SRB RECOVERY SHIPS ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

JACK MULLEN
INTERVIEWED BY REBECCA WRIGHT
CAPE CANAVERAL AIR FORCE STATION, FLORIDA – 11 APRIL 2012

WRIGHT: Today is April 11th, 2012. This oral history is being conducted with Jack Mullen for the SRB [solid rocket booster] Recovery Ships Oral History Project. Interviewer is Rebecca Wright, assisted by Jennifer Ross-Nazzal. We are in Hangar AF at the Cape Canaveral Air Force Station in Florida. Thank you again for taking part of your afternoon and sharing with us your experiences and insight to your operations. If you could start by giving us a brief overview of your career and how your career brought you to be part of the operations here for the SRB.

MULLEN: I've been here for about 22 years. Prior to that, I started out in the U.S. Navy and submarine service. I worked on the Polaris, Poseidon and Trident [submarine-launched ballistic missile] programs, and when I retired I got asked to come down and go to work at the [Kennedy] Space Center. I went to work on the Air Force side in [launch] pad safety, which covers all the hazardous operations on the Air Force side of the [Banana] River, and they also cover the thrust termination systems on the Shuttle.

I worked there for probably six or eight months, and the folks that work on the Shuttle safety program invited me to come over for an interview and offered me a job. At that time it was [Morton] Thiokol [Inc.]. Thiokol had the booster buildup at the RPSF [Rotation, Processing and Surge Facility], they had the complete buildup of the whole system in the VAB [Vehicle Assembly Building], and they supported pad operations. They also had marine operations over here at Hangar AF, and supported all the personnel on board the ships and the maintenance and did the booster retrieval.

I was in safety over at the VAB for several months, and one of the gentlemen that was at site safety over here at Hangar AF was retiring. They offered me that position, so I came over as site safety at Hangar AF. I worked that position probably for seven years. Then one of the retrieval managers was retiring, and the overall postflight manager offered me the position as a retrieval manager due to my past experience in the Navy and the fact that I was a charter boat captain and ran small boats anyway. It was a natural for me to fit into that position. I'd been a diver previously, so I knew what the diving personnel were going to be doing, I knew what the ship's people were going to be doing, and I knew what the hazards were for the boosters and equipment.

I've been in that job for 12 or 14 years now as a retrieval manager, retrieval supervisor, operations manager of the disassembly process and the retrieval process. As things have tapered down, marine operations has picked up some side contract work for the Navy, for NOAA [National Oceanic and Atmospheric Administration], and several other government organizations. We've been able to support a lot of that work with some of our personnel and shipboard equipment.

Particularly the Navy and NOAA, supporting them with underwater operations, ROV operations—which are remotely operated vehicles—and dive support where we provided the ship, the [hyperbaric] chambers, and the expertise to operate that. Retrieving things off the bottom—we've got a shipboard crane and enough deck space to support winches and other equipment to do retrieval operations and recovery in different depths of water for the Navy and for NOAA.

It's kept us busy. The Shuttle launches were real busy, real hectic. We just barely had time to get maintenance on the equipment done and turn the ship around and go back out and get them, [the boosters], to where we slowed down towards the end and we were able to support other contractors.

WRIGHT: If you'll break down for us some of the duties and the tasks of the supervisor for the management for the retrieval operations.

MULLEN: Yes. We have two ships [MV *Liberty Star* and MV *Freedom Star*], and basically they're independent operations. Two boosters hit the water, so we've got a team of 10 divers on board and a retrieval supervisor. Our purpose is to retrieve the parachutes, the frustum, and the booster and then not damage the hardware while we're doing the recovery. The divers end up operating at a depth of 100, 120 feet, and it's a pretty dynamic thing. We go out in some sea states that people can't get in the water. We have to stay on board till the seas calm down, the wind calms down, whatever the case may be. Then you have to make the decisions on whether it's safe to allow people to do the work, what condition the hardware is in.

