Interview with Edward Bullock

Interviewer: Jason Walker
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Location: Kingsland, Texas

WALKER: Today is May 25, 1999. This is an oral history interview with Edward Bullock, at the home of Mr. Bullock in Kingsland, Texas. The interview is being conducted for the Johnson Space Center Oral History Project in cooperation with Southwest Texas State University by Jason Walker.

On behalf of myself and the project we want to thank you for participating in the project.

BULLOCK: No problem.

WALKER: To get started with, we would like to know a little bit about your family background and educational background?

BULLOCK: Well, educational background sort of came after some of the family. I was married in 1957 after getting out of the Air Force to Peggy, my wife you met, and we have had five children, two of which we had while we were in college. I graduated from Virginia Tech in Electrical Engineering with a BS. She had just prior to our marriage had graduated as a registered nurse. Norfolk was my home, she was from North Carolina, Winslow, N.C. We had five sons, two of them born in Virginia. When I graduated, I went to work for NASA, but it was the Langley Research Center in the Electrical Engineering Department working on the Scout rocket, which was a self-propellant rocket launched out of Wallops Island, Virginia. Worked with them for about a year and a half, by that time the Manned Spacecraft Center and Project

Mercury were getting kicked off in our same area. They were at Langley Field also in Virginia at that time so I transplanted over to them. And came aboard with them in late 1961. In fact it was after the [Gus] Grissom Mercury flight that I actually physically transferred over to them. And went into recovery operations with Project Mercury, of course that was 1961. And then [19]62 came around and found us relocating to the Houston area. At that time JSC [Johnson Space Center] was not built. That part where JSC is now was just cow pastures and mud flats around Clear Lake. But they transferred us into a bunch of office spaces throughout the Houston area until they could get the site built up. And we were at a building along the Gulf Freeway there for about a year and a half maybe, before they finally got our building built where we were relocated on site at JSC. And, of course, we stayed in the recovery business there for quite a while throughout Mercury, Gemini, and Apollo. And I don't know what else you want on the front end of that. Is that detailed enough?

WALKER: No, that is fine.

BULLOCK: I assume that you want to get more detailed specifics later, but that is sort of a general overview of how we got where we are.

WALKER: O.K. Why did you choose NASA as a career?

BULLOCK: Well, I interviewed with RJ Reynolds and IBM and several other people considering jobs with them at the time I graduated. I didn't really have a high-grade point average. And they were looking for a higher grade point average I guess than I had, but I

happened to live in Norfolk which is only nine miles from Langley and decided to go over there and see if I could get a job with them. And I did. I interviewed on a Monday and they had me starting work on Thursday. They picked me right up and it wasn't… I did not even know that I was going to be dealing with the space program. I was an electrical engineer signing on with the Electrical Engineering Division. I didn't know at that time they dealt with the space program, but as it turned out they had about a three-man contingent sort of an offshoot of the electrical engineering division that was working on the ignition and destruct systems on the Scout Missile Project. So they channeled me in that way. They had some openings in that area so they channeled me over there and I worked on the electrical launch abort system for the destruction of the vehicle should it go awry. Also a system to develop accurate measurements of launch azimuths for the Scout. It was a four-stage rocket and we did get some things successfully into orbit back in those days, not the great big payloads of today. I don't know whether you were to young to remember the Echo Project, which was a big spherical mylar type thing that inflated in space and [you] could see it with the naked eye going around about every time it passed around here in the evenings. You would have people going outside to watch it. So we were part of that.

WALKER: What exactly was the Echo Project?

BULLOCK: Oh it was -- I don't remember now what the weight of the thing was. We were putting in payloads probably in the two-to-three-hundred-pound range maybe even a little less than that in the early stages. They were small payloads, sensors. The Echo Program, I think, was doing a lot of measurement of meteorite hits and small particles in space that would penetrate and would measure the frequency of the hits and things like that in space. And I'm

sure it had something to do with electrical signals reflection and that type of thing also. But I didn't really get into the payload end of it. We were mainly trying to get it off the ground and making sure it got up to orbit.

WALKER: Some of the positions you held were?

