

**NASA MSFC Oral History Interview
Steve Johnson Interviews – Apollo/Saturn Program**

Parker Counts
Interviewed by Steve Johnson
Huntsville, Alabama – Unknown, Circa 2012

Steve Johnson: I am talking to Parker Counts who went to work for NASA [National Aeronautics and Space Administration] in 1963 and was there until he retired in 2003. Parker, talk a little bit about your education. What prepared you to be in the space program?

Parker Counts: I graduated from the University of Tennessee in 1962. I always wanted to be an engineer, but, interestingly, I was not space-driven at the time and I decided to come across the border to Alabama and had an interesting interview. In fact, I had a courtesy interview, folks did not have a job in NASA at that time, this was mid-Apollo timeframe, and the key hiring had gone away. I got the wrong Jim Lindsey, as it turned out, so the people I did interview with did have a job in Quality and Reliability Assurance as a test engineer. They hired me on the spot and forty years later, I enjoyed a great career with NASA.

Johnson: Describe what that meant. That particular task, what did that entail?

Counts: Back in [Wernher] von Braun's era, he had wisely set up what many of us refer to as a three-legged stool. That is, he had equally staffed engineering components of the design engineering side of the house, which designed the rockets, then he had the test group, which did the physical hot fire testing of the rockets before they were shipped off to be launched. Then he had created Reliability and Quality Assurance as an equally staffed engineering group that would do the pre-static and post-static testing and we would do all the component testing. Everything that went into the vehicle, we had done the acceptance testing of as it came in. Our primary role was to assure that the designers, what they said they wanted out of the hardware, the product, we would test it to its full limits. It was our responsibility to make sure those limits were met. [There were] many discussions with our design friends because they thought we were treating their hardware a little tough. Again, that was our job because von Braun wanted to test everything on the ground before it was ever launched. He gave us that charter and that was the fun part of it, we got to test it.

Johnson: You joined Marshall Space Flight Center in 1963, the middle, so to speak, of the Saturn/Apollo Program. Talk about something you tested and how you went about doing it, something that was crucial to the mission.

Counts: Let me start with one of my first remembrances after I got the job. I was responsible for the leak checks of the systems, it was mechanical systems back then and pressure-fed. I had the privilege as a young engineer to climb around the aft end of the Saturn V with the five F-1 engines installed and had to locate with schematics every joint that fed the pneumatics to that engine or any of the other activity. My first operations were to do those to make sure everything was properly leak checked. I did the procedures and schematics to locate where to go test everything for the technicians.

Johnson: You said you did leak checks, and you also said before and after a static test you would be testing the hardware. When you did a leak check, what did that mean?

Counts: A leak check, they were pretty simple. You would go up with the system pressurized at certain pressures and make sure those connections were all leak free before we sent the vehicle over to a static test. When we would prepare the vehicle test wise, we would make sure that vehicle was ready to go down the road and be put into the test stand to be fired. After firing, we would come back and repeat that same set of procedures. We called that our pre and post-static testing of the launch vehicle.

Johnson: What were the main technical challenges for doing the kind of testing that you did?

Counts: The technical from the leak check standpoint, that was pretty straightforward. I moved from a systems test engineer into component tests, and we would have to go to the vendors for hardware such as pneumatic piping and pneumatic valves, prevalues were a big item back in those days, and all the varied components that made up the whole vehicle, then we would check them prior to their installation on the vehicle. That was exciting. I was also challenged to do the electrical side of the testing, again, at the component level. Those were early on things I did. There were challenges in that each vendor had a different problem, we would have the specs, we would have the requirements, and those that did not meet, we had to go back to the vendor or do our checks here.

Johnson: Would people be surprised to know how much testing of every single piece of the Saturn V was conducted, do you think?

Counts: I think they would. It was so very thoroughly thought through. That was the heritage Dr. von Braun instilled in us to make sure that everything was tested. We would test, retest, fire it, then retest it again to make sure it was right.

Johnson: Then, of course, there were not computer simulations that you could do. Did that require you to do more testing than, say, would be done now?

