

# NASA HEADQUARTERS NACA ORAL HISTORY PROJECT ORAL HISTORY TRANSCRIPT

HOWARD T. WINE  
INTERVIEWED BY SANDRA JOHNSON  
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JOHNSON: Today is June 3, 2014. This oral history session is being conducted with Howard Wine at NASA's Glenn Research Center in Cleveland, Ohio, as part of the NACA [National Advisory Committee for Aeronautics] Oral History Project, sponsored by the NASA Headquarters History Office. The interviewer is Sandra Johnson, assisted by Rebecca Wright. I want to thank you again for joining us today and agreeing to talk to us for this. I'd like to begin today by asking you how and when you began working for the NACA here at Glenn—or Lewis [Research Center], at that time.

WINE: I had just gotten out of the Air Force and was looking around to see where I could fit in. I had a sister-in-law that, fortunately, was a chemist out here. She said, "Why don't you go out to NACA and apply?" I thought, "Yes, that sounds like a good idea."

So I came out here and I was interviewed, and the gentleman that was interviewing me said, "We don't usually hire people on a journeyman level. Usually, you come in through the apprentice program," which was very famous at NACA in those days. It was a four-year program. He never mentioned anything about my going into the apprentice program; he wanted to hire me off the street as a journeyman.

I said, "Yes, that sounds like a pretty good idea." So, January of 1954, I became a civil servant, and from there on, it was just history.

JOHNSON: What did you do in the Air Force that allowed them to move you right into a journeyman position instead of being an apprentice?

WINE: I was a flight engineer, and even though there was nothing here at that time that would require those kinds of commitments, they probably felt that—and it may have been a test program because my understanding was there were only three people at that time that were being interviewed to come in as journeymen. One was an electronics guy, one was an electrician, and myself, as a mechanic. I don't know if it was a test program that they were trying to get underway, but everybody else that came in through the normal ranks came through and participated in an apprentice program. I was looked at a little strangely at times, but kiddingly, of course, and they said, "We spent four years getting in here and you walked in the gate, just got a job the same day."

JOHNSON: You mentioned your sister-in-law was a chemist out here? That's interesting. How long had she been out here?

WINE: Mary Ann [Buddie] had probably been here five, six, eight years, something like that, I would think, and then she eventually transferred down to Florida. She's since passed away, but retired from NASA down there.

JOHNSON: It was just kind of an interesting time for women, especially professional women to be with the NACA.

You started as a journeyman mechanic, and is this the Propulsion Systems Lab [PSL]?

WINE: PSL 1 and 2, yes, that's it.

JOHNSON: Can you tell us a little bit about the Propulsion Systems Lab and those first days and what you were doing? And what they were doing there at that time.

WINE: We were in the process of testing the Navajo Rocket Engine Program. All of a sudden, one night we were setting up for a run, and people came in and said the run has been scrubbed. This was like just when the Russians sent up their Sputnik.

JOHNSON: 1957.

WINE: 1957. Overnight, we became NASA, and prior to that, we were NACA, running rocket and jet engine programs in PSL 1 and 2.

JOHNSON: Talk about your first days there, and what kind of training you had as a journeyman, and maybe some of what you were doing when you first started?

WINE: My impression at that time was that everybody out here worked on days, and there were no night shifts, later to find out that they, of necessity, had to run on nights because of the power consumption. I was a little disappointed. They took me over to the Propulsion Systems Lab, and introduced me to the section head. He said, "It's a little late today—you might as well stick around the rest of the day, but tomorrow, you start second shift."

I thought, “Whoa, whoa, whoa, I’m not sure that’s what I contracted for.” Nevertheless, I came in the next day and met everybody, and from then on, it was just history. After I’d been here for three years, I thought that getting back to school and getting my engineering degree might be more of an advantageous program for me to get involved in. At that time, I discussed that with the division chief, and he called me in the office one day, and he says, “You know, Howard, I don’t think that’d be a good move for you. We’ve got things here that are going to be necessarily taken care of, and we think you’ve got the right kind of capabilities, and we’d really like to see you stay.”

I’d gone out to Colorado for an interview—this was right after the Space Program started—and they offered me a job out there, but my family had just started growing, and I thought, “Well, maybe the best thing for me to do would be to go to school.”

I volunteered for third shift, which was the shift that the testing programs were all done on because of the use of electrical power. Everybody else is sleeping and NASA’s running. We went out to Colorado and looked that program over and came back feeling that that really wasn’t the thing for me at that time. So, we stayed here, and eventually I got to be a crew chief on one of the test cells in PSL 1 and 2. I was there for 10 years at PSL, and things were routine. We were running tests every night, practically, and the big program that was coming in was the Centaur Vehicle. One of our facilities, the old altitude wind tunnel, was elected to go through a revamping program where they had to practically take the top off of the facility in order to accommodate a Centaur Vehicle. They asked me if I would be interested in going over there and heading up one of the shifts on accomplishing this mission, and so I said, “Yes, that sounds interesting.”

I got transferred over to SPC [Space Power Chamber]. It was a new name for the old AWT [Altitude Wind Tunnel], but it became SPC, the Space Power facility. We had to knock the top off of the facility, and they had a 100-foot crane come in and pick up a Centaur Vehicle that was to be launched, but at the last minute, or last few days before the actual launch, they decided they wanted to upgrade some of the instrumentation on board so they brought it back down from its launching pad. It became available, so NASA grabbed it up, and they flew it in here. It was like a new baby arriving. Interest was generated; people were coming out to see it. It had to be maintained 24 hours a day, 7 days a week, in either a stretch or a pressurized situation because it was only made of 1/10,000-inch stainless steel, which is pretty thin, and it could not support its own weight, so they had to keep it pressurized all the time. In order to ensure that, they had some of us on a 7-day, around-the-clock watch, where we'd come in on Saturdays, Sundays, and all through the week, just to make sure that the pressure was maintained and there wasn't a leak or something that took place.

All the time that this was happening, then they decided that they needed to go through this revamping of the old Altitude Wind Tunnel, and it became the Space Power Chamber. They put in some diffusion vacuum pumps and decided that the Centaur could be picked up with a crane and lifted up and set down into the facility in a vertical position. It was positioned that way, then we had to fabricate cold baffles around it that had liquid nitrogen flowing through them in order to simulate the conditions in outer space that the vehicle would be exposed to. That required hundreds and hundreds of soldered joints and little connections.