BULLOCK: Well, as I mentioned that was my starting point chasing down a lot of wiring and circuitry and schematics trying to find out where there were crossovers, wire crossovers. Or if there were some failures, and sometimes we would have some electrical failures in getting a second stage to light off or something like that, then there was some post mission analysis to try and go back through to determine the cause of the failures so we could get that taken care of. We had quite a few trips back and forth from what was then called Chance Vought in the Dallas/Fort Worth area and we would fly back and forth and get with their people and try to resolve what went wrong. I stayed there about a year and a half. I then switched over to what was then called the Space Test Group. It wasn't even called the Manned Spacecraft Center then. Space Test Group were a bunch of people they put together at Langley to try to get Project Mercury going. It was really a small contingent of people at the time, which when you really reflect back on it was really nice. You carried things from the front end of conception all the way through the design, the test, the completion and installation and everything. It was a front to back project whatever you were dealing with. And mostly I was assigned to deal with electronic location aides that were used by the various military units: Air Force, Navy, Army, Marines any one that could locate a downed vehicle which in our case we were doing water landings. Hopefully you were going to land in the planned area, but you really had to cover the world back

in those days. You didn't know where you were going to come down so you wanted to have military forces that were already available. But we would outfit them with specific electronic location receivers and so forth on the aircraft. So that they could locate it in the middle of the ocean wherever it went down. My job there was to test and install on the aircraft as well as train the military units. I did a lot of travel back then. I went to various Air Force bases or military bases of all kinds [and] train their electronic technicians on how to maintain this equipment. We would put it out in the field all over the country all around the world I should say. And the military has a high turnover in personnel. So I had to go out there and train a group. And this isn't equipment they used day in and day out. So you get kind of stale and the knowledgeable people would get rotated to another site or get discharged or whatever. So keeping the whole world trained in how to maintain that equipment was kind of a challenge. And there weren't many of us doing it. Consequently, I was gone a whole lot traveling. But it was real nice worldwide travel, two to three weeks' duration usually every six to eight months. Enjoyed the job immensely, it was the type of thing where you really looked forward to getting up in the morning and going to work. There were some who would ask the question how much do we have to pay to have this job instead of how much are they going to pay us to it? It was that kind of feeling about it. Real good camaraderie. We got to know a lot of the military people worked with them very close. We ran a lot of test with the high frequency direction finding. Back then another aid in locating people was a net that the FCC had and the military had in listening worldwide for location devices should there be a downed pilot or a ship lost at sea or whatever. And they would do cross fixing and high frequency direction finding. So we had to establish tests and we would go out there and sit two or three days in a row with a boiler plate Mercury spacecraft sitting in a water with an antenna and the electronics working. And then we would get

reports in from all the sites. We would plot all the data to try and determine how closely they could locate where we had the spacecraft (simulated spacecraft called the boilerplate). We also brought units in occasionally for the UHF, ultra-high frequency, sensors emitted a signal that aircraft receivers we put on them they could fly in and just… It was a homing device that they could come in and just drive right over the spacecraft. That is how you found them back then. In the Mercury Project, of course we had an aircraft carrier located in the ellipse which was the landing ellipse which they called the footprint. On each rev [revolution] in the early days so that anywhere they aborted they could get back on one revolution. And in that area we would have a carrier and at each end a destroyer. And we had helicopters aboard. I mean we were saturating the world with a lot of expensive military equipment. But at that stage of the game you had to do that. And we did have a few that over shot two or three hundred miles and so forth, so the equipment did come in handy. It did get used, so it made it all worthwhile. It was something to be proud to be a part of. A lot of that left later on, but during those days it sure was that way. I think Chris Kraft, who is a very notable person that you probably recognized the name. He headed up the Manned Spacecraft Center for many years. I think he was like maybe a Branch Chief when I hired on back then. He wasn't really that high up the ladder, but of course he later was.

WALKER: So you were on the Recovery team during Mercury. How long did you stay with this? Throughout the whole time?

BULLOCK: My main job during Mercury and the location end of it [was that] I worked with the aircraft units deployed at bases close by landing areas where we would fly out and do the

location. I would do the mission deployment with them. Then later on I worked on the development of a system where we could put similar equipment on the helicopters and on the aircraft carrier. Therefore, we would not have to deploy all the fixed wings all around the world. We could reduce the expense by putting the location equipment on the helicopters. Because I developed that system that changed my job. I then started deploying on the aircraft carrier. We would go out and locate it [the spacecraft] then the helicopter would bring the spacecraft aboard. Then we had to deactivate the systems on board and purge all the remaining propellants and so forth. Then of course the medical people, between the medical and the public affairs officer they pretty much handled the astronaut end of the business. But we had to buckle up the spacecraft and get it ready and actually handle the shipment of it back to Houston. I did that type of job all the way throughout Mercury, Gemini, and Apollo. Somewhere during Apollo, I can't remember exactly when but it was early on, they gave me a section head job, which is the first level of management. It was over the control center section for recovery. In the Houston area we had our new control center there where we and the military (Department of Defense) would man this recovery center. Then we could direct the activities of all the recovery forces throughout the world, the various ships and aircraft that were deployed for recovery. That was during Apollo.

