NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

JOSEPHINE JUE
INTERVIEWED BY JENNIFER ROSS-NAZZAL
HOUSTON, TEXAS – AUGUST 4, 2021

This transcript is the result of a series of conversations between Ross-Nazzal and Jue and does not match the audio recording on file.

ROSS-NAZZAL: Today is August 4th, 2021. This interview with Josephine Jue is being conducted in Houston, Texas, for the JSC Oral History Project. The interviewer is Jennifer Ross-Nazzal. Thank you again for taking some time to meet with me this morning, I certainly appreciate it. I wanted to start by asking if you would talk about your interest in math as a child.

JUE: My parents came over from China and became citizens eventually. Around this time there were quite a few Chinese coming from China, and most of them wound up in Mississippi. I was born in the back of a store. Eventually we moved to Houston. My parents had a grocery store in Vance, Mississippi, and then eventually, like I said, came to Houston when I was three months old. They purchased a store over in the Third Ward area.

At the time we were in the store, I would help when I was of age, must have been eight or nine, in elementary school. I helped as a cashier. Math came in handy when adding prices, getting the total for just a few items and not having to use the adding machine. If customers didn't have the exact change, then I knew what to do, because of my counting. I started to do counting by twos. I liked to count then. I did tens and twenty. So that was my interest in math.

ROSS-NAZZAL: You'd probably be good with new math.

JUE: Yes, they had the grocery store, and if I worked up front as a cashier, then I knew how to refund the money. Of course I had my parents give me some help to begin with, but after that I took over. That was my interest in math.

ROSS-NAZZAL: That's a great skill. I'm not sure many people have that skill anymore, the ability to count back change.

JUE: Oh, that's different in these stores today, because the register shows the exact change to be returned if you give cash.

ROSS-NAZZAL: Yes.

JUE: But going back many years there was nothing like that.

ROSS-NAZZAL: Why did you decide to attend the University of Houston and major in math?

JUE: I liked math because of the background I had. In high school I took all the math courses allowed: algebra, geometry, trigonometry, infinite series.

When I graduated at the time—there were other schools I could attend: UT [University of Texas, Austin] and some other colleges here. There was HBU; Houston Baptist [University] was just getting organized. There was another school. I'm thinking [the University of] Saint Thomas

was the Catholic school. I nixed them those two; no particular reason. I decided not to go to the University of Texas.

I thought, "Well, University of Houston is close by," where I lived over in Third Ward, "and I'll just go there." Staying in Houston saved my parents from spending their hard-earned money and savings—so I said, "I'm not going out of town." Also, they did prefer my staying home to still help in the store.

ROSS-NAZZAL: Did you have an idea what you might do with a degree in mathematics?

JUE: No. I chose math as my major and chemistry as my minor, not knowing what job I would wind up with.

I heard about MSC (the Manned Spacecraft Center) via the papers and radio. As soon as I graduated, I submitted my application and a transcript. Personnel called and told me to report to U of H, the Channel 8 TV station. Since I liked math, I told them that was my interest, they just placed me there where the computers were over at U of H, the Channel 8 television station. That's where all the programmers were. I became a member of the Computation and Analysis Division. I worked as computer programmer/analyst.

There weren't that many at the time. I would say about 80. When I started reporting there they gave me a couple of managers to talk with, so I wound up in information systems, and that's where I started programming. Programming was mainly used in time and resource cost analysis of projects for the Mercury, Gemini, and Apollo on the IBM 1401 and 7094 computers and then later the Univac 1108 computer. My title was mathematician, and I was classified as an aerospace technologist, AST.

ROSS-NAZZAL: Had you had any experience before this time programming computers? Had you worked with them at the University of Houston?

JUE: The only time I had a computer background was when I was attending the University of Houston. They had courses in FORTRAN and machine language. The machine language was MAD. That's what they called it.

ROSS-NAZZAL: What is that?

JUE: Michigan Algorithm Decoder, I don't remember the details. I took both courses. That was my start in computers. Once I finished my schooling there—I majored in math and my minor was chemistry—I wound up over at the Channel 8 TV station.

I did talk to a couple of NASA managers about the options. One job was more like scientific programming, the other was business programming. That sounded better than my getting into all that math.

It turns out I did wind up working for a man called John [E.] Leonard, he's passed away, so you won't be able to talk with him. My understanding was, "You have an option. Do you want to do programming on the 1401?" There was an IBM 1401 computer. It's a small computer. Then there was the other computer, IBM 7094, and that was more scientific programming.

So I took the course on the IBM 1401 system. I started working in that area with the program. I initially learned to program in COBOL, a business-related language also. I had

access to the machine with input loading keypunch cards or a mag tape to use in processing the program and then output to the printer for a listing.

When I started, they gave me an introduction to what I would be doing. They gave me a program, and I had to format it, being business, not the other machine where you do calculations. I investigated, originated, and developed some computer programs. It was more like reading cards then at the time; do whatever you need to do to get the data off the card and then output to a printer or magnetic tape.

During my career I did experience this evolution within information technology. I might be getting ahead of myself.

ROSS-NAZZAL: That's okay.

JUE: There was the evolution from the use of punch cards and large mainframes to the remote desk and handheld processors. Getting onto the laptops. I guess you would say it's like small stuff; it's not as bad, you don't have to deal with punch cards, etc. anymore. That was the start of my computer world. I started out on 1401. I didn't really do the 7090s because of the scientific area. I liked the business side.

ROSS-NAZZAL: Can you explain what you mean by the business side? Are you referring to things like payroll and HR [human resources] functions? Or is there another component to that?

JUE: I remember one instance. The JSC library in Building 45 requested a computerized application. It was like a public library requiring similar info. The application would include a books database which would have username, checkout and return dates, and building location.

