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

Gary Sweet
Interviewed by Steve Johnson
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Steve Johnson: I am talking with Gary Sweet, who worked with both the Saturn V and the Space Shuttle Programs, always as a contractor. Gary, talk about your education that prepared you to work in the space program.

Gary Sweet: In high school, my father ran a chemical plant and actually built chemical plants. He would take me to the plant on weekends and summers and I would work there learning the chemistry and the basics of processing different types of chemicals into other basic products and the knowledge of the engineering to process these in large containers, moving them around with pumps and valving, taking samples, and then going back to the lab and running the analysis on those samples. In doing that, we would create a product we could sell in a tanker or we would put into a flight form into bags and sell it in bags by the train load.

A lot of my knowledge of organization came from the Boy Scout program. I was an Eagle Scout. In doing that, you had to earn twenty-one merit badges as a minimum. A

lot of those merit badges allowed you to do a project. In doing that project, you would have to plan it, carry it through, and have an end result. You would then have to present that to the merit badge councilor. Then going into the military and gaining the knowledge of weapons, rockets, and missiles, when I came out, I had spent a year at Vandenberg Air Force Base, where we were launching Atlas, Minuteman, and Delta rockets, almost on a monthly basis.

Johnson: Which branch of the service were you in at that point?

Sweet: I was in the Air Force at that time.

Johnson: You also served as a Marine and as a reserve before that.

Sweet: Yes. Later on, after I had gotten out of the military and was working for USBI [United Space Boosters, Incorporated], I joined the Navy reserve as a weapons officer. I became sort of a weekend warrior. I would go to Memphis [Tennessee] and fly on [Lockheed] P-3 [Orion] air crew as an aviation ordinance person.

Johnson: That was the second time you worked with the space program as a contractor?

Sweet: Right.

Johnson: Before we get past this, talk about your college education that prepared you for the space program.

Sweet: In college, I got into a lot of chemistry, physics, and mechanics. As a chemical engineer, your knowledge was to be able to take chemistry and do organic or inorganic things with those subjects and possibly go into the process business or into research. I always enjoyed the processing part, the actual production, whereas research was a little bit above me, probably. Guys that liked to stay in the labs or sit and think about it, where in process engineering, you could actually buy some pieces and parts and soon enough, you have a cooker. You add some heat to it, you can move it around with some valves and pumping into another tank, and then process it another way, with either heat or cold, and add other additives to it to become another basic product such as paint or coatings. I got into those a little later. In fact, my father, when he was in college, his chemistry professor was the original inventor of Henry Ford's black paint. My father studied under him for four years. A lot of what I did when I went to work for my father was they were creating the basic products to go into paints, tallows, soaps, things like that.

Johnson: When you work for Boeing, were you in coatings at that point?

Sweet: No. When I went to work for Boeing, I was right out of the military. I was single. I had the knowledge of missiles and rockets. I brought chemistry to the table. They were looking for engineers in configuration control, people that could take a situation and say, "This manufacturer builds this engine. This manufacturer builds this stage. They are going to mate together." With all the physical aspects, this has to work, mechanical, electrical, pneumatic, vibration, several other modes that you would not think about. When you started to move the stage and engine together, some things could happen, parts could wear against each other or they could not mate up when they manufacture and put it together. There were a number of things. You had to do this analysis on each particular interface points. In doing that, then you had to document and present that analysis to the customer, NASA [National Aeronautics and Space Administration], to let them know this is actually happening and we know this particular area needs to be corrected. They would then go and work it out with the engine and stage manufacturers.

Johnson: Boeing brought you to the space program? That was in 1965 when you were working on the Saturn Program?

Sweet: Yes.

Johnson: Could you talk about the main technical challenges of your work in the Saturn Program?