The contractor that was elected to do it evidently had not had much experience in that type of soldering. He was more like in the welding, soldering, and construction work, and so

they were burning up things and leaking. NACA finally said, “Look, we’re going to take this job over. You guys get off of the property.”

They left, and it became a 7-day-a-week, two 12-hour shifts a day, project, in order to go over these hundreds and hundreds of connections, where they were all soldered together. This is 30 or 40 feet high, so you’re in a bosun’s chair or something, some means of transportation to get up to these sites to solder all these joints in. We finally, after about two months or so, constant re-soldering joints that had been soldered by the contractors, got it to where it was leak-tight. They pulled the chamber down and they were able to get the altitude that they wanted, and the program for the testing of it finally took place.

I was involved in that for about two years, and then they said, “We have another project that’s coming on board—it’s called the Zero-G Facility. With your experience in the AWT Program, we thought that you could go over there and be one of the lead people on the Zero-G Facility.” Another mechanic and I were given the task of heading up a group that would follow the contractors during the construction of the facility, which ended up to be a 510-foot hole in the ground. It was 28.5 feet in diameter, and then there was a 20-foot diameter vacuum chamber built within that dimension that the actual vacuum was going to be pulled on and we could actually drop a payload and achieve 5 seconds of zero-g.

Within that 5-second frame, they were able to come up with enough information, looking at the surface tension and liquid characteristics in a zero-g environment. Which was very critical, because once the payload was sent up and got into an orbiting configuration, the liquid that was in there was not laying like in the bottom of a bucket—it was just free to float around within the vehicle itself. The problem was that when they got ready to restart the engines, the turbines, the pumps that would become in operation, had to have something to pump against.

Otherwise, they would just, within milliseconds, just disintegrate and blow up because they needed something to kind of constrain them in their running. If they ran free, there was nothing to hold them back and govern them, and they would over-speed and disintegrate. It was very critical to know where the liquid was and how you were going to achieve getting that liquid back into the inlet to these pumps. As soon as those pumps came on, they had to have liquid against them. Otherwise, they'd just disintegrate and blow up.

JOHNSON: This was for an orbiting vehicle that had to restart?

WINE: Right. We went through that process, and then I was over there for another couple of years and became the first line supervisor at Zero-G. We ran some continuous programs over there on a pretty much daily basis. We'd get 5 seconds of zero-gravity for the preparation you had to pump down the chamber and all that.

During that timeframe, NASA had a celebration of, I'm not sure if it was a 50th anniversary, but there was a big celebration. At that time, Ames [Research Center, Moffett Field, California] and Langley [Research Center, Hampton, Virginia] and Lewis, every other year, had an open house where they'd invite the public in to see what was going on. In those days, you talked to people on the street and say "NASA," or out at the airport, and they wouldn't even know what you're talking about. It was kind of disheartening to us because we were totally involved in the programs.

It was our turn, Lewis' turn, to have the open house. The idea was people would be shuttled throughout several different facilities to see what was going on out here, and Zero-G was like the high point. People would come in off of the buses and they'd gather around the

chamber. We had built a special release mechanism up above it, that the engineer and I would be at, and people would be gathered around this hole, and looking down 500 feet. They're all going, "Oh," you know? The idea was that one of the features we would do here, in order to simulate zero-gravity, even for 5 seconds, that gives us a lot of data, but in order to do that, we had to release the payload, and it fell down 510 feet into this 12-foot diameter container, which was, I think, about 20 feet high. It contained millions and millions of little, tiny expanded polystyrene pellets as a decelerant.

The first groups that were coming through, we dropped, and of course, the people were looking and this thing falls down. When it hits all those pellets, there's a big explosion, so to speak, of these pellets being dispersed, so everybody's going, "Oh!" While the groups are moving out, we had a crew down below that had to replace the pellets. The only problem was these pellets had to come from a manufacturer that had to be fabricated, and one of the processes that these pellets—because they were like grains of sand, and they went through a heat process to expand them into little balls—these balls were very small. But the idea was that the propylene gas that was entrapped within these little pellets, when they were expanded, had to set for at least 24 hours for all of this gas to dissipate and get out of there, because the propylene gas was fairly flammable.

In order to stay on schedule, we decided that we'd measure the g-loadings on the payload to see when it was time for these pellets. After you drop in them a couple of times, the pellets would tend to stick together, and so the deceleration characteristics would go out the window. It was determined that we needed to get a whole shipment of these pellets like right now, and a company sent them to us in plastic bags that were transparent, and you could see the pellets. They looked to be about 55-gallon size. You can imagine how many bags it took to fill up this



20-foot high, 12-foot diameter container. Hundreds and hundreds and hundreds of these bags, so we'd put the bags on a crane and drop them down, and the guys down there would open them up and pour them into this big container.

The very first drop the next day, crowds were all gathered around, as usual. We dropped the payload and it went down and went, "Boom." All of a sudden, this black, sooty billow started rising up from the container. Everybody thought, "Boy, that's really intriguing." We got everybody out of there quickly. When this stuff came up, it burned with such a black, sooty condition that when it came up, it spilled out over the top of our chamber. Everything was getting black with soot and dirt, so all of a sudden, the division chief gets a couple of hundred of our people over there with rags. We only missed one show, but after that, we had a secondary payload because the one that went down, it's all burned up, it's down there inside all these pellets, but the people can't see that because it's filled back up with clean pellets. People would look down and we'd say, "Normally, we would drop this, but due to circumstances beyond our control, we won't be dropping it today."

The idea is that we get 5 seconds of zero-gravity by letting this thing fall free. There's a dome that goes on and you pull a vacuum around this thing, so that there's no drag on it. For 5 seconds, you get free fall unrestricted by gravity, and during that free fall period, there's a camera and a liquid container contained within the payload, so that the research people would then look at the film and see how the surface tensions of various liquids would react to the surface of the container that the liquid was being held in, so they'd have a better idea in determining how they were to design futuristic rockets that are going to be in a zero-gravity, that are in a neutral zone, and have to get started up again. That was a very interesting project that we had at the Zero-G.

It seemed like my career was in two-year segments because I was only at Zero-G for a couple of years. My old boss at PSL was starting to look at the development of a new PSL, 3 and 4, which was bigger and better. He was being moved up to a branch chief job, so then they asked me if I would like to go over and be a section head of where I first started, PSL 1 and 2. That was to include PSL 1 and 2 and 3 and 4, as it was being developed.

