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

Richard Dailey
Interviewed by Steve Johnson
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Steve Johnson: I am talking with Dick Dailey, a mechanical engineer who worked with the Astrionics Lab for IBM [International Business Machines] with Marshall [Space Flight Center]. Dick, would you tell me a little bit about your education?

Richard Dailey: I graduated from Virginia Tech [Virginia Polytechnic Institute and State University, Blacksburg, Virginia] in 1953 with a degree in mechanical engineering, specializing in thermodynamics, heat transfer. That is primarily the reason I was offered the job in Huntsville [Alabama], because the building of the Instrument Unit required all the electronics that were to be used be mounted on cold plates, which were liquid cooled and required a very close tolerance in temperature.

Johnson: You are talking about the Instrument Unit used to guide the Saturn V.

Dailey: Used to guide the Saturn V. As I explain to folks at the Davidson Center, when the Saturn V rocket lifted off the ground, the Instrument Unit took complete control

over the engines starting and stopping, when they would be ignited, how long they would burn. It kept track of location in space, it had a stable platform which allowed it to determine exactly the course and correctly maintain its flight path. It entered Earth orbit and then the Instrument Unit told the third stage to fire for the second time, taking it out of Earth orbit on toward the Moon. It then held the Instrument Unit and the third stage steady while the astronauts turned around, picked up the lander, and went on toward the Moon.

My function was to make sure the electronics, when mounted on the cold plates, were kept cool. This meant the junction of the electronics being mounted to the cold plates had to be controlled very carefully in terms of flatness and how hard they were mounted to the cold plates in order for the liquid circulating through the cold plates to pick up the heat and get rid of it through what was termed a sublimator. In one term, it takes liquid and transfers it to gas through a heat plate and dumps the heat into space. The Instrument Unit only had to operate for a few hours when the astronauts took the lander and went on to the Moon. My purpose was to make sure the electronics were maintained within their proper temperatures.

Johnson: You worked for IBM. How did you end up in Huntsville? What was it about IBM that brought you here?

Dailey: Primarily, IBM and Marshall were working to develop the computer required to do everything that was needed during this flight stage. In working with IBM in Owego.

Johnson: That is Owego, New York.

Dailey: Owego, New York, right. I was involved in making sure the electronics that were being developed and put together in Owego were to be maintained in their temperatures. My experience with working with thermodynamics and cooling of electronics was the primary reason I was offered the job in Huntsville. I came down for an interview, liked what I heard, went back and convinced my family that it would be good for us to move to Huntsville. We had a house built over in Fagan Springs and moved down here in December 1962 as a family.

Johnson: Could you talk about the challenges you faced in doing the work you did for the Saturn V?

Dailey: The challenges were to understand the building of the electronics, how they were put together, and making sure that the heat generated by the electronics was transferred properly. All of the internal design of each of the electronic boxes had to be

looked at to make sure that the heat was being transferred from the electronics, which, at that time, were transistors, early electronics. To us today, that is antique, but it was something that was working. They developed the technique and we mounted electronics in the computer so that the function of the computer, the flight path, all of the engine starting and stopping, was all programmed into the computer. That was built into a box, I cannot remember exactly how much it weighed, but it was less than 100 pounds. It was built in Owego, shipped to Huntsville, and IBM assembled the Instrument Units in a facility on Sparkman Drive.

My challenge was testing something on the ground that had to work in space in a vacuum. That is what we did with the Astrionics Lab initially. We did some work with the cold plates and electronics mounted in vacuum chambers to make sure we understood what the temperature gradient across that joint would be and make sure that requirement was imposed on all electronics that were to be mounted on cold plates in the Instrument Unit.

Johnson: How did you test the equipment?