Sweet: One of my interesting challenges was my boss was going to take a trip with Dr. [Arthur] Rudolph to California, and he wanted me to go out to the scientific library at Redstone [Arsenal] and become knowledgeable of Peenemünde [Germany] and everything that happened there. I went out to the scientific library and told the young lady there what I wanted to do. She brought me several books, but she also brought me the original Paperclip Project paperwork, typed. I was holding a document that was put together by the military officer who was interviewing and talking to [Dr. Wernher] von Braun and all of his team members. I read that entire document, made notes along with some of the information I got from the books, came back and briefed my boss so that when he was on the airplane, he could talk intelligently about Peenemünde and all the aspects of the rocket program at that time. He did, apparently, astound Dr. Rudolph that he was well-versed in this particular subject. (Laughs)

Johnson: Talk a little about that actual work you did in the Saturn Program.

Sweet: In doing this analysis, we would come up with these interface points, some of which would pass all of our criteria and others would not. We would have to sit down and document, with words and drawings, where this particular interface point was not going to work. We would then go out and present that to the customer, NASA, and work with them to get this changed, whether it was Boeing, Rocketdyne, two different companies, North American Rockwell, or McDonnell Douglas, whatever the stage or engine manufacturer was. In some cases, we would recommend other materials or other parts to go there instead of the ones that were called out. It allowed us to do a lot of analysis work and, with that analysis, come up with an answer in a lot of cases.

Johnson: Did testing figure in what you did?

Sweet: The testing would probably be done back by the actual stage or engine manufacturer based on what we felt, based on our analysis, would happen.

Johnson: How about the pace of work? With all these different projects going on in the Saturn Program, knowing there was a guarantee of a launch within the decade, take men to the Moon, was there pressure to keep a certain pace in your area?

Sweet: Our pressure was that we worked overtime six and seven days a week. Being single, I did not have a wife, so I was willing to do this in long runs. Actually all I had was a room off of Andrew Jackson [Way] in these people's home with no kitchen privileges, so I would have to eat all my meals out. I had been doing this for about six months and I wanted a day off to go see my parents in Memphis and my boss told me no. The pressure was to get this work done in a very short period of time, one or two years. We were going to be at that point, and we actually launched the first Saturn V in November 1967, unmanned. There was a pressure to meet all those deadlines.

Johnson: Despite the pressure, was the work environment good? Did you enjoy what you did?

Sweet: It was fantastic, we were in love with it. We look back today and those are the good old days in a lot of cases. Yes, there was a lot of blood, sweat, and tears, but there was a lot of gratification. When that rocket took off, the Saturn V took off, in November 1967, we were all pretty hyped. We were on top of the world because we knew then that we had ninety percent of it, and so did von Braun. We were ninety percent on our way and we had to take care of the bits and pieces.

Johnson: Did you know you were making history when you were doing this work?

Sweet: No.

Johnson: No sense at all?

Sweet: No sense at all. In fact, when I tell my grandchildren about this and I show them pictures, I have scrapbooks of all kinds of documents and things that I saved, I think it is hard for young people today to really understand that. It is because they are still in school and they have not been caught up in a real project that has international and national attention. You went to work every morning just as fast as you could. You knew you were doing something that had to be done that day. Then the next day the same way.

Johnson: I would assume that was different form the normal job.

Sweet: Yes. When I went into the Space Shuttle Program, it became just like that again, only it was on a smaller scale.

Johnson: In the Saturn V Program, did von Braun have any direct or indirect contact with the group you were working with?

Sweet: No, he did not. I happened to be in the old airport coffee shop one time, he came in, and I went over and shook his hand.

Johnson: He might have been dealing with people, but you were not?

Sweet: I was not at that level.

Johnson: Were you at the level where you had to worry about how much money you spent? This is in the Saturn Program.

Sweet: No, my job was to turn out the engineering effort.

Johnson: Were there any surprises in the work you were doing in the Saturn Program?

Sweet: I think the surprises would be that people who I was working with came from all kinds of places in this country, and backgrounds, to come to work for Boeing. Some of them had worked for a utility company back home, they had worked for some manufacturing company, or were right out of college. We all became a team and took basic rocket technology and said, "We are going to build the largest rocket." The capturing of that and that knowledge, people with just four years of college would

come out a mechanical engineer and, within sixty days, catch on. I say 'catch on' because NASA has this thing called acronyms and abbreviations which are very difficult for people to understand, but you have to speak in that language. Very quickly, you have to study up on their technology and how they are talking. Otherwise, you cannot catch up on the conversation in the meeting.