I went over there as a section head, and we got PSL 3 and 4 finally online with a lot of contractual problems associated with the fabrication of the instrumentation. Part of the problem was the people being asked to put facilities together in those days did not have the experience that was necessary in order to do the soldering and the technical support that was needed. We had, like, 52-pin connectors, dozens and dozens of them, that would bring in the data, futuristic. The object was to take these little wires, one by one, and put them in each one of those, and solder each one of those little connectors. Within the confines of the connector, 52 pins didn't leave you a lot of room. What was happening was the contractors were trying to solder each of these little connector pins with normal soldering irons, about a 1-inch, and it was burning the whole thing up. We had to take the job away from the contractors, initially. One of our electronic technicians, who was working for us at the time in PSL and was a sharp guy, he taught soldering, we had him take the contractors over to offices over in the hangar area, like classrooms.

He was teaching them how, first of all, you had to buy the right kind of equipment—tiny, little heads on the soldering irons—and the right technique in how to solder. We eliminated the possibility of big delays because these connectors were not shelf item; they had to be special-ordered. There was a lot of activity going on back and forth. These contractors were going to

school, so to speak, and our people were training them and teaching them how to do the soldering correctly.

After we got that portion taken care of, then PSL 3 and 4 got online, and everything was working fine. Then, I was moved up to Assistant Division Chief in the Test Installations Division. We had about 450 people in TID, Test Installations Division, and I was in that job, I think, again for another couple of years. I was Assistant Division Chief. Andy [Andrew J.] Stofan became the [Center] Director here, and he was an engineer here at one time, I guess, then he'd gone to [NASA] Headquarters [Washington, DC]. He was tapped to come back here as the head of Lewis. After Andy had been here for a short time, I got a call from his office, and he said, "Would you mind coming over? I'd like to talk to you." I said sure. He said, "I understand you've been around, you know all the nooks and crannies. I need an assistant—somebody I can depend on and help me out in making these selections. Would you be interesting in coming over to the ad [Administration] Building?"

I said, "Sure, that'd be great." As a going-away gift, since I never finished college, all of the guys in the old organization, Tech [Technical] Services, they got a hold of a big chamois and put it in a frame and said, "Here's your sheepskin." That was a beginning of a two-year stint in the Ad Building. Then, of course, we had during that period the [Space Shuttle] *Challenger* mishap [STS-51L], and so we had little setbacks.

During that time, or about the end of that time, Andy called me in and he says, "I'm going to have to go to Headquarters. They want me to go there and head up this new group. He didn't want to go, he'd just bought a house. He and I were having a lot of good times playing golf and enjoying our work together. He decided that since they'd said, "You've got to go," so he had to sell his house. He went to Headquarters. About that time, I had had about 33 years of

service, and all of a sudden, I walked in one day and I said, “You know, if Andy’s going, I don’t know who’s going to be the new Director, I might as well go.” That was the decision time for me to decide that I was going to retire. I retired in, I think it was ’86, in June, with 32, 33 years of government service. I was 56 years old, so I’ve been retired since.

JOHNSON: That’s wonderful, that’s really great. You’ve been enjoying it, too, I bet.

WINE: Outside of a few little minor surgeries here and there, yes, it’s been a lot of fun.

JOHNSON: If you don’t mind, I want to go back to that first position at the PSL 1 and 2. You mentioned that they wanted you on that second shift. What hours were the shifts at that time?

WINE: It was 7:00 to 3:30, and 3:00 to 11:00, and 11:00 to 7:00.

JOHNSON: You were on that afternoon shift.

WINE: Yes, and they rotated every two weeks, so I got a chance to see the daylight as well as the darkness.

JOHNSON: Most of the testing was done at night?

WINE: Yes, because of the power requirements. CEI [Cleveland Electric Illuminating Company] had to wait till people were going to bed and turning their lights off and those kinds of

power requirements were dropping off so that they could supply us with enough power to run some of the facilities. They used a lot of power.

JOHNSON: You also mentioned that you went back to school during that time, but you didn't finish. How did you work that out, and work full-time, and then go to school?

WINE: I volunteered for third shift, which meant that I would be here at the lab from 11:00 to 7:00, and then that allowed me to wash my face and get over to Berea, [Ohio] from 7:00 to 8:00, because my first classes over there were for 8:00. For the first two years, I was able to move all my classes to morning sessions. After about a couple of years, though, it became pretty evident, and in the meantime, too, I'm progressing here at NASA, it's about that time that the Director called me over and thought that I had a potential that he was looking for, and that my future here looked pretty good. He really felt that he had made it without getting a college degree, so a college degree wasn't absolutely necessary to achieve some goals that you might have. You wouldn't be in the professional ranks, but you'd be pretty well up there, and you'd be making good money.

He really didn't talk me out of it, but he kind of made it easier for me to make a decision that, well, my second or third child was coming along about then, too, and so I went out to Baldwin Wallace [University] for a couple of years, from 8:00 in the morning until noon. Then, I'd come home. My wife was working at the telephone company, so she would be down working, and I'd come home about noon, go to bed, and she'd come home at 5:00, get dinner, wake me up, I'd look at the books for a little bit, 11:00, I'm back out here for work.

We did that for a couple of years, and then I'd have probably kept going, except they said, "The classes that you want to take now only have labs in the afternoon." I said, "Boy, that kills it because I can't be two places at once, and I need to get a little sleep." After talking with the division chief, thought that that might be the best choice, is just stay here and see where it led. Fortunately, I was, it turned out, not on purpose, the only non-professional that had an office in the Ad Building, right next to the Director. There was a little bit of patting on the back, so to speak. We had a great experience over there.

JOHNSON: That's great that you were able to progress through your job like that without the college degree that most people think, if you're going to work for NASA, you have to have a college degree to work. Nowadays, it may be a little harder to do that, obviously.

WINE: I'm sure it is because then we had an apprentice program where we we'd bring kids in right out of high school who had no experience in technical business and put them into a training program for four years, moving them around to each facility within our division, and so they would have a feeling for what kind of mechanical ability they had to have in order to accomplish those missions in the various buildings. After four years, then they had a graduation ceremony. It was a big deal. If you were in the apprentice program, you were thought pretty highly of. That's why I always got a lot of kidding, because I didn't have to go through the program.

JOHNSON: You just moved right in to the next level.

WINE: Just about, yes.

JOHNSON: You mentioned that they did most of the testing at night, and then when you moved to that nighttime shift while you were in school, was that the first time you were there when they were actually running the testing?

