you to use the terms. I just sometimes have to figure out what they mean.

So two of them were screeded. They were of different thicknesses. I don't recall. I think one was four inch and one was eight inch, but they were reinforced. And we had to build these. We were having some trouble with Civil Effects Test Group engineers. They were trying to design these and have them built as scientific test structures to scientific measurements. You do not build things like this, use normal construction techniques to things like this because you have normal plus or minus variations in them. And so I as the chief engineer for Holmes and Narver were constantly in major arguments with their engineers on where there is a significant variance from a test structure to a normal construction variance. And whether it's one-hundredth, whether that matters or not.

And let me understand this. I'm going to pose a question and you have to say which one it is. You want it to be more like a normal construction or you want it to be more for a scientific?

[00:50:00] Using normal construction techniques, you want it to be as close to statistical measurement as possible, but you've got to look at practical limitations. It's like when we talk about Blue Sky Conferences, the scientists come up with ideas but it's up to the engineers to say these are limited factors based on current technology.

So I was in constant arguments with them out there, and one was on these domes. What we did on the dome, the first shot, we built a wood-framed dome, but it was a segmented dome, so you had flat spots in it. They weren't all round. So you had a quarter-inch deviation from the round segment. They didn't like it. So we had to tear that out and what we did, we went in and mounded it with dirt, then we put a concrete seam-breaker over it, and then poured the concrete

over that. Then we dug out the dirt afterwards. Unfortunately, the cement breaker didn't always work, so we had chunks of concrete and we had to chisel that away. Well, they got on my case because we made chisel marks in it.

On the underground garage, the roof slab, if I recall correctly, was a four-foot-thick reinforced concrete slab. To pour that in the state of the art that was available at that time, you put in your reinforcing framework, you laid a wooden walkway across that, and you would take these buggies and pour concrete into the buggy, take it out there, and dump it. OK. In doing this, the wood on the walkway rubbed against the metal of the reinforcing bars and dropped some wood chips in there. This engineer from Civil Effects Test Group got on my case because he said it affected the strength of the concrete. You're looking at a four-foot-thick concrete mass, of which when you pour concrete, it is not that accurate. You may measure it for 2500 psi [pounds per square inch] or design it for 3000. It may vary as much as 100 to 200 psi, depending on climactic conditions, weather conditions, you'd get dust that blew into the sand piles and stuff. So he and I got into an argument over this. We finally settled it by hiring a company to come up and core it and then take and run break tests on that through those areas. But he and I almost got into a fist fight over it. I mean that's how much temper.

Remember that when you're in these test buildings for a test program, you're building against a deadline. That shot date is set pretty much in concrete. The only thing that affects it is weather. And so we're trying to get all of this construction done and here's this guy arguing over, nit-picking over nothing that doesn't change one iota of his experiment.

And this is an AEC person, then.

No. He's a—

A lab person?

He was a civil engineer. He had worked in Morocco on the airstrips in Morocco. And he had come here and he was Mr. Big.

And who did he work for, that's what I'm trying to—

The federal government.

He worked for the feds. OK.

I don't know whether Civil Effects Test Group came from [U.S. Army] Corps of Engineers or where, but they were—

That group.

They were a user.

Got it. I understand.

They were a user like LRL. And they did have legitimate experiments that they were running.

[00:55:00] *I understand now. So that photograph you showed me before of the metal dome….*

That was one of them.

That was one of them, and you all engineered—

But in that case we built the ring around there. AMF manufactured the aluminum ring and we bolted it down. But that crushed. And that was in the Priscilla shot there in Frenchman's Flat, which was a balloon shot.

So when I go out to the test site and see the remains of those domes and that tunnel, those are things that you all engineered.

That was it. Yes. I was the engineer. My inspectors inspected them all. My surveyors surveyed them all in.

Did Holmes and Narver physically make them or did—?

No, Reynolds [Electrical and Engineering Company, REECo]—well, it was either Reynolds or a subcontractor. We prepared plans and specifications. In many cases, we got private contractors from Las Vegas. King Construction was one of them, as I recall.

That was to my next question, of how you were interfacing with REECo on these, building—

With REECo, we were the engineers. REECo did some of the construction. Most of their construction was baseline, like roads and things like that. The actual garage was built by one of the contractors. But we managed the contract.

Holmes and Narver managed the contract.

Holmes and Narver managed the contract. I had a contract administrator working for me that tried to make a deal with a contractor, and the contractor reported it to the FBI, and the FBI came out, and that guy went off the test site and never saw him again.