Dailey: That was a challenge. In mounting thermal couples inside metal close to a joint, we had to actually drill in and mount thermal couples within thirty-second of less or an

inch of the surface so that we could measure the temperature of the cold plate surface and also the electronics' surface. It was a real challenge because we had not done that before and did not know exactly what that joint would do in terms of restricting the flow of heat. That is why we had to look at surface finishes, flatness requirements, both on the cold plates themselves, which were about three feet square, and on the electronics themselves. We were working with contractors all over the United States, some out in Washington state, some out in Arizona, on Long Island [New York]. I made trips to these places in order to make sure they understood what the flatness requirements were and what we were attempting to do to maintain temperature.

Johnson: Did you have to develop any new tools or come up with any new materials in your work? If you did, how would you describe that process?

Dailey: I do not believe there were any new tools. Materials, I would have to say we did. Inside the sublimator, we had to develop a material full of holes where on one side it was a liquid and on the other side it was a vacuum. The process of sublimation, which goes directly from ice to a gas, had to pull the heat out of the fluid that was being used in the cold plates to keep the electronics cool. That we worked with an outfit out in Washington state to develop the sublimator requirements, the sublimator being where

the sublimation process took place where the liquid changed directly to a gas, eliminating the heat.

Johnson: Talk about the pace of work. You were there for eight years working on this. How fast did things have to be accomplished during these years?

Dailey: Let me describe one of the first things we had. There were two stages, the Saturn IB, which was the 200 series. In building the Instrument Units, we were basically learning as we went and putting these things together. We were putting in the cold plates, making sure the joints were spill proof, were tight so that when you turned on the pump that circulated the liquid in the cold plate, there were no leaks. We ended up having to make sure the joints between the cold plates and the liquid piping and flexible hosing was all tight and torqued down to specific inch pounds of torque to make sure those joints were leak proof. I guess that was one of the biggest challenges, making sure the system did not leak, there was enough liquid in the water accumulator, there was actually a water, glycol mixture in cooling the electronics. I guess the challenge was to make sure the system was leak proof and it performed its function. We ended up having to determine that in some of that vacuum testing. We made sure that temperatures we knew had to be maintained were able to be maintained.

Johnson: It was eight years, but was the pace of work fast?

Dailey: No, it really was not fast. We ended up building twenty plus Instrument Units over that eight year period and you wanted to make sure things were done right. One of my first jobs was to work on the third shift in assisting people on the floor to make sure things were being done correctly. That was working at two o'clock, three o'clock in the morning and trying to stay awake and make sure things were done right, inspect it properly. We had NASA [National Aeronautics and Space Administration] inspectors there watching everything we did to make sure we had done everything on the checklist so that when they torqued up a joint, it was torqued to the right requirement. I did not consider it fast paced because we had to make sure things were done right. If they were not done right, they had to be done over.

Johnson: Talk about the shifts you worked and the hours.

Dailey: When I first started here, I was not in management. I was working whenever the management people said I had to work. It was the third shift I worked for two or three months, shifted back to second, and then back to first shift. The hours were seven in the morning until the work that day was done. We worked eight to ten to twelve hour days, not for the entire eight years, but for the first months we had to in order to

make sure the process and the assembly work, things came in and had to be available at the right time. We had to make sure that was done correctly. When I was asked to take on a management job in the thermodynamics department, I had to make sure the people we had were top notch people. We had some of the most top notch engineers that I have ever met working. We still maintain contact with each other over the years. In fact, we have an IBM retiree group here in Huntsville of fifty plus people who worked on the Instrument Unit. We still maintain contact with one another.

Johnson: How about the work environment in the Astrionics Lab? Was it a good environment? Like many people at Marshall during this time, did you wake up in the morning thinking I cannot wait to go to work?

Dailey: It was challenging work. I met quite a few of the German team. Walter Häussermann is the only name I can recall. The one gentleman I worked very closely with, I do not remember his name, he has since passed away, they were all part of the German crew that came in. I could not wait to work with them because they were easy to work with, they were very close to one another, and they brought you into the team wanting to make sure you felt part of the team. They did. That is why I never hesitated to go to work. My wife did not like the hours because that left her to take care of the kids, but she understood that.

