NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

HECTOR GARCIA, JR.
INTERVIEWED BY REBECCA WRIGHT
HOUSTON, TEXAS – MARCH 10, 2010

WRIGHT: Today is March 10th, 2010. This oral history interview is being conducted with Hector Garcia for the Johnson Space Center Oral History Project. Interviewer is Rebecca Wright, assisted by Sandra Johnson. The interview is being conducted in Houston, Texas. We thank you for coming in today and visiting with us. We'd like to begin by you sharing with us how you became involved with the space agency.

GARCIA: I guess I can go back when I was a little kid. I grew up in The Valley [Rio Grande Valley] down in McAllen [Texas] and Pharr [Texas] during the 40's and 50's. We used to pick cotton in the summer. All the kids got together and we had a truckful of kids. That's what we did in the summer when we were 12, 13 years old. [We used the money to buy clothes for school.] We'd go out there, and we had those sacks that we dragged around. They were kind of heavy [when they were full of cotton]. You're by yourself really, so I just thought about space. I even was thinking of writing a story of going to the Moon at that time. I grew up during the war [WWII]. The toys we had were planes and tanks. I wanted to be a pilot, because we always played with tanks [and I wanted something else], but I had bad eyesight. [I had cut my left eye playing with a red wagon as a child.] So I knew I couldn't do that.

Then I said, maybe I can be an engineer, or make the Army my profession. Those two things, when I was little, that's what I [wanted to] do. While we picked cotton, we also had hurricanes that would come sometimes. So I got interested in the weather when I was little. I

remember one time we were out there and a hurricane was coming. There were some waves [wind and rain] that would come in, [but] they kept us out there until it was about to pour on us, because they wanted to pick all the cotton. Then they [finally] herded us over to a barn. I watched the wind [increase in speed], and I said well, wonder how all that works? So I got interested in the weather. Then I said, maybe I'll be a weatherman.

Eventually I became a migrant worker when I was 14, 15, 16. We used to miss the first part of the school year [about six weeks], but I would always catch up. I caught up so much that I [graduated] third highest [out of 142] in the graduating class. I was the high science and math [student]. The only thing, back then they didn't give scholarships [to Mexican Americans]. They did offer me a Bausch & Lomb Scholarship in Rochester, New York [that I *earned* by being the top science and math student], but I didn't have the money to go over there [and compete for a four-year scholarship]. So I went to Pan American College. It was a college. It wasn't with the University of Texas [Austin, Texas] yet. So I went there two years. I did work as a [summer] co-op with the Texas Highway Department. It wasn't TxDOT [Texas Department of Transportation] yet. It was Texas Highway Department. I became an engineering aide at the Texas Highway Department.

About that time, I got serious with my high school girlfriend. We made plans to get married. I was already registered [at UT Austin], and I was going to transfer to the University of Texas. Well, I ran out of money. At the Texas Highway Department they allowed me to work the semester, stay out of school and work the semester, but I got drafted [during] that time. The GI Bill [of Rights] was not in force. That was a period when the GI Bill was not in force, so that was a double whammy on me there. [I did not get any school benefits.]

Anyway, I got drafted. I wound up in the Pentagon with the Office of the Army Assistant Chief of Staff for Intelligence [ACSI]. The reason for that is that all through the [Army intelligence and physical] tests I made the highest grade, all through [basic training]. So I wound up getting a top secret clearance, and more than that, because I got CIA [Central Intelligence Agency], SEATO [Southeast Asia Treaty Organization], CENTO [Central Treaty Organization] and all others [except what the President had]. At the time they called that Cosmic [Top Secret (CTS) – highest North Atlantic Treaty Organization (NATO) security clearance]. I handled all the cablegrams and messages from all over the world [from our intelligence operatives]. That's what I did when I was in the Army. [Around] that time, my wife and I did get married, and we wound up [living] in Arlington, Virginia, right across from Washington [D.C.]. [We rented a house because I did not like apartments.]

I was still interested in getting back to school. I was interested in the space program more than before. I said, "That's what I want to do." So when I was in the Pentagon I started learning Russian, but then I stopped, and that was a big mistake. I should have kept on learning Russian, because of the later [NASA] flights with the Russians. The day that my wife was at the doctor, Alan [B.] Shepard's flight went up. I remember, I told my wife, "That's the first [manned] suborbital flight [MR-3 in May 1961]."

Later that week we happened to be in town. We had gone out to eat, and we were coming back. We crossed the [Arlington Memorial Bridge]. There [were] a lot of police cars. We were the last ones that [were allowed to get] on the bridge going across to the Virginia side. Who comes across? It was Alan Shepard in a convertible with an entourage of cars. I don't know who else was in there [with him]. I told my wife, "Here comes Alan Shepard." So it was funny that it happened that way.

Anyway eventually I got out of the Army and enrolled in the University of Texas. [The Army offered me a commission to stay but I turned that offer down.] I took the aerospace engineering courses. One of the courses that we had was Astronautical Guidance by Richard Battin. We had other more aircraft [related courses], but we did have that one [space-related] course. That was the main [space-related] course that we had. There weren't that many back then, they were just starting. So I was lucky to have gotten that course. It was very interesting [that] I had taken calculus before, but I actually learned calculus in that course.

At the end, when I graduated, the recruiters came over. I graduated in January '65. Back then you had to suffer through Christmas and New Year's holidays and then take the finals, which was bad. I don't remember the [NASA] recruiter, but they interviewed me, and then about a week later I got a letter that they were going to hire me.

So my wife and I came over. We had some friends here in Houston we stayed with. I went down to JSC [MSC (Manned Spacecraft Center) back then]. I did not like the job that I was offered, because it was going to be on a recovery ship. They told me the one that I was going to be on was going to be in the Pacific [Ocean]. I didn't want to leave my wife alone. We already had one child, and my wife was expecting another one. I was not going to leave her alone, so I turned down the job. They said, "Well, we'll send you around." So I went all over. I went to the Engineering Directorate and interviewed there, then there they told me, "Well, go to MPAD [Mission Planning and Analysis Division]. They're hiring over there." I went over and interviewed with Charlie [Charles C.] Allen in the Flight Analysis Branch. He told me what they did. I told him that I wanted to be in operations. I wanted to have both the technical and operations. He said okay. Of course when I told my wife that I turned down the [first] job [offer] she said, "Why did you do that?"

I said, "That's going to send me out there on a ship, and I'm not going to do that. I'm not going to go out there and spend weeks and weeks and then maybe the flight gets [scrubbed], and you stay out there." So I said no. We went back [to Austin] and I finished my finals. We had just about a week before we had to get out of our student housing. We were still waiting.

Finally I got a letter. They offered me a job [with MPAD]. I had other offers because of my grades, but I didn't want to work anywhere else but at NASA. Of course the pay was also a lot less at NASA, but I told my wife, "That's where I want to work."

LTV, Ling-Temco-Vought, in Dallas [Texas] had offered me a job, almost $2,000 more per year. Back then it was $6,800 or $7,200 a year. They had offered me $9,200, plus other amenities, and I was going to be close to my sister. I had two sisters and a brother in Dallas. I still turned it down because I wanted to work at NASA. I came to work on my birthday, February 1st, 1965. They knew that I was one of the first aerospace engineers, because there weren't that many with that [degree]. They were just mechanical, electrical engineers, even civil. So they said, "Well, we got the right job for you." Normally, they told me, they would put somebody that I would work with, but they didn't do it. They just gave me a project.

The project was the backup entry [computer program] for Gemini [spacecraft]. It wasn't working [properly]. I think GT-1 and 2 had already gone off. GT-1 was I guess because they were trying to check out the structure [and launch vehicle systems], then GT-2 I think was the launch systems [and spacecraft systems], then GT-3 was the first manned. It was a three-orbit mission. So we were coming up on that. They were having problems with the [backup] entry program. The RTCC [Real-Time Computer Complex] was having problems also I was told. They gave me the backup program. It took me one day and I got it to work.

WRIGHT: That had to be rewarding.

GARCIA: Yes. The problem was there were some burns that they would do, burns so that in case the retrofire system didn't work you would do this OAMS [Orbital Attitude Maneuvering System] burn with the OAMS engines, the [small] reaction rockets, that would lower the perigee down so it would [aerodynamically] catch the vehicle and eventually it would come down in a day or two [without a retrofire burn. One of the burns was being taken out of the program.]

They had contractors; I don't know whether it was McDonnell [Corporation]. One of those contractors was going to charge them thousands of dollars [I was told]. It would take them six months to fix the program. So I looked at it. The problem with the program was that it had parameters that had to go from one phase to another phase. [They] had to be carried over, the parameters, because there was no [easy] way that you could take a burn [phase] out without causing a problem. So I looked at it. In about an hour or two I said the only way we can do it is to minimize the burn by like a split second of the burn, which doesn't do anything to the trajectory in the simulation. Then everything gets passed over [to the next phase]. I tried it and it worked. That's the way the backup program was until we ended the Gemini project.

