NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

BROCK R. "RANDY" STONE
INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is October 18th, 2006. This interview with Randy Stone is being conducted in Houston, Texas, for the NASA Johnson Space Center Oral History Project. The interviewer is Sandra Johnson, assisted by Rebecca Wright.

I want to thank you again for joining us today.

STONE: It's my pleasure.

JOHNSON: If you would, if you'd share with us how you first became interested in space and how that interest led you to pursue a career with NASA.

STONE: Well, from the time I was a small boy I was interested in airplanes. My father was a pilot, and all my uncles were pilots, and airplanes were the only thing that interested me. Honestly, I was not all that enamored with space, even when we started the early rocket launches on TV. My mother would get me up in the middle of the night, because she was fascinated by space. We got to watch some launches and the first Mercury launches; I was in high school when that occurred. But I'm very interested in airplanes, and rockets were just kind of a sideline interest, predominantly my mother's interest in space.

But I went to the University of Texas [Austin, Texas] and got a degree in aerospace engineering, and when I graduated in 1967, it was at the peak of industry, both aviation and

space industries wanting new engineers. So a person with a degree in aerospace engineering that was more or less alive, breathing, and had a grade point average of one, got multiple, multiple offers, and I got a whole bunch of offers in the aviation and in the space industry. But my target was to go into aviation.

I actually accepted a job with Martin Marietta [Corporation] in Orlando, Florida, to be one of their wind tunnel engineers on a new project that they had, and when I accepted that job, I started writing letters of rejection to all the other eighteen companies that had made me an offer. Now, of course, today kids would say, "Eighteen?" But it was different then than it is now. It was much easier to get a job.

Two weeks before graduation I got a letter from Martin Marietta saying the program that I had been hired to work on had been canceled, and I actually got two weeks' severance pay. For a college student that lived on $50 a month, $221 was a lot of money, so I was in high cotton. But I had told everybody that I was going to work for somebody else except NASA. I called the gentleman that interviewed me, who was Jim [James D.] Shannon, and asked if the job opportunity was still open in Landing and Recovery [Division], and he said yes, it was. "Come on down and interview, and I'll show you around, and if you're interested, you have an offer."

Well, I was very interested, because I'd turned everything else down. I accepted the job and immediately was caught up in this adventure of getting ready for the Apollo missions. I got there the summer after the Apollo 1 fire, so we still had some recovery time to go before we were really ready to go fly, but being in Landing and Recovery, I started working immediately on recovery hardware, and after about four or five months I was assigned to the Mobile Quarantine Facility [MQF] Program as one of the junior Project Engineers for that. That was going to be the

quarantine trailer for the lunar return, to protect the environment from whatever we brought back from the Moon.

But in the interim I worked on that part-time, and I also worked on other recovery hardware. One of the pieces of hardware was a very simple thing called a grappling hook. It was the Aircraft Deployed Drift Reduction System, or ADDRS, and I actually participated in the design, did the initial engineering drawings, had one made in the shops out here at NASA, tested it out in the Gulf of Mexico off of the boat, the USS *Retriever*. The way this thing was supposed to work is when the crew got back and got on the water, if the ship wasn't right there, we were going to drop swimmers out of an airplane close to the Command Module, and they'd swim over there and put the collar on the Command Module to make it more stable and give the crew a platform to get out onto and then be picked up by the helicopter.

What we had found the first time we floated a Command Module mockup out in the water in high winds, it was a very, very good sailboat, and swimmers couldn't catch it. This grappling hook was part of the system that was going to allow you to drop something out of the airplane that had sea anchors on it. One end of this rope had the Apollo collar, and the other one had the swimmers' rescue gear, in case they were going to have to be out there in the water for a long time until a ship came to get them.

The idea was that once the crew was on the water, they would open a vent valve in the hatch and put this grapping hook—it folded up to a little two-inch-diameter cylinder. You'd put it through the hole, and it would open up, and it would be just—looked like a big fishhook with four prongs on it. Then the airplane would fly over and look at where the spacecraft was drifting, and drop the collar and the survival gear across the drift line of the spacecraft. These two things were tied together by a floating rope.

So the idea was that one of two things would happen. The spacecraft would come up against the rope, and the rope would either run up the side of the spacecraft and catch up on the upper deck where the up-riding balloons were on the Command Module. Or it would slip underneath the Command Module, and this hook that's down in the water would hook the line. Everything would come to a stop. Then we'd commit the swimmers to jump on the spacecraft.

That was a great program for a young kid. I got to fly in the airplanes. I got to learn about parachute technology, parachutes that became the sea anchors that were on these devices. I flew about 150 hours in C-119s here at Ellington [Air Force Base, Houston, Texas], dropping these things out of the back of C-119s, testing the parachutes and testing our ability to drop accurately across a drift line of a spacecraft. So I had a whole bunch of interesting flights in C-119s.

Then we moved out in the Gulf of Mexico and did this with the [U.S. National] Guard C-119s. I guess it was Guard; maybe it was the Reserves aircraft. Then we moved on to testing this in the Air Rescue C-130 aircraft, the four-engine turboprop airplane that's still one of the backbones of the Air Transport Command today. It still does a lot of workhorse work. But back in the sixties it was the airplane that the Air Force used for all their rescue operations.

We did a lot of testing out in the Gulf and perfected this thing, and, of course, we never had to use it in all of the Apollo Program. The Apollo spacecraft, except for the very, very first unmanned one, landed exactly where it was supposed to, right close to the ship. We drove up with helicopters and there was no problem. So my invention never got used, but there are still some of them in museums around the country, and I have the original prototype that I built in Building 10 sitting on my desk at home in my home office. It was presented to me when I actually left Landing and Recovery Division.

But for a young kid, what an opportunity to play. But, as you can see, not much aerospace engineering, except for maybe the parachutes. So I was still looking for an opportunity to go build airplanes, but my decision was I'll stay until we land on the Moon, and then I'll go build airplanes.

Well, the Mobile Quarantine Program became just a wonderful engineering opportunity for a young engineer. Even though I wasn't using aerodynamics or thermodynamics, I was getting to use basic engineering to help build these trailers and design them so they would contain, as we called them, "moon bugs" back then. And I was getting to train so I would be one of the operators of the trailer, either inside as the assistant to the Flight Surgeon with the crew or outside running the power systems and the communication systems and that sort of thing.

If people have ever seen one of these trailers, they'll recognize them as an Airstream mobile home type or travel trailer. It was a stock-looking Airstream trailer, except it had no wheels. It was built on a pallet that would fit into an airplane, latch down, and you could fly it around the world.

It was a lot more sophisticated than an Airstream travel trailer, in that it had its own contained diesel generating plant that could power a whole bunch more things than your travel trailer could. We had advanced communication systems on board. We had the ability to plug into an airplane's power system; we could convert that power to 110 household current and run everything in the trailer. We could plug into shipboard power and convert shipboard power, which was 440 volts, something that we don't use on land at all. But we could transform that down to 110 and then to 12 volts to operate the trailer.

So it had a whole bunch of interesting basic engineering things to do, but it still wasn't building airplanes. But I was having fun, so it didn't really matter.