In general, I think the NASA offices gave you a task. They wanted you to go off and provide this information; it's written on paper. "This is the format we want, so you read data off the card," and you come back with a printout of that information. We took the cards or mag tape and did whatever we needed to, printing out the information.

ROSS-NAZZAL: You mentioned that the 1401 was a small computer. I've seen computers from that age. How small are we talking? I'm guessing it was small compared to the 7094. But how big was that computer?

JUE: I don't recall the computer size. It's not anything like a big IBM 7094, but I never used the 7094. Turns out that there were other people in the section that did that. There were only about half a dozen of us at the time.

ROSS-NAZZAL: Can you talk some more about those punch cards? How would you create a punch card? The Center has hundreds if not thousands of these punch cards still around. How do you generate them, and how do you put them in the machine? Then you finally get that stack of information that you're looking for. How does that all work?

JUE: At the time when we were doing this, there were a few keypunch operators. The data would come in on paper, maybe an 11-by-16-long sheet of paper. They would punch it into the

card as it fed through the punch machine. Once they finished with that deck of cards then you would take the deck of cards and do calculations if necessary and send to the printer.

At that time, everything was hand-drawn or handwritten with the information to make it more, I guess, readable; if you can't read somebody's handwriting, well, print it out there on the machine. Once we print it out—we used lots of paper—we hand it off to whoever the customer was.

ROSS-NAZZAL: Who were some of your customers at that point?

JUE: Data reduction is one. That's the one I remember.

ROSS-NAZZAL: Were they in Flight Operations? Or was that Engineering?

JUE: I don't remember exactly. They probably were. It's a different organization. Our offices were in Building 12, with the middle area being used for computers, the 1401 and 7090s at that time. They had a machine for microfilm too. All that information was done on the floor. We would just give them the data. They would just print out on microfilm if necessary.

ROSS-NAZZAL: NASA of course was building the Center, and you were hired before the Center opened. How long were you at the TV station?

JUE: Yes. Let's see. I started in February '63 and by the end of the year our Building 12 was one of those that was getting ready to open. It was complete. I'd say by the end of December '63 we moved on out there.

ROSS-NAZZAL: What was it like moving onto the Center at that point? Was there any sort of excitement, or any memories that you recall?

JUE: I think everybody was glad to be out of the U of H visitor center, because you're a little bit cramped, not as big as if you were in Building 12.

ROSS-NAZZAL: Did you have your own office when you moved out here?

JUE: No, we shared. The most we ever had was four. You would have two against the window facing each other, and then the other two were toward the door.

ROSS-NAZZAL: I saw your videos, and I heard that you were the only woman at the time, and also the only Asian American working in your division at that point.

JUE: No, I was not the only woman.

ROSS-NAZZAL: You were not the only woman.

JUE: No. I was the only Asian woman. There were two others there before me. After I started in that building, they hired two more.

ROSS-NAZZAL: Was it a challenge, do you think, being a female working out at NASA in the '60s?

JUE: I didn't notice any challenges. I was just a worker. I was there, and I was doing my job. What else is there? I'm not sure. At the time I was just glad to have a job and working and earning money and making more money than my parents in the grocery store.

ROSS-NAZZAL: Oh yes.

JUE: It wasn't that big. But a couple hundred.

ROSS-NAZZAL: That's how much you were making when you started out? A couple hundred a week?

JUE: I'm trying to think how much I had for the year. I think 6,000 something for the year. My first two weeks I earned approximately $194, which I gave to my parents.

ROSS-NAZZAL: Oh yes, that's pretty good.

JUE: You might have to look it up. What is a GS-5 at the time?

ROSS-NAZZAL: GS-5, that's what you started out as?

JUE: I'm thinking I was a 5, Jennifer. But I know a year later I started became a GS-7.

ROSS-NAZZAL: That makes sense. I'm trying to think. I think nowadays with a degree I think you start out as a GS-7 but it could have been different in the '60s. The ranks might have a little bit different. What was your involvement with the major programs that were happening at the Manned Spacecraft Center, with Gemini and Apollo? Did you have any involvement with either of those programs?

JUE: Let's see. I'm trying to think. Eventually, as I got my promotions, I did some development. Development, design, and implementation of computer systems are associated with technical management problems. I'm trying to see what the details were. I wrote something down here. What we did was computer systems that were associated with technical management problems. One that I did eventually was a system developed for a major program office, like systems dealing with Mission Control Center equipment and compute performance summary and the status of Apollo modifications.

ROSS-NAZZAL: Can you talk about that? What exactly does that mean? Does that mean you were working as they were changing out hardware and software for the missions? Is that what you were working on?

JUE: I think eventually when it got through I was doing resources, time, cost analysis of major NASA products such as Gemini and Apollo. I learned to investigate, develop, and maintain large information processing computer systems. My duties include programming, formulating, testing, and documenting programs. Once you get a program, you go through all those steps. You have to have knowledge of the computers and how they work. Most of that was what we were doing at the beginning.

Eventually I became a project leader. All that up above, I was doing all the programming, until I got promoted to a GS-11, 12. There was a slowdown on hiring NASA personnel, and contractors came to do the work. I became a contract monitor. We civil servants became project leaders. We were out of the programming business. I maintained a close relationship with the contractor(s) who were given the responsibility to do the requirements, design, schedule, implementation, and documentation.

We looked for our contractors to do the work, and we maintained a close relationship with them. We made sure that they provided good quality, and they were very quick, showing the promptness of completing their task assigned to them. We had different contractors then. I'm thinking we had IBM [International Business Machines], CSC, Computer Sciences [Corporation].

ROSS-NAZZAL: Was this during Apollo and Gemini? Was that a fairly quick transition from doing work in-house to having contractors do that type of work for you?