WRIGHT: Amazing. What a great way to start.

GARCIA: I did that. Finally one of the persons I worked with was Larry [D.] Davis. He had been there maybe three or four months [before I started]. We worked together on a lot of projects. We actually did work one flight, I think it was Gemini X. We [helped] design the

trajectory and all the maneuvers. We [the Flight Analysis Branch] would get the requirements and then we would design the trajectory.

Going back to the ACR [Auxiliary Computing Room], I liked that because I liked operations. When they came up with a team, of course I volunteered to be on operations. We wound up working in the ACR. Like I said, they don't give us justice on what they wrote there [the *Roundup*]. We did a lot more important things [than what they discussed in the article].

WRIGHT: The ACR is, according to the information you gave us, on the third floor of the Mission Control Center [MCC]. Tell me how it all happened and how you were involved in that.

GARCIA: There was a computer room next to this room [located on the third floor of Building 30 opposite the MCC]. People called it the hidden room because they didn't want anybody to know that it was there and what went on in there [I was told]. I think in the beginning, GT-3, they had a guard outside our door [going] into [the] ACR. Only people that were supposed to work [the flight] would go in there.

Anyway, this computer was the old 7094. It was an IBM 7094 computer, the ones that had all the little lights [on the console] and the tape machines were on the walls and the printers were on the side. When we got our programs to work, like the rendezvous people, we [created] boxes of cards. We would load those up onto big computer tapes, but we left spaces in there where we would update with the [computer] cards. I don't know if that [the *Space News Roundup* picture] shows it, but on another picture we had a teletype machine. That's how we would get our vectors, the position [and] velocity. They would come over, and we'd read them. We had a keypunch person. They were girls—that's another thing. There weren't that many

female engineers, in fact, only one or two when we came. Of course there weren't [many] Mexican American engineers either.

We would call out the vector. The keypunch person would punch the card, then we'd run into the computer room and there was a card reader, a machine that would read the cards. He [the computer operator] would run the program. At a certain point it would stop, then you'd put in the cards. They would put in the information into the computer. The program would keep on going.

So I [set up the backup] entry program, the Gemini entry program. I had several boxes of cards. I loaded those up [onto tapes], then I wound up with a little pack of cards for the real-time. I'm not completely sure, but on GT-3, [I was told] we were checking out the RTCC programs. What I heard is that most of our information went onto the spacecraft, because they hadn't checked out the RTCC. Besides, it took so long to update the RTCC—they needed a lead time [of] a month, two months. [I was told] if the mission changed a little bit, or the mass properties, the weight, changed, they couldn't [update and] run it. They could run with the old stuff at that point where they stopped [updating], but we had the flexibility to run [with the latest data] real-time in the ACR.

So that might have been the reason [at the time] that they didn't want people to know what was going on in that room. [I was told that a] very few people know that the first rendezvous [maneuver update computations were] done by those people there [in the *Roundup* picture during GT VI-A]. Of course the emergency entry was done with my program [on GT VIII], but of course they kept that quiet too. It sort of bothered me a little bit when a lot of people got awards that handled my numbers, and nothing was mentioned [about where they came from].

WRIGHT: About what you did.

GARCIA: About what I did, but it didn't bother me, because I liked operations back then.

WRIGHT: Would you share a little bit more? When you talk about it's this group of people who did the first rendezvous, then the emergency entry? Explain that. Were you there when they were?

GARCIA: Oh yes.

WRIGHT: Share with us those [memories of Gemini VIII].

GARCIA: Larry Davis was the ACR chief. I was one of the ones like the rendezvous people, I was running my program. What happened [on Gemini VIII] is that they docked with the Agena and they started spinning. Of course they didn't really know [what was causing it]. They thought it was the Agena, but it was actually a stuck thruster in the Gemini. They had to activate a ring of thrusters. There was a mission [flight] rule that if you activated that ring of thrusters [RCS (Reentry Control System)] you had to deorbit as soon as possible [to the next planned landing area].

The RTCC was in the rendezvous mode [I was told]. The programs were in the rendezvous mode. When we [the team and crew] finally came up [with] what the real problem was, and they finally stopped the rotation, they tried to load the RTCC entry programs, and they

didn't work [I was told later]. We only had two revolutions—to either deorbit on one or the other one [even though the crew wanted to continue]. I think the recovery ship was the [USS] Mason. They were going from one recovery zone to another one. As soon as the [*USS Mason*] passed the time to deorbit [for the first opportunity], they would start and they'd head for the other [planned landing area]. It was 7-3, 7 was the orbit and 3 was the recovery area [in the West Pacific]. I think it was off the China Sea somewhere. They couldn't get a good deorbit time in the RTCC. It was way off [I was told]. Back then the engineers, when we ran something, we knew approximately what the answers would be. We sort of knew. So when they would run something, they would come up with an answer, and say, "That's not right."

The thing that I had with mine is that I kept it updated all the way through. We had mass properties just maybe a few days before launch, so I would update my program. Plus I had all the other orbital mechanics information in there that was already checked out completely. Anyway, so I ran [the backup entry program], because I did what we always did. We would check the RTCC. I ran my program. Larry Davis told me, "They loaded up your numbers."

I said, "Really?"

When they did the deorbit, we were trying a new system. It's called rolling [re]entry. It was a bank, reverse bank, so you had to compute the time to do the deorbit, the time to do the bank, which was [also an angle-computed] roll, and the time you come out of the bank [and roll] to the other side. The backup program had four or five numbers that you had to compute. The Mason said, "We see it." [Actually it was a relay from the (Douglas) C-54 (Skymaster) aircraft], and that was the closest to the target that they had ever had [up to that time], which was one and a half nautical miles to the target. [I am sure that the crew manually flew the bank angle commands that the spacecraft computer generated from the reentry data that was entered.]

I have to tell you the story on GT-5. The RTCC had the wrong Earth rotational—every 24 hours there was a delta angle that the Earth would go through, and that had to be added. They had the wrong number to add, but I had the right number. The RTCC had [sent a navigation update with] the wrong Earth rotational [range angle], a delta angle that the Earth would rotate [from the initial alignment of the inertial system] and that had to be added. They had the wrong number to add [which caused a navigation error position in the onboard computer] but I had the right number. When they deorbited on GT-5, they couldn't find them. So they gave me the numbers [the actual deorbit data], and I ran it. I told them where to find them. That's where they were, with my program.

Plus I did all the [Gemini entry] postflight—I had done the postflight from GT-3 on, we did a report after every flight. We did a postflight, what went right, what went wrong. So we would do a complete—like another [reference] mission, another flight. Like we do prelaunch [simulation], we did this postentry. So we duplicated the mission. That was done in entry, but it was also done on orbit and all the other portions of the flight.

I always did the postflight on the entry, the deorbit and entry. I knew my program was right. Prior to that, GT-5 was 98 nautical miles away from the [landing site], so the recovery ship didn't see them. So we had to scramble. They gave me the numbers that they put into their computer. I stuck it in mine and I said, "Well, they've got to be here."

WRIGHT: They were.

GARCIA: They were.

WRIGHT: I'm sure that ship was glad to know that you knew what you were doing.

GARCIA: Yes. The others—GT-3, GT-4—were also like 40 miles away. So we knew it was a problem. I told my supervisor. I said, "I put their numbers in and I get where it hits. I've got the right logic in there." That's why on GT-8 they took my numbers, because [our ACR team] knew from all the postflights that they were right.

WRIGHT: Did that continue after that?

GARCIA: No. They fixed the RTCC.

WRIGHT: Fixed theirs.

GARCIA: Yes. They finally went back and fixed [the Gemini entry program]. I guess at some point they didn't want to think that they were wrong, but that was a problem that they had. The problem was, like I said, that it was months [I was told] before a flight that they would have to shut everything down and just stay where they were. That was the big problem.

WRIGHT: You had the advantage of being able to work.

GARCIA: Oh yes. All of us. The rendezvous guys and everything. Eventually the rendezvous program got [checked out in] the RTCC [I was told]. Then the rendezvous was done from the RTCC, then we checked.

WRIGHT: Was it a small group that worked?

GARCIA: We had three shifts. For each one I trained a couple of guys to run my program. I eventually became an ACR chief also, then I couldn't run it, but I had people running the program. There were some contractors that would come in because they had other special functions.

I had a landmark star sighting program that I developed with the help of a contractor. I gave the requirements. I called it AGOP, which is Apollo Generalized Optical Pointing. We computed pointing programs for telescopes around the world. Well, actually there were just four that I remember. One was Jodrell [Bank Observatory] in [Lower Withington, Cheshire, England]. There was one in California and one in Denver [Colorado], then our telescope that we had here at NASA. So I think I remember it was four.