On Apollo 9 we actually put one of these things on the USS *Guadalcanal*—I believe that was the ship that we used—and did a dry run. Now, we didn't put the flight crew in when we got them back from Apollo 9, but six of us actually lived in the trailer for seven, eight days, to demonstrate that it had the capability to sustain a group of people for a week's period of time.

Really a fun event, in that we had the very first production microwave ovens in the trailer. And here we are, a bunch of twenty-plus-year-old young men that probably most of them had never cooked a thing in their life, reading the microwave cookbook. So it was an interesting series of disasters as we learned that you can't poach an egg in a microwave. We plated the inside of the microwave several times with eggs blowing up. But we did learn how to manage the trailer systems and be ready to go out on Apollo 11.

But I guess I kind of got ahead of myself, because Apollo 8, which was the flight that went around the Moon, and it was a—the decision to do that has to have been one of the most incredibly brave decisions any set of managers has ever made. We had never left low Earth orbit. We had a machine that we had an unmanned flight on and a one-man flight, and now we're going to leave low Earth orbit and go to the Moon.

Well, being a Landing and Recovery guy, we were worried about what are all of the potential places this thing can land. Well, if it just goes out around the Moon and comes back and you don't do any corrections, it doesn't land in the Pacific Ocean. It actually lands in the Atlantic Ocean. The Pacific Ocean was the target, but the Atlantic Ocean could have been the landing site if you'd have had a problem outbound and you'd done what we called then a deep space abort, where you actually turned around and came back. Or if you just flew around, slingshotted around the Moon, didn't go into orbit, there were cases where it ended up in the South Atlantic instead of the South Pacific.

I was assigned the job of going out on the USS *Francis Marion*, which was a troop transport. We left out of Norfolk, Virginia, in the dead of winter, in a winter storm with snow and ice, and headed to somewhere thirty degrees south of the equator. Well, it takes a long time from Norfolk, Virginia, to thirty degrees south of the equator, and so it was quite an adventure. There were two NASA people on board the ship, Denny [John D.] Holt and myself. There were a number of military photographers that we had from other places that were there to document it if the spacecraft came back there.

But we sailed for it seemed like forever through a North Atlantic storm until we got into the calmer waters of the South Atlantic. Of course, crossing the equator was an incredible event, because in Navy history, you have to be initiated into the Shellback community when you cross the equator for the first time. So that was a very messy, smelly, yucky event. They made you do all kinds of funky things to qualify to be a Shellback. Denny and I both survived, and we're card-carrying Shellbacks, who have documented crossing of the equator.

Apollo 8 hadn't been launched yet; we're still headed to be on station. We had a boilerplate, what looked like an Apollo command module, on board the ship that we would set in the water and launch a small boat to get our swimmers over to the spacecraft and put on the collar, training the guys how to do the collar, and then how to lift the spacecraft up onto the deck without damaging anything in the spacecraft. So it was just kind of fun and games in the South Atlantic.

But as we're sailing around there, Apollo 8 launched, and it had absolutely no problems going outbound and did its lunar orbital mission. Once it started back to Earth, it was now on a trajectory that was going to the Pacific Ocean, so we were released from duty. Now, we're hundreds of miles from absolutely nowhere, and there was still a storm in the North Atlantic.

The captain of the ship made the decision that we would take some R&R, rest and relaxation, in "oh, darn," Rio de Janeiro, Brazil, and we pulled in there on New Year's Eve.

So, what an adventure. Rio de Janeiro on New Year's Eve is party time, so that was an exciting side adventure for everybody on the ship, especially all the young officers and young civilians that were there to support the mission. And "oh, darn," we couldn't get out for several days. My memory is a little foggy on whether I didn't try to get out for five days or the airlines told me I couldn't, but anyway, Denny and I, I think we agreed that we called immediately when we got there and we couldn't get out. But anyway, we were there for a number of days.

Then we had to get all of these non-Navy people back to the United States. Well, the NASA guys were prepared with the old travel vouchers where you could use them just like money. They were government—I think they were called TRs—travel requests. They were just like a blank check with an airline. Well, I guess Denny and I probably used both of the TRs to get all of the military photographers and the people that were support staff to us back to the United States. I was very, very relieved, when I retired in 2004, I didn't have some travel bill for about $25,000 still hanging over my head. I assume it all got eventually straightened out with the various services that we were operating with then.

But a great adventure. A little side story on that, when Landing and Recovery people traveled back then, NASA had these beautiful aluminum suitcases that you could check out when you're going overseas or going out on the ships. They're much more substantial than the commercial suitcases that you normally use. So I had this great big aluminum suitcase. As you can imagine, we were out over Christmas, so we exchanged gifts on board the ship. Somebody gave me a record, and I don't remember what the record was, but I had packed it very carefully in the middle of my clothes in this suitcase.

When I got to Miami and it came through customs, there was a little hole in one side and a great big hole in the other side where people in the know looked at it and said, "Well, that was probably a .50 caliber machine gun round." So someplace out on the tarmac in Brazil, my suitcase got shot, and it destroyed my record that I got for Christmas. We had no clue what happened, but that's what it looked like, because it was clearly a bullet hole, and it ruined all my clothes and everything that was in that suitcase. But I checked the suitcase back in and didn't say a word, and I never heard a thing. And it was actually quite useless as a suitcase from that moment on.

But by this time I was pretty much convinced that this is a pretty exciting place to be. I'd keep on hanging around. I worked with Denny on a couple of other opportunities. We got sent out around the world to train the Air Force Air Rescue people that if you didn't land close to a ship would be the people that would drop into the water and safe the spacecraft and get the crew out.

One of the trips that I took was from Houston to Guam to work with the Air Rescue Squadron in the Pacific, getting ready for Apollo 11. I flew from Hawaii to Guam on an Air Force C-130 with the rescue guys that were stationed in Hawaii but were going to meet up with the rest of the contingent that was going to be from Guam, and we did our training out of Guam. Just an interesting adventure.

It was in the height of the B-52 bombing of Vietnam, and they put us up in the bachelor officers' quarters, which was right there on the end of the runway at the Air Force base in Guam, so about every other day about four o'clock in the morning the B-52s would start to take off. As the years go by your memories kind of fade, but my memory of that was that it went on for literally hours, B-52s taking off. I'm sure it wasn't that long, but when it's four o'clock in the

morning and you would rather be sleeping, it seems like hours. But that was a part of history that—we were doing something so historical from the perspective of trying to go to the Moon, and here the country was embroiled in this terrible war. It was a strange time spending on Guam.

I actually had a brother-in-law who was an Air Force enlisted man on Guam at the time, and we shared experiences, being there at the same time. One of the experiences he shared with me while I was there, they lived in barracks that were backed up against the hills almost right up to the jungle there in Guam. Periodically they would hear an explosion out in the jungle, and what that was is World War II shells and mines that were still live that had been part of the war, and it was wild pigs that would stumble over these things, trip them, and make them explode.

So it was kind of surrealistic to be in the middle of—you know, you're not in a war zone, but you're kind of in a war zone, and yet you're doing this really, really fun, fun stuff with the space program. We got to know the swimmers very well and followed the Air Force swimmers around the world on numbers of different training events. So that was just an exciting experience.