Johnson: How was the contractor experience from your end? Let us first talk about with the Saturn Program. How was the contractor experience working on the Saturn V?

Sweet: The Boeing management were right in there with us. They felt we were a team. NASA regraded us as the people who were really doing the work in this particular case, it was contracted out to us. Our results led to a picture perfect launch in November 1967. Without us, they would not have been able to accomplish that. People do not realize there was a building on the corner of Meridian [Street] and Oakwood [Avenue] that held 3,000 people in five different companies.

Johnson: You are talking about the Huntsville Industrial Complex?

Sweet: Yes. That building had people from Hayes, Brown Engineering, Chrysler, Boeing, Teledyne Brown, some NASA people were there. We were all working on

different types of contracts. We had a cafeteria that we all ate in. You would come down and find people you knew. I actually ran into a guy about the first month that I had lived down the street from in Memphis. He was working for Chrysler on one of their contracts. This is a guy I grew up with.

Johnson: You actually left in 1968, before the Moon launch, but when that launch happened in 1969, do you remember your emotions? You contributed to it. How did you feel when the Moon launch happened?

Sweet: I can tell you exactly where I was. My bother-in-law had died. We had been at his funeral the day before. We were in Memphis in my mother-in-law's den when this took place. Even though I was no longer working on the project, I felt very gratified that I had contributed to this. I probably would have stayed a lot longer in it, but a lot of the engineering was done by November 1967 and they were not going to need us. They were not going to build another rocket that size for a while. We felt we had to get out of there and find employment, and I went to work on an airplane.

Johnson: Back in 1976, you came back to the space program, working on the Solid Rocket Boosters. Talk about that. Who did you work for again, United Space Boosters, assembling and refurbishing the boosters?

Johnson: Right. I actually had answered and sent a resume to Boeing because they were competing with USBI on this particular project. Somehow, my resume wound up at USBI. I got a call from a guy who said they had just won the contract. It was actually people from Chemical Systems Division that builds rockets out in California. He said, "We are going to for this company called USBI and we are going to locate in Huntsville [Alabama] and also at Cape Kennedy [Florida]. We found you have a resume that says three or four words and they are chemicals, pumps, valves, and robotics. No one amongst all of our resumes has that knowledge. How did you get that?" I proceeded to tell him. He told me to come down there and talk to them. I went down to Huntsville and had a conversation with them. The president of the company, it was a very small company, there were only fifteen, sixteen people in Huntsville at that time, and he came in and said, "We need you. Whatever it takes, we will make it happen." I thought this was pretty neat and that I would like to do this again. They made me an offer and I moved to Huntsville.

Johnson: What did you do as your part of the work on the boosters?

Sweet: When I originally came aboard, my job was to create a processing system, equipment, people, and knowledge to apply a thermal ablative coating to the outside of the Solid Rocket Boosters, and to do that with an industrial robot. That would allow us

to repeat the process fairly precisely, versus an individual trying to do it. We were working with large parts and this coating would go on layer after layer after layer because sometimes we would reach up half an inch in coating. This coating consisted of ten ingredients, two liquid and eight dry. We would have to mix it up in two different pots, one container would have everything except the resin and the catalyst in it and we would add that later in our application tank. Then we would pump it out of there to a spray gun that I designed. As it passed through the spray gun, if it was not actually operating, the material had to flow back to the pot. It is never stopped in suspension, it became a solid material and would fall away. You would have all kinds of maintenance problems.

Johnson: You developed this. Were there problems?

Sweet: This was a chemistry that NASA had been working on for years in the Materials and Processes Laboratory. Their application work was very crude. I think it was because they did not have people who had the knowledge, nor did they have the money, to carry it on. When USBI was hired, that was a task that they gave us, please help us with this. That is why I was hired. We quickly found out the laboratory facilities they were working on at Marshall Space Flight Center in Building 4707 were not going to have the latitude to do what we needed to do in a very quick period of time. We

could manage and run that facility and gain knowledge with the material, but we decided we had to go somewhere else.