All of those came from my program; all the pointing. In fact sometimes we'd get out when we had time. We'd go to our telescope here and look at the spacecraft on the way to the Moon. It was rotating. We could see where the Sun would flash. Every time it went by the Sun hit it and then it would flash. So we knew it was rotating. They call that the barbecue mode. [The rotation allowed the vehicle's outside surface to maintain the same temperature throughout.]

WRIGHT: Mode. What an interesting insight, you developed the program to be able to go do that [provide pointing angles].

GARCIA: I liked the job that I had, because I interfaced with other people at other Centers. Since I was interested in the weather I became a weather contact for our flight control team. So I worked with the weather people. I took some courses in the weather with the weather guys. We used to launch balloons to get all the [upper wind] information. We were launching balloons in Gemini. We would get the information and stick that into our programs, then we would know [it was safe to launch]. It was mainly for the launch in case of an abort.

Not much for the [splash down] landing, because Gemini was just a vehicle [designed for a water landing]. It was mainly when we started Apollo and for the Space Shuttle that we started using the [upper] winds more than before, but we started with that. Since I got involved with that early too, with the winds, they knew that I was a "wind" person. That's what [some people] called me. So right after the end of Gemini I went to the first Saturn V launch, unmanned. I went down to the Cape [Canaveral, Florida] to coordinate the winds. [Apollo 5 was the *first* qualification of the Saturn V launch vehicle and Apollo spacecraft with the Service Command Module (SCM) and a boiler plate Lunar Module (LM).]

We were in this building and we finally got a go for launch [for Apollo 5]. We had sent the last wind information back to Johnson [Space Center]. I was the only one from JSC, but there were three or four guys there. So they said, "Come on." So we went up to the top [roof] of the building to get a good view of the Saturn V. The guards came over and ran us off. Then we had to hurry to get to a [clearing] where we could see it. We got there with about five seconds to spare.

This was the big rocket, Saturn V. We were close enough, maybe a mile and a half or less, I don't remember, but we could see it. You could see it about this tall [indicates with hand].

When it blasted off, it ignited, it seemed like it didn't move. It stayed there for a little while, then it slowly went up. It was so slow. Not like the Space Shuttle.

Then we got the sound. That was the first time I had ever heard that sound. It was like a clattering or shattering, like it was waves, the sound, and it almost hurt my ears it was so loud, but that was the first time that we had launched a [complete] Saturn V [with an Apollo spacecraft, SCM, and a boiler plate LM]. It was unmanned of course. [It did go into orbit.]

But it was the complete Saturn V and it was a test. Of course my wife was watching from our motel, because I took my wife down there. Afterwards we went out to eat to this place that somebody had said, "Go to this place to eat seafood." It was upstairs. We went up. We sat down, and two tables from us was Walter Cronkite. I told my wife, "That's Walter Cronkite." The reason I knew it was him is because when I was in the Army they had films [where] he would give [us] his pep talks. Walter Cronkite. I don't know if he was ever in the military, but he would dress up in a soldier's [military correspondent] uniform. He would tell us all about that. So I said, "That's Walter Cronkite."

WRIGHT: That's neat. That was a good day, wasn't it?

GARCIA: Yes. It wasn't so good coming back. That was when Dr. [Martin Luther] King got assassinated. We were driving back and I told my wife, "I don't know." They had this [gas station] on I-10, back when I-10 wasn't that big, and we had to stop for gas, and it was an all-black gas station, and, well, we were Mexican American. [So I felt safe even though they looked upset and angry.]

Going to the Cape we had stopped in New Orleans [Louisiana]. There were two streets that form a triangle. There was a drugstore, but it was triangular, it had two entrances. We came in on one entrance, and they had two counters separated by a wall. We went to the other counter on the other side and they wouldn't serve us. They said, "Go over to the white side." I told my wife, "Well, let's go." So we went over. My wife has green eyes and kind of light skin and sort of brown hair, blondish brown hair. So we went and sat there. We had our drinks, and we decided to go out that other door [which turned out to be the black entrance].

There were—it was like a boycott. The blacks were there with all their [signs]. There were newspeople there with cameras. We came out. They thought that we were trying to break the [picket line] and I told my wife, "Let's get out of here." That was before King got murdered.

My wife said there was a lot of policemen and maybe some military. I didn't see them, but she said they were all military, maybe National Guard. The blacks were going up and down. They were trying to boycott the drugstore at that point [the black entrance].

WRIGHT: What a historic trip for a number of reasons.

GARCIA: Yes, then coming back, like I said, they killed Dr. King.

Anyway that was the start of the Apollo program [for me]. I guess we were satisfied with Gemini because we made all the accomplishments that we set out to do, the rendezvous, the 14-day mission. We checked out all the systems, the EVAs [extravehicular activities]. So we were kind of happy about that.

We were transitioning into the Apollo. We kept the ACR going, and they changed the name to the Real-Time Auxiliary Computing Facility, RTACF. Before the end of Gemini I

worked in the Control Center. Well, I moved from there to the Control Center, to the back rooms. They call it a Staff Support Room [SSR]. Larry Davis, myself, and two others became Trajectory Support Chiefs. They called us Traj. We were in the SSR, which was the Staff Support Room, next to the Flight Control Room.

We mainly worked with FDO [Flight Dynamics Officer] and RETRO. Back then in Gemini and Apollo we had Retrofire Officers, they called them RETRO. FDO was the one that took care of the on-orbit [and launch trajectories]. RETRO took care of the ascent [for aborts] and the entry, which was what I really was working on. I did work on orbit some. I did some translunar trajectories, because I got moved around. I was in several sections but still in the Flight Analysis Branch. So I worked in different areas. We were still a team. They changed our name to Mission Support Section. We worked the Apollo program. The [first] main one that I really remember is Apollo 8, because that's the one that we went for the Moon.

When I was at school, when I studied under Richard Battin's book, there were several trajectories that you could have. One was one that you could go around the Moon and come back in case you had problems [called a free return trajectory], then the other one was a fast trajectory where you didn't have that capability. So NASA chose to keep the one with the flyaround capability, which was good for Apollo 13, because if they hadn't had that, they had no thrusting capability, other than the LM [Lunar Module]. They couldn't use [the SCM because of the explosion]—[as] they went around the Moon, they couldn't do a burn. They usually did the burns behind the Moon [to get into a lunar orbit]. So we wouldn't know whether they did them or not. [On Apollo 13, the LM was used to perform three burns—one to get back to the free return trajectory, one to assure a Pacific landing, and one mid-course correction burn to achieve a safe entry trajectory.]

On Apollo 8 one of things we did in the ACR was we computed a time that they would show up when they came around the Moon. So when they did the burn we knew if it came out too early, they didn't do the orbit around the Moon. If they came out at a certain time—there was an optimum time they would come out—then we knew they were [in] the right orbit around the Moon. They did. So we would compute that time in the ACR. There was a lot of things we did there. So they came around the Moon. When they came out, we knew. We in the ACR were probably the first ones that knew that they were okay. So we all went, "Yeah, they're in orbit around the Moon." That was as far as the [main] one that I remember, Apollo 8, because that was the first time we left the Earth and went around the Moon.

WRIGHT: Were you able to hear all the loops?

GARCIA: Yes. Well, even in the ACR we had a [squawk] box. We could punch up some of the loops, but we had more when we were in the Staff Support Room inside the Mission Control Center. So we had more loops. There were some we could talk and some we could just listen.

The ones we could talk were with the FDO and the RETRO and maybe one or two of the guidance officers, but we couldn't talk to the Flight Director or the CapCom and some of the medical doctors [unless they called us]. We couldn't talk to those. Each one had their own set [of assigned loops].

We had our headsets. Even in the ACR we had our headsets. We had our monitors too. We would take information sometimes from the monitors, because the RTCC would run something [that we needed for our programs]. They would have some information, so it was a two-way street. Sometimes we'd get their information, sometimes we sent them information.

We had a camera in the ACR and a table and when we would get our information, [if] it was something that we couldn't really talk right away, we'd put it underneath [the camera], then they would read whatever they wanted off of our information. So we did that, but when we were in trouble, like GT-8, we did [most of] that by voice, because that was the quickest way we could do it.

I enjoyed working the operations and working computer programs. That was a balance that I wanted, so it's a good thing I didn't take the recovery ship. No, sir.

WRIGHT: That was a good decision.

GARCIA: Because that would have been pretty boring. Plus it wasn't good for my wife, so I didn't want to do it.

WRIGHT: Like you said, you had so many opportunities to study meteorology and put all those things together.

GARCIA: Yes. Well, I eventually became what they called the weather guy or the wind guy. So I used to go to White Sands [New Mexico] and to Edwards [Air Force Base, California] and also to the Cape and talk to the weather guys, because you had all kinds of programs and sensors. I would [also] go with our weather guys. SMG was the Spaceflight Meteorology Group. They had their offices on the wing that was the Control Center and then the office on Building 30, an area there between the two buildings, or the two sides of the building [Building 30], and that's where the weather guys were. At one time that's where they were.