Came back from Guam, and then we're really now preparing for Apollo 11. There were several of us that were trained, that had been Project Engineers on the development of the trailer, that were trained to be operators on the inside of the trailer and operators on the outside of the trailer. We kind of drew straws on who was going to get to be Apollo 11's operator on the inside with the Apollo 11 crew, and John [K.] Hirasaki, who was not only a colleague but a close friend, he got the winning straw. So he was going to be the guy inside. I was going to be the lead on the outside of the trailer.

So the adventure begins for Apollo 11. Of course, the part of Apollo 11 that people remember the most is the [Mission Operations] Control Center and landing on the Moon and all

of the wonderful TV that we had. Of course, I never got to see any of that until after the fact, because out on board the ship, on Apollo 11 the only communications we had with the outside world was the military communications system and the ham radio shack on board the ship that actually brought BBC [British Broadcasting Corporation] and other things that were broadcast on the ham band. So I listened to the Apollo 11 landing on radio. It was a British broadcast of the Apollo 11 landing. So we, of course, didn't get to see that, but it was still just pretty exciting to be part of the process.

When the crew started to return to the Earth, we started our really intensive preparation with the trailer, making sure everything was working. One of the important things when the crew got back on the ground was to talk to the President of the United States. It turns out Richard [M.] Nixon was going to be on board for the return, so we were practicing staging all of the things for the President.

There's several pictures of Richard Nixon around the trailer before the crew gets back, looking at the trailer and looking at a mockup of the Biological Isolation Garment or BIG that was developed for the crew to get out of the spacecraft and get on board the ship. I was the model for the Biological Isolation Garment for President Nixon, so I've got a picture of me shaking hands with the President of the United States, wearing this strange-looking suit.

After we go through the Apollo 11 experience, I'll digress a little bit and talk about the BIG, because it was an interesting program that several of us were test subjects on.

But anyway, the crew is en route, and John Hirasaki and the Flight Surgeon, Dr. [William R.] Carpentier, were preparing all the inside stuff for the trailer. One of the interesting things that the trailer had the capability to do—when the lunar rocks came back, they were in a vacuum-packed stainless steel box to protect the rocks from being contaminated by Earth contaminants,

so you could do a real scientific analysis without having to separate what got on them when they got back. The trailer had a device in the side of it where these rock boxes would actually fit into this transfer lock. We would vacuum-pack the rock box in three layers of heavy plastic, suck it down, and then heat-seal the edges, so the box was completely protected.

Then we'd put it in this transfer lock and fill it with a high-tech decontamination solution, "high-tech" meaning it was Clorox [chlorine bleach] of a very, very high concentration. But, it smelled like Clorox. It would bleach your clothes; it would hurt your hands. So you had to be real careful with it. But it was kind of like a washing machine. You'd set this thing in, close all the hatches, and wash the exterior of the plastic, because it had been in the trailer and had been contaminated with lunar material, so we're washing off the lunar material.

When Apollo 11 returned, that was the plan. We'll take the rocks out through that hatch. Then we'll fly them back to Houston and then bring the trailer back to Hawaii and then back to Houston. So we're all ready to do all of these activities. Apollo 11 landed with absolutely no problems, and we got the crew out of the Command Module safely and into the trailer.

We got the Command Module on board the ship, and you had to do some safing on the Command Module so the reaction control system propellants were safed, and you had offloaded the important things out of the Command Module into the trailer for shipment back to Houston. To do that we had designed an airlock that would go from the trailer to the Command Module. It was just a big plastic tunnel, but the way the trailer system worked, it operated at a less pressure than atmospheric pressure. So what that means that any leaks the trailer had it sucked into the trailer instead of ejecting whatever was in the trailer out into the atmosphere.

So we ran the trailer at a negative pressure the whole time that the crew was in it, and this plastic tunnel was operating at the same negative pressure, so it had these big aluminum hoops,

and it was hooked to the trailer in a very high tech fashion. We used duct tape. Actually, it started out snapping on to give it some structural integrity, but the seal was actually duct tape. Back then we said we couldn't go to the Moon if it wasn't for yellow tape. Yellow tape was the equivalent of the gray duct tape you see today.

But everything, I mean, we had hundreds of rolls of duct tape out there, of this tape to tape the things up with, and that's how we hooked it to the trailer. It had a seal that strapped it down to the Command Module, and then we taped around that to make sure we had a good seal. So once the Command Module was on board, John Hirasaki and the flight crew offloaded the rocks into the trailer, and then John would bag them up, send them through this decontamination lock, and then they were flown back to Houston.

So my claim to fame on Apollo 11 was I was the first guy outside of the containment facility to handle the rock box, because I took the Apollo 11 rocks out of the trailer and walked with armed guards to the airplane, as if somebody is going to steal the lunar rocks on a Navy carrier. But we did have Marine guards going to the airplane. So that was the Apollo 11 experience on board the ship.

Five more days back to Hawaii and then we moved the whole trailer, with the crew and the doctor and John Hirasaki inside, on this special truck to a C-141 cargo aircraft, large military jet. Put it in the jet and then flew the whole thing back to Houston. Those of us that are operating the trailer are on the airplane with the trailer, and then we land at Ellington, take it to what was then called the Lunar Receiving Laboratory, Building 37, I guess, and had another airlock that we backed the trailer up to, and then the crew and everybody in the trailer could get out and spent the rest of their twenty-eight days of quarantine in that building. Much better digs than being in the trailer for seven or eight days.

I said I was going to digress a little bit on the Biological Isolation Garment. Originally the plan had been to pick the Command Module up with the crew in it, and then have them exit the Command Module on board the ship through this airlock, after we got it hooked up, and just walk into the trailer, and they could just be in their flight suits.

There was an incident on Apollo 9. Crew was out of the Command Module. We were picking the Command Module up, and the lifting loop had a structural failure. We didn't drop the Command Module, but the thought of dropping the Command Module forty or fifty feet, if it's coming up the side of the carrier, with the crew in it got people so nervous that we looked for an alternative way to get the crew out.

So the decision was made that hey, it would probably be okay if we got the crew out in the water. They would put these suits on, and then they would get out of the Command Module, and then we'd pick them up in the helicopter. Then we'd do our normal thing with the Command Module with the crew not in it. But there was no such suit in the world to keep bugs contained inside a suit. There were suits that kept bugs from getting from the outside in, but not from the inside out.

So Life Sciences did the design. Life Sciences at the Johnson Space Center did the design of this suit, and then the cadre of young Landing and Recovery engineers got to test it. I was one of them; John Hirasaki; I think Buddy [Ralph H.] Culbertson was another member of the test group. But we actually went out in the Gulf of Mexico, practiced putting these suits on inside a spacecraft mockup, and that was spacecraft 007. It was a real Command Module, but one that was never going to fly. It had real seats in it and all of the postlanding survival gear, the radios and all of that, and that's what we used to train the crews to get out of the Command Modules, and that's what we used to test all of the postlanding hardware.