WINE: Yes, pretty much so. We would do some preliminary check-outs and get things ready, but the third shift would come in, and of course, we'd go home at 11:00. They would finish the outside check. There was a regular procedure for checking all of the valves and all the components outside of the building, plus the checking out of all the integral parts and pieces and all the things associated with the run. Then, they would close the lid and start the vacuum pumps from the equipment building. There was a coordination.

Also during that period, the actual operation of the facility—in other words, opening and closing valves and bringing vacuum in and maintaining pressure—that was all being done by engineers. The engineers were getting a little upset with the idea that they'd come out and work all night, and then they were required to be available for an eight o'clock meeting, to see what happened that night. The nights that they ran, they were kind of bushed, and so that was getting to be old hat. They finally said, "This isn't working too good. The engineers are being unhappy and in order to get this thing going, maybe we ought to look at some of our techs who were interested in operations of the facility, maybe they could sit in or fill in for engineers, on occasion."

There was a big meeting and it was mentioned that, at that time, I was an assistant crew chief on PSL-2, and the meeting consisted of an explanation of this business about the engineers. It was decided that the crew chiefs who wanted to could sit next to the engineers and kind of

learn the procedures and so forth of how to operate the facility. I was never short on pressing my luck, so to speak. As we're walking out of the meeting, I walk up to the section head and branch chief at that time, and I said, "Hey, you know, we got a couple of crew chiefs who are very elderly." I mean, they had been around a long time and they really weren't interested in doing this job, but they were the crew chiefs, and that's the way they were going to set it up. I said to Bud [Erwin E.] Meilander, who was the section head at that time, "Hey, you know, I'd really be interested in working into this operations business.

He said, "Calm down, Howard, you've got to wait your turn." It wasn't long after that, though, that they had me filling in with the engineers, and then finally, the engineers were only doing their calculations, and the mechanics were operating the facility. It was a big change in philosophy, at that time.

JOHNSON: To allow you all to move into that position and be responsible?

WINE: Right.

JOHNSON: You mentioned all the checks that you had to do before the run, and they had to do final checks. I would imagine there's a lot of safety issues with propellant and everything that you were using out there. Were there ever any incidents, or did you ever have any problems while you were there?

WINE: When we were running gaseous oxygen and hydrogen, there was a procedure for slowly pressuring the system, which was outside, so they'd back up a hydrogen or an oxygen trailer, and



that's the pressure and supply, but it had to go through manifolding and valving. In order to get it into the building, you had to open these valves slowly, after you hooked the trailer up. In one instance, it turned out that the guy was opening the valve faster than normal, and evidently, there must have been a little, miniscule piece of dirt or something in there, and it blew that valve clear over the building. It went and landed clear on the other side of the building. Fortunately, nobody was there, because he had opened up the valves and he had gone on to finish the rest of the check-out procedures. As he was gone, boom, this thing goes off and the valve goes clear over the building.

We've had other instances where we've had liquid fluorine, they would bring in a big trailer from Plum Brook [Reactor Facility] full of fluorine. Fluorine was so hazardous that if there was a spill of any kind here at the lab during the running, people over on the observation deck at the Cleveland Hopkins Airport could be killed by it. It's pretty stiff stuff. The procedure was we only ran on weekends, when we were running the liquid fluorine. The wind direction and temperature had to be within certain guidelines, otherwise we couldn't run. There were times when we'd come out here on a Saturday, and this one engineer, especially, his wife used to send in split pea soup, so we'd sit around, eating soup and watching the clock, and waiting for the wind to change or the temperature to come down, or whatever.

There were times when we'd just say, "Well, we didn't make it today—we'll make it tomorrow, or next week." They found out that this stuff was so hazardous that they then used to take the big trailer in Plum Brook, bring it up here into the South 40, and then transfer some of the liquid into a smaller one, and bring that one to the facility, in order to run it. We didn't need that much.

One of the procedures was once you pressurized the lines, you'd go around and feel to make sure that there were no hot spots. If there was anything at all, any pieces of dirt or miniscule dust or anything, so the interior of all of the plumbing and the hardware and everything had to be 100 percent clean. One time, we were running and evidently the valve in the chamber—fortunately, it was in the test chamber and the lid was closed, but we were all in the control room—we had a positive air pressure in the control room, so that any leakage of fluorine out in the shop or in the test cell could not migrate into the control room.

We had this thing all set to go, and they pushed the button to fire, and all of a sudden, the screen went blank. Just that fast. It turns out that one of the valves must have had some particle of dust, dirt, or whatever in it, and as soon as they hit that button for that valve to open, this whole thing just blew up—the valve blew up. We looked at it on the slow motion, and I forget now, these were all high-speed cameras, thousands of frames per second, they were taking pictures of this event, and you'd look at one frame and the valve was there, and you'd go to the very next frame, and the valve is gone. It just happens that fast. It was very, very critical handling material, and you had to be very careful with it.

JOHNSON: You said that everything had to be clean. How did you make sure that things were clean? What was that process?

WINE: If they put any new valve or any tubing in or anything like that, what they would normally do is they'd flush it and clean it as well as they could that way, and then, in a closed system, they would induce a very diluted quantity of fluorine. Then, they'd go along and feel the lines to see if there was any burning going on inside. Wouldn't be enough fluorine to explode,

but it would be enough to burn. If the lines were all clear, then we never had to open them up again, which we very seldom wanted to open because any time you'd open it, you'd have to go through this whole procedure again of checking out and making sure that the fluorine was going to have a very clean—very clean—environment to operate in.

JOHNSON: When you were running the tests, did you have to vent substances, different things, out into the atmosphere? Or was everything contained?

WINE: No, pretty much contained because the stuff was, I forget now just how many parts per million it was before it was hazardous to you. If you could smell it, it was too much, for that particular program. There were other programs where you'd vent things, but not fluorine, no.

JOHNSON: These other programs, things would have to be vented?

WINE: Yes.

JOHNSON: That was just something that was a controlled venting?

WINE: Hydrogen and oxygen, yes.

JOHNSON: If everything was run at night, was it very noisy?

WINE: Yes, it was. Quite often, we would get complaints from people calling in to the front office and saying, “You guys were running last night, it was very, very noisy, is there anything you can do about it?”

We said, “Well, it’s either test or no test,” but the neighbors were pretty good about that. I’m sure they had to put up with a little inconvenience.

JOHNSON: I imagine the open houses maybe helped with some of the complaints, maybe.

WINE: Yes, I think that might have been in the background of minds of some of the management people, to think that we’d get more people involved and be appreciative of this noise.

JOHNSON: At that time period when you first came out here, you were relatively young, I would think—early twenties, maybe?

WINE: Yes, about 23.