I got to know all the weather guys. I liked that part of the job, because a lot of the people that I worked with in Flight Analysis Branch, they didn't go anywhere. All they did was stay at their desks all day long, work the computers.

That's something else too. When [I] came to work, we had slide rules. I don't know how long it took before we even got a four-function calculator. With the 7094 computer, we had to submit our work and wait a day before we got the information back. Eventually we got some kind of interface where we could get on and type our information in and then it would come back, but that was I don't know how many years later that we got that capability. We were doing our computations [mostly] in our heads. We did use our slide rules just to get an approximation. We had our logic written down. We'd go through the equations that we had down, then we'd get something close. You can't read the slide rule [accurately], but we used to wear our slide rules on our belts.

WRIGHT: Got to have tools.

GARCIA: Then we finally got the four-function calculators. We also had a different calculator at the beginning. It was electromechanical. It would go round and round and round and it would go ka-chunk ka-chunk ka-chunk. You'd get one number at a time come out. I didn't trust those. Didn't trust it. Anything mechanical I didn't trust. I trusted my slide rule better than one of those mechanical calculators, but the thing about it is when I was working with the Texas Highway Department that's what we used.

I have a story on that. The engineer I was working with, he went on vacation, and his supervisor came over when he was gone. He said, "Fix this problem that we got." So I redid all

his design on one of the highways, which was on Highway 281, the portion down there in Hidalgo County. I redid the whole thing. When he came back he said, "Oh. Thank you." [He was an aeronautical engineer, not a civil engineer.]

WRIGHT: Maybe we should have kept you in the Highway Department. They could use you now.

GARCIA: I was only like a one- or two-year student at Pan American College, but I fixed it all up. The other highway I worked on was the one that goes to Padre Island, Highway 100. I always remember that.

WRIGHT: You made lots of people happy going there, didn't you?

GARCIA: Yes. What we did, we moved the highway a little off to make it bigger. We did surveying, so I was real happy about that. I learned a lot in the surveying. I learned how to design the highways. I also know that when they say going around a curve [for example] you can go only 50 miles an hour, we built a pad like 15 miles on that. So when I go around the [curve], it says you can only go [a certain speed], I know you got a 15-mile pad.

WRIGHT: You might not want to share that secret with everybody. Speaking of design, you mentioned earlier that you designed trajectories.

GARCIA: Yes, the prelaunch trajectories [for our abort studies and entry studies].

WRIGHT: Then you were talking also about the tools. Can you give us an idea of the evolution of the technology and how that affected the different areas that you worked in?

GARCIA: Before we had high-speed [interactive] computers we had to do parameter studies. They always say, "If you can go to the Moon, why can't you fix this or that, cancer and stuff?" I say well, the translunar trajectories or translunar mechanics or guidance, that's fixed. You can't change that. That's physics. It's very easy, but to go where you want to go, you have to design when to do the maneuvers. In order to do that, we had to do parametric studies to find the best angle, the best time to do the burn. It took a long time.

You'd run something. You'd have to wait a day and then do a little tweak and send it back in, but when we got the high-speed [interactive] computers and [minimized] the time to get the answers back, it really improved, and we put all those improvements into our programs. You start off with the basic program and then you tweak it until you got what you wanted. Of course there's navigation and there's guidance. Navigation [you have to know where you are] is planning how to get there, then the guidance is guiding it through all those points.

Now the high-speed entry, we'd never had to hit that [precise entry trajectory angle before]. Jon [C.] Harpold was the one that did a lot of that work on [the] high-speed entry coming back from the Moon. That was very critical. If you missed [by] a little angle you could skip out or you could skip in, then you're done for. So he did all that work. I was sorry to hear when he went, but I used to talk with him a lot, because I was doing the Gemini entry. At that time he was doing Apollo.

WRIGHT: Speaking of the Moon, tell us about Apollo 11 and your role in that mission.

GARCIA: In Apollo 11, like I said, I had all that [ACR] support. The landmark sighting, lunar landmark sighting. The telescope pointing angles for the observatories. What else did I do on Apollo? I had several programs that I had come up with. One was called the work schedule program that had all the vectors. At the time we were going to get the vectors, all the tracking stations, the look angles [entered prelaunch in the program]. We'd run that in the ACR.

The main thing was the star sighting program. It's what they would send over to the crew at certain times. I think they actually had a [sextant] to look at the stars. They checked their position with the stars. That was some information that went directly to them. Of course we took care of the how much fuel, OAMS [Orbit Attitude and Maneuver System] burn, and OAMS time on their maneuvers too. We did a lot of that, but there wasn't [that] much to do translunar [in terms of ACR support].

I always got the night shift, but, I liked that, because that's when we did [most of] the work. Even on the orbital Apollos, I used to get on John [S.] Llewellyn that we now have all the information ready and you need to start doing something [for the deorbit]. I would push him sometimes. John Llewellyn was a RETRO for Apollo. He was a character. He was always doing crazy things. Of course we did a lot of stuff on the splashdown party.

Anyway, I always wound up on that [night shift]—I don't know whether they call it the second shift, but I wound up on that. Like I said, I didn't mind, because I always talked to the astronomers. I always sent in the information that we ran. The astronomers would come back and say yes, we found it. They would get the pointing angles and everything. I talked to NORAD [North American Aerospace Defense Command], because we were always checking

where the spacecraft was, especially when it was in [Earth] orbit. They would run a program. We'd give them a vector and they would run what they called a COMBO [Computation of Miss Between Orbits], because NORAD kept track of every particle. I don't know [down to] what size, but they kept track of everything.

I used to talk to a Captain Lewis, since I was the one at night, I don't know during the day whether they talked with them or not. Harpold came one time at night to see me, and he sat down. Everything was so quiet [during translunar]. He said, "You're the only one talking." So I'd like to get a hold of the [translunar and transearth] tapes on the Apollo 11, since I was in the back room running all the programs in the ACR. There was nothing [much] going on other than keeping track of where the vehicle was [and consumables]. He surprised me. He said, "You're the only one talking on the loops." So I knew I was doing something for Apollo.

WRIGHT: Did you still have a lot of your clearances?

GARCIA: I don't know. I don't know.

WRIGHT: I just was curious, talking about NORAD.

GARCIA: All I know is when I came to work for NASA they gave me a secret clearance, but I don't know whether they would have to redo my top secret. I also have a funny story on that. When they were checking me, when I was in the Army, to get my clearance, I had a good friend that had a welding shop down in The Valley. Well, his father had the welding shop, and he was

working there. He had the helmet for welding, and he had a swastika on there. He said when they came to check, "I had the swastika [helmet] on." That's when I got my clearance.

WRIGHT: In spite of your friends.

GARCIA: He and I built a semirobot. We could make his head move and his arms and his hands. We had like a flipper thing [for the "hands"]. We had it at a science show when we were at Pan American College. I got an offer from some company [after that]. They were doing robotics. I turned them down too.

We had our science show in the basketball court of the field house. We hid up in the scoreboard area [where we had our controls]. We had a robot, and all the kids would come and we had voice connection. We could hear them and we could answer their questions through a speaker in his chest. We used "cellsyns" to move the head, arms, and hands. [They were electrical motors that were synchronized to duplicate movements in our controls.]

WRIGHT: There're probably kids today talking about, "We had this robot, it was talking to us." They still don't know.

GARCIA: Yes. I designed it and my friend built it because he was a welder. [I did help him build it when I had time.]

WRIGHT: He could make it work. That's a good combination.

GARCIA: Yes, but he wound up getting in all the pictures [except one]. He got in the newspaper. He just happened to be there when they came. He was finishing up. He got in all the pictures that went in the newspaper. [We had a lot of fun with the kids also.]

WRIGHT: But you got to work on Apollo 11, so that's a good tradeoff. You mentioned a while ago too about [Apollo] 13, about how important it was. Were you part [of that mission?]

GARCIA: I did not work on 13. Apollo 11 was the last Apollo flight I worked on, because they took a group of us to work on the Space Shuttle. I worked on the Space Shuttle aborts, which is mainly the Return to Launch Site [RTLS] and the landings in Africa [Transoceanic Abort Landing (TAL)]. We did the Abort to Orbit [ATO], where something happens, you can still go into orbit, but then the ones that you land in Spain or land in Africa I remember. So that's mainly what I did on the Space Shuttle, plus the real-time support. Some logic of mine did get into the Space Shuttle computer, on the aborts, on the GRTLS [Glide Return to Launch Site], which was the glide portion.

WRIGHT: Tell us your thoughts when you learned about Space Shuttle and some of the initial ideas that came out?