But we would get in the Command Module and then put on these suits, which weren't particularly easy to get on. Then we'd climb out and get in the raft, and the question arose, well, how hard is it on the human body to be in one of these suits for hours if the helicopter can't get to you? The Air Force dropped their swimmers—you don't want to stay in the Command Module, because it gets pretty hot and nasty quickly sitting on the water, so you get people out and you're in the raft.

So we did a test. How does the human body survive in a Biological Isolation Garment for an extended period of time in the ocean? I can tell you, very poorly. Number one, laying in a little raft in one of these suits where you can't see much, and you've actually got what looks like an oxygen mask over your nose, and you're breathing through filters that as soon as they get a little damp, it gets harder and harder to breathe. They get hot. The suits were a dark color, so they got hot very, very quick.

So I can tell you after about an hour, the first guy got really, really sick, and we had to get him out of the suit, which wasn't easy. It was very difficult to get the hood off and get this face mask off of you if you got sick. So we made a design change. We had an emergency zip flap. It was this green ball that was on the side of the helmet that you could just take it and rip it, and it ripped a hole in the—I guess it was Velcro or something like that. It broke the seal, and you could pull the mask off so you didn't suffocate in there because you had filled up the mask. No gracious way to say that.

All three of us, within about two hours, had to get out of these suits, because you just couldn't—evidently we didn't have the right stuff to be tough and competent astronauts. But the decision was made, if you ever got into that situation, that you would not stay in those suits. You would breach the quarantine and bet on the come that you weren't really going to have a problem

with lunar material. So we did that on Apollo 11 with the Biological Isolation Garment. We did it on Apollo 12. Of course, they weren't in the suits very long. They came out of the Command Module; the helicopter was right there and picked them up.

So after Apollo 11 we started training now for Apollo 12, and it was going to be a one, two, three shift. John Hirasaki was going to run the outside, and I was going to run the inside with Dr. Clarence [A.] Jernigan. So I had my opportunity to live with the crew for a number of days.

There's very important preparations for crews coming back, like what do they want to eat, so we had the right food on board the ship. Al [Alan L.] Bean wanted to eat spaghetti and spaghetti and spaghetti and spaghetti. So we had lots of Al Bean spaghetti on board.

Pete [Charles Peter Conrad, Jr.] wanted to make sure that I knew how to make martinis. I'd never made a martini in my life, so I had a little bartender book and learned how to do that. And just so you know, we weren't breaking the law, because we were a United States Quarantine Station. I had all the paperwork. We were legal. We were an entity in ourselves on a Navy ship. It was like we weren't on the ship, so we could have our own bar, and it was, I guess, legal.

But anyway, I learned how to make the drinks that the three crewmen liked. Al Bean was an iced tea drinker, so he was easy. Dick [Richard F.] Gordon [Jr.], I believe he was a Scotch drinker. I know Pete was a martini drinker, because I didn't know how to make martinis. So I practiced; I knew James Bond liked them stirred, not shaken, so I knew all of the buzz words.

But we're getting ready for Apollo 12, and I had done all the important stuff; learned how to be a bartender. I knew how to cook spaghetti, and I knew how to do all the other things that it took to run the trailer. It was actually a fairly simple device, but it had some amount of intricate controls to keep the pressures right and to manage the sewer system so you didn't contaminate

the outside world with potential lunar material. So, it was not all that complicated, but there were things to do, and you had to practice running the systems and running the communications. We were responsible for the communications system to allow the crew to talk back to Houston once they got on board and that sort of thing.

So there was some amount of training, but now it's time for Apollo 12, and once again we fly the trailer from Houston to Hawaii. It was on a C-141, and all of us flew on the 141 to Hawaii, and we put it on the ship, and that was the USS *Hornet*. That was great to be on the same ship for [Apollo] 11 and 12, because you had the same deck crew, and everybody knew how to manage the trailer and knew what the rules were. So it was a lot easier on Apollo 12 than it was on 11, just from the logistics standpoint.

But once again we couldn't see any of the TV that the world was getting to see. We didn't see launch. But we did have a spectacular view of reentry. Apollo 12 landed early in the morning, and you actually could see it, the Service Module, after it separated from the Command Module, coming apart through the sky. It was very, very spectacular in the early morning sky. We picked up the Command Module on binoculars and actually saw it before the parachutes came out. That was really, really exciting. But then once they got on the water, then I had to go back into quarantine and be ready for the crew to get there.

I'll tell you a funny story that I tell the kids when they ask me what I did on Apollo 12. The night before the crew landed, I finished reading a book. It was a Michael Crichton book, [*The*] *Andromeda Strain*. Anybody that's ever read *Andromeda Strain*, this stuff that came back from outer space ate rubber and ate aluminum, and we had a trailer that had rubber seals; made out of aluminum. So as you can imagine, your imagination runs wild. But I'm fairly certain everything's going to be okay, because Apollo 11 was okay.

But the crew arrives, and my first duty is to help the doctor do their initial physicals. We had to draw blood, and the doctor had warned me that Pete just flat didn't like needles. He'd let you stick him, but he didn't like needles, and sometimes he nodded off when you stuck him. I actually, before Pete passed away, I actually told him that I told this story, and I hoped it didn't offend him. Because just when we got ready to draw blood, he went to never-never land and we drew the blood and then brought him back around.

It always amazed me, because Pete Conrad was always one of my heroes. He was one of the people that was, in my view, the right stuff. He was a pleasure to train with. He was a pleasure to work with. He was clearly from Apollo 12 on through his Skylab experience, one of the bravest, most capable men I'd ever been around. And yet you show him a needle, and [snaps fingers] he was gone.

So it just always kind of amused me that that was the case, but we got through all that, and now the physical's over, so Pete says, "It's five o'clock. Time for a drink." Of course, it was—I don't remember what time of day it was, but it was nowhere near five o'clock. But it was "Miller [beer] time."

I said, "Well, Pete, I do know how to make martinis." I'm trying to impress him. I said, "Well, how much vermouth do you want in your martini?"

He says, "Well, where is the vermouth?"

I said, "It's stored back there under your bunk."

He says, "Well, you get the gin cold in the ice tumbler, and then you just walk my glass by that bottle of vermouth and don't bother to take it out." So Pete drank very simple martinis. It was cold gin only, with an olive, not an onion. And I had olives, by the way. So that was kind of fun.

Then right after they had the cocktail time, it was time to talk to the President of the United States. So I'm setting up the com [communication], and I'm talking to the White House communications people. The President has a call sign; every President has a call sign, and Nixon's call sign was "Crown," so I assume that meant he thought he was king, but it was never clear to me.

But we got Crown's com guy up, and then we're getting ready to do—if you remember seeing pictures, at the end of the trailer they always had a TV camera looking in where they showed the crew when they were talking to the President. Well, Pete and Al Bean and Dick Gordon were back there at the back of the trailer. They hadn't opened the curtains yet, and the most famous quote that I can always quote, Pete Conrad turned to Dick Gordon and slapped him on the back, and he said, just before we hooked up the President of the United States, he said, "I told you, Dick, if you stuck with me, you'd be farting through silk."