So the contractor was honest, in that case.

Yes, the contractor was honest. He said, This guy's trying to make a deal. When I was at Elk Hills Naval Petroleum Reserve, we had strict federal procurement regulations that we adhered to, and I was personally responsible for the legitimacy of everything. We had hired a contract administrator and he didn't like to work for me because my rules were too strict. He left and he went up to Teapot Dome. They caught him pulling shady stuff at Teapot Dome. He's in jail, or went to jail.

A lot of times, we don't think about the government as being honest, and in many cases it isn't. But there are a lot of honest people that play by the rules, work by the rules, and do not take advantage of their positions. I believe I was one of those. I never took gratuities. I never made a deal with a contractor, and I fired anyone who did. I called the FBI in at Elk Hills Naval Petroleum Reserve because they were stealing oil. So I got that shut down. We put in systems

that would preclude that from happening. You *can* compromise your honesty but you do so either at the risk of getting caught or at the risk of your conscience, or if you don't have a conscience, it doesn't matter. I happen to have a conscience and I happen to play by the rules. So that's me. Good, bad, or indifferent, that's me.

We've got just about less than fifteen minutes left. We have to decide whether we just want to break here, because what I do what to get into with you are the actual tests of Plumbbob, but we don't have time to do that today.

OK. The only other thing I'd like to cover, then, is selecting the Rainier site.

Great. Let's talk about that.

Rainier was to be the first true underground tunnel shot, and they'd selected a mesa out in the far reaches of the test site to put a 1700-foot-long tunnel in with a Q on the end of it in which **[01:00:00]** the device would be set off. I participated in the geological work with geological survey on the selection of the preliminary site. One of the aspects of this was again a personal experience. One of the assignments in this project was to drill a recovery hole from above on top of the mesa down into the resulting cavern. I got the job, it was my job, to find out if this could be done. So I took a surveyor and we took what was called a Dodge power wagon, it had a winch on the front of it, and we went out through the back side, north side, of the test site down a road down there, and as we came down that road we saw an airstrip off to the right at Groom Lake. It's currently referred to as Area 51. And we saw a plane coming in, and it landed and tipped over on its wings. And we saw this crew run out and put out outriggers under the wings. It was a U-2. And it was being tested out there at that time.

What did you think?

It looked like a glider to me because it's got long narrow wings. I thought, what in the hell is this? But we went on from there—

Did you have any sense that anything was going on out there? Did you know—?

No. No. No. I had permission to go out there. We went up by Groom Mine north of where we wanted. We'd looked at geographic maps. The plot of them, we saw that the canyon came up on the back side of Rainier Mesa and that there'd been some ranches in there at one time. We thought there might be a road and we could find a road up there. So we went up by Groom Lake and came back down. And we did find a road up onto the top of the mesa. It was an old abandoned road. It was tough to get up, but we got up to the top. When you got up on top of the mesa there, they had cap rock, because that came from the volcanoes, cap rock. And we got so far across the mesa because we wanted to get over so we could look down into the Nevada Test Site. We came to a point on the cap rock that we couldn't get by it, so we parked the power wagon and walked over to the edge and looked down onto the test site. Beautiful view and everything. Turned around and came back. Tried to start. Again, we're forty miles from nowheres. We *couldn't get it started*. Couldn't get it to turn. And we thought, Oh, my God. What we can do is go over to the edge and light a fire and hope that the guard that comes up there every hour will see us; or we're just abandoned, because we just had everyday clothes on and we're up over 7000 feet now. For some reason I thought, I'm going to do something. There was a lug wrench that you put the lugs in the tire there, and I gapped the battery, and it sparked, because I wanted to check to see whether the battery worked. What it did was release the starter and we were able to start up. But we didn't get home until midnight. We went down through all that, no lights, no nothing, down through that whole area.

You left the lights off because the—or—

Well, we had *our* lights on.

But there were no other lights, you're saying.

But there's no lights there. You're in the remotest of country roads that you can find.

Who was with you on that? Were there scientists with you when you're—?

No, just the surveyor. One guy. There were just two of us.

Just the surveyor. Surveyor and you. Oh, my gosh.