Counts: I think the difference would be that we had to do a lot of things manually as opposed to having the simulated test. We had test equipment, the best we could get at the time, but certainly not to the level of what testing the simulators and the things that have now been developed in the later generations.

Johnson: While you were testing, did you have to develop any new tools or come up with any new materials or were you basically testing the materials that were already there to see if they did what they were supposed to do?

Counts: Pretty much, we were designed when I came into the program, so we were more in an operational phase of making sure these vehicles were tested. As we turned these vehicles over to the industry base, then we were involved with monitoring them. Again, one of those strong features of the Saturn/Apollo Program was that having done the testing, having done the designs, prepared us as an agency when we turned production over to the various contractors. We were able to monitor them. We had the hands-on experience to be able to evaluate their experience and make sure they did a good job.

Johnson: You have already mentioned vendors and contractors. From your end of things, talk about the vendor experience. Was it a good experience? Did the various

vendors and contractors involved with the Saturn Program, was that, in general terms, a good experience during the Saturn days?

Counts: In the Saturn days, again, very good experiences, everybody was excited. This whole forty, fifty thousand folks that were involved in going to the Moon, every vendor we went to was very excited about being a part of it. We did not have any issues, Some may not have been able to perform as well as others and we had to weed out the good and the bad, but as far as their attitude and working together, it was good relationship.

Johnson: Of course, you worked at Marshall on various other programs and there were contractors involved in that too. Did the experience stay as good over the years as it was during the Saturn days?

Counts: I will fast forward with you for a moment with the External Tank for the shuttle. From the vendor perspective, I think the excitement was there. We had the same kinds of things, but what happened in shuttle was the vendor base, ninety percent of that tank was vendor-procured. It was very critical that we have a good relationship. Then I was the project manager, so I relied upon the contractor, Lockheed Martin, who for thirty-eight years had the External Tank. They did a marvelous job as a prime contractor and all our subs had that same fire in their belly, if you will, in terms of we

are working on the shuttle. I remember very well we brought many of those vendors to the launch site to let them see a shuttle launch. They just marveled, my part was on that thing. It was a good relationship. As we worked toward the end of shuttle, we did not have a high volume, high production rate, we did not have a large launch rate. Vendors had to start looking at themselves from a business case. They wanted to be a part of it, but there was not a lot of business when you are not turning out. It was hard.

Johnson: Basically, they could not make a living on a few shuttle launches. Let us go back to the Saturn Program. What was the work like then? You joined in 1963, a couple of years passed, the president guaranteeing a Moon landing, humans on the Moon within the decade. What was the pace of work like in those days?

Counts: I always told people that our standard work week was ten hours a day, eight on Saturday, and then we used the weekends if we did not get it done. It was demanding, but fun. I do not think any of us in the program complained about the long hours because it was very rewarding to be working toward it. We had the challenge and those were exciting times.

Johnson: You were essentially working ten hours a day, maybe eight on Saturday. How many years did this go on?

Counts: This pretty much went on for the first ten years, at least, of my career. That is when I was more heavily involved in the test engineering. During that time, my first level management job, we did pre and post-static tests of the F-1 engines, H-1s, and J-2s. All of those came under the group I had the privilege of working with. We did the test on those. All that time, they were vendor procured engines. When they came in, we would do the same rigor that we did of the whole vehicle. We would test that whole engine as an assembly. Then it was taken to a hot fire, it would come back, and we would do a post-mechanical. The same logic was test before you hot fire it, hot fire it, and then you come back and do a post-static. Then the engines were ready to be installed on the vehicle.

Johnson: What was the work environment like? We are talking a decade of working what most people would consider a very long week. Was everybody feeling like “this is what we need to be doing?”

Counts: From my perspective, I cannot think of anything or anybody who was unhappy. We shared in the work, it was very exciting. I did not see anything. It was not one of those “I do not want to work today.” Obviously when you have some stress and issues and problems that are not the most exciting things, but overall, we knew what we were working on, we knew where we were headed, and it was exciting.

Johnson: How did you control costs? Was there talk about money?