After Apollo we started, except for the Apollo-Soyuz program which was that joint Russian thing which again was a water landing, because we used the Apollo spacecraft. But later when they left water landing the recovery branch as such was pretty much dissolved. So we were fed into other areas. I was fed into an area that worked in mission operations in the control room area. I was again given a section level job, and my people manned the consoles for network communication jobs, tracking, command, and several of what we called flight support. We were

in the flight support division and these were flight support positions. There was a flight control division and a flight support division. The flight control were the retro officers and all the people who did work on trajectory and mission planning and flight scheduling and that type of thing. The flight support division on the other hand kept all the systems in the building working in the Mission Control Center. The computers, we had computer operators under us, computer maintainers were under us. That became my business, learning all about that. I really didn't have a wide background on that. That was a very challenging job for me. Later it became enjoyable, also but it was really challenging for a long while. Did that all the way until I left.

We had little things jump in and out of there. At one time JCS was getting very active in earth resources technology. Some of us were involved in two ends of the business, I was. One was what they called the ground truth. What they did was they took all kinds of sensors aboard NASA's aircraft and they would fly them over various known sites: forest areas, national parks, or the Trinity Bay area. They would gather data with all there airborne sensors. We would be on the ground getting the same data at the same time as to what was actually there. The sensors would try and get information on what it looked like through infrared and the various wavelengths and different frequency bands. At the same time satellite data… We tried to correlate the three things, the ground, air, and space borne equipment. The purpose was to try and forecast crops throughout the world. It would be good to know if you could get a signature on what a field of corn looks like versus a field of peas or whatever. Then from space you could tell what it was looking like as far as the crop a country was putting out. Wheat was one of the main things they were tracking at the time, because Russia and its known problem in producing wheat in some years. It would be good for our country to know whether or not we would have a

sale of wheat to Russia. We would know how their crop was doing. There was a lot of emphasis put on that for a good while. I was mostly in the ground truth end of it, actually physically going out into those areas taking measurements for the scientific community to then analyze. The other end of that was when the spacecraft and aircraft data would come back we had some computers doing some of the imaging enhancement on the computers. Taking that raw data and trying to develop and get good data to be interpreted. We were on that end of it also.

WALKER: Was this during or after Skylab?

BULLOCK: No, I guess it was going on during Skylab and post-Skylab. It hung around there several years. I think most of it got farmed out. Goddard had the earth satellite which they launched, and they had the satellite end of that, earth resources technology satellite. Then the NASA center in Slidell, can't remember the name of that one, [I] went over there a few times, ended up doing a lot of the airborne sensors, instead of the JCS sensors back then. It was something that I don't think Kraft wanted, I mean he was a shuttle man from word one. He wanted to get on with shuttle and put all our emphasis on that. Little by little the earth resources left JCS and went to other centers. I think Aimes got a piece of it. Huntsville, I don't know if Huntsville got a piece or not. It was scattered about. I know there was nothing left at JCS.

WALKER: What was your affiliation or position during the early part of shuttle? I think you said you had retired in 1983.

BULLOCK: Right, 1983. I was there during Shuttle 8.

WALKER: Through Shuttle 8.

BULLOCK: Right, Again I was still dealing with the flight support area, computer operations, computer maintenance, some of the various console positions that were in support nature such as the network people [who] kept in touch with various tracking data sites around the world. They were under my area also. But mainly computer operation and computer maintenance. Even had such thing as lightning in the building and other such things to worry about. Facility type things I should say.

WALKER: What position do you think provided you with the most satisfaction? I remember you were saying about the recovery during Mercury.

BULLOCK: It varies with your situation. The whole career -- I thoroughly thought you could not ask for better. It was just a great job description came out of there. Some of the technology was not have been very transferable if I had decided to leave. You couldn't write a good resume. There were not too many people hiring recovery experts. There just was not a lot of demand in private industry. That did not help too much. But later on, when I got into the computer operations, all that did. But as far as enjoying it, I was young when I hired on there, heck of a lot younger, and did not mind and could keep up with the travel and that type of thing. You got to a point where you should got burned out on that travel though. As exciting as the job was, you know, it got to where you did not want to be away from home and your family. It really worked out good for me, although the travel went on probably a few years longer than I had wanted it to.

About the time that I was burning out on the travel I got this more or less stay at home job at the Control Center. I could deploy every now and then, because I had also climbed the ladder a little bit as far as grade level and so forth. I was assigned to some of the Command Centers in Hawaii or in Norfolk, Virginia. Command Task Force [CTF] 140 was the head honcho looking over the Atlantic. It was CTF 130 out of Hawaii that looked over the Pacific fleet and all the naval assets. And command and control was sort of divided that way. Well in my new position over the Recovery Control Center I went in that direction. Rather than deploying to far out remote areas, quite often they were sending me back to my home in Norfolk, which was my birthplace, where my family lived. It was nice to be able to get trips that way. I didn't mind those trips, it took us home. But as far as going over and sitting out in the boondocks somewhere waiting for a spacecraft to fall out of the sky, I was tired of that kind of stuff. I guess I liked both ends of it. It happened at different phases of my life. It couldn't have broke better for me. I don't think.