Now that was one of my experiences. There are two other I want to relate. We wanted to see if there was an alternate route in there, instead of coming in from the north, going west and then coming up from the south. Our map showed an old airstrip out in that area. Now this is part **[01:05:00]** of Nellis Gunnery Range. And I went over to Nellis and talked to the commanding officer, told him the time that we planned to go in there, because what would happen is the fighter planes would go up to Tonopah and do whatever they did. If they had any ammunition left, they would come down and strafe this airstrip. OK. So he said, `Fine. You're cleared for that.`

So there's three of us, we're in a power wagon. We get the power wagon and we go by Tipipah Springs, which was a city. An Englishman tried to sell the city up there one time. And we went by the springs and just started down into this next valley over there. And we see two P-51s (I think they were P-51s, yeah) come over. We had some smoke grenades, so we threw out some smoke grenades and they wobbled their wings and left. So we continued on down this road, came up alongside the airstrip, and we're about 200 yards up on this road adjacent to the airstrip. Well, I hear something and I look out the window and here's a P-51 on the deck going at mach, and the loudest bang, and I peed in my pants. Scared the living hell out of me. He laughed. You could see him laughing. You could see the pilot, you know, it was just like frozen in time. But

then he waggled his wings and went on. He just wanted to scare us. He knew we were there because they had radioed ahead.

So we went on and we were unsuccessful in finding a way up. It was blocked. But we did see something extremely interesting. We saw some wild horses out there and they build dung heaps. They all do their job at the same location. These dung heaps were maybe five or six feet high, and there were about ten or twelve of them out there. Beautiful horses. Wild horses.

Two other incidents related to Rainier before I go into the digging of the tunnel. I'll go into that the next session. But we went out there one other time—two other times I went out there. And we had built an access road into the area, and we still hadn't gone up the back side. And we had snow. It was still early spring or winter. And I was with a [U.S.] Geological Survey scientist. His last name Dobrovolry, I think that's the way you pronounce it. And I was curious about geology and so we were talking about that. And I kept asking him questions and he said, Let me tell you a story. Because I could never get a straight answer out of him. And he said there was a geologist out in Iowa and he was out on this farm and he was plotting a little arroyo. And this farmer came up to him and asked him what he was doing. He said he was just plotting. He said, You're a really smart man, aren't you? He said, Well, I know a little. And he asked him some questions and he was getting this conditional answers. And the farmer said, I'm going to trap him. There was a cow out there in the pasture. This is a brown cow. And he says, OK, smart Mr. Geologist, what's the color of that cow? And the geologist said, Brown, on this side.

So that was the story he told me on the way out there. We got up further and when we started up this road that I'd been on before to get on top of the mesa, there was heavy snow. **[01:10:00]** And on the front of a power wagon, you have a winch with a steel cable. And he

would get out and he'd hook this winch to a tree and we'd winch ourselves up because we couldn't drive anymore. We had to winch ourselves up on top of the mesa. Well, this took a while, and people were beginning to get concerned because we were out in an area that was radio silent in those days because you had towers, didn't have satellites. And so they sent someone out to see if they could locate us. By that time, we'd turned around at the top. He saw the cap rock and others. We turned around and were winching ourselves back down. When we just got out of the snow, these guys showed up. You're OK? Yeah, we're OK. Let's go.

But that's it. We can talk about the tunnels next session. But I thought those might be interesting.

They're interesting because they give the sense of how really isolated—

Everything's pioneering out there. There's *nothing* that wasn't a new adventure every day. I look back on my career and I say—you've seen this book. Nobody should have a career that enjoyable. Nobody's entitled to that. And I was fortunate enough to live through not only this history of nuclear testing and dealing with the nuclear scientists and the forethought of Plowshare. I was *thrilled* to be part of Plowshare. I did some work on design of nuclear power plants. I went through two of them in Dothan, Alabama, Farley One and Farley Two, and a couple up there at the Tennessee Valley Authority near Chattanooga. I was involved with storage of nuclear waste with the OCRWN [Office of Civilian Radioactive Waste Management] One project in Washington. I was executive sponsor of that. Brought in the largest oil field in the United States. The Cuban missile crisis. I brought the last missile on line, personally went out there and saw it on line. I was in San Diego when it happened and I flew to Dallas-Fort Worth Airport. Colonel Manson had called me and said, `You've got to get back.` When the American Airlines plane landed, it taxied to the end of the strip, stopped there, the doors opened,

two MPs [military police] came on, said, Mr. Harbert there? And I said, Yeah. Went to the front. They had a helicopter out there. They flew me 180 miles back to Dyess Air Force Base. I sat in on a meeting. They said, You've got to bring these up. I said, Fine. I went and got some clothes and flew out to the last site. Brought the missile up in three days, a two-week job, and put the warhead and target boards on.

I want to get that whole story another time, but we're right at the end, so I have to—

[01:13:39] End Track 2, Disc 2.

[End of interview]