JUE: I'd say we civil servants were working Mercury, Gemini, and Apollo during that timeframe. This happened probably back in, I think, 1970.

ROSS-NAZZAL: I did come across something that you had written for the Engineering Directorate reunion that you wrote a program related to the radiation dose that the Apollo Command Module would take. I was curious about that. Can you explain why the program was needed?

JUE: Would you expand on that a little bit more?

ROSS-NAZZAL: Sure. I came across a biography you had written for the Engineering and Development Directorate reunion on the fiftieth anniversary of Apollo 11. One of the things that you wrote was that you wrote a program related to the radiation dose of the Apollo Command Module. I was just curious why Mission Control needed this program, why it needed to be developed, and what it was you were working on in particular. Were you working on say the barbecue function of the Command Module to keep the astronauts from getting extra radiation? I wasn't really sure what it was. I read that one sentence, and I thought I'd ask for a little bit more detail if you had it.

JUE: I'm trying to think. I started out as a programmer, and as a mathematician, data analysis. They gave me the AST classification, aerospace technologist.

ROSS-NAZZAL: Here's what I have, "a specific program included the radiation dose of the Apollo Command Module." You also wrote, "As an aerospace technologist, assignments required knowledge of various mathematical modules of scientific programing in machine and

FORTRAN knowledges for the IBM 7094 computer." I know you explained to me you didn't really use those computers. I just thought perhaps you had worked on that, but maybe not. Based on what we just talked about.

JUE: Like I said I was concentrating on the other computer rather than the 7094. In further thinking about it, I think it was to determine that the radiation was not to exceed a certain limit when the astronauts were in an Apollo flight.

ROSS-NAZZAL: I have read that there was a change, an evolution of computers at JSC. Did you work on the 360s as they came on board? Or were you still working on the 1401?

JUE: No, the 1401.

ROSS-NAZZAL: So you never worked on the 360s.

JUE: Yes, they brought that over, and then I think they did switch; I don't quite remember too much about the large-scale machines.

ROSS-NAZZAL: Were you involved at all with the Real-Time Computer Complex?

JUE: Not really, but the Software Development Laboratory was part of the complex.

ROSS-NAZZAL: You didn't necessarily do any work with people in Flight Ops. You were focused more on as you said more business applications.

JUE: Right.

ROSS-NAZZAL: We've talked about just briefly how technology was starting to change. It seemed to change pretty rapidly. Did that have any impact on your work and how your time at the office changed over the years as you worked on Gemini and Apollo and you started moving more towards the Space Shuttle Program?

JUE: Once I got out of programming, I became a contractor monitor. You would determine or work with the contractor, whoever their representative was, whoever my interface was. We just talked about what was necessary to do the job. I'm trying to think if we gave them paperwork to go do their job. I can't remember for sure. They were given a task, and they would look at what was necessary to do the job. They would look into the operations, the application software, maintenance, and developing hardware or software that was necessary.

ROSS-NAZZAL: Were there changes in how much information you had access to over that time period? Was there an exponential growth in the work?

JUE: There could have been. But when they produce the reports, then they go to whoever my contact was, and they screen it for whatever purpose they were assigned.

ROSS-NAZZAL: Tell me a little bit about your hours working out at the Space Center. Did you work long hours? We've heard from a lot of folks who worked out here that they were so committed to meeting the presidential goal that they were working constantly. What were your hours like?

JUE: We stayed within the regular hours, 8:00 to 5:00 or 8:00 to 4:30. There was nothing that we had to stay after hours to get something done. We always honored our commitments, got it done.

ROSS-NAZZAL: Were you living in the Clear Lake area when you first came out here to work?

JUE: No, we were in Third Ward where my parents were until we got a home over in Maplewood in Southwest area.

ROSS-NAZZAL: When did you get married, Josephine?

JUE: August '65.

ROSS-NAZZAL: Did you meet your husband out here at NASA?

JUE: No, I met him through a friend, and he was looking for a job at NASA, so I introduced him to somebody at Lockheed, and that's where he started working. I'm trying to remember,

Jennifer. I guess we had Lockheed as a contractor. I just mentioned a name where he could go to Lockheed and talk about a job.

ROSS-NAZZAL: There seemed to be a very heavy social component out here at the Manned Spacecraft Center. There were a lot of clubs and organizations. Were you active at all in any of those activities?

JUE: No, once I got through, I went home. I was active in Chinese Baptist Church doing things there, i.e. establishing and setting up monthly senior programs and meetings.

ROSS-NAZZAL: Yes, I think I've seen the finding aid. I was going to go up to Rice [University] at some point when their archive opened. I noticed you donated some photographs.

JUE: What was that?

ROSS-NAZZAL: I think you donated some photographs to the Rice archive.

JUE: Photographs of what?

ROSS-NAZZAL: You and the Baptist church. I've seen a couple of references to a finding aid.

JUE: Oh. Really? Oh, okay.

ROSS-NAZZAL: Yes, I'll send you the link. You can take a look.

JUE: I recollect we had a church meeting with reps from Rice wanting to set up an area featuring Asians. I did give them a few items of myself.

ROSS-NAZZAL: I'll send you that link. Do you have any memories of the Apollo 1 fire out here? Did that have any impact on you and your work?

JUE: No, it didn't impact our work, what we were doing. But it was just such a tragedy to hear about the astronauts getting killed like that. No, I wasn't involved in that.

ROSS-NAZZAL: Did you ever work with any of the astronauts during the Gemini or Apollo Program?

JUE: No. The only astronaut I worked with was [William M.] "Shep" [Shepherd]. That was when I started working over in Building 4 South.

ROSS-NAZZAL: So you worked with Bill Shepherd?