WALKER: You talked about being away from home so much, was that a strain on the family lifestyle?

BULLOCK: Absolutely. When we transferred out to Texas we had no family out here, no relatives. There was no one that Peggy (Mr. Bullock's wife) could call and say, I got a doctor's appointment and I've got three of the kids sick or whatever. As I mentioned we had five boys and they were all kind of young back in that age. And she pretty much had to do all of it while I was gone. Yeah it presented a pretty good hardship. The hardship was more on her than it was on me. She's tough, she survived it.

WALKER: You had just mentioned recovery, how was the famous Gus Grissom incident in Mercury perceived by recovery?

BULLOCK: You mean as far as the loss of the Liberty Bell.

WALKER: Right.

BULLOCK: It so happens the Marine helicopter pilot that was flying -- that actually hooked on to the spacecraft… They had actually hooked on to it when it was at or just below the water, it was already sinking. He [Grissom] was already in the water. He came out. Wayne Koontz was the pilot's name. He later came to work for NASA in recovery. He held onto it for as long as he could until he got a red light indicator on the helicopter that he had to cut it loose.

I understand, I was reading something recently that they are thinking about going out in two or three miles of water and seeing about trying to recover it. I don't know, there was a lot of speculation back in forth that of course he claimed that. . . There were two ways out that spacecraft. One was he could detonate or blow the hatch as sort of a emergency 'get out of here now' type thing. You could also climb up through the tunnel part pushing out all the electronic packages and the parachute anchoring apparatus. That was the hard way to get out. He, of course, claimed that the hatch blew of its own accord. It was always questioned whether that was true or did he really panic and bail out so to speak. He got out before the collar was on. We had swimmers in the water. But it had no free board to speak of at all. If the hatch goes before the collar is hooked on it's going to sink. In fact, it sank and he came close to sinking. I wasn't

on the scene at the site, but as I recall all the details he didn't have a helmet on and was shipping water in the spacesuit. He was sort of floundering himself. It wasn't going to be too long before he was going to go down. So then all the emphasis, of course, was put on getting a harness on him from the helicopter. Which they did and got him safely aboard. But there was always that question of did he blow it or did it blow itself type thing. With the spacecraft sitting at the bottom of the ocean there was no post-mission analysis of what went wrong there. I think they would still like to do that from what I hear.

WALKER: Going back to the family lifestyle. The community, everyone lived together around the complex?

BULLOCK: Well, not really. It sort of seemed to go in clusters though. There were several of us that I am fully aware of that moved into the LaPorte area off of Fairmount Park. Another cluster of people moved into the Timber Cove area which is close to the Seabrook, which is closer to where the eventual JCS site was built. Right across from where the site was eventually built there's an area called Nassau Bay. A lot of people moved in there. El Lago was another, a lot of the astronauts moved into the El Lago area. I know Grissom lived there, [John] Glenn, and Deke Slayton, several of them did. Another group moved over to the Friendswood area which we eventually moved to Friendswood ourselves. There wasn't much down there. When the Manned Spacecraft Center came in down there just naturally a lot of us were in these localized little communities and got to know each other pretty well and all. There were other people with other jobs there also. That area just boomed as soon as it started developing. Obviously all the restaurants and the commercial businesses. It is amazing the difference now. There is a world of

difference. We were welcome wherever we were. Everybody saw that as a real shot in the arm to the economy. Of course, LBJ did too, because that is how he worked on getting us down here. I guess you're familiar with the fact that back before the decision was made to move us to Texas from Virginia there was a real push to move us to Patrick Air Force Base in Florida. In fact they were going to give us a facility right there near the Cape (Canaveral). My understanding is that politics got to play in it. LBJ was pretty high up, he was top dog in the space business back then. So he got Texas.

WALKER: Would that have been more convenient for the control center to be next to Cape Canaveral?

BULLOCK: There would be a lot who would argue that way. But I don't see how. You see there was a split of responsibility once it lifted off the pad and immediately the responsibility shifted to the Houston control center. Those electrons flow pretty fast so it was not a real problem dealing with it.

From a recovery aspect we always deployed some people down in the launch area to do launch abort type recoveries -- pulling it out of a fireball or whatever might have happened down there. I don't think it was a big advantage or disadvantage to be in the Houston area. I think originally if they asked me to vote I would have probably selected Florida. But as it turned out I liked Texas and I loved the Houston area.

WALKER: They told us when we went to NASA about splashdown parties after Apollo 11.