We've had boosters that were bent from hitting the water. We've had forward skirts that were just about torn off from impact, and we lost them on the towback. Ended up still recovering the booster, but our real tow points are on the front of the booster, so we ended up improvising to be able to return the hardware to port. That's a coordinated effort. You've got a dive supervisor and you've got the personnel, and you've got to walk through the process with everybody and ensure they fully understand what you want them to do. They're out in the small boat in rough sea, and you're up on the bridge watching them. They think they're doing what you want, and you hope they're doing what you want, and the end product is that you have a booster in a condition where you can tow it back and nobody got hurt.

It seems like every time we went out there was something different. The hardware may have been damaged, the boosters may not have landed the way you expected them to, the frustum ended up floating off in the middle of the night. Just an immense amount of things that made the job interesting and challenging. Parachutes at the beginning of the program cost somewhere in the neighborhood of $100,000 apiece, so they wanted to recover those and clean them and reuse those. We tried our very best not to damage them. We put floats on them. We've lost one of those or two of them in the past; parachutes have sunk the floats.

But most of our hardware has been retrieved in reusable condition. We may end up having to have the divers cut parachutes or cut lines that weren't normally supposed to be cut due to entanglement. We've had hardware break loose on the booster that wasn't expected to get damaged and managed to recover. An aft IEA is an integrated electronics box, and it gives all the commands for the release of the bolts and stuff so the booster can pop off.

We have challenges of trying to find the hardware in rough weather out there. When they launch, the weather at our site was not a constraint. The weather back here at the launch pad was the constraint. If it was nice here and it was bad there, too bad. You got to sit there and rough it out. In real rough seas the frustums land and they're not very high above the water. When you have whitecaps and everything, trying to keep track of your frustum, trying to keep track of your boosters, it's pretty dynamic.

We had one situation after *Columbia* [STS-107 accident] where they wanted to have a ship in close to shore with a debris radar on it, and the ship I was on off shore with a debris radar on it. That was fine, except it took the ship in shore like 10 hours to get out there after the booster hit the water. They're in the process of coming out, and somehow or another the boosters landed fairly close together. There's a current, and there's a wind. They were drifting together, and they were going to make contact in the water. It was one of those situations where I didn't have another boat to help me. I had divers in the water doing an inspection, and I asked them how close it was on the underwater coms [communications]. They said, "We're at six feet now and closing." So I had one of our small boats, I said, "Just hook up to the risers and start pulling," and I gave him a direction to pull.

The diver is down there going, "Okay, they cleared." I said, "How far?" He says, "You don't want to know." The aft skirts bell out—we got a good picture of it, you can see two of them real close together. It was a pretty impressive little thing. It was one of those things that you don't want the hardware to get damaged, and it would have. They weigh 186,000 pounds apiece, so if they bump into each other, something's going to get damaged. It's things like that that make the job very rewarding, but also very challenging.

WRIGHT: The way you were describing it, you have a lot going on at the same time that you're responsible for.

MULLEN: Absolutely. We've got a group back here that wants to know what the condition of the hardware is, what's going on basically minute by minute. The manager in charge of the retrieval process for both boats is calling back on the radio or sat [satellite] phone on a regular basis giving a timeline of what this boat is doing and what this boat is doing and where we're at. You're trying to keep track of logging everything, watching the people in the boats, watching the people on the deck, and watching the hardware. Plus the ship is dynamic. It's a real challenge, but you feel good when it's all done and successful. I've been privileged to have a wonderful group of people to work with. Their term is, "We made you shine again." Yes they did.

WRIGHT: You have two crews that are working close together as one. Sometimes I think people forget about how important the ship's role is in the retrieval. Can you share with us the dynamic of having the ship in the location, and what its role is in the retrieval process?

MULLEN: To start the process, we have to get close to the booster and to the frustum for photography, for video assessment we call it. The captain's in the process of putting the ship up as close as he can without entanglement or bumping anything so that the videographer can get as good and clear pictures as he can. In the process of doing that, we're getting personnel ready to put them in the water for an underwater video assessment. He's trying to minimize anything the ship will do as far as wake and moving parachutes or frustums, but he's also trying to get as close as possible for the above-water video assessment. There's a lot involved in that.