Johnson: How were you able to control costs? I would assume working for a contractor that controlling costs was a big deal.

Dailey: Yes, we were on a fixed price contract. Fixed price with incentive fees, I think. You watched each and every thing that happened, especially with the subcontractors we had, who we bought electronics from. We worked with North American, who built the stable platform. They were very easy. We never had any trouble with any of the subcontractors, one on Long Island, very easy to work with. I did not feel cost pressure because it had to be done and done right. If it were a little over cost, we probably ate part of the cost from our incentive fees.

Johnson: Talk about any paths you went down that did not work. How did you recover from those?

Dailey: When you think about it, the making of the cold plates was probably one of the most challenging things because the actual cold plate itself where the liquid went through was no more than a quarter of an inch think. Behind that was a one inch thick piece of aluminum honeycomb. To have someone build that and build it right, I think that was probably the biggest challenge we had. I do not remember who built them. Mating the cold plate itself to the aluminum honeycomb was probably the most

challenging part of the thermodynamic system, what we call a cooling system in the Instrument Unit with the cold plates being the challenge they were. We were able to overcome that and came up with a very flat, surface finished coating that helped the transfer of heat between the electronics and the cold plate surface.

Johnson: Were there any surprises?

Dailey: When we think about the IB series, where there was only the first and second stage, they were primarily test vehicles. They transmitted results back to us. I cannot really remember saying there were any really significant surprises except we knew after the IB series finished that the cold plate system and thermodynamic system in the Instrument Unit was working properly. We were able to test, got results back from temperature measurements on the electronics that were maintained within their temperature limits. We were able to measure the performance of the stable platform so that the gyroscopes were properly cooled and maintained. That required internal cooling because the electronics in the stable platform were not able to be mounted on a stable platform.

Johnson: Did you have experience with other NASA centers during your work or was it always with people from Marshall?

Dailey: We did a little bit with the people at the space center in Florida, but it was primarily with Marshall. It was very little with the space center in Florida.

Johnson: In the work you did do even a little bit with the other centers, did you notice any difference between the centers? Was there any rivalry that you noticed?

Dailey: No, not rivalry. I think it was a comradery rather than rivalry. We were there to do a job as a contractor, and the job was to get the rockets in the air, working properly, especially when they got down to man rated. When they first started putting man on Apollo 8, we had to make sure everything was working properly. No rivalry at all between the centers. It was we had to do a job and do it right the first time.

Johnson: Can you talk about Dr. [Wernher] von Braun's involvement with what you were doing? Did he come around? Were you in meetings with him? Was he involved in the project you were on?

Dailey: He was aware of the work being done by IBM. I was in several meetings with von Braun. I never met him personally, but my impression was [he was] very knowledgeable, very direct, questions pointed, and if you got the right answer, that was fine. If you did not get the right answer, he would point again and again to make sure

he got the answer he was looking for. After the landing on the Moon, he came around and was thanking us for the work that was done.

Johnson: What did that mean to you?

Dailey: I always say that my time here in Huntsville was the highlight of my IBM career, close to thirty years. I spent twelve years here in Huntsville, but I do not talk about everything else, I talk about Huntsville. That was the highlight of my career with IBM.

Johnson: You worked on your project. Can you talk a little bit about the integration of what you did with all the other parts? Was that something that you considered or were involved with the integration of the guidance system with everything else that made the Saturn fly?

Dailey: I personally was not involved with the integration, that was the electronics people. I knew them. In fact, the manager of the electronics group lived right behind me over in Fagan Springs. We worked as a team to put a unit together that would perform its function. That function was to make sure the astronauts, when they picked up the

lander, were on their way in the right trajectory. There was never a recorded failure in the Instrument Unit in all of the flights that it performed in. Never one failure.

Johnson: How proud are you of that fact?