You can block that out of this if you feel like it's inappropriate. But I am cracking up over at the com station, and I'm thinking, "Boy, I hope that wasn't live to the world." I look down, and thank goodness, I had not turned it on yet, so it was just between the four of us or five of us in the trailer.

Then they talked to the President, and we went through the next seven days getting back to Hawaii, and flew from Hawaii to Houston.

One of the things Pete's crew did on the Moon is they went to one of the early lunar landers and brought back the TV camera off of it. They took it off the lander that had landed there several years before. The object was to look inside this thing and see—because even when you package things perfectly, Earth-bound bacterium is probably in the device, and they wanted

to look at it and see if any of that survived and that sort of thing. So they brought this TV camera back, and I stowed it in the trailer.

We get back to Houston, and we're all so excited to be getting out of this trailer, because they had been, obviously, in the Command Module for eight days, nine days—the Command Module or the LM [Lunar Module]—and then the trailer for I think it was seven days. I really don't remember, but it felt like forever getting back to Hawaii. So they were really ready to get out of the trailer. I was ready to get out of the trailer.

So I was offloading all the things that I'm supposed to offload, and I forgot the Surveyor camera. I left it in the trailer. So I had to call my boss that night, because they took the trailer away. They took it and put it in another quarantine area in the back of the Space Center, Building 227, I believe, is where we had it all hooked up.

So I had to call my boss, and I said, "Uh, boss, uh, the most important thing we brought back, except for the rocks, I left on board the trailer. So could you move it back over here so I could get it out?" So the next morning they brought the trailer back, and I was able to get that, and they started the analysis on the TV camera.

But that was a fun period of time. I think I spent another seventeen days, eighteen days, in quarantine before they released us. They were a lot of things to do. I still had to offload all of the other secondary things off the Command Module, so I had plenty of work to do in the Command Module, because there wasn't a whole crew of people doing it; it was just me that was operating in the Command Module there. So I was plenty busy. But it was really exciting to get out and to have been—look back now that, hey, you were part of a real historical event. Not like the guys in the Control Center that really accomplished landing on the Moon, but even though it was a peripheral, secondary thing, it was really an exciting part of history in your memory bank.

So that's always been very special to me, having the friendship of Pete Conrad and Al Bean and Dick Gordon. Even though over the years we didn't see each other or anything, I felt a kinship for the three people. When Al became a famous artist, I even bought one of his prints of his lunar pictures and have followed his career.

In the trailer Pete was very talkative and wanted to talk about the lunar experience and talk about what he saw and how neat it was and this, that, and the other. Dick Gordon wanted to talk about watching the Moon go by, because he was in the Command Module and didn't get to land.

Al Bean wanted to think about it. I bet he didn't say a hundred words in the time I was around him in quarantine, the whole time. He was very, very introspective through that whole period of time. A major event like that just affects people differently, and Al really wanted to think about it and digest it and dissect it and lock it into his brain, and clearly he did, if you look at the art he has created since then. It's just magnificent, detailed art, and it came from his head and not from the pictures. So it's clear that he was thinking about all of this all of the time. So it was really neat to know those people in such an exciting time.

Can we stop just a second?

JOHNSON: Sure.

Pause

JOHNSON: When you first started talking about how you came to NASA, you mentioned that you hadn't told NASA that you weren't going to take the job yet. When you interviewed with

NASA, did you know it was for Landing and Recovery, and if so, how did they explain that to you, or did you really understand what you'd be doing at that young age that you were?

STONE: When I went to the NASA interview, I had no clue. I knew it was the Johnson Space Center and not another part of NASA, but that's all I knew. I didn't know what kind of jobs they were interviewing for, but they wanted to talk to aerospace engineers with a grade point average of at least—and then we were on a three-point system, not a four-point like we are today—and it said on the door that we're looking for students with a two-point-seven-five or above out of three. And I'm thinking, "Boy, this isn't good," because I had about a two-point, maybe a one-point-nine overall.

I had a two-five in engineering courses, but I really didn't care much for, at the time, history, English, English composition. Dumb; I figured out twenty years later that I missed out on a lot of opportunities to improve skills that you really need as an engineer. But as a young kid I just didn't care about that stuff.

I had an appointment, and I got to the door, and I'm looking at this thing, and I'm, "Well, I don't have that kind of grade point." So I knocked on the door and went in, and it was Jim [James D.] Shannon, who ended up being the Deputy Director of MOD just before I took over Mission Operations Directorate, and a gentleman from the admin [administration] side of Landing and Recovery, Grady [P.] Henderson. I didn't know it was for Landing and Recovery until we got into the interview, and that was one of the reasons I wasn't particularly interested. If they had talked about flight dynamics or spacecraft design or something like that, I would have probably jumped on it.

I liked the people. I liked Jim Shannon and Grady Henderson, and the three of us have been friends from that point on to this day. But I wasn't particularly interested in the job, except for the part you will get to travel a lot. That sounded kind of cool. But it was not high on my priority.

But when I got in there, I said, "Look, guys, I don't have a two-point-seven-five grade point average, and I don't have it not because I partied all the time." Well, that was maybe not quite true. I didn't party all the time, but I did work full-time the whole time I was in college, and nothing—engineering, even though I had a very good grasp of the concepts, I wasn't the world's best at the analysis. So I had to work real, real hard to get Bs and A-minuses in engineering.

But I figured that working hard was worth something, and they really were looking for people that were willing to do operations type things, not analysis type things, and that was the kind of stuff I was good at, doing things and making things happen, reading instructions, following instructions, creating instructions for how to do something. I could do that sort of thing, so it would probably have been a good fit if I'd have just said yes right then, but I wanted to build airplanes. My job the last two years at the University of Texas was I was a lab assistant for the wind tunnel facility. I taught a wind tunnel lab, and I ran the low-speed wind tunnel for two years, and that's what I wanted to do. So I just kind of put it on the back burner.

When I called them, they explained, "Here's the job I have. It's in the Systems Branch. You'll get to travel a lot. You'll get to design, work on, hardware for recovering spacecraft, and you'll get to test it."

Well, getting to work on it and test it and have hardware in your hands, that was appealing to me, so I decided, "Well, I can do this for a couple or three years, and then I'll go build airplanes," and I accepted the job.

JOHNSON: Was there any thought at that time—you mentioned Vietnam earlier. Was that ever something that you either worried about or thought about as far as going into the military?

STONE: Well, I can digress a little bit. The only thing I ever wanted to do was fly and fly for the military, as a kid growing up. I said I was interested in airplanes. That was kind of an understatement. I had a singular goal. I was going to fly fighter airplanes like my dad did in World War II. He was not a fighter pilot; he was an instructor pilot. But he flew all of those airplanes, and I was going to do that, no matter—I was just going to do that.

I applied for the Air Force Academy in 1960, a year and a half before I graduated, and I got what they called an alternate appointment. So somebody had to not go for me to get to go. So I didn't get to go my freshman year. I applied again the next year. Still was an alternate. I got accepted to the Air Force Academy after I had eighty-five hours of engineering at the University of Texas, and I made the decision that, yea, verily, I just can't give up nearly three years of college to start over.