JUE: Yes. We're getting way ahead there but that's okay. What happened is that I wound up over in Space Station because I got my GS-15. Based on my background I wound up there, because I had to do user workstations. You know what I'm talking about, user workstations? I'm sorry, or computers.

ROSS-NAZZAL: Yes, I was going to say I'm guessing desktop computers.

JUE: Yes. When I got my GS-15 that was probably the last four years of my being there, maybe 1993. What I was doing over in Building 12, I was in charge of user workstations for the whole site. When Space Station came on, they were independent, so I wound up doing what I was doing for the whole site, doing this specifically for Space Station.

Let me go back. In 1974 I transferred to the Spacecraft Software Division becoming the manager of the Intermetrics contract with the responsibility of developing and maintaining the HAL/S compiler for both the Space Shuttle onboard and ground-based computers located in the Real-Time Computer Complex (RTCC) in Building 30. HAL/S is a real time high-order programming language. Some think it stands for Houston Aerospace Language. (HAL was mentioned in the movie, *2001: A Space Odyssey*.) It was developed by Intermetrics in Boston to verify Shuttle software design concepts and algorithms. It became available for the IBM 360 and onboard Shuttle AP-101 computers. I also chaired the HAL/S Language Definition and User Coordination Group. The board discussed and approved any modifications to the HAL/S language and its applications.

I did participate in the definition of the HAL programming language by advising our chairman of the HAL language control panel of the technical aspects of proposed changes. At the time the person in charge of the board was Jack [John R.] Garman. Had the background in procedures required to access input of proposed changes to the HAL compiler. Working with Intermetrics we provided this information to the board. Jack was the chairman, and it was up to

him whether he wanted to approve the changes or not. We had to make sure we had knowledge of the computer hardware design.

After I did that then I got my GS-14 when I went back to Building 12 in the DPSD (Data Processing Systems Division) and was given total responsibility for user workstations. This included procurement, requirements, maintenance, training, consultation, and problem resolution. We received user requirements, worked any issues, scheduled installations, and networked the computers. We were responsible for all the workstations that we were putting out there on the site. Again, a user workstation is like your desktop computers at the time.

I was over in Spacecraft Software. I mentioned the HAL compiler and the board. After I got the job as section head over in Building 12, I went back there. I was section head in the Service Center Section. We were responsible for all the desktop computers that we installed on-site. It was called user workstations. When I became head of the Service Center Section, in DPSD, the user workstation effort was included along with user education, user assistance (the Help Desk), service marketing, education, demonstrations, products, and services.

Then a position came along over in Space Station located in Building 4 South. I was given a GS-15 to be the project leader to do exactly what I was doing for the site, but I was restricted to doing it only for Space Station. I became chief of the Information Systems Office responsible for establishing, integration, operating and maintaining the Management Information Systems (MIS) for the Space Station Program in 1993. That's when I worked for Shep. He was in charge of Space Station until he went on a flight for Space Station, so he had to go back to training. There was a new person who became head, and that was Randy [H.] Brinkley. So that closes out the things I have done.

ROSS-NAZZAL: I did want to go back and just talk about a couple of other things that I was thinking of. When you first started working out here, until you left, were there different tools that you used? You obviously used a computer, but were there tools that you used in the ’60s that you weren’t using say in the ’70s, ’80s, or ’90s? We often hear about flight controllers wearing pocket protectors and using different engineering tools. But were there tools that you used as a programmer that you were relying on in the ’60s that you weren’t using in the ’70s or ’80s?

JUE: I’m trying to think. I don’t recall. I’m sure there were. The computers, that’s the only thing I can think of changed out. We did have IBM 7094 computers along with the 1401, but we also had the UNIVAC 1108 system. I don’t remember anything else after that because once we got off the mainframes, we started using workstation computers to get the job done.

ROSS-NAZZAL: Tell me if you would, how did you learn about the new technology as things were coming out. Were you continuing to take classes at the University of Houston? Or were you working with these companies and they were giving you demos and that’s how you were picking up this information? Can you talk about that a bit?

JUE: There wasn’t anything to learn outside of the computers. We had training. You didn’t have to go to school or get some training outside the site. User workstation, you just pick up on it. There was probably some software there. Of course if we needed training, we’d call in the people who were involved. I’m trying to think what the user workstations were. They were a

different workstation. I have to go back and think what kind of workstations they were. I don't remember specifically.

ROSS-NAZZAL: Oh, sure, like I said, it's been a while.

JUE: I'm sure there were some others besides IBM. I have to think on that one.

ROSS-NAZZAL: While you were working out here you got married. Did you have children?

JUE: Oh yes. I started over there at NASA '63. I got married in '65 and then I had twins in '66.

ROSS-NAZZAL: Oh, wow.

JUE: Two boys. Then a daughter in '72. While working there then of course I was not in management, I was just a programmer. You were allowed six weeks to stay home. That's what I did.

ROSS-NAZZAL: How did you balance your career? That is a big interest these days with folks. How do you find that work-life balance? I imagine at that time there weren't a lot of day cares. How did you handle having twin boys and then you had a daughter six years later? How did you handle childcare?

JUE: It wasn't easy. My mother started off, and it got to be quite a bit of work for her because she had the store. Once I took off and started a job then my other brothers and sister helped out in the store. In a way I was on my own. After I got married and had a husband, of course he was very good about helping to rear the children. I'd say he did half of the load. We would drive out to wherever the kids had to go to nursery, drop them off, pick them up after work, and do your thing that evening, dinner, put them to bed; it was up again the next day, same routine. It was quite a bit of struggle, but we managed.

ROSS-NAZZAL: I've seen in some of the *Roundup*s that you were involved with the Federal Women's Program. Do you recall your involvement? Would you talk about that?