GARCIA: I didn't think that was the right thing to do. I didn't think that we should have given up the Saturn V. It was our heavy [lift] vehicle that we had. It was stronger than the one the Russians had as far as I remember. All the plans that they had didn't work out, like we were going to launch twice [a month] or maybe more. I worked with the [weather] people in

Vandenberg Air Force Base [California]. We had started a launch site there. They already had just about everything done. I even went there one time to talk with the weather people, because we were going to launch balloons from there to get the upper wind data. I knew where the landing field was going to be. [Their PX (Post exchange) would have to be moved.] They eventually shut that [launch site] down. We never were able to do the launch frequency that was advertised.

There were one, two, three, maybe four Saturn Vs left. One wound up at KSC [NASA Kennedy Space Center, Florida], one in [NASA] Marshall [Space Flight Center, Huntsville, Alabama], and one here. I don't know where the other one went. Maybe they used it, but we had these vehicles that could have flown too. They wanted to go to a system that we could recover like the solid rocket boosters.

I did work on the landing areas and on the Orbiter. It really got me too that on the first manned orbital flight, John [W.] Young and [Robert L.] Crippen were on that one, they had a bunch of [small] flags. I didn't get one [of the plaques with the flag]. I did a lot of work on the aborts and getting the wind data, all that coordination with Edwards Air Force Base. I went there several times and coordinated all the [balloon release schedules]. I'm not saying that I was discriminated against, but from the very beginning, I never got any awards, never got anything. The main thing that I know is Larry Davis was one of my best friends, and the guys I worked with at my level were good, but [I] never got anything, not even for the emergency deorbit, [and] all the work that I was doing. I don't know what the other guys did, but I knew what I was doing, since I worked on mainly the night shifts [during the flights] where all the work was done.

The next person that [came] after me on landing days on one of the orbital missions, he said, "You've done everything." He said, "What am I going to do?" I had already gotten

everything done [RTACF entry tasks]. I had pressured John Llewellyn to get his stuff done. I would tell him what the good vectors were, because we ran our stuff. I said, "This is a good vector and this is the time you've got to do it."

He says, "I know, I know." But John Llewellyn was kind of a crazy guy. One of the flights, he had to come in, he parked on the grass.

WRIGHT: I think I've heard that story.

GARCIA: There were a lot of stories going on. We did a lot of stuff.

WRIGHT: You mentioned earlier about the amount of females and Mexican Americans. Were there others?

GARCIA: One or two. [Most Mexican Americans] came from south Texas. None of them came from the big cities [that I knew of]. In The Valley, a lot of the people there go back to the Spanish [settlers], when the king of Spain sent people over [to populate south Texas]. We're more self-reliant. I was surprised one time when I got out of The Valley and I was traveling with my two uncles. One of them had blue eyes and looked very Anglo and the other one had brown eyes, looked like me. We went to this restaurant. We were out of The Valley, halfway up to San Antonio [Texas]. We stopped. They wouldn't serve me and my uncle but said, "We'll serve him." My [other] uncle said, "He's my brother and he's my nephew." So we all walked out. It was pretty bad back then. It wasn't just the blacks. I had never experienced anything in The

Valley, because we were like 80 percent of the population. We belonged to the old settlers. A lot of us came from the old settlers.

I've been upset for a long time, because when the war between Mexico and the US was fought, the Nueces River was supposed to be the border, not the Rio Grande. They forced Mexico to give up that land, and they forced Mexico to pay the settlers for the land. Of course Mexico never did, and the Texans went down there. Since the Spanish or Mexican Americans had large ranches—that's where the cattle industry came from, from the Mexican American cattle people—they took over. There was only one ranch house [and few ranch hands] or there weren't that many. They would come in and push them out or kill them, and they would take over the land and the cattle. They went all the way down to the river. My wife's family had 25 square miles from a grant from the king of Spain that they lost.

Of course everybody [has] been fighting for the mineral rights. That's what they [have] been fighting for, because that was supposedly not in the [treaties]. What they did, if you go to the Land Office in Austin, everything starts with the Spanish land grants, even up to Austin. The Spanish land grants, that's where all the land papers start. Of course they had bogus land sales all the way, but anyway, that's a different story.

WRIGHT: But a very interesting heritage.

GARCIA: In here [referring to resume] I've got where I was a migrant worker. It was me and my brother. My parents didn't go. It was just me and him, with this other group. We'd go and pick asparagus and tomatoes. At one point, when I finished [working], we used to come late to high

school, but in [our] senior year my brother and I said, "No, we're not going to be late." So we bought a car. The car didn't get there, but we did. [We used to travel in the back of trucks.]

Then we got into football. So my senior year I did spend the whole year [at school]. I wanted to spend the whole year before I graduated, because I wanted to be an engineer. Of course our counselors, they discouraged me. I didn't like that at all. They wanted me to go to trade school. I told them, "I'm the highest science and math student in the school."

"Well," they said, "but you can't succeed." So they discouraged me. There was only one teacher that didn't do that. I remember her. Mrs. Brooks. She knew I wasn't just a regular migrant worker. [But it was still just lip service, since no effort was made to help me get a scholarship.]

WRIGHT: You did that as a part-time job.

GARCIA: Yes, but it was pretty bad. Some of the stuff back then. Of course now everybody knows that anybody can be anything just given the right environment, the right training.

WRIGHT: So many of the barriers are gone now, but it's still determination. Tell us about your transition to Houston. You had lived in Austin as a student, and you got the job, and then you came here. Where did you and your wife live? You mentioned you had friends here.

GARCIA: Oh yes. We just stayed [with them] when I turned down the job and did the interviews. I was happy with work—I mean when I went to interview with Charlie Allen. He became my boss, and he was the only one that eventually gave me a good evaluation at the beginning,

because he knew that when I came I didn't go to any training. I came straight in and started working. He was the only one that really gave me a good evaluation.

When my wife and I came we were looking for a place to stay. We wound up in South Houston. We rented a house. I never wanted to be in an apartment, so I rented a house for six months. I signed a six-month lease. I told my wife, "At the end of six months we'll buy a house."

So we came over here to Nassau Bay [across from JSC]. My wife was a nurse, RN. I was an engineer. They [still] wouldn't sell us a house. I saw some people there that were the same rank as I was. They were Anglo, and they got a house in there. We didn't. So I said, "Look, they don't want to sell us a house."

So we went and got one, still in [what is now part of] Webster [Texas]. We got one in Green Acres [subdivision], which turned out to be a bad deal, because the developer ran out of money and left.

But the house had a swimming pool. That's where I kept physically fit. I wanted to stay physically fit, so we stayed there. We had a water well for the neighborhood. We were in the county. We didn't have meters on the water; we just paid a certain amount. We always had problems with the water. Lines would break, and we had septic tanks. One time one of the water lines broke. My neighbor was not very friendly. He blamed us that it was our sewage that was coming out. We had ditches, so he dammed it. We would go and break up the dam. [That was what the county people told us to do.] So it got to the point where one night they came and broke our windows [with baseball bats]. My wife was pregnant. We had just moved in there.

I called the police and they came over, then they accused me of doing things [to them]. The policemen took their side. I said, "Look, my wife is pregnant. Why am I going to be doing all this stuff? They broke my windows [and glass got all over the kids' beds]."

They eventually moved away, which was good, because they were going to move or we would. It got to the point that my wife said, "I don't like to live here in Houston. It's too much discrimination."

I said, "It's fine. It's where my job is and we'll stay here." So we stayed. I didn't really want to get into this, but this is my experience here with my job, but my coworkers were the greatest. They were great, especially Larry Davis. He was a good friend. We went out together.

WRIGHT: You arrived in the midst of the whole space fever. Everybody was rushing to get to the Moon. Tell us about your working schedule. Were you here more than home?

GARCIA: Yes. It was hard on my wife. I came to work February 1st. Like I said, I don't remember whether it was $7,200 or $6,800 a year. I doubled my salary in 11 months, but it took a toll on us. We had to work. We were on [tight] schedules. We had to work Saturdays, Sundays, nights, sometimes double shifts, because we did a lot of simulations. Not only were we working on our programs during the day, but then we had simulations in the evening. We worked until midnight, then we had to be back at work at 8:00 [a.m.]. My wife didn't like it too well, but I said, "Well, this is my job. We've got a mandate from the President to launch, to get to the Moon before 1970." We were working our tails off. There were times when I'd leave and then three or four hours later they'd call me, and I'd come back, [in] the middle of the night.

So that first year we worked a lot. The second year also, but the third year wasn't that hectic, but the first two years were pretty hectic. Pretty hectic.

WRIGHT: How did it change when you left the ACR to move over to the Shuttle area?

GARCIA: We got moved over after Apollo 11. Like I said, I didn't work [Apollo] 12 or 13, but I was around the area when they were working on all the gadgets to clean the air [after the Apollo 13 accident], because we were still doing some simulations. I would see them working. Whatever they had on board, that's what they had to work with. They were duplicating on the ground, and I would see them. Some of them were my friends that were working on that, I remember, but we kept working on the Shuttle. Mainly it was less simulation, less mission support. We were working more on doing parameter studies.