Dailey: Absolutely. When I say we sat and watched [Neil] Armstrong put his foot on the Moon on a black and white TV [Television], I say I was part of that. That is why I say that is the highlight of my IBM career. I was part, and our team was part, of putting that man on the Moon.

Johnson: As a contractor, what was your experience like working with NASA?

Dailey: When you say contractor, we were being paid by NASA, we were under contact to NASA, but we were part of a team effort. I do not say we were never pinned down as being a contractor. We were part of the NASA team that they put together to build the unit and build a rocket to get man to the Moon. I never felt that I was considered a "contactor" or a sub, whatever you want to call it, below their level.

Johnson: You were not an employee, you were a member of the team.

Dailey: I was a member of the team, the IBM/NASA contractor team that put man on the Moon. Yes, that was why I consider that the highlight of my IBM career.

Johnson: Talk about NASA Headquarters. In your experience, did Headquarters help or interfere with the development process you were involved with?

Dailey: I do not remember having felt any interference at all as long as we were meeting schedule, meeting close to cost, and performing properly. We never had any trouble with NASA Headquarters. In fact, I know we had meetings with NASA, and if there were NASA Headquarters people there, I do not recall them standing out as different than part of our team. We were there to do a job. NASA was there to do a job, and we were assisting them, making sure it was done properly. I do not consider NASA Headquarters having effected or influenced anything we did at all.

Johnson: Talk about how you felt when the Saturn Vs were flying successfully and you knew that you had contributed to that. How did you feel?

Dailey: Every time one launched, we watched it. We were able to attend one launch in Florida. I do not know how you can describe being pleased with what happened or a feeling of exaltation about every time one went and it went properly, you knew good

and well that your part of that was there working and working properly. Every time the astronauts picked up that lander and went to the Moon, yeah, I did part of that!

Johnson: Did you know or did you sense at the time that you were part of making history?

Dailey: No, I guess I would not consider myself as being part of making history. I was part of something that was very unusual, something that had not been done before, and being part of that made it so special. If I could go back and do it again, I would do so without hesitation. When I had to leave here, when the job was over, it was a downer. Having been through what we went through here, the family all felt part of it, our kids grew up with it, they all knew what we were working on, and they all felt a part of it.

Johnson: We know how much recognition von Braun and the German team got. Do you feel like the rest of the thousands of technicians and engineers and assembly line workers, people like you, contractor teams, got the recognition for your contribution? Do you feel like you did?

Dailey: Talking about recognition, that means you want a pat on the back. You do not need a pat on the back because you already know you were a part of that team and you

were able to accomplish it. That, to me, was satisfaction enough. I did not need somebody to come around and say good job. I knew what we did and did right and making part of history was all I needed. I did not need anybody to pat me on the back. I was not looking for it, I do not think anyone else really did. They knew they were part of an unusual and unique team. There were all sorry to see it end, but I do not believe we were looking for anything, recognition.

The drive that von Braun put into this program, his personal involvement with the program, and the recognition he got was well deserved. Without a push from a very strong engineering character, I am not sure we would have done what we did. When President [John Fitzgerald] Kennedy said let us put a man on the Moon before 1970, that was enough, plus von Braun's involvement. I am sure glad IBM got in as part of the job. That is why I am back here. I love Huntsville, love the area, and I would not leave here unless I absolutely had to.

Johnson: When you think back on the work you did and the work the entire team accomplished, was there one thing that jumps into your mind, something you think about on a regular basis?

Dailey: I show people a picture that is right by the Instrument Unit out at the Davidson Center. There is a picture of an Instrument Unit in a cover with all of the team standing around. It is the IU-501, the first 500 series IU [Instrument Unit] that was shipped out of Huntsville. I look at that and I ask people who are looking at the picture if they can find me in the picture. I am there, but I do not know where I am. I am part of that team. That in itself is enough. I look at that group of people who worked long hours over the years to do the job that was done. I look at that one picture and I say I am part of that. That is what I get satisfaction from.