Counts: In my earlier days, that was before I got into the program management side of things. Cost was never an issue for us. I guess, in all honesty, von Braun had an open checkbook to go do everything he needed to do. Money was not an issue in the Saturn/Apollo Program. As we moved into further generations, things got tougher and you had to manage to a cost and schedule. Things got much more difficult as the next thirty years of my career progressed to an order of stronger management role. We had to manage the cost, and that was different. Apollo, at least as I was testing things and going, money was never an issue.

Johnson: In later years when you were working other programs up to and including the shuttle, you were still involved in testing, am I correct?

Counts: I went into testing, I got into systems engineering for a while, then into requirements, but I eventually ended up managing programs. I kind of grew out of the testing after about ten, fifteen years.

Johnson: In the testing part in the first ten to fifteen years, were there dead ends in the testing you guys did? If there were any dead ends, how did you recover from them? Did you test things that just did not work?

Counts: We did have failures. I did start early. The last part of my testing side was when I was involved with the space shuttle main engines, when we started setting them up. They were the pacing item for the space shuttle. That was one of my field assignments. I had a short assignment at the Mississippi Test Facility where we were to set up the engine firings, but I remember one of the problems we had there was starting the start sequence. We must have literally destroyed six or eight engines just trying to get the start sequence on this finely tuned engine. Of course, it turned out to be a Swiss watch once it was set up, it worked perfectly. We burned up several engines just trying to do the start sequence. It comes to main stage in about a second and half. That is really turning things up quickly.

Johnson: Zero to sixty in a second is what you are saying. (Laughs)

Counts: Yes, it was really running hard.

Johnson: Was it a surprise it was so hard? You had had success with the Saturn V engines. When you were working on the shuttle engines, was it ever a surprise you were having so much trouble?

Counts: I think it was because we had come off as very successful because every shuttle we launched on thirty two vehicles were successful. We had some problems with those and we had some failures even during flight, but we had margins to cover them. It was well-designed. We had done a very good job in testing and preparing everything for the vehicles and for the launches, so we were coming off a very successful program. I think when we tried to stretch the technology, particularly in that shuttle main engine when we were looking for higher performance, we ran into several problems.

Johnson: Of course, the shuttle main engines were one of the marvels of the aerospace industry. How much pride do you have about the fact that you contributed to that engine being so special?

Counts: Certainly the engines were probably the highlight of the second phase of my activities. I did get called on to go to California and spend three years at the factory, this was when we were having trouble building the main engines. I left Mississippi and went to California for three years at the Canoga Park facility where Rocketdyne was

building the Space Shuttle Main Engines. I spent three years there working with the contractor to try to work through and price. We were resident office folks out there. I was the resident quality and reliability assurance manager out there for three years. That was exciting to get involved in. It gave me a greater appreciation of how a contractor has to work, sometimes sitting back 2,000 miles and saying why can you not do this and that. Being in the factory was a real eye-opener for me and helped me develop a career base where I then had a greater appreciation about the contractors and what they have to go through by having to live through that time with them.

Johnson: Between Saturn and shuttle, you worked on Skylab. What was your Skylab involvement?

Counts: Skylab was that fill-in program between the Apollo Program until we got shuttle up and running. Fill-in meaning we used residual hardware coming out of Apollo and used the remaining Saturn vehicles to get Skylab up. My role there was with the orbital workshop. They took and removed all the propulsion lines off of that and made it a habitable workshop. I was responsible for the mechanical systems on the orbital workshop for Skylab. I had a year's assignment out at McDonnell Douglas. That program got into some problems early on in terms of schedule and getting it through. I think it was about ninety of us that went out to work with that contractor. That was a

pleasure to work and get the vehicle prepared and tested for our standards. Then we shipped that third stage as it was, known as the orbital workshop, to the Cape [Kennedy] to be mounted to the Saturn V vehicle and be launched. I got to go and spend another year at the Cape while we were preparing Skylab for launch.

Johnson: You worked on planetary missions after that. Talk about what exactly that entailed.