JOHNSON: You were married already and starting a family?

WINE: Yes, just married.

JOHNSON: Did they have a lot of activities at that point? I know some of the other Centers, especially during that NACA time, so many people after the war were coming in, and they would

have parties and they would have gatherings and things like that. Was there a lot of that going on?

WINE: Oh, yes. And the retirement parties were outrageous. The shops would all get together. When our director of retired, he was, I guess, of Viking background, or somewhere back in there. They took the main cafeteria and we built a whole half-section of a Viking ship. One of the guys' wives was in costuming, on the outside, and she made these hats with the horns, the Viking horns, and they had big, long rudders and oars. It was a real production. Of course, then all of the divisions would make presentations to them.

When I retired, they knew I was into golf a lot, and so they went to one of the local golf courses and asked them if they could borrow a golf cart, and they said, "We'll clean it all up and return it in good shape," so I guess they got it. My wife and I and family and everybody came for my retirement party, which was at the main cafeteria. They introduced us, they said, "It's only appropriate that you have a green jacket." So they had a green jacket for me, and my wife and I got in a cart. They had trails of sand on the floor in the cafeteria, and little greens for different spots. You'd go to the first green and maybe this division would have a representative there, and they'd make a presentation. Then, you'd go to the next one, and they'd give you a presentation, and so forth and so on. By the time you'd get through, I'm not sure how many holes they had—they must have had like five or six in there—it was kind of a fun night.

JOHNSON: That sounds wonderful.

WINE: We had some humdinger parties. When Bill Egan, he was a division chief, again a non-college guy, but he was my boss, and he moved up, the first time that a non-professional was in the Ad Building at that time. He was the director of, and so he had about 1,200 people under him. When he decided to retire, it was at the old picnic grounds, not the one that you're familiar with. The old picnic grounds used to be just before the road, going down and going up to the south side of the reservation, here. That was the picnic grounds. Andy [Andrew B.] Szuhai who was a division chief at that time, and I were involved in all of these extra-curricular activities. In the wintertime, we flooded the baseball diamond which was there and made an ice-skating rink out of it. It didn't get cold enough, so, because of the terrain, some of the water was deep and some of the water was this deep, so the thin stuff froze up pretty good. We had skating parties in the wintertime. That was a lot of fun.

Getting back to when Bill Egan retired, it was at the picnic grounds, then, and it was all trees and everything around there. They had this, I don't know, 75-foot crane or something back in the woods, coming down. There was like an astronaut's chair there, and so they said to Bill, "Well, Bill, we're going to do a little toasting of you, so you sit in this chair, here. The people will come up and tell you how great you were." When the presents ended, he was sitting in this chair. They said, "Well, Bill, we're going to blast you off to your retirement. Good luck." They had CO2 bottles going off, and the crane pulled him up about 20 feet up in the air. Everybody's all, "Ah!" It was really an experience.

JOHNSON: It seems like they tried to outdo each other for each one of these retirement parties.

WINE: Everybody, every event, the next one up had to be bigger and better. We had a lot of fun in those days. It was a real pleasure, coming to work.

JOHNSON: That's wonderful. Did they have events for families, too, when your kids were little?

WINE: Yes, the families were included in these things.

JOHNSON: Okay, so they had picnics and different things.

WINE: Retirement parties, and Christmastime, I was part of the Christmas celebrating committee, we had Jack Frost, and he had a little presentation up on stage in the DEB [Development Engineering Building] across Brookpark [Road], here. They have a little play, and the kids were all up there with their parents. After the play was over with, then Jack Frost is running around throughout—one of the employees, naturally. Then, everybody would go downstairs to the cafeteria and have ice cream. There were an awful lot of social activities going on.

JOHNSON: It sounds like it was a family atmosphere, everybody was close. Different areas, I would imagine, had to work together for different testing and different projects that were going on?

WINE: It was more like a family kind of event thing. There were some tests that, of necessity, that facility had the capability of developing those kinds of test parameters, so that project would

go over there. It would depend on, like, at Zero-G, anything that had zero-gravity associated with it, people would bring projects over, and we would run tests for them over there, also.

JOHNSON: In these facilities like the PSL and Zero-G, as part of the Technical Services Group, when they had these projects that they were going to run testing, were you involved in the process of getting things ready or designing the way it was going to be tested in those facilities? When did you come in, as far as what was going on?

WINE: Normally, I would be involved, as was all of the technical people, the engineers would come up with an idea and they would come over and say, "We've got to have this done, we have to have this done." If it was a big job, big fabricating job, then the fabrication people would come over and weld and put in pipes and whatever was necessary. Then, the engine would come, and then we would kind of take over and install the engine. Then, hundreds of instrumentation lines that went from the engine into the control room. We'd run those lines and we'd install gauges and monitors.

We had monometer boards and we had some old aircraft cameras that they'd get on a set point, and the pressures would be varying. So, the profile of the tubes, they'd need to know what the pressures were. In order to do that, when they'd get on a steady state point, they'd say, "Okay, take a picture." You'd push one button and three cameras would go off and take pictures of where the monometer boards were at that point. That data was sent over to a bunch of gals who were data analysts, and they would plot and show, get all of the information out of that, and that report would go over to the engineers. Then, they would either come back and say, "Well, we were close, but we needed to modify this," or, "We're going to have to run again because this



point didn't look that good." There was always a give and take kind of thing, but it was as a result of the previous tests, would determine what the next test was going to be.

JOHNSON: You were talking about the training and these apprentices, and they would go to all the different areas and they would learn about all the different areas in working in the technical services area, your group probably had more exposure to everything that was going on at the center, at the time, than probably any other group because you had to be there.

WINE: The people assigned to, like, PSL, for instance, we didn't go to any other facility. We would stay at PSL. Some guys would go to PSL and their whole career was at PSL. The engineers were a little bit different: they would go to a facility that had the capability of the kind of testing that they would require. If it was at PSL for this portion of it, that'd be good, but they might have to go someplace else for something else.

JOHNSON: During those early years, did they have a newsletter, or any way of getting information around the Center?

WINE: Yes, they had, I think it was *Wingtips* or something, that was published once a month or something like that. That has continued on, and now, I don't know if you've seen one, but it's Technicolor, I mean, it must cost a fortune to make. All the guys that I talk to—there's still several of us who meet every Thursday for lunch—so there's the camaraderie kind of thing, that we all work with back then, and we comment occasionally on what's happening out here now. Even my own experience, coming out here today, this is the first time I've been back here. I

haven't been out here probably for three or four years or longer, and that was only because the Supervisors Club was having a picnic at the end of the season, so I came back for that, to see some old faces. Most of the guys don't come out anymore. In the old days, in previous years, people would come back on a regular basis, but it's so difficult to come back, now. You got to go here, you have to get a badge, you have to get a new picture, you have to do this.