But during this time I had discovered when I took the military physical that I had a color deficiency. Some branches of the service call me color-blind; some of them call me color-deficient. I could not pass the Air Force color test, which was these little colored dots and you see numbers. I see colored dots; no numbers. So I had figured out I was not going to be able to fly for the Air Force.

But when I was a senior at UT, the Navy came in and wanted any aerospace engineering student to come take their flying aptitude test. It was a whole bunch of technical things and eye-hand coordination things, and I scored the highest in my class on this aptitude test. So the Navy is all thrilled. They fly me down to the Naval Air Station in Dallas [Texas]. I took another flight physical. I told them about the color deficiency, and they said, "Well, we don't use that thing. We use a thing called a lantern test."

I passed the lantern test. I think, "I'm going to be a Navy pilot." And yes, I knew I was going to go to Vietnam if I became a Navy pilot. It's what I wanted to do. But in the interim from the time that that happened to graduation, the Navy changed their flight physical. They redid it using the little colored dots.

I failed, and they said, "Well, you can still be in the Navy. We'd love to have you. But you can probably be a supply officer."

So I made the decision that that was probably not the right thing, and I would just take my chances with the draft. I had a student deferment, but if I couldn't fly, I didn't want to just go join up and go. But throughout the whole Vietnam era I had either a student deferment or a technical deferment when I came to work for NASA. But I was always extremely disappointed that I never had that opportunity to be a military pilot, and I would have gladly gone had been called. But no, I avoided it through my work.

JOHNSON: Did you ever learn to fly?

STONE: I did. I did. I am not a licensed pilot anymore. I don't do that. I love it, but the amount of money that it takes to fly regularly, and even though it is kind of a passion, it's not a passion

that I want to sink every bit of spare cash into, like some people do. So I fly model airplanes instead. I'm a big model airplane—you can always walk away from those crashes, and they never cost you more than three hundred bucks.

JOHNSON: That's a good philosophy. Well, when you first came to Landing and Recovery, they'd been recovering the spacecraft before with—

STONE: Yes, Mercury and Gemini.

JOHNSON: —Mercury and Gemini, and there were some people that had worked on those. I know they were hiring a lot of people and kind of building up the forces before Apollo, and as you mentioned, you and Denny Holt and several others were very young. What type of reception, or how did you get along with those engineers and those technicians that were doing that before you got there, and how did you train to know how to go out on the ships and then train divers and to do that sort of thing?

STONE: We had a wonderful relationship, especially with the technicians, because we got to do things hardware-wise, and we got to work in Building 10 and help design and build things. If you built a good relationship with a technician, you could turn out things that you couldn't do if you didn't have a good relationship. So the successful ones built those good relationships, and the technicians accepted the young engineers that were willing to listen to them instantaneously. The ones that came in and says, "I'm an engineer. I can tell you what to do," they didn't get along too well, nor were they very successful. The older engineers that were part of the process

were really glad to have young kids to send out on the ships and they didn't have to go as often. So we got along real well there.

The training was done to learn how to do these things. Some of the training was just kind of self-taught. We built procedures for everything that we were going to do, especially those things that were hazardous associated with the spacecraft. In safing the reaction control system and that sort of thing, we typically had [North American] Rockwell [Corporation] engineers that that's what they did with us. So we went through a training program to understand the hazards of the systems and how to protect the environment around the spacecraft from these hazardous chemicals that they use in the reaction control system. But the Rockwell engineers were actually the ones that did what I would call the dangerous detanking of the spacecraft and that sort of thing. We just safed the mechanical systems, and then the Rockwell guys, once we got the spacecraft back to dry land, they would finish that process.

But it was really learning by doing, and we would go practice it out in the Gulf of Mexico, and then we would take that knowledge that we built out there and then train the military swimmers and divers how to do it and teach them all the safety protocols around the spacecraft.

JOHNSON: How was Landing and Recovery Division organized at that time when you came in, and how did they decide—like you said you started working on hardware and then, of course, went to the Mobile Quarantine Facility. How were the duties divided up? How was it decided who went on the ships and who traveled and did the different things that you did?

STONE: Yes, there was a Test Division that tested hardware, and there was an Operations Group that did all the planning; where do we need the ships, how many ships, what kind of support do you need here, make arrangements for the helicopters and the aircraft and that sort of thing. That was a branch in itself.

My branch, that I was in the whole time I was in Landing and Recovery, had kind of bits and pieces of Hardware and bits and pieces of the Operations, and, because we were probably, in most cases, the youngest guys, we got the ship duty more than other people. So it was an organization of Systems, Operations, and Test, and then there was one Training Branch that their responsibilities was to take all this information and turn it into manuals that you could hand to a Navy guy that was going to handle the spacecraft on board the ship, and say, "Here's the things you need to know to stay safe." So that's kind of how we were organized.

The Division Chief at that time was Jerry [Jerome B.] Hammack. Jerry—interesting, interesting history. He's one of the people that had his name on the patent for both the Mercury and Gemini spacecraft, and Jerry was a very interesting man to know. The reason I kind of singled him out, he and I have crossed paths over the years multiple times. He's in his eighties today, and he taught me a lot of things when I came to work for NASA, and I'm teaching him to fly model airplanes now, so it's kind of an interesting cycle of life here.

JOHNSON: Get to teach the teacher.

STONE: That's right.

JOHNSON: Well, you mentioned the ADDRS, the drift recovery system.

STONE: Aircraft Deployed Drift Reduction System.

JOHNSON: Reduction System—as one of the pieces of hardware that you worked on. Were there other types of hardware that you can recall that you'd like to share some information about?

STONE: On the hardware I actually worked on, that grapple fixture that went with the ADDRS, and then the parachute system and the line system, all of that together is an integrated system I worked on. But, there were even some less glamorous things, like the sewer system on the Mobile Quarantine Facility. How do you drain the travel trailer tanks and protect the outside environment? We designed a set of holding tanks that had very specialized filters on it. We could pump the waste out of the trailer into these holding tanks, and then we shipped the whole thing, these holding tanks, back to Houston. They stayed in quarantine with the trailer until everything was released, and then they were dumped just like you would dump a travel trailer at a station.

So I worked on those. I worked on the power system for the Mobile Quarantine Facility, integrating the diesel generators into the electrical system of the trailer, and then doing the integration of the other transformer devices that took these different voltages. So I worked on that. What other hardware? That was principally the hardware that I actually had a design hand in. A lot of little things associated with the trailer that once we took delivery of it, it didn't work exactly like it ought to work, and so we did a lot of interim design and fix on the trailers before we ever used them on Apollo 11 and 12.

JOHNSON: Was that done on site, those changes?

STONE: Yes, it was all done on site. We actually had a building that was designed for four trailers, where we could have four trailers in there. We actually had built an exhaust system so you could take a flexible exhaust hose from these diesel generators and run under the side of the building, and we had an exhaust stack. So we could actually run these diesel generators in the building to check it out. The building had shipboard power and aircraft power, so we could test the trailers in there against the different power systems. And I, at a high level, worked on that and integrated the use of that building for the trailers.