Counts: Before I started the shuttle, one of the first responsibilities to get the shuttle system up and running was the Tracking and Data Relay Satellites. They formed the network of satellites in geostationary orbit that would provide the continuous communications to the shuttle and to the ground. They had to be launched in this 22,000 mile geostationary orbit, so they needed secondary propulsion stages coming out of the shuttle. Shuttle would get up to low Earth orbit and then you had to have a two stage solid rocket motor to propel those large satellites up to their final destination. After Skylab, I went to work with those and eventually became the project manager for the upper stages. That was a program out of Marshall, because it was propulsion, so we managed that. That is what we used the first few flights for, to get the tracking data satellites up.

With that capability established, then there were planetary missions that needed to be put into planetary positions or travel to the other orbits, needing that propulsive power coming out of the shuttle bay. We had the Magellan, the Galileo, and the Ulysses missions. They were exciting missions, quite large, very expensive in terms of billion dollar-type planetary satellites. We had the responsibility not only in that phase to provide the two stage solid rocket motor to give them the thrust from the shuttle, we also had the responsibility as Marshall to integrate these payloads to the upper stages and take that as a combined payload to the orbiter. We followed through the testing of the orbiter. Our test and launch complex was off the west coast where we managed it, so we would support the shuttle launches and then transition to the west coast, San Jose [California] at the Air Force facility to then follow the mission for the next eighteen hours to get those planetary missions going. It was quite successful. All those planetary, you were targeting from a propulsion standpoint. We had a target to hit and we hit the bullseye on all the planetary missions. It was quite exciting to finish the planetary, and we also got all the Tracking and Data Relay Satellites up. It was a very exciting program.

Johnson: You had one of those careers where you were at Marshall Space Flight Center, you were in California, you were all over NASA territory not only with NASA but with contractors. What was it like having a career that called you to live so many places?

Counts: I have often been asked that question. I guess my answer is I could not have dreamt of a more fascinating career. I would never have thought I could put all these pieces together. I enjoyed every move, everything. There are always a few issues, but from a concept and from a career standpoint, I could not have put the pieces together in any better fashion. It was great.

Johnson: Did working on the Saturn V Program, which, as someone has said, is a marvel of systems engineering because so many things had to go together to allow us to do something that we had never done before. Did that set you up to make all these other things you did a success? Did you learn things during your early days working in the Saturn Program that benefitted you the rest of your NASA career?

Counts: Absolutely. I could not say it more strongly because it was a marvel, it was first things. I think it also contributed not only to my ability to understand and go through it and be part of it, I just had a small part, as many of us did, but it was a beautiful opportunity to be involved. It also built confidence in us, confidence that we had been there, we had done that. I think we rode that confidence all the way through shuttle. Even though we probably had more issues, we launched a couple of missions tragically, but we knew we could do things and that, at least from a personal standpoint, prepared me quite well for the rest of my career.

Johnson: Could you talk about the differences between Marshall and other NASA centers? Specifically, were there rivalries over the course of your career that you noticed?

Counts: Yes, that probably comes in any strong, competitive [environment]. We have ten NASA field centers now, and, of course, that competition was with Johnson [Space Center] and Kennedy [Space Center], Stennis, and Marshall were the propulsive-type centers. Then there was competition with the others, primarily budget, as it got in the later years, because of the invariable argument, why do we need humans, why do we not go robotic, we need more science, we need less humans. It was there. We would be foolish not to admit it. I think we have come to appreciate that there is room for all of us to exist in this thing. In the later years, particularly on the human spaceflight side of things, I think we have come together now very strongly in trying to support where we need to go in space exploration. I think the teams now know we have a very restricted budget, we have economic situations that are very difficult. I think we are all working together to make it a stronger one. I think before everybody had their own roles, Saturn/Apollo, for example, I think it was clear the roles each had. Then we moved to budget constraints and things got a little tight. Now I think we are seeing we have to all play well and work together. I think it is working in the right direction.

Johnson: Let us drop back to the Saturn days for a moment and talk about Dr. von Braun's involvement in what you did, which was testing. Did he visit a lot? Did he have a real interest in what your group was doing?

Counts: Absolutely. He was there at every opportunity. That was his strength, he was there among the people, he was there to give leadership and guidance. He was just a marvelous man, as many of us will testify. Personally, I came late, so I was in a few meetings with him, but I did not have the hands-on that many of the others that came in the mid-1950s had. What a great leader we had. He set the stage, but he would be around. He was very gentlemanly. Everything I remember seeing him do, he was very much the gentleman, respected the people, and kept us invigorated and kept us challenged.