Then having meetings on going this way or going that way [on the designs]. At first we had the designs on a fully recoverable Orbiter with the booster rocket coming back and landing, which was the start of the return to launch [site] abort. We took what we learned on that one to apply to the abort when we had a throwaway tank but recoverable boosters. But we went through all kinds of configurations. We tried all the aerodynamic [configurations] on the wings. Finally we settled on that one configuration, which was a compromise really. [The Air Force had a lot to do with the final delta wing design.]

WRIGHT: You felt like a good compromise?

GARCIA: Yes, I enjoyed working on it, but I didn't like the work we were doing, because we were leaving the boosters [Saturn Vs]. I wasn't the only one. There were several of us that didn't think that that was the right thing to do, but that happened. So I said, "Well, we'll just do the best we can." At that time they also brought more contractors in. They were doing more of the work. Some of the work I was doing, they finally took over, and we became like managers of [small] contracts that we had.

But I still had my own programs, and I could work on that. Then I started developing the real-time weather coordination, because they were going to need that, more than we worked on for Apollo, because of the landing sites.

Like I said, at that time I did a lot of traveling. I went to Edwards, I went to White Sands, and got to meet all the people that [worked] with the weather and the operational people. Not only just the weather people but the operational people, because I don't remember [for] which Shuttle mission [I went to White Sands]. We were landing in Edwards [on STS-1]. Eventually we were going to land at KSC. Well, we landed at KSC for the first time, then on the third time [STS-3] there was a lot of rain or something at the Cape. There were problems at Edwards [also]. I was doing all the weather coordination and the winds. We had conferences. I finally [agreed with the decision] to go to White Sands. That's the only way, because the Orbiter could not stay up much longer. Nobody wanted to go to White Sands, because they weren't prepared. So they gave them 24 hours [to] a day and a half, to transport all that stuff from Edwards to White Sands and then to set up all the communications and whatever they had to set up. When I went to White Sands later, when I was working with RSOC [Rockwell Space Operations Company], they said, "You're the cause of us landing in White Sands. You were the one."

I said, "That was the only thing we [the entry team] could do." But they said they were glad. That was their only landing. That's what they always go back to.

WRIGHT: The best part, it was a safe landing, because of the weather.

GARCIA: Yes, but in history maybe they [may] have something of what they had to do, but I know they had to do a lot to be able [to support the landing].

WRIGHT: Yes, in a short amount of time.

GARCIA: They said, "We were scrambling." I think they worked all night.

WRIGHT: Were you involved with the approach and landing test?

GARCIA: Indirectly. I knew the people that were working on it. We had the programs. I knew what they went through, but I was involved in with the aborts, because you had to do approach and landing, but not the design of the approach and landing. I knew the people that worked on that, because we all worked on this thing [the Space Shuttle], but I was mainly more on the aerodynamic forces when you come in. That was more of what I did.

WRIGHT: What were your memories of STS-1, with Crippen and Young?

GARCIA: They called me up, I don't know, [about] a month before the flight, because they were concerned about the aborts. So I went, because that's what I worked on, the aborts. Mainly the RTLS, the return to launch site. They called me up because they said, "We're kind of confused on some of this stuff." Actually I don't know why but they called me, so I went and told Harpold. I said, "John Young called me, he wants me to go over and tell them all about the RTLS, the return to launch site." Which includes the powered [abort], so I went over all the things that we had to do.

I said, "We checked it all out, it's fine." They said okay and thanks for coming, but I think that they just wanted to see me probably. [I had only talked to them on the phone before.] That's what I thought, because they knew all [about the aborts], they just wanted somebody to tell them. I said, "I don't know why they called."

I was in the staff support room in the mission when we did the entry. That was our first entry, but we had the times that they were going to go into blackout and the time they were going to come out of blackout. We had computed those times real-time in the ACR, so we knew. We were just listening and listening, until it came time for that. They did come out at about the same time.

WRIGHT: Well, that was exciting.

GARCIA: Oh yes. Everybody was on pins and needles.

WRIGHT: Especially for a manned flight, first time out.

GARCIA: Yes. Oh, I remember when I was talking to the [weather] guys at Edwards. They said, "We saw the landing. John Young came out and he was just jumping, looking at the Orbiter. I think he kicked the tires."

WRIGHT: What an exciting time for you to have worked on these three different spacecraft.

GARCIA: Yes. I didn't work on Mercury but I knew [some of] the people that worked on Mercury. Carl [R.] Huss became our MPAD division head at one time, and I used to talk with him a lot. In fact I bought [one of] his car[s]. He had a T-shirt that said he was the first Retrofire Officer in the free world or something [like that]. They worked out of KSC when they did Mercury, but he was a good guy, Carl Huss. He said, "I'm the first Retrofire Officer of the free world." All those stories.

WRIGHT: How many Shuttle flights were you assisting with before you left?

GARCIA: [STS] 51-L [Challenger] was the last one that I worked on. In fact I was part of the launch systems evaluation advisory team, LSEAT. We had programs [in the ACR] that I ran. I did not develop them. Some other people developed them, but I ran [them] and I had my people update the programs in the ACR. We'd take the wind information from the balloons and we'd stick it into the programs and run the analysis.

The Orbiter had sensors on the wings and on the belly and on the nose. I think the tank also and the boosters had sensors. We would compute what we called load indicators. We started two days before [launch] running the programs. That was just some of the programs. We

were also running the [abort] entry at the same time, and I was doing both, the entry and the launch.

The load indicators would tell you whether there was too much stress on certain parts of the Orbiter. I did that for most of the Shuttle launches. I would give [some of] the presentations to the mission management team at the Cape from here at JSC. We'd convene a meeting. The meeting was mainly for the load indicators, since I was the wind coordinator or I was the landing support officer, and I was responsible for the wind coordination and the running [of] the programs for the loads.

On 51-L, I know there were several delays. One with a broken handle. Oh, that was a perfect day to launch. That day everything was right. The weather was right. The winds were calm, the upper winds. The handle broke. I said, "Oh, boy."

Anyway, the problem with the O-rings, we knew about that, and I can tell you a story about that. I gave the [load indicator] presentation to the mission management team from here. The load indicators were right on. There was no problem. I said, "There's no problem with the load indicators."

In fact they were lower than on some of the other flights. I'm talking about the last analysis that we did, right before launch. So then we went back to our consoles. Since that was my last work that I had to do, I went down to the Control Center [Flight Control Room] that was not being used. I plugged into the flight dynamics console, and I was listening.

I was listening to all the discussion about not launching because of the cold. I don't know whether it was [Morton] Thiokol or somebody. They disavowed. They said, "We're not going to give a go." Then managers came over and said, "We got to go." They mentioned that the President was going to give his State of the Union message and the teacher [S. Christa

Corrigan McAuliffe onboard] and we had to go. So there was a lot of people that said no, mainly the contractors. As far as the winds, it was fine, but the problem [was] with the O-rings [because of the cold].

They went ahead and went. They had an open mike [I think]. I was watching when it exploded, I heard [what I think was] the boom in my ear. I said, "Oh." It wasn't that I said, "Oh, the work we had done for three or four days, so many delays," but for the astronauts. Before, I went down to a meeting at KSC, and [Francis R.] Dick Scobee was there. We had meetings with the mission managers. I think this was the last meeting that we were doing at the Cape when we went through all our configurations and all our work that we had done. Everything was fine for the launch.

Somebody had brought me [to the meeting] and they had left early. Dick Scobee said, "I'll take you to your motel." So when we got in the car he started talking. He said, "I'm not worried about the vehicle. I'm not worried about the Orbiter. I'm not worried about the tank or the [boosters]." He says, "I'm worried about all the young people." NASA had hired a bunch of people, because at one time they hired so many and then they didn't hire anybody for a long time, then they started hiring the new ones.

He said, "All the young engineers. They depend on the computers." He said, "You guys, you older guys, you know. Since we worked with you guys we know that you guys know approximately what the right answer should be." He said, "The young guys just depend on the computers. They depend on the answer that they get." That was his opinion, but he was not worried about the vehicle.

So he dropped me and said goodbye and I shook his hand. That was the last time I saw him. That really bothered me. I knew two or three of the ones that died. Ron [Ronald E.]

McNair, because I had talked to him. He was doing experiments and I remember we had talked about some experiment.

[Judith A.] Resnik was in one of my meetings sometime. I would have a meeting prior to the mission and discuss something. So she was there, then the other two or three I didn't know very well. I didn't know the teacher, but I knew Resnik and Ron McNair, and then Scobee. It really bothered me, because I had heard all the discussion prior to the launch. I had heard all that.

WRIGHT: Did it have a bearing on you deciding to leave when you did?

GARCIA: No, no. It's just that the time to fly again took a long time. I got an offer from RSOC, but right after [the accident] I got detailed to different offices. I eventually became acting head of both the ascent and descent units in [the Flight Design and Dynamics Division]. I don't know. We changed names as we went along, but I, with another person, we shared the two units for a while.