After that's done we start working to the point where the underwater video assessment is done. He's basically holding position close so we can have underwater coms. The guys underwater taking the video also have coms, so we get an assessment of what the hardware is at the same time.

After that's completed we get personnel back on board and launch small boats to do what we call parachute retrieval work. The three parachutes, inevitably one of them is going to be tangled on the booster. At least one, usually three of them. They have to work that loose, and we're trying to hold position, keep track of the parachutes as they start coming loose. While all that is going on, we're at the back station of the ship watching the booster and the hardware.

Then you've got to also monitor for ships in the area, and you've got to keep track of where your frustum is because it's usually windy and it's moving. The watch standers are keeping track of that, they're looking for other ships in the area or something else.

Then you get to the parachute retrieval. Once the parachutes are all free, they're floating with big floats on them. A small boat comes up to them, and we have what we call a retrieval line. We have to position the back of the ship as close to them as we can without running over them, but we have to pass them a line from a parachute reel on the deck. The captain has to position the ship, the ship gets into position, and we start the parachute retrieval.

Well, now we're back in another complex thing, because these parachutes are 133 feet in diameter. Every now and then one of them will open up underwater, and that's a huge drag underwater. We're trying to inhaul, and it just basically stops the parachute reels, stalls it, and we have to sit there and wait for the surge of the wave to get down to where we can inhaul a little bit more. This may take 15, 20 minutes to get a single parachute on board.

It gets dynamic if there's two of them tangled together. Both of them may be coming on board and one of them may start slipping out. You've got a rope attached to one of them, and you have control of it. The other one is tangled, but maybe it's not tangled tightly, and it may start slipping out. Then you have to worry about whether you're going to tangle the rudder or the prop [propeller] of the ship, that gets to be a problem.

There's a lot of seamanship. There's a lot of things involved. If the parachute is starting to come underneath, you can turn the thruster on and blow it back away from you. You can move the ship forward and put a little bit of drag in the water and keep it away from you. It's a ballet trying to keep everything going properly.

WRIGHT: Is that the captain's call when to do that or is that you?

MULLEN: Captain and us both. If he doesn't understand what's going on, then you have to give him direction. It's not easy realizing what condition the parachute is in unless you've actually been down on the deck and looked down in the water to see what it is. It's a learning experience for the captain, and you keep a lot of people working that way.

After we get the parachutes on board we go out for the frustum. The frustum is floating upside down in the water, the pointy end is down. It's got a parachute attached to it and riser lines. Again, this is another ballet between the back of the ship and small boat. They pass a line, we get the retrieval line, then we start cranking the apex of the parachute up onto the back deck of the ship onto the reel. Once we get that parachute onto the reel the risers are streaming out.

We're towing the frustum—we've got a special piece of hardware on the back deck called a power block. It was developed many years ago by engineers for commercial fishermen. It allows them to crank the nets with tuna and salmon and stuff like that, just crank the net up in there. The net may be a mile long, but they just keep pulling the net up and it tightens up till they've got a clump of fish that they can hoist up onto the back deck of the ship.

Well, it worked for our parachutes. Back at the beginning of the program, they got an engineer from the West Coast and he helped them design one. We kept it for 20-something years, then finally it got to the point where it wore out and replacement parts weren't working too good, so we went out and contacted the company where this engineer was. The company worked with us very closely, and I bought three brand-new ones from them that did a better job than what the old ones ever did.

We're at a point now where we've got the risers on the back deck. We have the power block hooked up to our crane, and it's powered by the crane also. We put the risers in there and swing the boom of the crane back aft of the ship, crank the risers through there and suck up any slack on the reel. Then the operator locks down and—between the captain and the supervisor—they figure out what the best course is where he's going to get the minimal movement. If it's rough out there, you can handle one movement from one direction, but if you have two movements you can't time it and control your lift.

That thing weighs 6,000 pounds approximately, and it's 12 feet in diameter, so we try and give the crane operator the best heading that we can put the ship on for him. Then he sits and does his timing, watching what's happening to the frustum in the water. We just tell him, "It's all yours. This is the best we can do." Then it's up to the training and skills that he's got to pick it up and put it on the back deck without damaging it. I think we've gotten 208 of them or so on board. STS-4 went to the bottom of the ocean, and that's probably the only set of frustums we lost. Again, that's a coordinated ballet trying to keep everything going smooth.