I can remember times when guys would come in and say, "Jeez, I forgot my badge," and they'd be driving through the gate, and they'd hold up a pack of cigarettes or something, and the guy says, "Come on, come on, come on." We kidded the guards in those days. Of course, the guards were all civil servants—NACA employees, too—and the firefighters were all NACA employees, too. The guys who cut the grass were all NACA employees. Then, they started getting into contracting and we kind of lost the personal touch. They used to kid this one guard, he was like Barney Fife or something, we'd say, "You got your one bullet today?"

He said, "Yes, I've got it right here in my pocket." We really had a nice time in those days, and I'm sure that it's not prevalent today.

JOHNSON: Definitely NASA as a whole, it has a different atmosphere than some of these earlier days. In 1957, that inspection that you had here at Lewis, at that time, it was also the year of Sputnik [Russian satellite] and all the activity that was spawned because of that, do you remember being aware of what was going on as far as Sputnik was concerned? When that happened and if the atmosphere changed, here? Any of those activities?

WINE: Yes, because we'd been running, it was either the Ivanhoe or the Iroquois Engine, the Ramjet engine in PSL 2, almost on a nightly basis, 7-8 hours every night. Under a normal

situation, we'd come in, get the facility ready, and check the engine, make sure that everything's all set to go for the third shift coming in to run it. I think I might have even been on third shift, then. We came in, expecting our normal running thing, operate for six or seven hours of runtime. If you weren't operating the panel, you'd be doing inspections, so you'd rotate around from outside inspection to inside inspection, and then there was an observation port, where you'd go up and you'd be looking in a porthole at the engine, and making any reports of changes and things like that. That would be one of the jobs that would rotate around. We were all getting set up for a run that night, and nobody said anything.

All of a sudden, they said, "Run scrubbed."

We said, "Why is the run scrubbed? We've been working all day, getting the engine ready, and we're set to go."

They said, "Well, the Russians and this Sputnik thing has caused everybody to be in an uproar, and so everything stops right now." We stopped that night, and within the next few weeks, all of that paraphernalia and parts and pieces of the Iroquois rocket motors, it was taken out of the test cells. We were just standing around, waiting to see what was coming up next. Then, they started to get into the rocket business.

JOHNSON: It definitely was a shift in what you were working with.

WINE: Yes, and it was like that—[snaps fingers]—instantaneous. We were ready to go one night, and five minutes later, we were dead in the water, yes.

JOHNSON: Was there a sense of, “We have to hurry up and get this done because they’re ahead of us now?” Was that the feeling here?

WINE: No, I don’t think—initially, of course, as the momentum picked up and more and more people became involved. Up until then, each of the NASA Centers almost operated independently of the other ones. There was kind of a competition, as to who was going to run what. Some, like Ames or Langley, had huge, huge facilities that you could put an airplane in. Their claim to fame was airframe structures and airplane components. They couldn’t go to the altitude that we could go to, but we couldn’t put a big airplane or a rocket of a big size in our test chambers. That’s why PSL 3 and 4 eventually became built up and online.

Each of the Centers had their own specialty. Icing research was pretty much Lewis—we have an Icing Research Tunnel here, and the only other similar facility, we were told, at that time, I think it was in Russia or some foreign companies. Companies, even airplane manufacturing companies, were interested in bringing samples of their wing structures or some other nacelle part, and putting it in our Icing Research Tunnel to see how their de-icing equipment would work. We could simulate, we could actually make ice form on the wings, or whatever. There was that kind of camaraderie, but it was still pretty much independent. In other words, if there was a big airplane engine program coming along, everybody pretty much knew that Lewis was going to be the engine people. That was our forte, engines and propulsion.

JOHNSON: That’s what you started focusing on, as far as the propulsion, for the early work?

WINE: That’s what their whole career was, here, was propulsion.

JOHNSON: What did you start on next? Everything stopped with Sputnik.

WINE: Then, rocket engines came in.

JOHNSON: Okay, so it was the rockets for the launch engines?

WINE: Right. They weren't that big. We started out with smaller ones because the facility would only hold so much, plus the thrust capability of some of these new rockets that were coming along was so great that our facilities were limited in what they could handle. I think that may have propelled the PSL 3 and 4 to really get going. They were bigger and had a little more capacity.

JOHNSON: After they announced the original seven astronauts and they had that gimbal facility here and they had to train here, do you remember any excitement or anything going on, as far as when those astronauts were coming through, and during that time?

WINE: Where the Centaur Vehicle was tested was at one end of this tunnel, and at the other end was a huge area of tunnel. The gimbal rig was constructed over in that side, and the astronauts were brought here to sit in this chair and go through this gimbaling thing. They had a picture of the Moon on the wall of the tunnel, and the guys would get in there, strapped in their seats, and they had little nitrogen jets that they could manipulate in order to simulate where they were going. They'd get them into a kind of a free fall—they were going all kinds of crazy ways. It

was their job, then, to try and hit the right button at the right time, so that that little jet of propulsion would slow it down, and then maybe back it up and then square it away, so he was then able to concentrate on the thing. John [H.] Glenn, every time he would come here after that, and even later on, years later on, in some of his presentations, he'd always say the same thing. He said, "When I came here to Lewis the first time and they put me in that chair, I got sick. As a result, every time I drive down Brookpark Road, I get a little queasy."

JOHNSON: I can imagine. That doesn't sound like something I'd want to do, not at all.

WINE: I guess you needed a tough stomach.

JOHNSON: I think so. You mentioned that you moved from that PSL 1 and 2 into the Altitude Wind Tunnel. Can you talk about some of the things, or do you remember some of those projects that you were working on at that time?

WINE: That was where the Centaur went in. That took a lot of time.

JOHNSON: Also in that early sixties timeframe, when President [John F.] Kennedy announced that we were going to go to the Moon, can you recall the atmosphere here at Glenn? I know especially these NACA Centers were so much involved in research—in research, not just on stuff they wanted to research, but in cooperation, as you mentioned, with companies and airline companies and different things like that. Do you recall a change or anything at that point, where things were getting more focused towards a goal instead of pure research?