At that time I got a call from RSOC. RSOC took over the wind coordination, the prelaunch, the analysis, both on the landing and the launch, what I was doing. They took all that over. So they offered me a job as a unit leader, manager. I was 50 at the time. I said, "I want at least 10 years." I didn't get anything signed or anything. He was a friend of mine, the manager, because I had gone to Rockwell at California plenty of times. I had talked with him on the entry.

He was moved over here [RSOC] then, so he knew me. That's why he offered me the job. He said, "I've got a task for you, to develop the teams to do the prelaunch and prelanding analysis, to design the programs to do all the work, all the landing with the winds and the load

indicators on the launch." I said fine. They didn't want to let me go at NASA, but I went to talk to Gene [Eugene F.] Kranz. He looked and went over it and [said], "Okay, I'll let you go. You're going to be doing the same thing anyway." So he let me go to RSOC. I left NASA on one Friday and started working on [the next] Monday.

Needless to say I finished my job in seven years and I got laid off. It happened at a time when there was a lot of layoffs because of financial problems, like what they're maybe going through now.

I became a project manager, which came with the real-time support of both the landing and the launch. So it's all in here I think [referring to resume]. This really helps [with our interview] because I did this when I got laid off, and I started trying to get another job. That's how I wound up in Austin.

WRIGHT: Did you go to work somewhere up in Austin?

GARCIA: I did this [the resume] for the University of Texas, because they had an opening. In fact one of the guys that I had taken courses with was now head of that part of the engineering. [Byron D.] Tapley I think his name was. So I went and interviewed with him, but there were several other people, and he eventually told me, "Well, we need somebody that has a doctor's degree." All I had was a BS degree. I took some extra courses but I never got my master's. I went to the University of Houston when I was working here, but I didn't finish.

I took the meteorology courses here with the SMG. The other thing was that if I had finished the Russian [course], I would have been able to get a job, but I didn't do all the Russian [classes]. In the Pentagon they had places [to study languages]. It was self-taught. I was

learning Russian, but then we worked 31, 32 days [in a row with double shifts]; we had rotating shifts. In the Pentagon, all the stuff that was going on was at night. That's when we had all the messages coming in from all over the world.

I finally didn't have time to keep up with the Russian studies that I was doing. I knew a few words and knew a few phrases, but it's a hard language, very hard, but I knew the alphabet. It's a Cyrillic type alphabet. I knew the alphabet, and I knew some of the phrases, but it was hard. It was very hard. By yourself, it was hard to learn, but it would have helped me a lot.

Anyway, it took me nine months to get a job in Austin. My wife and I moved over there. I worked for 12 or 13 years with the Texas environmental agency, [TCEQ (Texas Commission on Environmental Quality)]. I worked with the EPA [also], and it was pretty good [for me]. I had to start at the bottom, but within a year or two I became a section head. People that had been working there for years [were passed over.] But I was older than they were. I already had [supervisory] experience. I had been a unit leader at RSOC and an acting one here at JSC. So I said, "Well, [upper management] made the decision."

I stayed there until when I was 68 I think. Five years ago, I finally couldn't take it anymore. In between while I was working here [JSC] I bought a farm in The Valley. I had somebody working it for me, it's a citrus farm, then I fired him and did it all myself. I would go down there, I don't know for how many years, until in '86 or '87 we had that big freeze that killed all the trees. So I told my wife, "No more. I won't replant." People replanted and two years later they got killed again, but then they replanted again and it's been fine since then. So I was doing that in between all the work we were doing here.

WRIGHT: Busy man.

GARCIA: I was trying to keep busy. Even when I look at this I say, "Did I do that?" Just right after 51-L, I worked with the reconstruction some, mainly with the winds. People were trying to blame the winds, and I would say, "No, no, it was not the winds, it was not the winds." They would say, "Well, we had the [contrails showing shears in the winds]." I said, "Even the analysis [showed that the loads were] less than in some other flights. It's not the winds."

I would run the simulations again and again, because after it blew up—well, actually it was more of a [burst of] flame, it wasn't really an explosion [from what I saw], it was like a puff, when it broke the Orbiter apart, it wasn't an explosion, because it would have blown it to bits with all the hydrogen in there, the oxygen.

It's like it just burned out. Right after that, they called me to go launch some more balloons. Right after everybody realized [what had happened], because for a time the people were shocked. I was shocked. I knew what happened, but still I couldn't really move.

Then I got a call, "Go run some more balloons." So I had to go back to my post in the SSR and call down to the Cape and say, "Release some more balloons." So we started releasing the balloons. Several of them, to check the winds. We ran the analysis on those and the ones prelaunch that we did, then on those new ones. It showed that the winds were not that critical. So at some point they stopped with the winds being the culprit.

Then of course they really found out what it was. Of course, like I said, we knew. I had gone to meetings two, three months before 51-L. There were some people there, mainly the contractors, saying, "We need to fix it before we fly again." I guess because there was a teacher and the schedule that they wanted to keep they said, "No, we'll do it after." It's too late.

I don't know if that has ever come out that people knew already. There were several flights, because they recovered the boosters, they saw the gas escaping. They knew that. They knew the problem. The contractors knew it, but the NASA managers didn't [fix the problem first].

WRIGHT: At the initial part of the Shuttle program when they were landing in Edwards, and then as you mentioned they wanted to bring them into Kennedy, did you have a lot of work you had to do to adjust for the landings to be from Edwards to Kennedy?

GARCIA: Oh yes. Yes. The weather.

WRIGHT: Can you share with us some of the challenges?

GARCIA: It's different weather and also it's a lake bed at Edwards. At KSC we have a [finite] runway. I had been on that runway. So it's a different rollout, different aim points. We had aim points where you had to hit so you would be able to stay on the runway and have a good landing. Of course the weather was bad sometimes because of the humidity, especially in the summer.

Then the approach was a little different also. A lot of times we'd go through Texas. A lot of times we'd go through Mexico, but to me Edwards was a lot easier to land at, because it was very forgiving, but not at KSC. That was something that we really had to make sure to go into KSC, because of the finite runway.

That was the main difference there. Other than that we still had the HAC, the Heading Alignment Circle. It would be the same. We had more capability at KSC, as far as the balloons and the weather [support], but to me it was a little tougher until we finally started landing there.

WRIGHT: Do you want to take a look at the notes you had made to see if there's some areas that we might not have talked about?

GARCIA: Even when I graduated from high school, I still went to work as a migrant worker, because that was the quickest job that you could get, but I worked mainly in the packing plants. My brother went to work at a factory, but they said I was too young or something. So I couldn't work. So I had to go back and work in the canning plants.

WRIGHT: Were they in Texas or did you go out of the state?

GARCIA: No, Illinois. That's why you're [called] a migrant worker. We used to go to Rossville, Illinois, the one where they had the asparagus and tomato plants and the corn. [They would provide cheap housing where] we used to work. They would pack bales of hay, and we'd put them up in the barns. That was hard work, but that's where I developed my muscles. Also pulling that cotton sack.

The people were very nice. Some were not, but some were very nice in Illinois. After I had gone two years to Pan American, I ran out of money. So I went back to work at an engineering company. I was a draftsman. It was Fox Valley Engineering in Aurora, Illinois.

We worked until the contract ran out. They laid us all off. I told this friend of mine that had gone with me, I said, "I'm going to go to Chicago."

I got on a train, got off [in Chicago], because in Aurora we got the newspapers of Chicago. So I saw that they needed people. I had taken two years of chemistry at Pan American. So I got off and went to one of those places that are those job agencies. They sent me to this place in South Chicago. It was called Vitamins, Incorporated. They hired me the same day I went down. I didn't know how to get there. They put me on an el [elevated] train and they sent me all the way down. It was underneath first [like a subway], then you came back out.

I started working there. Well, of course, I found a rooming place [close by] in Green Street. It was a changing neighborhood. The people that owned this rooming house—me and another person were the only ones there—somebody bought them out, because they didn't want to stay there anymore. They left. The black people were moving in. They didn't bother me, so I started working. Of course I got the night shift, but the one thing they did for us is they gave us vitamins. So that's the first time I started drinking [vitamins] and taking vitamins.

The reason they needed somebody is because where I went to work, the section was new. They had two rooms and the doors were this thick [indicating thickness]. The room that I was in was where we did all our calculations [with slide rules], because we made mixtures. Large mixtures. One person that was working during the day—he was training me—he came over and he said, "Don't you have any questions about all this new equipment, new side of the building?"

I said, "Well, tell me about it."

He said, "It exploded."

I said, "Well, what happened to the person [working there]?"

He said, "He exploded too."

WRIGHT: Oh, now they tell you.

GARCIA: Yes. So I said, "Well, I'll be careful." We had some lamps [in the other room]. It was irradiation, I think it was ultraviolet light. They would get hot. They would run cooling water through them, then once the mixture got through it fell into a tank. We would take solvents and take the vitamins out once a day and once a night.