JOHNSON: Talking about the Mobile Quarantine Facility, what type of contingencies as far as once the facility was on the ship and the astronauts arrived in their BIG outfits, what type of contingencies were in place as far as if some type of contamination happened on board the ship, and any other contingencies during that whole process, can you recall?

STONE: Well, once the crew got on board the ship and the spacecraft got on board the ship, what you were trying to do was contain the lunar dust and any bacterium that may be on the lunar dust and lunar material. The decision was made early, early in the program that this system was not designed for viral protection. Viruses are extremely small and extremely difficult to protect against, and the National Academy of Sciences had come to the conclusion that it would be more than likely a bacteria that we would be dealing with, bringing it back as part of the particulate of the lunar material.

So that's how the trailer was designed, and all of the spill contingencies that we worked on were designed to be contained and cleaned up as if it was a biological spill. The logic here is that lunar bacteria and space bacteria is going to be enough similar to Earth-bound bacteria that the things that kill Earth-bound bacteria will kill space bacteria. So our cleanup and decontamination procedures were just like they would be in a hospital for a biological spill, blood splatter, that sort of thing.

So we used betadine, which is still one of the principal chemicals for killing bacteria. Prior to surgery, they swab the area of your body before they operate on you, and we used that as one of the chemicals to decontaminate an area, like around the hatch of the spacecraft when we put the airlock on it. Before we broke that seal and took the airlock down, we decontaminated the outside of the hatch with betadine and washed all of that down. We were prepared for wastewater spills. We were prepared to contain those and decontaminate the wastewater if we sprung a leak in the trailer.

One of the interesting contingencies that we prepared for was because these trailers were so well sealed, if you're on an aircraft flying at altitude and the aircraft had an emergency decompression—lost all the pressure in the cabin—because the trailer is so well sealed, it would actually blow the trailer up. The computations were that if you did not do something mechanical to allow the pressure in the trailer to relieve, you would blow the ends off of the trailer. Not a good thing, because then you've completely lost your containment, and there was no way—yes, you could clean up the inside of the airplane, decontaminate it, but now you have no quarantine trailer to move forward with.

So we actually designed a system that had a bunch of pressure switches in it that sensed the decreasing pressure in the airplane and would pull some latches on the back hatch of the

spacecraft, and the door would just fall out and let out the air out the back of the trailer. We did a test where we tested that piece of hardware in a C-141 at altitude where they have a big dump valve in that airplane, because it's an airplane that they can drop paratroopers out of, so they have to have the capability of depressurizing the cargo bay, and they had great big valves, so it was very similar to a rapid decompression due to a window blowing out or something. Opened these valves, and it turns out that the mechanism didn't operate fast enough, and the pressure in the airplane dropped before it could pull the pins. We didn't blow the end out of the trailer, but we sure made it look funny as all that stuff fractured and the rear door broke and we couldn't have done it.

We came to a real simple, simple, simple solution, and that was we put blow-out panels where the filters on the side of the trailer, great big filters that filtered down to, I don't know, twenty microns of particulate. It's like the filters they use in mines to take out the fine, fine dust and purify the air in a mine. That's where the technology came from. But we had these foam blow-out panels, so if you had a rapid decompression, these foam panels—they were scored with a big *x*—they just blew out. So you had a three-foot-by-eighteen-inch hole in both sides of the trailer that all you had to do was put another panel in, put a new filter on it, and you're ready to go. So that was the low-tech solution to the problem that we tried to solve in a high-tech fashion.

Most of the contingencies we planned for were spills, release of lunar material, or biological waste that could have lunar material associated with it. So those are the kind of contingencies we worked with, and our two first-line defenses was Clorox—we didn't call it Clorox; we called it sodium hypochlorite, because it was a little higher percentage of—Clorox is mostly water with sodium hypochlorite in it, and this was more chemical and less water, so it was very, very effective at killing everything.

It was also very effective if you mixed it with oil, causing a big fire, so we had to figure out what the highest percentage of this stuff we could use so it would not react at a level with grease and oil on board a ship that you caused a fire. So some of the guys in the Test Group worked with that until we got a percentage that the medical people said was strong enough to kill anything, but not so strong that it caused a fire if it mixed with contamination grease and oil. So that was kind of an interesting plan.

So we used Clorox and betadine as our two things to sterilize the world. And, you look back on it, and we really didn't need to do that, but, as the National Academy of Science has said, the probability is extremely low, but the consequences are potentially devastating. So that's why the country invested in the Quarantine Program.

But I always thought afterwards, if there's any problem with lunar dust, it's going to be me, John Hirasaki, and the lunar astronauts. We're going to die of whatever that is, because the environment in the spacecraft was so dusty. When they transferred the rock boxes from the LM and the suits from the LM into the Command Module, the dust was just unbelievable. I was gray after I unloaded the spacecraft.

JOHNSON: You mentioned that you had read that book before you went into Apollo 12. Did you have any real concerns, knowing that you were going to be covered with that dust, other than that possibility that it could be like the book?

STONE: I was twenty-four years old and invincible. But yes. Yes, I knew that there was some level of risk there, and we signed a release that we understood the risks, and, we sure hope you don't die, but you're accepting these risks as part of your job.

JOHNSON: What made you decide to do that? Was it just because you felt that you were invincible, or did you just want to be a part of such a historical event?

STONE: How often do you get to be part of history and this close to history? And I truly did not believe it was going to be an issue, truly didn't.

JOHNSON: You mentioned that your father was a pilot, and, of course, your mother was the one that was interested in space. How did they feel about what you were doing?

STONE: Well, my father died when I was fourteen years old, so he didn't get to see this. But my mother was, I guess, as proud as any human being could possibly be. There were more articles about me in the Brownsville [Texas] paper than you could shake a stick at. I must have a folder that's two inches thick, and it's nothing that I told them, but my mother was calling the editor on a regular basis, telling them what her little boy was doing. So there's lots of stories, the ADDRS, Apollo 11, Apollo 12, what I was doing on board the ship on Apollo 13 and all of those things.

So she got a huge pleasure out of vicariously being part of history, and one of the great thrills that I believe I was able to give my mother is when I was a Flight Director, I had a shift where I was going to deploy a PAM [Payload Assist Module] spacecraft out of the [Space] Shuttle, and Gene [Eugene F.] Kranz invited my mother to be in the viewing room for the deploy. He's up there giving her a blow-by-blow of what's going on, and after we completed the deployment and everything was calming down in the room, I turned around, and I had a big sign that said, "Hi, Mom." So that was a big deal.

JOHNSON: A very proud mother. You mentioned that you had the four trailers here on site, the MQF trailers. When the ships were out—and I know that there were multiple ships that would be available for the splashdown, and contingencies in place in case something happened—were these ships equipped, each one of them equipped?

STONE: No. Only the primary recovery ship was equipped with a trailer.

JOHNSON: What would have happened if they had had to land somewhere else, as far as transferring?

STONE: There was almost no way they could land somewhere else if they had landed on the Moon. They could have landed somewhere else had they aborted and not gone to the Moon. Apollo 13, we were actually able to move the ship, the primary recovery ship, and recover Apollo 13, even though it didn't orbit the Moon. It just did a slingshot coming back. But there were abort scenarios that would put it someplace else where the primary ship couldn't get it, but none of those scenarios allowed you to land on the Moon. So we only had one system.