George Hardy, who was, at that time, Mr. Solid Rocket Booster, and my boss, Dr. Lavico [First Name/Spelling?], made a deal. They said we had to go off site and do this. We had to have that latitude. George shook Dr. Lavico's hand and said, "Make it happen. I will make sure all expenses are paid and everything works." We went to a warehouse on Putman Drive. I located it, went inside, took a look around, and said, "We have to make some changes here." The owner, Mr. [First Name?] Putnam, said, "Whatever changes, I will make them for you, and will add them to the rent." We made a lot of changes.

To digress a little bit, I was supposed to get on Republic Airline Flight 242, which crashed. I chose not to take that flight that day. I took an earlier flight because I was going to go to Toledo, Ohio, but I thought I would drive up and visit my grandmother who was in a nursing home in Adrian, Michigan, which is only about an hour's drive away, so I took an earlier flight. In doing that, I got up there, went and spent the afternoon with her, and then got back to my hotel and noticed on the television that they were talking about this airplane crash in Georgia. It was a flight out of Huntsville going to Atlanta [Georgia]. I looked at my ticket and realized that was on flight 242. I

thought, "I guess I missed a bullet there." (Laughs) I got up the next morning, could not call my wife because, for some reason, our phone lines were down, and could not get through. I called work, when I called work, a gentleman who was seventy-five years old who had worked in the space industry for years, said, "Gary, this cannot be Gary, you are dead." I said, "No, Jim [Last Name?], I am not dead." He drops the phone, runs down the hall to Dr. Lavico's office.

Johnson: The company you worked for thought you were on that flight.

Sweet: Yes, because their reservations person had that paperwork and I did not call until ten, eleven o'clock in the morning when I got to the factory I was visiting, who we would eventually buy these robots from in Toledo.

Johnson: You were still with the company, thankfully.

Sweet: I was still with the company. I did a survey of all the industrial painting robots in this country. I put that together, and we came up with using that company. We came up with the equipment to mix all these materials in and keep it at temperature and moving, and then the ways of taking density and viscosity readings, along with other types of analysis we had to have to be able to put together a true chemistry based on

our lab work. We were finding this was fairly consistent with what would work as if we applied it. One has to understand that we were using two different solvents as our transition, one of them methylene chloride, the other perchloroethylene. Methylene chloride is a paint stripper. Perchloroethylene is used to clean people's clothes. The reason those were picked is the methylene chloride would kick off immediately, allowing the resin catalyst to set up and glue itself adhesively to the metal surface. The perch was there and it came off slowly, allowing that resin catalyst to do its work. It was a strange mixture. We, of course, had to handle all of it in an environmentally controlled atmosphere.

Johnson: When were you able to get this process underway and consistent to where it became the process?

Sweet: We worked all summer of 1977 to accomplish putting it on test panels, doing tests. Our goal was to apply it to two nose caps that were going to leave and go to new Mexico for what they call a sled test. They would send this nose cap mounted on a sled down and release it. They were testing the explosive bolts and that would drop off and we would check to see for damage to see how well it held up. We accomplished, working a lot of overtime, the goal by Christmas of applying our coating to the two

nose caps, had them in the crate and shipped before we left to go on Christmas break, which USBI then got a $50,000 incentive award in January for us meeting that goal.

Johnson: Once you had the process done, you had it all set, did this make or contribute to the Solid Rocket Boosters being as reusable as they were intended to be?

Sweet: Yes.

Johnson: How much, would you say, did this contribute to that effort?

Sweet: Our next step was to take that particular prototype setup down to Kennedy Space Center and put it in areas that were set aside for us, designed specifically as a spray booth. We went down and installed that particular setup, plus two more. We installed three different robotic application systems in those three rooms and did what I would call a frustum part. We applied a coating on that as our first piece. Because we were really not satisfied with that. We then took it over to the other side of the Cape, to the Cape Canaveral side, and used a stripper method of high-pressure water to remove that coating, which we were going to have to do eventually anyway. Then we brought it back and reapplied it again as a flight test hardware.