We used ether. One day I opened [the 55 gallon tank] up and the ether came out, because I think it had been under pressure. I took a big whiff of it, and it knocked me out for a few seconds. I woke up on the floor. I said, "Oh man." There was nobody there. I was the only one there. I said, "Oh boy." I opened the window, because it was in the winter. I took gulps of the cold air to wake me up, because I was still kind of groggy. When I woke up I was kind of groggy. I didn't even know how long I was there. I looked at the instruments, made sure that the things were working right. Now I know why it exploded.

WRIGHT: Yes. So how long did you keep this job?

GARCIA: One year, and then they laid me off, because they closed down the night shift. But another incident happened [before I left]. I had never known what they did at night for the phone. They put a big alarm for the phone. Since I was kind of jittery with all the stuff [that had gone before], the phone rang I guess—well, I didn't know it was the phone ringing—it was like an alarm. So I got out of there. I went downstairs and went out and the door closed on me. I couldn't get back in. There was nobody there except me. I was the only one running the plant,

because I was running another section and then running mine. I had to break in. The windows were ground level, half of the windows [were above ground], because they would take oil for the heater down in the basement. So I broke in. I didn't have anybody to call. The chemical processes were running. There were [specific] times that I had to go in and change dial [settings]. I said, "I can't wait until morning or anything, I've got to get in there." So I managed to open one of the windows [the one used for refueling the boiler]. I had to jump down in [the basement].

Anyway I got laid off. I decided to go back to school. I said, "Well, I still want to be an engineer." So I went back to school. That's when I went another year [to Pan American College] and I ran out of money and got drafted. [I had told my local draft board that I was already registered at UT for the semester starting in January [1960], but they were all Anglos and they didn't care to help me get a deferment. I lost all my deposits, including housing deposits.] I've only gotten two telegrams my whole life. One was my girlfriend sending me a telegram for my birthday, then [in December 1959] "Greetings."

WRIGHT: "From your government."

GARCIA: "From the government." I'm considered a Vietnam veteran, because we had advisers. Nobody knew. It was two years before the actual Vietnam War [officially] started. I learned a lot while I was there [in the Pentagon]. I had an appreciation of what we could do, secret, but then I also didn't like some things that the CIA was doing, of course, with [Fidel] Castro. Always they were trying to assassinate him. I'm Latin and he's Latin. He was doing what he

thought best for his people. They were trying to assassinate him all the time. In fact he did get shot.

Of course I can say that now. We were all concerned, because at that time Russia was palsy-walsy with Castro. Well, if they find out that Castro dies—he didn't die. They tried everything. They poisoned his cigars [plus other things I cannot mention]. So when he was ranting about the CIA, he was right. I didn't like that, but it was not up to me. It was policy that the US had [at that time period]. There was some crazy thing that they made us sign; a paper that we were not Communist. That's crazy. I mean if you're a Commie you're not going to say you're a Communist, but about the only good thing [about the Army] is that I got to see Walter Cronkite [in the films]. So I knew [what type of person] Walter Cronkite was.

WRIGHT: That's a good thing.

GARCIA: Yes. I saw [Cronkite] when we did the [20th lunar landing anniversary celebration]—oh, that's another funny story. My wife and I were in line. I don't know what we were doing, but we got in line [for something]. Alan Shepard was in front of us. The guy that played Jose Jimenez [actor Bill Dana], he was his friend, so he had him there [as a guest]. My wife said hello to Alan Shepard. We started talking. That guy who was playing Jose Jimenez came over and said, "How do you feel about me portraying Latins like that?" I said, "It's funny." To me it's funny. So I didn't mind that at all. It was kind of funny that I saw Alan Shepard crossing the bridge [into Washington in '61], and then [in 1989] I finally met him and my wife met him too, because he was the first American in space.

WRIGHT: Yes, he was a hero.

GARCIA: The story with John [H.] Glenn is they didn't want him to fly again. That's why they didn't give him any more flights. They wanted to protect him since he was our first American in orbit. So that was the story on that. They didn't want him to fly anymore. [Yuri Gagarin (Soviet cosmonaut, first man in space) died in a plane crash in Russia].

You know that the first black astronaut [candidate] died in a plane crash, right? [Robert H. Lawrence, Jr., US Air Force Manned Orbital Laboratory (MOL) program, Group 3.]

WRIGHT: Do you want to tell us more?

GARCIA: He was here, and I met him. I don't know what happened, but he crashed [at Edwards Air Force base in California]. He was the first black astronaut in training, but you never heard much about him. He crashed and died. On one of the flights that I was working on, Gemini [IX], the [primary] crew crashed at St. Louis [Missouri]. I was one of the first ones [in our ACR team] that heard about it. It was Elliot [M.] See [Jr.] [and Charles A. Bassett II]. The backup crew had to take over on that flight.

WRIGHT: You've had some really nice memories and then you've had some great losses that you've dealt with.

GARCIA: Oh yes. My wife and I were shopping when I heard about the Apollo [1] fire. Of course a lot of us when we were talking about having pure oxygen in there said, "That's not too

good." I met Gus [Virgil I.] Grissom. I was going from Building 30 to the astronaut building to do something, or I was coming back and he was already coming back. He was in his suit. He had been doing some simulations. He said hello to me. That's the only time that I'd seen Gus.

I had some dealings with some of the astronauts. [One of] first ones that went on the maneuvering unit, was [Robert L. "Bob" Stewart]. I went to Rockwell with him one time to do some of the guidance and navigation [studies]. I spent some time in the Engineering Directorate. Like three, four, five months. They would send me wherever they needed work done. I went to different places, but I always came back to MPAD.

That's where [E&D (Engineering and Development)] I met some of the astronauts, in the simulators, because we were checking out the IGN&C, which was the Integrated Guidance, Navigation [and Control] system. I wound up going with some of the astronauts to [Rockwell], because they had simulators at Rockwell also. I would get behind them when they were doing the simulation. It was pretty neat. You almost felt like you were landing with the Shuttle. In fact I even tried [landings]. I crashed once, but I landed one; I landed the Orbiter.

They had the view. They had the runway and all the sights around when you turn. It was pretty good. Of course, then I wanted to be an astronaut.

Eventually eyesight didn't matter anymore. I had radial keratotomy done on my eyes too, but that didn't work either. I mean it worked [on my eyesight], but it didn't help me. I applied to be an astronaut at one time. I did, back when I was younger.

WRIGHT: Not everybody's like John Glenn, gets to fly when they're older.

GARCIA: Yes, John Glenn was old, but he made it [back into space].

WRIGHT: Yes he did. Well, thank you so much for giving up your afternoon for us and sharing all these nice memories

GARCIA: Oh, it's my pleasure. I guess I was glad that I worked [with the space program]. I don't think I'd have been happy working anyplace else, even though I worked with the environmental agency [in Texas] 12, 13 years, which was a lot to me. I like the operations, and the technical side too. So I was glad that I was able to work on both sides. There were some times that weren't good, but some times that were. I let everything roll off my back. I didn't care.

WRIGHT: It's really nice you got to live out your dream from a young child, that you got to do the things that you really wanted to do.

GARCIA: Yes, because when I was a kid picking cotton I knew that I was going to work somewhere, that I was going to be a pilot. At that time I didn't know I didn't see that well. [So I settled for aerospace work.]

WRIGHT: But you got to see a lot, so that's what's really amazing.

GARCIA: Yes. Yes. I'm glad that I had a part in it, even though I wasn't really recognized that much. It didn't matter to me, as long as I knew what I did. I was very happy. My wife wasn't too happy with the work, with the amount of work that I did, but we got through that. We were

able to work things out. I know that three or four of my buddies got a divorce. It was hard on families. You really had to be dedicated to work that many hours, especially at the beginning. But I think that was the only way we could accomplish our goal within the time limit that was set by [President John F.] Kennedy. Oh, I went to his inauguration.

WRIGHT: Did you really?

GARCIA: Well, I was out there in the snow. My wife and I were out in the snow. It just happened that that was my day off when I was in the Army. I said, "We're going." So he was Catholic, and we were Catholic, but that wasn't the reason. It's that he had a lot of goals for the country.

WRIGHT: A lot of hope.

GARCIA: Yes. We went, and at the time my camera didn't work right. Something happened to my camera and I was able to take just a few pictures, but we were out there. He was like that [indicating size because of distance], but we saw him, we could hear him. We were there. Even though it snowed all night, I remember. My wife said, "You really want to go."

I said, "Yeah, this is our only chance."

WRIGHT: That was a good decision.

GARCIA: I went. I said, "We've got to see him." I saw his wife too one time. I was walking by the White House on the outside. She was coming out in a limo. I saw her. It's just too bad, all that happened to him.

WRIGHT: Yes. Well, thank you.

[End of interview]