BULLOCK: Always, after all of them. That started back in Project Mercury. Of course, they were splashdown parties back when we splashed and landed in water. They still go on, I imagine, through shuttle does not splashdown any more, they're landing. Most of that time I was sitting out in the middle of the ocean somewhere or on some island somewhere. I wasn't here available for them, but later on I went to some. But really I didn't get to many of the splashdown parties. They were big events. The military that was up here at the time they partook in them. They were big events.

WALKER: When you were not in recovery anymore you moved to the shuttle. What made working during the shuttle so challenging?

BULLOCK: My own personal background did not, was not heavy in computers. When I graduated from college they were still marveling at a thing called a diode. It was amazing, the silicone stuff was amazing. Of course, my job had always been in operations, dealing with people and teaching them how to operate the equipment. It was a totally different thing then being aware of how computers worked and the type of data processing that goes on and takes place. And what technology was involved and even what devices were used to troubleshoot to find problems. But as it turned out all these experts we had working for us. NASA had very good NASA teams of civil servants there. In addition, we had some real top-notch people who worked for IBM, also Philco and Computer Science Corporation. Had a lot of contractor individuals that we could pull on, and they did a lot of that work for us and with us. The biggest problem, from my viewpoint when I first went in there, was computer availability, which is

basically how many hours a day should it be working versus how many did it actually work. Those figures were very low. So they brought me over there and said, your problem is to fix that. We want to see computer availability hours upwards 85-90% available. At the time we were talking 45-50% available. Well, what was happening they didn't have any one individual that they could take each of the contractors by the nap of the neck and make them quit pointing fingers at each other. It was always the computer operators pointing fingers at the software people saying the problem is not our operators, the software had a bug in it. The software people would say wait a minute we checked everything we can in our software, our code is right. It's the hardware that has a problem. So they would sit around and point the finger and nobody is fixing anything. So we created a position just to resolve that problem. That was my main job for a while. When I left there computer availability was over 90%. We're talking about old computers. I'm talking about computers that broke. Nowadays they just don't break like they did then. We were flying through Apollo with computers that just don't have the power that my PC has right now. They just didn't. I can remember, I forget whose election it was, but it was Walter Cronkite talking about this new idea in computers' going to be able to predict the outcome of the this election before the first hour or whatever and it was the IBM 360-75. Well we were still flying with 360-75's, five of them out there on the floor. Finally graduated up to some 370's and I don't know what they're dealing with out there now. But it is far advanced from what we were. They're much more capable, faster, and smaller. It took a lot of volume with just computer and computer related hardware. Now you can package it up a lot better. Anyway that is what was hard for me. Just a whole new world of getting involved in computers and the people who talked the computer language that staggered me. The main thing I had to

have them do was to break down all that code into understandable English that I could understand what are problems were.

WALKER: You mentioned that this one department was saying this was this person's fault and then … During the '60s, during Apollo and the goal to get to the moon before 1970, was there much animosity built up or was that main goal – were you so focused on that main goal…?

BULLOCK: It was such a team concept, pulling together. I don't think. The reason finger pointing took place to begin with was the fact … It was mainly with the contractors. NASA didn't have reasons to point fingers. But it meant money in their pockets if they didn't get good evaluations. If they got a good evaluation it was dollars to the contractors. So they didn't want to get hit with a problem. It was easy for them to say, wait a minute this is not my problem it is his. That never superseded the urgency to get things on schedule and try and get the program going. I wouldn't dare say that about them. Everyone was pulling together as hard as they could. Obviously if you could pull together and make money you would do that rather than pull together and lose money. But they were all making money and they all produced good they put out some long hard hours out there. Whenever you blew the whistle they would come. They were on call twenty-four hours a day. And we ran those computers for a great time twenty-four hours a day. I mean not just in mission direct support, but in mission preparation. As well as all the guidance and navigation and trajectory type programs that had to be run and tested and verified. And so many simulations that tied up so much of the computer resources there.

Simulations were kind of a fun time. That was when you could crash and burn and get up and walk away from and get up and try again. There was a lot of that. There were a lot of bugs that people threw into the system to test the astronaut crew and also the flight controllers. The bugs were designed to test them in the spacecraft, but also designed to test our controllers at the console. All of sudden this stream of data was interrupted with a bunch bogus data they would have to analyze what was coming downstream from all the telemetry to resolve the problems. That was a good experience. I like the simulation. It was amazing how many times real life followed the simulation. The problems that were thrown in as a test simulated somehow magically something like it or something similar to it would seem to happen during a mission. Simulation time was time well spent.

WALKER: I was reading your biographical information and it had mentioned you had won an award for your work on Apollo 13.