Johnson: Compare the leadership, which you just talked about, under von Braun with leadership in later years at Marshall, and maybe even NASA. Was there ever anyone who was able to be all the things von Braun was during the Saturn days?

Counts: No, I do not think we have anybody that, in my mind, could come up to that level. I was privileged to work for all ten center directors in my career base. The ten I

worked for, there were different personalities, different leaders. I got closer to the ones later and worked very closely with them. I have very fond memories of direct involvement with our center directors. Everyone I dealt with was fair and honest. We had to work through problems, but von Braun was that special kind of guy that only comes around every once in a while.

Johnson: Staying in the Saturn V days, talk about the integration of all the different parts, projects, designs. When we got to the point where we had tested and it was time to fly, did it all fit together the way you expected it to? Did everything perform like you, in your mind, a guy who worked on it, thought it would?

Counts: Because we had the rigors of testing and because we went to all the special efforts as well as preparing the vehicle for shipment to the Cape, for stacking it at the Cape, for the tests that were done there, we were all integrated into it. Those first firings, you were pleasantly surprised that everything worked together, but I was pleased the amount of effort, integration, and testing that we did prepared us for that. You do not know what that outcome is until you see it leave the launchpad. When it does, and when I completes its mission, then you can breathe a sigh of relief and be happy.

Johnson: Do you remember your feeling when the Saturn V finally flew?

Counts: I was there for that one, at Apollo 17, and my remembrance of that one, that was the first time you speak of testing. We had a ground simulator and we had all the hardware simulated in the Quality and Reliability Assurance Lab where we were. That was all set up in the event you had a problem. I distinctly remember we had to delay that launch and Marshall finally got a little notoriety because they said Marshall had a system. We had a failure, I have forgotten what it was, but it was fun through that simulator. They found it, validated it, and said you are safe to fly. It was good to see it go. It was sad, we had other launch vehicles ready that could have gone, but it was a good closure to a very successful program.

Johnson: When the Saturn V, and even the shuttle, for that matter, flew, did you have enough familiarity with all the testing and all the things that had been done that you were confident? Do you remember being confident that it was going to go and be successful, that you had done everything you needed to do to these spacecraft?

Counts: We go through, again on shuttle, I will be specific since I was responsible for giving elements on the shuttle, be it upper stages as a payload or External Tank. With those specifics, we go through quite an elaborate preflight readiness review, so we are

confident, at least for our elements. In my case, either of those three or four projects that I worked on, we were confident we were ready to fly at that point. We felt good about it. I cannot speak to the whole system. By this time, we had now been very focused on making sure that our particular elements were ready when we come together at the launch site, and much more carefully in the later days after *Challenger*. We had a very rigorous review process we go through. Being part of that, we saw it totally. I think we went into it pretty confidently. Each element would have to give our go status, so we were ready for launch. Sitting through the process, we became confident that after we finished that process, we felt like that vehicle was ready to go.

Johnson: Despite all our testing, we had the accident with *Challenger*. You left in 2003, so you actually left before *Columbia*, but you were there for the *Challenger* disaster. Talk about that. How did that effect what you did?

Counts: Let me take you back. I was there for *Columbia*. I was in Washington [District of Columbia] running a program. I was part of it. In fact, that very day, I was coming home to retire on February 11, which would have been on my fortieth anniversary. I was in Washington doing the Shuttle Program. *Columbia* was February 1 and I had just gotten back to Marshall, just landed, and I got a call from the folks in Washington saying we were about to land *Columbia* and they were only fifteen minutes away. Then I

got a call saying we had a problem. Then I was able to run out to the center. I did work both, and I will give you the flavor of each one.

For *Challenger*, I was the upper stage manager. I was working the Upper Stage Program, so we were the payload on *Challenger*. We were satisfied, we had given the go for our upper stage payload and had integrated it into the shuttle. Things were ready to go. I was there. Unbelievably, we were on our consoles, we were dead silent for a couple of seconds. The hope was we would see an orbiter fly out of what looked to be a cloud, but, of course, it did not.