JUE: I think it came about based on the civil rights movement. We decided to form a committee. There's somebody that was in charge, [Virginia] Ginny Hughes. She was in charge of the program, so we would get together and talk about what we could do about making sure that we didn't run into EO [Equal Opportunity] problems. The thing that came to mind was that we ought to work with the women to try to get them out of the secretarial positions and put them in higher up positions. That's what came to mind at the time, forming the Federal Women's Program.

ROSS-NAZZAL: Had you encountered any sort of EO problems? Or heard from the other women on-site that they were having difficulties?

JUE: Now I know specifically of none, but I do know that there were a few that were part of the EO Office. They said that they were experiencing some problems, but it wasn't like a whole lot. The specifics, we never knew.

ROSS-NAZZAL: Were you in charge of helping to come up with ideas of how to move women out of secretarial positions? If so, what sort of ideas did you come up with?

JUE: I think what we did is we just talked about it. As far as getting involved, no. We didn't talk to any of the people that had problems.

ROSS-NAZZAL: Did you ever present any of your ideas to management?

JUE: No. I didn't find that it was necessary.

ROSS-NAZZAL: I have found at least one newspaper article that includes you from the '60s. Was there a lot of interest in you since you were one of the few professional women on-site here at the Manned Spacecraft Center in the '60s? Did you have to field any requests for interviews?

JUE: Nothing that I can say that I was involved in, only the FWP, Federal Women's Program. Like I said, I wasn't involved in the EO, having problems.

ROSS-NAZZAL: Did you maintain any relationships with any of the other professional women on-site?

JUE: Yes, there is one. She was in my section, and we might talk; she's retired too. That's Karen Clark, she started as a co-op in 1963. We talked, I don't know, every few years, but that's about it.

ROSS-NAZZAL: Did you maintain a relationship with her while she was on-site, while you two were working together?

JUE: Yes, we just talked and we might go out, have lunch or something like that and talk, but that was about it.

ROSS-NAZZAL: Did most people go off-site to eat lunch during the '60s or were you primarily having lunch here on campus or at the cafeteria?

JUE: At the beginning, before I became manager, yes, we went out to eat probably once a week, just like we were over at U of H. We just took off, because we weren't like in a pressure mode, so we took off. Once we got on-site, yes, we still went out. But we also had some evenings together. We might plan something, especially like Christmas. Going out to someone's home. The other connection is maybe we go like on a side trip. But that's about it.

ROSS-NAZZAL: What sort of side trips would you take?

JUE: This was like on a weekend. One of the women had a place out on the beach, and we would go there and spend time with the group if they wanted. We had managers that had a place that was open to us if we wanted to have some kind of an outing there.

ROSS-NAZZAL: It sounds like you were a fairly social group.

JUE: Right, we had a special bond at the time.

ROSS-NAZZAL: What do you attribute that bond to that you had with your group?

JUE: Oh. I guess everybody was just congenial, didn't have any animosity toward each other. We respected each other doing our job.

ROSS-NAZZAL: Did you have any major technical challenges when you first came on board as an AST? Things that you struggled with?

JUE: When we came on board, we didn't know too much about the AP-101 computers. Since I was going to work on that machine, I was told to attend 1401 class. As we move along I'm trying to think if there was training elsewhere. Maybe again getting to understand user workstations. I did have somebody show me what do you want as far as the computer software and hardware. Details were provided and we just went from there. If they needed a program on the user workstation, we were able to provide it. But I can't think of anything specific we did through the user workstation.

ROSS-NAZZAL: Did you have any memories of Apollo 11 or 13? Those were such significant missions here at the Manned Spacecraft Center.

JUE: I wasn't working in Building 30 at the time. I was in Building 12. That happened during the time I wasn't manager. We were just support personnel doing our job over in Building 12. Yes, we heard about Apollo 13, but we didn't have to do anything about it. Not from my standpoint, but maybe some others that were involved that were in Building 12.

ROSS-NAZZAL: Were you at home when the lunar landing happened? Were you watching it on television?

JUE: I was not involved with the flights but had the opportunity to watch TV within our building.

ROSS-NAZZAL: I've read stories where people here in Houston, they had space fever. They were really interested in the space program, and they were sort of treated as a celebrity because they worked out here at NASA. What was your experience? Did you tell people that you worked out here? What was their reaction?

JUE: Yes. If somebody asked me where I worked they were surprised that I got into NASA, and they asked me what I used to do, or what kind of work I was doing. I guess some of them felt like they wished they were involved in the program, but some of them had a hard time getting in.

I think there was a time when JSC was closed to hiring. They had to go elsewhere again, but a lot of them were impressed that I wound up there.

ROSS-NAZZAL: Did you have any mentors out here in the ’60s? I know you mentioned your supervisor John Leonard, that you worked for him. Were there any folks that helped mentor you especially during your early years as a programmer?

JUE: No, there wasn’t any. John Leonard was a very good manager, and he took care of his group. He was just a nice fun guy.

ROSS-NAZZAL: Did you mentor anyone while you were working out there? Since you didn’t have a mentor, did you mentor anyone when you moved up into management?

JUE: No, I did not. Jack Garman helped me. He was like a mentor that I looked toward. I was impressed with him and his care about helping me, to support me, anyway, in what I was doing. He was a great support person when I was in Spacecraft Software; 1975, I think that’s when I was over there. I was helping out with the HAL program.

ROSS-NAZZAL: Can you talk about the type of support that he provided to you?

JUE: Oh, the information. If there was a question, especially if it was technical, he would help me, if I didn’t understand something. He took all the time necessary to make sure I got what I

needed to do the job or to learn about something. Sometimes he would have to go to the chalkboard, maybe draw a diagram.