After that's done, it goes back to the divers' job. We have a plug we call a DOP, diver-operated plug. It fits up into and locks in the nozzle. They take it down and lock it in the nozzle, and then we give them an air hose that supplies air from the ship's compressor. We pass this air hose, they hook it up to the DOP, then we turn the air on. It blows air into the booster, which displaces water out the throat of this DOP, and 30 minutes or so after we apply air the booster starts rolling over. We monitor the water coming out of that thing until we get what we call blowby, which means that we've dewatered to the point that it can't acquire any more water, just air blows out the hose.

That's completed that process. We now have a booster sitting flat on the surface of the water, and if the wind is blowing that booster is taking off, just like a kite. So before that booster comes all the way over, if it's windy the captain is going to be backing the ship up real close so that we can hook the towline up to a tow pendant on the booster. We don't have a whole lot of room. It's like 150 feet, and the booster is already 40 feet out. That drops us down to like 110 feet, so we've got to try and join these lines together.

We have a piece of hardware called a weak link, which are two aluminum plates with holes in both ends. One set of holes is solid and the other set has got a slot cut so that it will fail at a given load. If we overload it we don't want to damage the forward skirt, so it fails and leaves the booster right there, and away the ship goes. We have to go back and retrieve it.

We have to connect that weak link and that towline together. It's usually done right there on the back deck of the ship. Here's the captain and me up there sweating this. The small boat is trying to get this towline to us, and they've got to make it up as quick as possible so that the ship and the booster don't bump. Usually while this is going on we're in the process of still blowing the booster over, meaning getting the rest of the water out.

It gives you about 10 to 15 minutes of pretty severe stress. There's not a whole lot you can do. If the booster is coming over and the wind is blowing and the guys can't get it connected back there in a timely manner—a good ship handler is really imperative. He's got to have good depth perception to be able to tell what the booster is doing and what his ship is doing. It's a teamwork thing. We've got a guy on the back deck that is monitoring the position of the booster and running the deck crew back there. It's definitely interesting. Gives you that couple minutes, and as soon as that line is connected, you can move away. Thank goodness, got a chance now to breathe.

WRIGHT: It's definitely a potential opportunity for a lot of bad things to happen at one time, isn't it?

MULLEN: Oh yes, absolutely it is. It definitely gets your attention. Keeps your heart rate up there for a couple minutes till that's completed. If you get the calm beautiful weather out there that you always want to have to do these operations that you very rarely ever get—you just back up over there, hook the lines up, dump the thing in the water, and move the ship away, because nothing's moving but the ship. But it doesn't happen that way very often.

WRIGHT: You mentioned a few minutes ago that you bought three new power blocks at some point. Were there other major pieces of equipment that you bought along the way to help the ships do the job?

MULLEN: Yes, we've upgraded. We bought new cranes for the ship, and we've upgraded the parachute reels. The parachute reels were designed basically to go on ships of opportunity. At that particular time when they were designed, they were not to exceed 2,000 pounds of pull, because they were going to pull parachutes in from the apex, which is the top, so there shouldn't be any drag. Well, they weren't on ships of opportunity. They stay here with NASA ships, and the parachutes weren't pulled in except for the first time by the apex. The rest of the time it was coming in by the risers, so that gave them a potential to open up.

They went probably to 1998 or '99 with the parachute reels at the original design, which was designed for basically a 2,000-pound inhaul. We would break gearboxes. We'd burn up drive motors trying to inhaul the parachutes, because we had well in excess of 6,000 pounds of pull. We didn't know what it was, but we knew it was in excess of 6,000. So we said, "We need to upgrade this stuff." We did some tests and flow rates, and found out that really they weren't designed for inhauling what we had for a load. We got together with ground operations design engineering—that was NASA and USA [United Space Alliance] at the time. We came up with a new drive system for them, and it replaced all of the components in the system that were failing on a regular basis. It gave us a very reliable system.