Johnson: When did you know you had a process that was the process?

Sweet: We knew about the fall of 1978. They had moved us to the Cape to Merritt Island. They told us we would be down there for a year, two years, to get it set up and working. Then they would bring us back to Huntsville. I had been working overtime straight for over a year and a half. My wife wanted to take a trip to the Bahamas for her birthday. They told me I could take a weekend off it I wrote this document that entailed every sequence and every operation from when you walked in the door, did all this work, then walked out the door. It became about a 1000 page document, which, to my astonishment, a year later was still being used in parts. After doing that and then bringing another two or three more pieces of hardware in, by the end of 1978, we had accomplished our goal. It was ready for use.

Johnson: You had, at that point, a process that could be repeated consistently, have the same coating on every part that needed to be coated?

Sweet: Yes, and people trained to do this.

Johnson: When the first shuttle flew, do you remember your thoughts of that? You had certain thoughts when the Saturn V flew. Compare, maybe, your thoughts when that first shuttle flew.

Sweet: By that time, I had been moved back to Huntsville to start a manufacturing operation over on Sparkman Drive in the old IBM [International Business Machines] buildings. When I entered those buildings with two other individuals, no one had been in them, other than maybe a caretaker, for years. They had been left there by IBM, who moved out of them after the Saturn V Program. Moving in there, we were told we needed to put together a manufacturing operation that would produce components for the Solid Rocket Booster, nose cap, frustum, the separation rings, system tunnels, on and on. In doing that, we were going to have to train people, buy equipment, install it, and make it a true manufacturing facility for rocket motor parts.

By April of 1981, when they were ready for the launch, I was given a free ticket and I took my wife and children with me. We drove down to the Cape. We were there for two or three days. The first day, we decided we would try to get to a certain area causeway where we could watch the launch and our car was within reach of us. We were in a line at two o'clock in the morning. It was bumper to bumper, four lanes going into the facility. It is dark, my children are asleep in the back of our van. When we get there, you

could feel the tenseness. I have seen movies, and I have seen Saturn V launches at this time, but they were at a distance or were on television or movies. When you were part of it and you are going toward the countdown, you realize that this one people are on, two individuals. This was not an unmanned launch like it was in 1967. This has real people on it and this thing has to work. Of course, the fifth computer did not respond, so they closed it down. Here we are, waiting, waiting, waiting. On Monday, they came back and tried it again. Of course, we launched. The feeling of the people there and myself was so filled with adrenaline. You were caught up in it. This thing had to work because this is the answer for this country's responsibility and position in space and the exploration of it.

Johnson: Starting with that very first launch and proceeding through all the other launches, did the process you developed immediately kick in where we took those first Solid Rocket Boosters to see if they would do as they were intended to do?

Sweet: Yes, and in 1984, NASA decided they would make USBI recompete their contract.

Johnson: You had been doing this process of refurbishing and assembling the Solid Rocket Boosters for the shuttle.

Sweet: They put a team together in Huntsville to work on this contract rebid. I was on that team and we decided we wanted to come up with a bigger, better robot.

Johnson: You wanted to take the process you had been doing and make it better.

Sweet: We wanted to take that to the next level, and we wanted to do all of the operations we were doing, all the prep operations plus the coating application, and the paint top. We wanted to do all of that with automation. We chose a large gantry robot, manufactured in Germany by the Nico [Spelling?] Robotics Company. We used that along with software that we were creating on a deck computer system. That would allow this deck computer to talk to the gantry robot computer, the PLC, Program Logic Controllers, that were operating all the chemicals or all the end effector. End effectors are the things on the end of the robotic arm that actually do something. In some cases, we created an end effector that would have to go and rough up the surface. We created this huge brush that was round with all these brush ends on it. We would take that and run it across the surface of the white paint that was on the metal and rough it all up so we could eventually get a good anchor pattern grip with that particular surface. Then we came along with another method to clean all that off using high pressure heated water, and at the same time, sucking up any kind of debris or dust.