ROSS-NAZZAL: Was that a challenge for you, moving from business computing into working spacecraft hardware? Did you have to learn about this new reusable spacecraft before you started working on software for the vehicle? Can you talk about that?

JUE: The only challenge I felt was that here I was going into a high-order language, and I wound up having to sort of learn what the purpose of the program was. But getting into the technical details, I didn't have to do that. I had a good contractor, Intermetrics. They were not on-site, but they had their facility up in Boston, Massachusetts, and at the time we would have support from them. If they had to come down, we would talk with them about what was necessary for the HAL compiler.

ROSS-NAZZAL: Can you talk about the high-order language? How was that different from the type of work you had been doing previous to that point? How was that language different from say FORTRAN or machine language?

JUE: It was geared only for the Space Shuttle, the AP-101 computer. I guess you have to understand technically how those computers work. I can't get into the hardware because I don't know too much about it. There's something about the language that they selected that's not as easy to work with. More technical.

ROSS-NAZZAL: You mentioned you were working with the HAL compiler. What is the HAL compiler? Can you tell me more about that?

JUE: Yes. Again, I didn't get into all the programming. It was more like a procedure-oriented language. You have to know FORTRAN a little bit to understand what is involved in the higher order language. It's not a simple program to work with. I can't say any more than that. I don't remember exactly everything about it except that it was a more technical computer program.

ROSS-NAZZAL: Were you doing a lot of traveling since you were working with the contractor? Did you go up to Massachusetts and monitor their work?

JUE: Yes, we did several times. Jack Garman was there to help too. Sometimes we had to have the board meet, like the HAL Language Board, so we just met up there. Intermetrics would present their changes, if there were any, which there was all the time. We met like once a week. Maybe we would do it down here with a telecon and talk at least once a week when we were first starting out.

ROSS-NAZZAL: What were some of the major challenges that this software faced that you recall? Were there any that you were really working at that time?

JUE: No, I would say the programmer was there in the contractor world. We were monitors, making sure the job gets done, that they follow through.

ROSS-NAZZAL: Was there any challenge that you had as a project leader on this effort?

JUE: None. I think what happened is we had some great contractors, and they did their job. There's nothing like where I had to come back and say, "Hey, this is not correct." It seemed like they were always one step ahead and knew what they were doing.

ROSS-NAZZAL: Were you well versed in HAL yourself as the project leader? Or were you more focused on meeting deadlines and things like project schedules and just overseeing the work?

JUE: I didn't have to get into the details. I just based it on the inputs I got from them and try to understand what the changes were. I never had to say, "Hey, this is not right." It's a challenge to just have such a high-order language, but you can depend on the contractor to do their job.

ROSS-NAZZAL: Definitely important, that's for sure.

JUE: We had good contractors. I don't think there's anybody that we had to do something with them.

ROSS-NAZZAL: That's always good to hear, and probably easier for you as well that you didn't have any of those challenges. You talked a little bit about your work with the user workstations for the whole site. Was that making sure that everyone on-site would have access to a desktop computer? Was that your project?

JUE: Yes. That was when I became chief of the Service Center. I went back to Building 12. We were responsible for the entire site. We did the acquisition, allocated the equipment, and installed the IBM PC hardware and software, the software being Microsoft Word, and networking, maintenance, Help Desk. We had a Help Desk that you call and if you had problems, we would direct them to whatever they needed to get the problem resolved. We provided training. We also loaned out PCs and software for home use. We began with IBM workstations for the entire site. There was some interest in Apple computers, but our division did not provide or support them. Another large task responsibility when in Service Center were mass moves. There were reorgs causing movement within the building or to another building. Another org was responsible for relocating the user desks and work boxes. We were responsible for moving equipment (computer, printer, etc.), networking, and checking once the move was completed to ensure the user workstations were up and running one hundred percent (in production mode).

If an organization had requirements for the machines, we would get the number of workstations required, we would determine how to set them up, network them. Of course we had contractors that did this. CSC [Computer Sciences Corporation], IBM, and Ford were the contractors. Once I got the information from a certain branch or division, they would say what they needed, so we would work the requirements, and we would network the equipment. We had the Help Desk. We had training if they needed some help in Word or whatever software they were using. We might provide one-on-one training, or we can have them come over to the facility where we had PCs and software that they could check out on loan for home use. We would set up a class if necessary.

ROSS-NAZZAL: Why did NASA make the decision to bring desktop computers to everyone on-site? Was there some sort of mandate by Congress? Or was this something that NASA itself recognized was a need? Do you recall?

JUE: I was in Spacecraft Software, and that's where we were developing the HAL compiler, but the next thing I know is that workstations were being installed in our division, and that's when I noticed. "Hey, looks like we're going to do desktop computers." Somebody made the decision; I don't know who exactly. It turns out that we had a couple over there in our Spacecraft Software Division, and the information that we were getting is that it's time to move on into that area for software, printer, networking, etc. Once it started booming, I saw the section chief position being offered in Building 12. I went back there and started working in the workstation world. We called them user workstations then.

ROSS-NAZZAL: Why did you apply for that position? Was there something of interest to you? Or you were looking for promotion?

JUE: More like a promotion.

ROSS-NAZZAL: How did you start working on the spacecraft software? How did you get into that world?

JUE: I saw one of my mentors, Jack Garman, he was moving over there to support the division chief. He was going to be the chairman for the HAL board. So I looked over there and checked

to see if there was a way I could transfer over there, if they had an opening. That's when I got the go-ahead to move on over. It was approved by our division too. I was there about ten years.

ROSS-NAZZAL: Were you doing any work with the Shuttle Avionics Integration Lab?

JUE: No. Where was that lab?