JOHNSON: During the testing time when you were out in the Gulf with the Command Module mockups, how many different mockups were there, and how much interaction did you have as far as with the astronauts training on those mockups and that sort of thing?

STONE: We had several boilerplates, and *boilerplates* means that it had no insides; it was just a shape, a geometric shape of a Command Module. We used those to train the shipboard people on picking them up and showing them where the RCS [Reaction Control System] thrusters are and stay away from this area. They had the up-riding bags on them so we could have them upside down and so the people that we were training could see what it looked like when it was in what was called stable 2, with the heat shield side up and the hatch side down. We had balloons that would right it up.

But there was only one spacecraft mockup that the crews and the test subjects could use, and that was spacecraft 007. It was a real airframe, but it was just not completed. It didn't have the Reaction Control System. It looked like a real spacecraft from the outside. It looked like a real spacecraft from the inside. The hatch was a flight hatch. All of the radio gear, postlanding radio gear, was flight gear. The antennas and that sort of thing were all flight gear.

We did all of our training with that one vehicle, and we took every crew out into the Gulf to have them have the experience of exiting a spacecraft into the raft and being picked up by the helicopter. We did that for every crew. Now, my group didn't—that wasn't always our responsibility to go out when they trained the crew; we're not in the Training Branch. But, because I was going to work with the Apollo 12 crew, I went with them, and John Hirasaki was out there when we did the Apollo 11 crew, just to get to know each other and have that interaction. So we did get to work with the crews in that sense.

We did another series of testing with that same spacecraft, a training, but we did it in a tank in Building 260 out at the back side of the site, and we did it in the tank because it was really too hazardous to do out in the Gulf. That was what was called stable 2 egress. That was when the spacecraft was upside down, and the up-righting bags didn't do their job, and it stayed

upside down. You can't open the side hatch, because it's on the down side of the spacecraft in the water, and if you opened it, it would just fill up the spacecraft. It would roll over, finish filling up, and sink.

So the only way you could get out of the spacecraft, if it was stuck in that mode, is to remove the hatch that they use to go from the Command Module to the Lunar Module. Remove that hatch, and then allow the water to come up in the Command Module, and then swim out through that hole. We did that training in Building 260, because we felt like we put the crew at too much of a risk out in the Gulf.

JOHNSON: Did you ever have a chance to go to [NASA] Kennedy [Space Center, Florida] to support the recovery efforts there?

STONE: I did. We did some of the early work on recovering spacecraft from a launch abort where the rocket blew up on the pad and the abort rocket would take them off and they'd come down out in the swamp. We actually went down and worked with the Kennedy people. They probably knew as much about the spacecraft as we did or more, but anyway, we went down and worked with them. Because we had done all of the emergency egress work with the Command Module in the Gulf, we helped them with emergency egress of the Command Module if you had a launch abort.

Now, if it landed on the ground, there was some chance the hatch wouldn't open, because it could deform the airframe and you couldn't get the hatch open. So we worked with them on methodologies for getting them out the top hatch; that most likely would not be jammed. We actually even developed a technique for cutting into a Command Module with a chainsaw-type

device, to be able to cut a hole in the spacecraft knowing exactly where not to cut, with the tankage that's in there, to be able to get a crew out with the hatches jammed.

So we did work with the Kennedy people down there a number of times. I guess I only went down there a couple or three times in my career, because it was spread over several different groups of people that did that work.

JOHNSON: So you never actually got to see a launch?

STONE: Actually, I didn't see a launch until Apollo 15. I had been out on the ship up through 14, and then 15, I was part of a scientific study to look at the shock waves generated by the spacecraft as it exited the atmosphere. We actually stationed a ship, several ships, underneath the flight path of the Saturn V with very, very sensitive microphones, and once you didn't hear the rocket motors, we could actually detect—the idea was to see if you could detect the shock waves off the spacecraft as it's leaving the atmosphere. That is the only Saturn V launch that I got to see, and I was seventeen or eighteen miles offshore, so I didn't see the liftoff. I saw the fireball coming over the horizon. That's the only Apollo one I ever saw.

Then [Apollo] 16 and 17, I was actually in the Mission Control Center training to be a guidance officer. Landing and Recovery had been disbanded as a division, and we only kept the small cadre of people that were going to be going out on the last few ships, and I was training to be a flight controller.

JOHNSON: You mentioned that when you first started, you came right after Apollo 1. I think you started in June—

STONE: June 1967.

JOHNSON: —and the Apollo fire had been in January. What was the atmosphere like at the Center at that point, and did anything change for Landing and Recovery, that you were aware of, because of the accident?

STONE: What changed for Landing and Recovery was a whole bunch of changes in hardware on the spacecraft that we had to now be familiar with. The new hatch was the principal thing. Apollo 1, you couldn't get the hatch open easily, and the Block 2 hatch was something that we had to become very, very familiar with, because we had to be able to open the spacecraft from the outside, using the special tools, and if we're going to train the crew on how to get out of the spacecraft, we had to have full knowledge of the hatch and all of its failure modes and all of that.

It was a hardware change, mostly, for us, and there wasn't just a big mental reset on what you were doing, I don't think, though I guess it was really a reminder to all of us that what we were doing, even in Landing and Recovery, working around these high-energy chemicals and systems, that it wasn't the safest thing in the world that you could be doing, but it was part of history.

JOHNSON: Being from Texas, coming to Texas wasn't an issue for you like it was for a lot of people, but you were working with a lot of people that had never been to Texas before. But coming to this area and the way it was in the late sixties, what was your experience as far as moving to this area, and where did you live when you first got here?

STONE: When I first moved here, I had a cousin who lived here in Houston. He lived about at Broadway [Street], I guess. I stayed with he and his wife for a week or so, trying to figure out where I wanted to live. I got down here a week before I was supposed to report. Naïvely, I drove around where my cousin said all the nice apartments were, and there was one that says "ten minutes from NASA," and it was really a cool-looking apartment complex. It was right at the end of Park Place on Texas [Highway] 3. If you're familiar with the area, that's about fourteen miles or thirteen miles up the road, and you could might be able to make it to NASA in ten minutes at a hundred miles an hour.

But, I believed them. I didn't drive out there. So the first day I said, "Well, I'm going to give myself a little extra time," and I left thirty minutes early, because I was supposed to be at Ellington. That's where the administrative offices were was at Ellington Air Force Base, and that's where you checked in and got your badge and all of that stuff. Well, I'm sure glad I left thirty minutes early, because I just barely made it to my check-in time.

I lived in that apartment complex for six months, and then I moved to the Balboa [apartment complex] in Nassau Bay [Texas]. Then I eventually bought a house in Clear Lake City [Texas] after I got married, in '71, I guess.

JOHNSON: Well, we've been going for a couple of hours.

STONE: Oh, have we?

JOHNSON: Do you want to break for today?

STONE: Yes, I probably ought to.

JOHNSON: Okay. We can pick up there and talk a little bit more about those early days and the other missions that you worked on.

STONE: Yes, great.

[End of interview]