Another one of our applications was to come up with a better gun that would apply this coating. The gun that I had originally designed did not meet our needs on speed. We wanted to make this go a lot faster. At this point, we were still tweaking the formulation. We had done a lot of work on resign and catalyst, different types that were out there for manufacturers. If we had three robots putting this on, why can we not build a robot to take it off with high pressure water?

Johnson: This is off of the used?

Sweet: Off the used after you drag it out of the water. It was taking them close to 200 man hours to remove these coatings with four or five individuals in these heavy environmental suits with these high pressure guns they would hold to remove this coating off of each piece. By this time, it has pretty well glued itself to the surface. It is tough to get off. It would take over 125 psi [Pounds per Square Inch] pull tests to get a plug of it off. They would spend a lot of time doing this. I came up with a robot that would cut this like a knife, literally, using a high pressure blast gun, almost a knife gun, in the hand of the robot itself. The robot could take this because, unlike an individual, it would hold it exact. We thought we would cut this down to six or seven hours. We were really optimistic that we could do one whole frustum in six or seven hours. We did it in twelve minutes. It was like we decided to go to the movie, we watched the

movie, and in twelve minutes, the movie is over with and we paid for a two hour movie. Whoa, wait a minute, we cannot have done this, this is unreal. We actually did it in twelve minutes the first time out.

Johnson: I have to believe this development would certainly have made NASA happy because it cut down man hours and cut down costs. Was this one of the bigger cost-saving things that ever happened with the shuttle?

Sweet: Big time. In fact, I got the Manned Spaceflight Awareness award because of my work in accomplishing that task. That was an awful lot of cost savings for them, along with the fact that we had already created many more cost savings with less personnel using the other things we did on the other gantry robots.

Johnson: I understand there would be updates to the equipment, to the computers, but was the process used consistently during your time with USBI?

Sweet: Yes. All of that equipment was still being used right up to the point where they did the last booster components for the last flight.

Johnson: When the *Challenger* accident happened, did that effect what you were doing?

Sweet: It affected us personally because my wife's cousin that she grew up with was married to Dick Scobee, Jr., his son. We had been at their wedding in Houston, Texas and met Dick Scobee and his wife. We knew the commander of *Challenger* personally. I was a foreman at a jury trial in Huntsville when it happened. I got a call and called back to the office. They said I needed to see if I could get out of jury duty because they were sending me to the Cape. I had to go down and be part of the team to walk the beaches, pick up components, and mark and identify them. We had to put all this together for an investigation team in one of our big warehouses. I did and spent many weeks at the Cape walking the beach, pulling debris out of the water, things like that.

Johnson: Were you worried at all about the future of the Shuttle Program at that point? Was there any worry that this was so shocking that it might stop what we were doing?

Sweet: I was, but I felt the situation we had run into with [Gus] Grissom, [Ed] White, and [Roger] Chaffee in the capsule fire, we had worked our way through those problems and, two years later, were able to go on with the Saturn V Program. I thought we were surely not going to give up. Everybody knows when an astronaut or a test pilot goes up, there is a risk. Their families know it, they know it, even the engineers know it. It is a fact of life. My boss, George Muirfield [Spelling?], the chief engineer at USBI, he had written many letters to Thiokol and NASA explaining what was wrong

and eventually we were going to have to do something about it, and he was ignored. The actual prescription for disaster was a lot of things that took place for that to happen. It was not just one thing.