ROSS-NAZZAL: In Building 16.

JUE: No, I wasn't doing that. I was working with the lab over in Building 30 at one time. There was a Software Development Lab there. In that lab, we established plans and procedures for the development, implementation and maintenance of the HAL/S compiler for both the Space Shuttle on board and ground-based computers.

I was given responsibility later for the Software Production Facility (SPF) on the second floor of Building 30 while working in the Spacecraft Software Division. This included day-to-day operations, hardware (IBM equipment), software, and maintenance. The product of the SPF was the flight software for the Orbiter computers. I was also responsible for security administration in the SPF. I oversaw what was going on in those two facilities at one time.

ROSS-NAZZAL: I wonder if you would talk a little bit about that. You started out, you were trained as a mathematician, with an Aerospace Technologist (AST) classification, and then you became a project lead and then a project manager. What sort of training did you receive from

NASA to move into these types of positions? Obviously being a project manager requires a lot of skills that you didn't learn as a mathematician.

JUE: I think the one that really stands out was when I became a section head, because when you become a manager there are certain courses that you have to take. I remember I took a couple of them. All section heads were required to. They were required for newly selected managers. Training included working with personnel, handling personnel issues, learning the role of a manager.

ROSS-NAZZAL: There definitely was training that you had to take.

JUE: Yes, there was.

ROSS-NAZZAL: Were you one of the first female section heads in your area?

JUE: Yes.

ROSS-NAZZAL: Was that ever a challenge for you?

JUE: To me it was just another job. I didn't look upon that as being any problems with the situation I was in. There might have been some envy among some of the women there, but I never noticed it. They didn't treat me any differently from what I recall.

ROSS-NAZZAL: How did you find out about the Space Station position?

JUE: It was opening up. I was in Building 12, a section head. As soon as I heard that the International Space Station (ISS) was coming on board, I heard through a friend they were looking for somebody to head up the computer world over there, so I just went ahead and applied.

ROSS-NAZZAL: What interested you in working for Space Station?

JUE: I guess it was the GS-15 challenge. I would be responsible for the management information system (MIS) for the ISS. It was all the work I was doing in User Support. That was the name of the section in Building 12. When I heard about it then I said, "Well, all they wanted to do was install workstations just like they did for the whole site. I'll go ahead and sign up for it." But I didn't have to have all these other classes or a Help Desk, because we still used some people in our area for questions. When I went over there then I had certain people that could help in case, but we didn't have anything for the whole site like Building 12 had. But they were willing to help us because they got the computers for us.

ROSS-NAZZAL: That's nice. You had maybe a slightly smaller workload since you had Building 12 to take up some of those responsibilities for you.

JUE: I wouldn't say it was easier. I think we were more involved because we were getting a new building, 4 South, and we had to make sure wherever we were going to reside that we had all the

connections to get the job done. I also traveled to Japan to discuss their involvement in the Space Station Program.

ROSS-NAZZAL: What floor were you on in 4 South, do you recall?

JUE: It was the fourth floor.

ROSS-NAZZAL: Josephine, why did you decide to retire from NASA?

JUE: They were giving you an incentive to leave, because they were trying to downsize. I decided well, after 34 years, maybe it's time to leave. I went over there, and they offered a payout. I was accepted.

ROSS-NAZZAL: That was in 1997 that you retired?

JUE: Yes. I was there, yes, it was 1997, 34 years.

ROSS-NAZZAL: Very long career. It's interesting to me. So many people have such diverse careers, but your career really was focused on computers and technology the entire time that you worked here. You must have seen so many changes.

JUE: I guess I was too busy to notice any of that. Yes, there were some challenges, but I think I had all the support I needed to get the job done.

ROSS-NAZZAL: You were evaluating and grading contractors when you started working with Jack Garman, and you continued in these various positions that you were in?

JUE: Yes. As soon as you become monitors, you're having to grade contractors. We did a lot of that with IBM. They were a main contractor over in Building 30 when I was working with Jack Garman. When Jack Garman moved over to Building 12 and then again I saw that the workstation world was opening up, there was that opening for User Support, so I felt like, "Hey, this is my area," so I applied and got it.

We had contractors, and you have to grade them. When evaluating the contractor upon task completion, they were graded on quality and promptness. Of course if they don't follow through, you always can talk to the manager and see what you can do to straighten it out. When it came to documenting the evaluation, they know that it's the evaluation that they're going to be provided monetary rewards. But I thought the contractors were very helpful, very useful.

ROSS-NAZZAL: Did that eat up a lot of your day? Did your days include things like budget, scheduling, those sort of things? How did your day change say from 1964 until 1995? I imagine it was quite different.

JUE: Trying to think what to say about that.

ROSS-NAZZAL: I know it's an unusual question. I'm just trying to get a sense of like I said the changes that you experienced. I imagine you were probably working on just coding at first. You

had one main job. Whereas you probably had quite a few tasks that you were juggling as a manager.

JUE: When I began working at NASA, it was doing work myself with little interface to complete the task. Becoming a manager did entail much work, more connections with people to get to the end product. When I first started I was a youngster, and it was like, "Hey, it's a job, and I'm glad to have a job working at NASA!" I just put my all in it and felt like as I work for NASA I want to go as far as I could. When I first worked, I didn't have an interest in being a manager. But as it happens, as you get the programming, and then after we started doing the programming they said, "Hey, we're going to get computer support from contractors." They decided with NASA people maybe you ought to not hire as many and get contractors to do the job. That's when you were a lead, taking over a project, and having somebody work for you.

ROSS-NAZZAL: I wonder as you look back is there anything that you can point to that you think is something that you're really proud of that you would point to that maybe no one knows that you played such an important role in.