Johnson: Were you involved with the work to figure out exactly what had happened and redesign things to make sure it would not happen again?

Counts: We were. On our part, we had to establish a review team to verify that the payload did not cause a problem. It was really interesting because there was an issue in our minds with the spreader beams, these were the beams that mounted the 45,000 pound payload into the shuttle bay. There was some concern about this material maybe being fractured, it could have been something. Our group's greatest fear was these beams broke and then it shifted during maximum dynamic pressure we went through at that timeframe and that we might have caused that accident. We had to form a team

and go do that. We were very rigorous. Every element put their team together, and we did an overall team working it with the commission.

Our side of it was when we pulled those beams out of the ocean, they were bent but not broken. We were able to at least validate that the payload did not cause the issue. Of course the issue, we knew what caused it later, it came on out. Yes, we were involved. We did not have any redesigns to do, but we did revalidate everything that we do in the process so that we would have a safe payload because we had to fly the Tracking and Data Relay Satellites. They had to be up for the shuttle to be successful.

Johnson: How about *Columbia*?

Counts: *Columbia*, I was in Washington doing the Shuttle Program, so I was involved in the detailed activities.

Johnson: You were in Washington for two years with the Shuttle Program. Explain what you did in Washington.

Counts: In Washington, I was the deputy associate administrator for the Shuttle Program. Primarily, that means we watched the budget. We had the responsibility for

the entire shuttle budget and we had to defend that budget to Congress. Most of that work was primarily interfacing with the congressmen, the staffers, and answer all the questions. It was very incumbent on that person to be able to stay in touch with the other field centers so we could get all the answers together. We developed a great relationship with all the program managers and project managers because Congress is notorious for wanting answers and wanting them quickly.

Our challenge was to get the right answers to the folks. That was the side of it that was not hands-on hardware as much as it was dealing with the congressional budget, working with NASA Headquarters, keeping information flowing on where the shuttle was, how we were meeting our schedules, and how the elements were coming together. It was good that it happened at the end of my career because I had had hands on hardware in the field. That really made that a simpler job for me because I knew who to go to for the information and I had the hardware knowledge. Hardware knowledge in Washington is a bit of a rare thing. I think it worked well and kept us able to answer the questions from Congress.

Johnson: Did you have any function in the post-*Columbia* investigation?

Counts: That is why I did not retire on February 11 and stayed until we got a plan together that set up the recoveries and find out what we needed to do. I stayed on until July to finish the initial planning and get the activities together and support the agency in that regard. Then it came into a commission review, so they took over. I stayed that extra six months just to get the plans together.

Johnson: The job you did during both the *Challenger* disaster and *Columbia* really had nothing to do with what the various commissions indicated caused the disasters. Do you care to comment or say your opinion on how things might have been handled differently by NASA or if there as a culture that was unfortunately not changed in time to avoid these accidents?

Counts: The one thing I would say is there was a distinct improvement between *Columbia* and *Challenger* relative to the contingency plans. We were not prepared for *Challenger* in terms of contingency plans, what would we do. I think *Challenger* proved that we had put the right plans together for the contingency. We knew who to call. I mentioned I just came back, and the first thing we did within forty-five minutes of that accident was we had all the teams assembled on a telecon and called everybody together that needed to be there for it. The contingency plan was a big difference, I think. When you go through those things, they are intense, and, when we have a failure,

we tend to possibly get into a very conservative mode. I cannot say it is bad or good, we are treating with human life, and we have to treat it very much so. We have to look at those things and we come out. Between the two, the one big difference I saw was in how the operations were run.

Johnson: This has been mentioned by other people that launching rockets with humans on board is a dangerous business. Do you feel like what happened came with the territory, or could we have avoided those two disasters?

Counts: In hindsight, of course you would not have launched on a cold day.

Johnson: That is with *Challenger*.