WINE: There was more of a camaraderie between the various Centers, and all of the Centers were more inclined to work towards one end, and that was to get a man up into space. Prior to that, each of the Centers pretty much operated on an individual basis. If there was a project that was coming on board from Washington, some of the Center Directors would be up there beating the drums to get the project assigned to their Center. There was a lot of competition between the Centers, then, but when the space program came into focus, at that time, I never heard any communications or comments or anything about, “Well, this should be done over here,” or, “this should be done over here.” It was, “Get the job done.” If it took this Center and this Center and this Center to coordinate with this Center, then that’s what we did. Everybody had one goal in mind, and as a result of that, there was a lot of commonality and friendship generated. Unfortunately, as the space program petered out, then everybody didn’t have as much to do, and so they all had to justify their existence, I’m sure, and so there was a lot of the nitpicking going on at that time.

JOHNSON: In the early seventies, you had some significant layoffs, as most places did. Did that have an effect on the morale, as far as the center was concerned?

WINE: Coming off of a high like that, getting achievements of landing a man on the Moon, there was a certain drawback in not being able to continue the program. Things seemed to be going along okay, and then when Andy was called back to Washington—I understand from Andy, later on, that the Director for Houston went to Headquarters and pounded and cried and whatever he did. At any rate, they said, “Okay, we’re going to have co-chairmen of the program,” and that

just devastated Andy. I think that probably resulted in his early retirement from NASA because he retired just a few years after that. He was sent out to California, and this other guy, I guess, was co-chairman, or whatever. Never worked out too well.

JOHNSON: You mentioned you were there with him when the *Challenger* accident happened—what about the Apollo 1 accident? Do you remember anything about that?

WINE: Not a whole lot, other than it happened. The *Challenger* was so vivid because at that time, I was assigned to the Ad Building, and we watched it on Andy's TV, in his little private conference room there. He and his secretary and I, and maybe one or two other engineers, were the only ones there. That made it more personal because the other ones, you didn't see the thing, and you were doing a job and working wherever you were assigned. The closest you came to it was you read about it in the paper or you heard it, word got sent around the lab. It wasn't quite the same as watching the thing actually.

JOHNSON: Going back to Apollo, you had Neil [A.] Armstrong, who started here. Was there a sense of pride in the fact that he was the first man on the Moon and he started here?

WINE: Yes, certainly. He was an introverted kind of guy—he didn't like publicity much. He came back to the Center for a couple of activities, presentation kind of things, but he kind of became a recluse, almost, from the Space Program once he got out of it. We didn't see or hear too much from him, but occasionally, and of course, his name would always pop up.



JOHNSON: You mentioned the Zero-G Facility. That just fascinates me, and you were there when they were first starting to build it, digging that 510-foot hole and in five seconds, being able to get the amount of data that they got is pretty interesting, that they were able to do that.

WINE: Originally, the other phenomenon of that facility in its original planning stages, I didn't mention it because it really never panned out, but they had a cannon in the bottom of the vacuum chamber. Catching this big can that the model ultimately settles into was on rails, and so, in its original conception, the idea was you'd pull the can out of the way and you'd put the model on this gaseous nitrogen, high-pressure gaseous nitrogen cannon. You'd shoot this thing up, and while it's going up, this is coming out. There was a timing that we were a little concerned about because if this wasn't there and this thing came back down, it could cause a lot of damage.

Initially, they went with smaller payloads and just round balls, really. But the whole concept was you'd pull the deceleration can back, put the model on the top of the cannon, and fire the cannon. It would come up to the top, and this would come out of here, and you'd get 10 seconds of zero-g. The complexities of running all of these activities at one time, and everything had to be perfect, it got to a point where it's so much easier to leave the deceleration can in place and hang this thing up here, and let it go. You get 5 seconds instead of 10.

JOHNSON: It was free fall, right?

WINE: Yes. The reason they allowed it to free fall with no atmospheric influence on the surface of the tension, was they had a vacuum pulled in there. This payload was falling in a vacuum, so

there was no air drag, nothing to give it any sustainability as far as the air was concerned. Just free fell for 5 seconds.

JOHNSON: That's amazing, the amount of information they got out of that 5 seconds of doing it over and over and over again, I'm sure.

WINE: Yes.

JOHNSON: I'm going to ask Rebecca if she has any questions, if you don't mind.

WRIGHT: I just have one that I think of, quickly. You talked about how when NACA transitioned into NASA, there seemed to be more of a camaraderie, that the Centers seemed to have more of a purpose in working together. Were there any other things that you noticed during that transition period? You came out here and you worked and you learned from the people who had been here for so long, as part of NACA. Were there other philosophies or other ways of structure or organization? Anything that you can think of that you could start to see the NACA way of doing business was now turning into more of a NASA way of doing business?

WINE: There wasn't anything obvious. I guess the only concern that was every thought about was bringing all these Centers, with all of their various expertise together to get the job done, which NASA and NACA had never done before. It had been pretty much an individual Center activity, to accomplish whatever it is they were trying to do. Now, all of a sudden, everybody's pulling in the same direction, which was kind of a happy and unusual experience for us. Now,

everybody's working together, instead of we have to be in competition with the various Centers to get the work out of Washington, because they only had so many dollars.

But when the Space Program started, the money was no problem. You need some people? They're here. You need some equipment? It's here. It was gung-ho, let's do it, and that was the camaraderie thing that transpired and encapsulated the whole concept of NASA at that time. There were people being brought in from other disciplines that we had never really been involved with, so it was a big, happy family reunion, and there wasn't any—at least, I was never made aware of it—competition between Centers, then. It was like, whatever we need to do, we do. Whoever can do it, does it, and that's it.

WRIGHT: There were members of the Lewis Research Center family that left to go to different Centers—especially to Houston, to become part of the new Manned Spacecraft Center. Did you ever have any inclination to leave Lewis, or were you happy being here?

WINE: The kind of work that I was involved in all my career here wasn't of a specialty enough that they would want to come down and say, "Hey, we can use you at Goddard [Space Flight Center, Greenbelt, Maryland]," or someplace else. The only time that anything like that ever happened was like I say, when I went out to Colorado to interview at General Dynamics. That's just when the space program was getting started. I think what they were looking for was somebody with a little bit of NASA experience, even though I didn't have much at the time. They were just entrenching down in [Cape] Canaveral [Florida], and so it was a new learning curve for them, too. I think they were probably thinking, if we could get some people with some experience, at least we'd be a little bit ahead of the game, rather than starting out from scratch.

Their only mission up till then was shooting rockets. The connections between the various Centers and who's going to do what, it all became a mishmash.