JUE: Nobody knew that I had such a role outside of NASA. Again, when I did that program over in Mississippi, 2019, I think, yes, two years ago, nobody knew what my background was. That sort of opened it up to a lot of people.

I go to Chinese Baptist Church, and I'm in charge of the senior group. We meet like once a month or twice a month. I get speakers to talk. It turns out that after I did this talk over in Mississippi, I did it for the church, and a lot of them didn't know what my background was.

They just knew I worked for NASA. They were sort of in awe at the things I did, and they think that I should be doing other things for the church, like being head of other committees. That program working with the seniors, that I mentioned, that started when I left NASA, '97. That's 20 some years now.

ROSS-NAZZAL: Yes, it's been a while.

JUE: I talked about what I had done at NASA, and some of them could understand, but some of them of course not technically. But some of them if they were familiar with computers could, it meant something to them.

ROSS-NAZZAL: You had a great career. Do you miss coming out here to the Space Center?

JUE: They were going to have something for the NASA folks September over in the Center there like they did two years ago. But they canceled it because of the virus.

I was on the Suggestion Award Committee, and people would submit suggestions, some technical. We met, I can't remember how often, maybe once a month. We would go through the suggestions and then if they were approved, we would then decide on the amount of the award based on what they provided.

ROSS-NAZZAL: I think I had seen that you won an award for saving the government some money. But it wasn't very clear in the *Roundup* as to what that was. It looked like you had received a similar award.

JUE: Oh yes.

ROSS-NAZZAL: What did you receive that award for, Josephine, if you recall?

JUE: It was, "In recognition of a notable contributions to the improvement of operations resulting from an adopted suggestion" dated March 20, 1989.

ROSS-NAZZAL: I was curious what it was. It didn't say, it just said you had received an award for saving the government funds.

JUE: I don't remember the specifics. But I did also receive a NASA Exceptional Service Medal in March 1991, a Certificate of Commendation in July 1990, a Superior Achievement Award in December 1997, and an Equal Opportunity Award in December 1983.

ROSS-NAZZAL: Josephine, is there anything else? I think I've exhausted most of my questions. I may shoot you a couple e-mails here and there as I dig through the archive.

JUE: If you have some questions, send it to me, and if something opens up about my memory then I can send it to you or talk again.

ROSS-NAZZAL: I did notice you were shuffling through your notes. I wonder do you have your NASA biographical data sheet? Is that what you're referring back to? Years ago NASA used to

maintain those. But NASA no longer does. Do you have copies of those anymore? Do you know?

I've seen them for a number of folks that we've interviewed from the '60s, '70s, and '80s. They would maintain these. NASA had these on these folks. They were a typed-up sheet, kind of like a NASA resume. It would include things like your education, your kids, your marital status, and then your positions with the years and a little summary about things that you did. It was always in governmentspeak, which you'd have to interpret, but I was just curious if you had one of those.

JUE: No, I don't have that.

ROSS-NAZZAL: Maybe that wasn't standard. I just assumed that was standard for all civil servants, because contractors wouldn't have one of those.

JUE: I don't remember doing that. If there's other questions, if I'm not clear. I know my voice is not that great.

ROSS-NAZZAL: No, you came across quite clear and I've got the microphone right next to the speakerphone.

[Break in audio]

JUE: I didn't see anything different from my colleagues because of my gender. I did hire an Asian man when I was manager of that Service Center. When I talked to him recently, I asked him what's the status of the Asians being hired at JSC. He said, "Well, they did hire another Asian guy and an Asian woman." I don't think they're in Building 12 anymore. I think 12 has been changed to something else, he told me. Do you know?

ROSS-NAZZAL: It's been completely gutted and renovated now, yes. It's a lot of conference rooms.

JUE: Yes, well, he just said he's not there anymore, he was in 45 now.

ROSS-NAZZAL: Yes, it's got a green roof, it's very high-tech.

JUE: Based on the Civil Rights Act of '64 we had that Federal Women's Program. So there was other things I had to do there besides being a member. We were working to take care of the NASA employees. With 4,000 NASA employees there, there were about 1,000 women that were employed, but only 170 in the professional positions.

ROSS-NAZZAL: I think that's very unusual, the fact that there were so few professional women, and so many women concentrated in the secretarial fields.

JUE: Yes. That's all they were. I didn't tell you. My parents, they wanted me to be a teacher, but at the time when I was being hired, for women the jobs were teachers and maybe nurses or

secretaries, and I said I didn't want to do any of that. Luckily whatever happened at NASA just opened up a new world.

ROSS-NAZZAL: Very different experience from your mother's experience for sure.

JUE: Sure. I think a lot of the women out there now, they're making great contributions. Should be. I don't know how many they have out there now. But I think when we were working there they must have had about 1,000 women, but there were only, I think 170, if I remember when I wrote something up, in professional positions. I think based on what's happening to the U.S. we're going to see a more diverse country. At the time when I was getting involved, women in business or industry, they have to try a little harder. We have to show that we can do a better job in anything. We just have to stay in the race, just run faster.

ROSS-NAZZAL: You didn't seem to express that, but did you feel like you had to work harder than the guys, that there was pressure on you because you were the only one?

JUE: No, I didn't get that feeling at all. See, NASA, I guess the government, they wanted to be more diverse. There were diverse occupations of women throughout the Agency then. I think that the women employees out there, they made some significant contributions to the aeronautical and space fields. So no, I can't say that they were prejudiced at all.

I enjoyed working out there as long as I did, but I think when I gave it up that was at an opportune time. So you stick it out. Stay there.

ROSS-NAZZAL: That's the plan right now. I got to pay that mortgage. Thank you very much for your time today, I really appreciate it, Josephine. Good luck with the house and all the improvements.

[End of interview]