We went to where we were having to do maintenance after every launch, major maintenance on several of the reels, to where we don't do any maintenance at all. We do proof loads on them on an annual basis, but as far as replacing broken parts, we don't have to do it anymore. That went away completely. We've got very reliable systems that pull in excess of 9,000 pounds, so that fixed that.

We had a Prentice crane, which was a logging crane they'd adapted for use on board the ship, with an extra hydraulic pump to allow it to operate the power block. It was a small crane, had like a 20-foot reach, and probably a 5,000-pound lifting capacity. We got a committee together, and NASA safety and design engineering put together a package and let out bids. North American Crane up in Washington state ended up with the winning bid. They supplied us with two cranes in, I think, late 1997. We've made some mods [modifications] to those cranes but nothing major. They've had corrosion, caused problems to hydraulic cylinders, but they've been real real real reliable. We haven't had a failure that we have not been able to retrieve a frustum and other hardware. They work real good for us.

WRIGHT: Did your crews install this new equipment here ?

MULLEN: Yes, we fabricated everything here. All the mods to the parachutes reels was done by our machinists and our welders and our mechanical techs [technicians], we did all that work. Jiminy Christmas—the cranes, we modded [modified] the deck pedestal that the crane mounts on. We did the mods to that here so we could utilize the deck pedestal that we had previously. We've made mods to the ships to make the attachment to the ship of this pedestal more secure and stronger.

We sent the ships to the yards, and they had tow winches put on them to allow us to tow an external tank barge as well as the booster. The company we got was the low bidder, and we had nothing but problems for the first two or three years. Actually we still have problems with them. My guys tore the winches apart probably three times down here fixing them before they finally took the boats back to the shipyards again and manufactured new parts and made them better.

We got the SOLAS davit. SOLAS is [International Convention for the] Safety of Life at Sea. It's a Welin Lambie [Ltd.] davit like they had on the [RMS] Titanic, only an upgraded version. We got these davits for our boat on the upper deck that stays on the ship at all times. It gives them the ability to have a fast rescue boat, or if they need to run to shore or run into port, it gives them the ability to launch and recover.

Those came in from England, and we got no technical reps [representatives] or mechanics. We got them in shipping containers and took them off and built them and put them up on board the ships and got them operational. That was another one of the challenges, you feel better after you completed it. The Brits [British] are different than Americans, so we had a lot of fun putting that together. We got both of them on the ships and got them operational.

WRIGHT: What about some of the navigational type of equipment, the GPS [global positioning system] and the tracking of the debris?

MULLEN: Oh yes. Just after *Columbia* NASA decided that they really didn't know how big anything was that was coming off of the Shuttle and tank and the boosters. So they contacted Weibel [Scientific] radar company over in [Allerød] Denmark. They make a really really high-grade Doppler radar which can pick up things as small as a BB [ball-bearing ammunition], and it gives a profile of it. There's what they call a radar cross section so you can get an idea what the density of something is and what the size of it is. These radars are phenomenal. We put one on each ship, or we set one out at the impact area and one would be just at the mouth of the port. The one at the mouth of the port had a unique position because it was looking between the Shuttle and the external tank. There was nobody else in that position; nobody could see that position.

That was a pretty important radar right there, but the other part is as you're getting up high and things were starting to separate [from the Orbiter], the other radar that was out at the impact point picked up all the stuff. They've been a real big asset to NASA as far as seeing stuff. The Navy had been using these on the Trident missile program. They had one, and we went to the shipyard and determined that we needed to have a doubler plate put in the radar. Then we had to figure out somewhere to put the CONEX [connectivity exchange] box, the control station for the radar.

The Navy's radar had a 20-foot-long CONEX box that we had put down on the main deck, and it made it real hard to do anything. 20-foot-by-8-foot-by-8-foot takes up a lot of space in the middle of the working deck, because we're still doing recovery operations. We talked to the radar folks and asked them if they could reduce the size of their container, and of course they didn't want to do that because they had a nice big air-conditioned container on the back deck.