BULLOCK: I was not specifically singled out so much as I was on duty in the control center at the time the Apollo 13 'Houston we've got a problem' came in. Of course a lot of activity had to take place in fairly reasonable time. Cool heads had to prevail. From a recovery stand point, as you know, they were on their way out, outbound toward the moon when this happened. It was not going to be a real urgent matter that o.k. they are going to land here in a short while, move ships around. But our job was also to keep the State Department, we had a tie-in with the State Department in Washington to keep them informed of the mission situation. Whenever there was, and during that course of time there were several times it was going to land here or there. It was going to be in the Indian Ocean, it was going to be the best we could do. Whatever plan they ran

came up with different landing areas. We had to then check to see what was in the area as far as military resources, if not commercial shipping. Is there some Japanese freighter out there nearby? We were just having to look at every possible landing site until they narrowed it down. Then if they did a maneuver then it would regenerate a whole stack of new numbers as to where the landing could occur. And of course there was the concern that they might skip out, because of the shallow…. This was before all the good maneuvers and burns that came about just right, otherwise they would have been a real problem. There was a concern they may not land at all. They'd hit earth's atmosphere and because of the angle of attack coming in it would just cause them to skip out into space and not be recovered. Of course all these things were being discussed and what do you do about it. But it was truly the flight control team with the astronauts on the ground in simulators that basically developed. They had actually simulated a LM rescue type thing during a simulation. The explosion didn't occur the same way, but they did have to evacuate into the LM and ride in and so forth. Of course for not as long as we had actually had to this time. But anyway the crew on the ground with the simulator and the various contractors that were familiar with the on board systems and all the life sustaining systems, they all worked around the clock to develop means where by they could purge the atmosphere out of there that was getting toxic to them. Plus the temperature control -- they had to ride with the electronics turned off for great periods of time just to conserve energy to be able to come in and re-enter. But anyway, our part as part of a team -- I happened to be the one on duty at the time and contacted some of the agencies and was involved in some of the meetings and the decision making, although I won't jump up and say I made all the critical decisions. I don't think I made anything that was a critical decision. We responded to their critical decisions. As you know it turned it landed right by the carrier. Everybody was there and all ended up well. It was sort of a

group achievement type thing that I got an award in that way. But it still is one of the highlights of my life. I remember that night and all the days following it. And all the involvement in that. That and the Glenn flight during Mercury were my two highlights.

I was on the plane, in fact I was the first one to spot the spacecraft that Glenn was recovered in. He had a supposed concern of a heat shield problem. He had a faulty heat shield indicator that indicated that his heat shield had been deployed. Turned out that didn't happen. Everyone was concerned about getting through re-entry. I was on a Navy P-2V which is a twin-engine I guess it was an anti-submarine warfare plane back then. I don't think they even fly them now out of Roosevelt Row in Puerto Rico. I was flying on the upper end of the primary landing ellipse. He fell short of the carrier. He fell closer to the destroyer Noah, but at the time back then we didn't know much about people coming through the time of re-entry and the lack of communication. Where your bladed material just destroyed the communication from the spacecraft. At 10,000 feet when his shoot pops open his electronic beacon starts generating a signal and I was on the plane. We were the first one's to pick it up. Just tracked that dude right on in. He had just hit the water and fact his chute was still visible on the surface and just starting to go under, sort of an orange and white chute. The Navy pilot [was] flying the plane, I was operating the equipment. It had a blistered nose on that baby, all Plexiglas nose and my seat was in that Plexiglas. It was just almost 360-degree visibility. I could not see behind me, but it was wide open. He lowered that plane down to about fifty feet off the water it seemed like. Of course he was flying tight concentric circles around him. That thing had a big sixteen-foot whip antenna and that thing was just sitting out there bobbing and I was thinking any minute we we're going to hit that antenna. It felt like we were that close. Anyway we vectored the Noah over there to it,

which caused a big problem. The Noah hooked on to Glenn's capsule and was going to bring it aboard with a crane type operation, which isn't the primary way. The primary way is with helicopters and back on the carrier deck and all that. Well about the time the Noah got it and was in the process of elevating back up onto the deck, the helicopters off the carrier, the Marine helicopter pilot off the carrier, came up beside the destroyer and they were just hovering like a bunch of bees. They wanted to get the swimmers in the water and they wanted to do it the way with the carrier. It was quite a bit of inter- service rivalry. I mean it was all the prestige in the world. Could you imagine what a salesmanship job they could do convincing these young guys in the Air Force and the Navy come join us here. We do this space work and recover crews. There got to be a lot of inter- service rivalry as to who actually got to the astronauts first. It all ended up well. I don't know what rank the guy was on the Noah, but he eventually made his point clear to the helicopters to get out of there. They couldn't hear what they were talking about out there trying to direct traffic.