Counts: That is with *Challenger*. And *Columbia*, had we known that we had a transport mechanism to get that foam from that bipod on the External Tank down into the wing area of the orbiter, all the systems engineering up to that point said we did not have a transport mechanism. In hindsight, we knew we did not. Those are the two critical things about those two accidents that could have prevented it. As we look back, I was in the readiness reviews for *Challenger* and I thought the biggest issue was the C state. As I remember in the flight readiness reviews, the seas were going to be twelve foot levels,

so the program manager had to make the call. Somebody had to elevate that. That was one of the bigger discussions. We understood other things were going on behind the scenes. Like you said, it is human spaceflight, it is a risky business, and we do know there are going to be those and we may not get everything, but we have to try. In the future, we have to put safety number one and keep everybody there.

Johnson: We were so successful in the Saturn V days, and with those glaring examples you already talked about, very successful during the shuttle years. Does the success by NASA sometimes make the agency overconfident or make the people who work on these complex systems overconfident that we have done everything and things are going to go well?

Counts: I know through the comments and the press releases people picked up on that. I guess I can only share with you a personal feeling. I do not think I ever felt overconfident because it was instilled in us from the very beginning that you have to treat human spaceflight very specially and very conservatively. I do not think that changed, at least in my mind. I know from an external source people can comment on those things and say NASA got overconfident. That, I think, is maybe an overstatement. I can only say it personally because from my perspective, we thought we were doing everything we were trying to do and we were trying to stay to a very conservative base.

I do not think we let confidence factor into that under the confidence that we can do these things. As far as being overconfident, I did not experience that in my lifetime.

Johnson: We know how much recognition Dr. von Braun and the German rocket team received, certainly at the beginning of NASA. Do you feel like other people maybe did not get as much credit as they deserved?

Counts: No, I think not. I think von Braun was the leader and he got considerable credit for a lot of things, but that was a team effort. I think the one thing I remember about Dr. von Braun as it relates to people getting credit for everything is when he brought his German team over. He said, "We are going to speak English and we are going to be a team. We are kind of a foreign element, so this will be a group, this will be with the United States, and we will do it together." I think that was the credit he is due, it is deserved. You have egos in any of these things, you will have those that stand out and wish they had gotten more, but I felt privileged to be part of the whole opportunity, not only through Saturn, but through my whole NASA career. I felt very blessed and privileged to have that opportunity.

Johnson: You got to work at Marshall and various other centers and you also got to work at Headquarters. Do you think over the years, from what you have seen and being

at Headquarters, that Headquarters for NASA was a contributor, or did Headquarters get in the way in any instances you can think of?

Counts: I think early on it was clear we had strong leadership from Washington as well as the field centers. I am sure there were a lot of backroom discussions. Again, I was a young engineer, so I did not get involved in those. I think there was a good balance there. In later years when I was there, I tried to normalize the activities from a shuttle perspective, I could not do it for the agency, of course. I at least recognized that my role was not to be the manager back to my External Tank days or something else. I had to rely on the program and the projects to do that. Mine was to be the integrator of those results and to keep the money flowing and to keep people doing.

I think we got a smaller role and it should have been smaller. I think in the shuttle days it normalized itself pretty much. It was not nearly as big as it was in the beginning. We transitioned down, and yes, you are going to find incidents where the bureaucratic role in Washington from a field center standpoint was stifling. Those are just challenges you have to work through there. Nothing of that was insurmountable. You would like to have had a little less involvement sometimes in some areas, but when you build a pretty big program, you are going to have to deal with some of the bureaucratic issues.

Johnson: You worked on the Saturn V, you worked on the space shuttle, two of the vehicles that have meant more to human spaceflight than any others. When you think about your career doing that, what comes to your mind? How do you look at that?

Counts: I just marvel again to be so blessed to part of it. As I said earlier, if somebody asked me to put it down on a piece of paper, what would you like to do in your lifetime, I would have failed miserably. I could not have come up with such an exciting career. I am blessed and truly happy with everything that came out. We had some rough times, everything is not always a bed of roses, but the reward and excitement outweigh any problems that I experienced through my forty years at NASA.

Johnson: It occurs to me that I need to ask a question or two about the External Tank work you did. The External Tank, one of the marvels of the Shuttle Program, was also a little bit of a troublemaker with the foam which would come off. The foam was put on to prevent ice, but the foam came off instead of the ice. Looking back at the development of that, what is your take on the External Tank and what it contributed to the Shuttle program?