In reality, the elastomeric qualities of that gasket were not as good on that gasket as they were on the original gaskets. Because the company that manufactured that material was using less solvents in its process, they were still producing the gasket, but it no longer had the elastomeric qualities it originally had. When that happened, the results down at the Cape when the technicians would put it together, this is not like we used to use. The reason they removed the solvents was because EPA [Environmental Protection Agency] regulations were forcing them to lower their VOCs [Volatile Organic Compound] out of their plants, which is a good thing. In reality, no one had paid a whole lot of attention. NASA's problem with the Shuttle Main Engine wells, for a long time there, a lot of crisp money was thrown into that problem. Our cold temperature testing of the Solid Rocket Booster components did not happen because that money was given to the Shuttle Main Engines. It was a tradeoff. If you did not have the main engines, you were not going to have a flight anyway. Cold testing data was never available to the individuals, [Lawrence B.] Larry Mulloy, Dr. [William] Lucas, George Hardy, to be able to make an intelligent decision on whether to launch or not to launch. The ice literally being on the vehicle in all kinds of places was an indicator, but

no one could say show me the data, show me the test information. That was not available.

Johnson: Eventually NASA got back to launching space shuttles. What was it like getting back to overseeing your job? Was it a relief or was there a pause and you started back?

Sweet: It was not much of a pause because I was on the investigation team working for Marshall Space Flight Center. A lot of us key people, we were brought in to be a part of the investigation and analysis. We were so involved in trying to figure out how, when where, why, and how can we make these changes and make this work that by the time we got finished. We all knew we could now correct this, we can make these changes and fly again. We were so quick through that, a period of months, that we really always felt we could make this happen again.

Johnson: The space shuttle flew for many more years, accomplished great things. Of course, the program ended. Can you give me some sense of your feelings about the Shuttle Program and your involvement, sense of pride, in what the shuttle was able to accomplish?

Sweet: The pride is that we have an International Space Station that is manned by people from all countries, all types of people, women, men, black people, Indians, every type of astronaut. It has allowed us to gain a tremendous amount of knowledge of working in space and dealing with materials and processes in space. We are still there. People do not realize it, but there is a building dedicated at Marshall Space Flight Center, as well as others, where we are in constant, 24/7 contact with people on the Space Station on the experiments and the various things they are doing. With that knowledge, hopefully, we will be able to build a new heavy lift vehicle to go beyond there. I was disappointed we were not able to carry on with the Ares/Constellation Program, maybe another administration might pick up on that, but at least the heavy lift vehicle will allow us to put pretty large items further in space, payloads. Those payloads could go to Mars, they could go a lot of places, and allow us to, if not go there personally, go there robotically.

Johnson: You worked on the Saturn Program, you worked on the space shuttle, certainly two of the greatest programs in manned spaceflight. What is that like? What feeling does that leave you with?

Sweet: I get up in the morning and I feel my life has had a real purpose, that I, along with other people as a team, have done some remarkable things. My grandmother,

when she died in 1982, was eighty-six years old. When I would talk to her about and she saw us walk on the Moon, she would tell me when I was a child that she would ride horses to school. Cars did not exist in rural Michigan. They had no heating or electricity, things were considerably different. Today, man has walked on the Moon and has done it repeatedly. I was one of the individuals who made that happen. I went to a high school where there were about ninety boys in my class. About fifteen of them are millionaires. Another ten or fifteen are PhDs [Doctor of Philosophy] or doctors. One of them wanted to show a slide show of some of his adventures to the class reunion. He put the computer and projector up and could not get a picture. I walked over and I hit one key and his slide slow instantly started on the computer.

Johnson: It took a rocket scientist.

Sweet: Yes, to start his slide show. This is a world-renound eye surgeon, who, by the way, was in the top of our class, and I was probably in the middle. (Laughs)

Johnson: Going back to the Saturn Program, really America's space program, we know the recognition that Dr. von Braun and the German rocket team got for the Saturn Program. Do you feel like the other people, yourself included, for both the Saturn and for the space shuttle, got the recognition and the applause you deserved?

Sweet: I felt I did. I do not think some people in NASA management that came after the German team got the recognition they deserved. My father always said the pioneers hit the arrows, the settlers get the land. He told me I was a pioneer. Coming from my father, that was a pretty big statement. The contractors, we always felt we were pretty well taken care of. The young people today that go out there and work, it is sort of like a job because strange things do not happen every day. Where we were jumping miles, they are jumping inches. If they get this other rocket going, then they will get to jump some miles.