We never had any union problems here, never even had unions, but down there, it got to a point where, I understand—I was never there; I visited there, but I mean I never worked there—it got so tight, everybody was vying for a position or a job, or whatever, that if a mechanic wanted to drill a hole, he had to call an electrician so he could plug the thing into the wall for the guy to use. There was a lot of friction between unions which were down there—and we'd never had a union up here—so I'm sure the people who went down there went through a bit of frustration, but it worked anyway, in spite of it.

WRIGHT: You talked about working on different engines, and of course, the Apollo era that you did. I know you were here for part of the Shuttle. Did you have specific work that you remember working with for the Shuttle Program?

WINE: No, not really. The only people that might have been involved would be maybe somebody out at the hangar that might have been involved in the [Shuttle Carrier] Aircraft, that 747 that was converted over in order to carry the Shuttle, but I don't recall us being involved in structurally building and fabricating the bracketry that went on top of the 747 in order to support the Shuttle. I think that was all probably done at Ames or one of the more airplane-involved flight-type programs. They're in a better weather situation, and although we've had several aircraft programs, like icing research and stuff, we were very heavy in that—still are, I guess. Some of the zero-gravity stuff, but that was all taken over by the big [KC-135 Zero-Gravity

Program aircraft], where you see pictures of people floating around in there. It was good for PR [public relations].

JOHNSON: You mentioned you traveled to some of the other Centers. Was that to see the facilities?

WINE: It was more for meetings.

JOHNSON: I didn't know if you went to see any of the other chambers or test facilities and how they were run.

WINE: Not really, specifically. We went out to San Antonio [Texas]. The Center Director was friends with the commanding officer.

JOHNSON: At the Air Force base?

WINE: Yes. We loaded up the Convair [aircraft] that we had—I think there were about 12 or 15 of us that flew out there. Really, the good part I got out of the whole meeting was they took us for rides down through the water, and we had dinner down there.

JOHNSON: On the [San Antonio] River?

WINE: Yes. We had a meeting the following morning, I guess to justify the flight, you know how that is. I haven't spent any time or any involvement with any of the other Centers, other than just going to various Centers for meetings.

JOHNSON: As part of the Technical Services, did you talk with people with Technical Services? Like, at Langley, Jack [A.] Kinzler, and then he went to JSC [Johnson Space Center, Houston, Texas]? Did you ever have any involvement with these other Centers that had that same division?

WINE: Maybe at the upper management level they did, but I didn't feel that we relied on or depended on any other Center for much, and we had a couple of Center Directors who were really, really sharp guys, and they were really, really Lewis. If somebody knew something more than they did, that was not the information they wanted. There was a lot of competition, this program going up.

JOHNSON: If you don't mind, for a minute, just think about what do you think is your most significant contribution in your career with NACA and NASA?

WINE: I suppose gravitating to be Assistant to the Center Director. It's a goal that up until then, I didn't know of anybody, and I was the first non-college-graduate person type to have an office in the Ad Building, right next to the Center Director, and my own secretary, which was unthinkable when you're talking about grease monkeys out in the shops, putting parts and pieces together, years ago, and ending up at that point.

JOHNSON: Did you ever think, when you first started out here, did you have that goal? Not necessarily that specific goal, but the goal in mind to keep moving into management and more into those types of positions?

WINE: Yes. Every time we'd have a yearly performance appraisal, usually it was done by the section head, and that was Bud Meilander, was the section head over at PSL 1 and 2, and then 3 and 4. The division chief was Bill [William] Harrison. Every time I would have my time to be evaluated for my performance appraisal, normally you'd go in and the first line supervisor would normally take care of it. Most of the time, for some reason, when it came my turn, a section head was the guy.

Invariably, the time that it was my turn and I'd be in with the section head, Bill Harrison, the branch chief, happened to show up. I think it was probably because I was ambitious, I guess, and was asking the questions that they weren't comfortable in saying that you're going to do this, and we're going to do this for you. Bill Harrison, the division chief, said, "Don't worry about it, Howard. You're going to make it. Just keep going." It wasn't a very personal kind of time. You'd go to parties and things like that all together, but management was management and employees were employees, and it wasn't like a country club kind of atmosphere, although the communications was great, and the relationship was good. It wasn't like, "Come on over my house, I'm having a cookout." Everybody got along happily.

JOHNSON: That's good. What do you think would be your most challenging work that you did while you were here?

WINE: Probably the most ambitious was that Centaur Program, which drew a lot of attention. We were given this space vehicle, one of a kind. There was no room for any error in judgment or operations. You could destroy a vehicle that cost millions of dollars, and it was irreplaceable, almost, at that time. That and Zero-G were the two most interesting programs and projects that I was involved with. They were both unusual, out of the norm.

We were putting jet engines in and firing them off every night, that was no big deal. Now, you had challenges that you'd never experienced before. During the construction of the Zero-G, one of the welders stepped back to check his weld and fell and got killed. It was a very unusual event that was taking place at Lewis at that time, and there was a lot of attention. Of course, you were in the public eye all the time. Everybody wanted to make sure that we didn't screw things up, and it was a first time—it was the only time—kind of deal. There was a lot of emphasis and a lot of pressure to perform and do the right thing at the right time.

JOHNSON: As you mentioned, when you first started, people didn't really know what NACA was, or NASA, but then once the space program started, then you're in the public eye because people are watching. A little bit more pressure.

WINE: Sure. I guess.

JOHNSON: Is there anything we haven't talked about, or anything you want to mention while we're still going?



WINE: I don't know—you've brought up some things that I hadn't thought of for years, but it was a great time. I think everybody, up until more recent times, it was more of a family atmosphere. A lot of fun, a lot of work, a lot of hard work, but we came up with a lot of crazy things to do.

JOHNSON: No regrets about not getting that degree and taking the path you did?

WINE: Not really, no.

JOHNSON: It sounds like you had a really good career.

WINE: I think so, yes.

JOHNSON: Definitely an interesting one, that's for sure, interesting projects.

WINE: We had four kids, and they all were able to get college degrees. One went on and got to be a lawyer, and I have a niece, she must be a brain, she went to Case [Western Reserve University, Cleveland, Ohio] and got an engineering degree, and then she went to Ohio State and got a law degree. She's out in California, making big bucks. Everybody's doing well.

JOHNSON: That's good to hear. Thank you for coming in today and talking to us, we really appreciate it.

WINE: It was fun and painless.

JOHNSON: That's always good to hear.

[End of interview]