Counts: Let me first say the External Tank was the highlight of my career with NASA. The initial design, I was not involved in. I came along as the second or third program

manager behind Jim Odom. Jim was one of my mentors. It was a great program, great contractor. We had some problems, we had to take some reductions. I was part of that team that reduced it. Then I was challenged to go manage that contract after we took 1000 people off the program. As you might imagine, I might not have been the most respected project manager coming in. Two weeks after I got the job, we were asked to build a super lightweight tank. We were able to add more then. That was the highlight. My seven years on External Tank, we did go from a redesign of the External Tank through a weight savings program to give us 7,500 pounds of weight savings.

Every pound of that External Tank is worth a pound of payload to orbit. It became very critical when NASA made the decision to meet the Russians in the fifty-two degree orbit. We lost fifteen thousand pounds of performance, so we could not even get the modules of the space station up. A great challenge to the tank team was to at least come up with fifty percent of that weight savings. We did that, we had issues, two of which I remember very clearly. We had chosen aluminum lithium as a material. That was a material that had never been used in a space application. It was known to be not easily welded, and there are 36,000 inches of weld on the External Tank.

We thought we had it whipped when we made the initial welds. It turned out we could only do the initial welds and not the repair welds. That became a problem and we had

to develop whole new procedures to weld. We also lost what I call the recipe for the aluminum lithium. We made the ingot sizes small. When they were that small (Gestures), they met all the material properties we wanted. When we expanded that to the size of ingot we needed to make External Tank barrel sections, we lost significant properties. We had to form a team and go work that. There were two issues that could have put the shuttle out of business. Without the External Tank's weight savings, we could not have built the space station.

It was challenging, but the team rallied and we overcame some very difficult situations and produced the Super Lightweight Tank. We did it on schedule, we met the Russian module, it was the first to be launched, we did it and accomplished our weight savings of a little over 7,500 pounds. More significantly, I guess, it probably has not been done in many development programs, at least my friend Wayne Little's tells me, I do not know of any development program that ever came in under budget. We finished \$20,000,000 under budget for the development of that third generation tank. It was a marvelous success.

When that was done, I left that program in 2000 and went over to do Solid Rocket Booster Program. The foam and all the other things came later. I was not involved in the recovery. I think on my watch we launched fifty-one tanks, many of those Super

Lightweights, to start building the station. That side of it was probably the most exciting time in my NASA career.

Johnson: Did your time as a test engineer in the Saturn Program help you as you worked on this effort to make this tank do what you wanted it to do?

Counts: Certainly, because that built in a rigor. That was the good part about the test engineering side of it, we were very clear on the processes. We had to build it, we had to establish the rigor of the test program as we were doing it. That benefitted me. As I became a project manager, those were instilled in me as to how to do things. I think it worked well as we worked through it. Plus, I think it was important that we had a good team of folks and had to communicate that to them. Test engineering gives you an opportunity to communicate back to your designers or your hot fire guys because you have to keep a good dialog going. Those two aspects benefitted me in my career as I moved into program management.

Johnson: You, once upon a time, were the kind of engineer who crawls around on a Saturn V doing testing. You moved from that to a project manager. As someone who worked in the space program for decades, which would you rather do, be a hands-on guy crawling around on a spacecraft or manage a project?

Counts: Each of those had a place in my life is the best way I can answer it. Each one prepared me for the further role. Quite honestly, I enjoyed the program sides and project sides better because it was expanded and we had the challenges of meeting the schedule and driving a program to completion and accomplishing it on budget. That was more of where I wanted to be. I did not know that at the time, crawling around in the back end. It is interesting you should ask that, Steve, because every place I went early in my career, boy, I wanted to stay right here and do this, I wanted to be hands-on, right here. Then I had a wonderful branch chief who said, "Parker, I will challenge you. I want you to go over here and work in component tests." I did that for two, three years. Then he said, "Now I want you to go over here and head up the engine program and do the test program for these engines." Each time I said, "But I like where I am. I do not want to move." After the third move, it had built my confidence to a point that I felt very blessed to be able to move forward and keep going in my career base.