Those are my two big events, that and Apollo 13.

WALKER: Obviously you felt elation when Apollo 11 occurred. Where were you?

BULLOCK: Actually it was pretty late. I was at my sister's house in Norfolk, Virginia. Myself and one other fellow had deployed to work with Command Task Force 140 in Norfolk. Of course when they are on the moon there is no recovery going on. The fellow I took out with me worked for me -- he was junior fellow. I let him handle the late shift out there. I knew there wouldn't be anything going on other than everybody celebrating. So I decided that I would

celebrate at my sister's house with my family. My mother, father, sister, wife, and we were all down there. That was my role nothing heroic to do on Apollo 11. Other than we figured we did what said we could do. A lot of luck went along with that. I'm sure all the stories have come out about how close they were on the LM as far as selecting the landing site. Of course I wasn't aware of all that at the time being there. It all looked smooth and sounded good to me.

WALKER: What do you think the future of NASA and the space program is? Do you think they will go to Mars?

BULLOCK: I think eventually. It's a guess, like anybody else's guess, but I think that if they can make room for the money the technology is there. I think there is a lot they can accomplish and will it is just going to be a matter of having to end up spending the money. I guess that financial situation is what has led it to become a joint effort with Russians and the other countries to get involved. If that's the only way you can do it then that is a good way. But surely in my mind not the best way. I would rather see us doing it alone and going alone on it. But that is a lot more expensive. I think all the things you can dream they're going to do. They made a believer out of me by working with them. There are some smart people down there.

WALKER: Was it just a United States effort during the 60's or was there help from our allies?

BULLOCK: Well, for one thing one of my supervisors had been a pilot in the Royal Air Force. We had some of them come over and come to work for us. But they hired on as civil servants. They weren't doing it as a representative of a foreign country. They were from foreign

countries. We had several Canadians. When they went out and tried to hire highly qualified technically competent people, and of course just the nature of the program at the time it attracted some qualified people and it got some top people out of some foreign countries that wanted to come aboard and work. I don't know that many of them actually were acting as an agent of foreign country so much as they wanted to come in and get involved. We had cooperation as far as recovery and so forth if we needed assistance from other countries. We worked that through the State Department if it involved another country. We gave them the situation and they would go off and resolve it as to getting aid. If we needed over flight clearance to get into somewhere for locating a spacecraft. Sometimes you had problems with diverting a ship away that you didn't want approaching the spacecraft. But no, I don't remember it being a big joint project like we talking now.

WALKER: Was there ever any problems that arose when dealing with someone's airspace?

BULLOCK: Fortunately, we didn't have that many border contingency type problems. We had a couple that landed short or landed long. Gemini 8 landed in the wrong ocean. We were able to get one of our destroyers there within several hours. We had one of our NASA people aboard the destroyer. We were able to locate it with one of our aircraft locating devices. So all that went according to Hoyle, other than it was a destroyer in the Pacific rather than a carrier in the Atlantic that ended up getting them. That was the one where one of the thrusters stuck and started to get into a situation where they were out of control. Just about had a blackout or greyout, they almost went unconscious before they had. They had a mission rule that if you have a stuck thruster like that and your rotating then you're going to abort to landing at the very next

opportunity. And they had to…. The re-entry control system that they would have to use to combat the stuck thruster, well you were using up your backup now so they didn't want to stay up there any longer than you have to. So they just chose to land. I forget what revolution it was on, but they didn't get a full mission out of it. But we didn't have to fly over foreign countries there. We always had the Russian trawler situation sitting off the launch areas and stuff like that. Quite often out by the carrier you would see Russian trawler's out close by the landing area. They knew where we were landing too. I remember a lot of the over flight clearances were simulated. During simulations we would have to get State Department to get clearance over some country. Just as part of the simulation.

WALKER: Knowing what you do know now. What question would you have me ask you?

BULLOCK: I don't know. I haven't thought about it from your prospective. I don't know. I guess "would I do it again?" Gee there is nothing I could think of that I would change. Except for maybe cut back on some that travel a little earlier than I ended up doing. It was the best job a person at my age and experience. Plus, even when I was in school I just knew I was never going to end up back in circuit design or backing a development lab or anything like that. I came out of school wanting to be a teacher. But teachers didn't pay anything. I had two kids and three more. So money wasn't there. I thought that would be the ideal occupation. As it turned out I got to be a teacher. I was going all over the world teaching the military on how maintain and operate this equipment. Got to fly all the time. You just couldn't beat it. I can't think of any other question.

WALKER: What was your interaction with the astronauts?

BULLOCK: Early on I did. I remember their name. I don't think would remember mine. We did have interaction, quite often at meeting levels when we had the mission readiness reviews down at the Cape where they would go over any open-ended problems. What level the problem was and how that [unintelligible] the schedule. Of course they attended the same meetings we did. And we would have a part of the presentation to make and so forth. The more face to face and one on one interaction really came when you were involved in the recovery aboard the ship or whatever. Like Gus Grissom when I deployed on Wally Schirra's mission during Mercury. He was going to land down in the Pacific. My job then was to go out to Midway Island and work with a tug boat unit developing a cradle nest of tires on a tug boat. When Schirra's flight ended the aircraft carrier would retrieve them, but they wanted to get that spacecraft back to Houston for post mission analysis. Of course, I was out at Midway and my boss and Gus Grissom were out there and we, I actually had the tug boat end of the business. We went out there. Before that I flew on the plane that helped locate the spacecraft. It was right by the carrier, but, I mean, it was all there together. Then they had to transport it back home so we had scheduled, as I mentioned earlier part of our job was to button up the spacecraft and make sure it got back to Houston. They wanted to off load it from the carrier onto the tugboat. I was out on the tug and the carrier lays a pretty good flat area out there, but the tugboat is just bouncing around just all over the place even though it wasn't a rough ocean. It was just hard for them to land that thing swinging on a cable to nestle it down on the tires and mattresses used to cradle it on this tug. We were just about to call it off, because it was getting awful dangerous. The thing about wiped some people out. As it turned out it happened to sit down just right one time and a

guy happened to disconnect the cable just in time before it was about to raise out of there again. And off we ran back to Midway. We had scheduled a C-130 to bring the spacecraft back. Well [John] Glenn and [Scott] Carpenter and I think several of them were on the 130. Of course I flew on the 130 back to Houston with the spacecraft to make sure it got back. They were aboard the aircraft. So we got some face to face time with them. I didn't do much of it, but I got a few autograph pictures. There were some that really had everything that was ever produced and got it signed. I got a couple but not much. But we didn't have daily contact. I guess early in Mercury we had a lot more contact with them when they were trying to practice getting in and out of the spacecraft like out in the water area, putting the collar on, blowing the hatch and letting them egress out. We got some time with them there. That was prestigious. Good feelings that you actually knew someone of that statute.

WALKER: Your post-NASA experiences.

BULLOCK: I came out of NASA in 1983. Moved to Burnet County thought we were going to retire on a 80-acre ranch and build a nice home and stay up there forever. It didn't work out that way. We sold a chunk of the acreage. Moved over here onto the lake. In 1985 we still had a bunch of toys stored in a barn out on the acreage we still had. These toys were left over from when we formed a corporation back in 1970 and worked on it until 1975 making and selling toys, wholesaling. We folded all that up in 1975, because it got bigger then we could handle. It was just a family thing, plus we hired a bunch of high school kids to work the equipment. But when we folded it up we did it in such a manner that if we ever wanted to, it would be preserved pretty good and we could always re-do it. In 1985 we decided that stuff just sitting out in that

barn was going to rot away if we don't get rid of it. So we decided there was crafts show in Kingsland, $10.00 a table for two weekends. We went over there pulled everything we could from the barn and set up a table in Kingsland. Sold $650.00 worth that first weekend. Said hey, this isn't bad with a kid going to college. We might look at that as a source of income. But we sold out of a lot of the toys. We had to go and make some parts just to have to just to get together some toys for the next weekend. Sold another $650.00 worth. Said that was a good $10.00 investment. So we may look into this. And that was the start of doing crafts shows. That was in 1985. We are still doing them today. We've cut back on the numbers. We no longer take shows that are just $10.00 booth fees. I mean that $650.00 was nice, but we are doing a lot bigger and better shows. A lot more money is involved, both output and input. We are doing about eight shows a year now. I guess we are going to do that for a few more years now. We enjoy the traveling. I mentioned to you earlier that we do more out of state stuff. We like that a lot. It gives us a chance to visit friends and relatives. And see parts of the country we haven't otherwise seen. The main thing that keeps us still doing it is that occasional thing when someone pats you on your back telling you how great they like your toy and the kids love it and they need to reorder or whatever. It is somewhat of an ego trip. Just to have someone willing to pay for something you made or designed. That's what we're doing now and I guess that is all were going to be doing. Other than trying to keep up with the house. That loses the battle sometimes when we're making toys. We make more toys than we keep up the house, at least I do. That is about it. Lots of grandchildren. They get up here with the water here. Nine of them. Ten on the way. All of them are located in Texas so we get to see quite a bit of them.

WALKER: Alright, Appreciate the time.

BULLOCK: No problem at all. Glad to do it. I hope everybody contributes something to it and it turns out to be something. It would probably be nice to have for posterity – somewhere down the line somebody may read it or hear it.