We talked them into going down to a 12-foot-long container and decided that we could mount that up on the 01 deck and secure it up there safely. It was significantly smaller, but big enough. They had their air conditioning. They had enough room for all the equipment that they required for this operation. It provided them a dry spot, secure for their equipment. We had the radar mounted to the best position that didn't interfere with deck operations and allowed them a clear view of the launch.

This goes back to another one where we're working with the captain, ship's crew, in that the Shuttle comes at us. We've got the side of the ship pointing towards the launch site because that gives it the best exposure for the radar. Well, as it comes at us and goes past, we can't see it, we've got to turn the ship. The radar will rotate, but it starts looking at the ship, so we've got to turn the ship the same speed that the radar is tracking the Shuttle coming across.

The ship causes interference. They don't want to lose any data, so we had to develop a process where we were on the right heading, right speed, right location, and turned at the right speed. We have a crane on the back deck. We don't want to shoot the crane with the radar, because that gets in the way, and we don't want to shoot the stack, so we've got this area here [demonstrates]. The ship has to turn basically the same speed the radar is tracking.

We developed that and didn't have any problems with it. It's a good process, works well. We've used it for other commercial launches and NASA's COTS [Commercial Orbital Transport Services] program with the SpaceX [Space Exploration Technologies Corporation] launches that have happened in the past, and the upcoming ones. It's the same process. We're pointing the side of the ship towards where the vehicle is going to be coming above the horizon, and as it tracks across we're going to be swinging the ship to allow them to keep tracking and not lose signal due to shooting the ship or something else solid on the aft end of the deck.

To continue moving forward on that we've got a camera system that NASA wants to try to use for this next COTS launch, the SpaceX Dragon [capsule]. It's a long-focal-length tracking camera system. They want to be able to see Dragon come loose from the second [rocket] stage and then see the protective panels that cover the solar panels release. The camera is in position, and it's got a good enough focal length to be able to see that. We built an adapter that adapts to our deck and allows them to adapt their camera and housing to it. It sits on our deck bolted in place well.

They will be just like the radar. Both of them will be swinging and tracking as the ship swings to allow them to have clear view of the sky. This is going to be a first, a prototype to make sure it works. They want to do it in the future, and there's potential it could keep the ships running out for other things for that matter. There's a lot of spacecraft and other things that they want to be able to see, and since you launch them on the West Coast or on the East Coast, they go over water so that the boosters don't fall back on populated areas. You just about need a ship to put yourself in a position to see that sort of stuff.

WRIGHT: These two ships were built in the early '80s, 1980 and '81. Do you feel that there's still a lot of use for them?

MULLEN: Yes, they haven't been overused. They may have been overstressed at times, but they haven't been overused. They're well maintained. I think that they've got a future. They spent a given amount of money back then, which seemed like a lot of money to people then, but nowadays when you look at a replacement you're looking at $30 million or $40 million. They may not need them today, they may not need them next year, but they may need them the year after. There's other organizations in the government and education areas that would love to have access to them just for a short period of time. It's one of those things where you possibly can offset the cost enough to make it not feel so bad to have a boat sitting around. They can be kept busy. Whether they're kept busy making money is a different story, but they can definitely be kept busy.

WRIGHT: They're unique how they were built.

MULLEN: Yes, they're unique for what we do. They're designed for shallow draft, which allows them to come up the river here, the water depth being probably 11-foot on the average. They can get up here to the hangar to allow them to transfer boosters and other hardware if necessary. Good docks out here, good crane support, so you can get stuff on and off.

They've been upgraded significantly since they were originally built. The 01 deck was extended locally. Our welders here and marine engineers designed and built the deck extension which comes from an 01 house right now. It comes out behind that and alongside the stack. It used to be just a tiny area, and it's been extended so now it covers up the hyperbaric chamber and allows us a lot more room for a boat to be installed up there and a davit and working space.

We took the ship to the yard somewhere around 2000. The original design allowed the ship to roll fast, which meant anything in the upper areas was taking a lot of movement, be it people in the bunks on the 01 deck or people standing watch up there on the bridge. There was a lot of quick movement, so they put a flume tank in it. It's in the port ship tank, runs across. It's baffled and it's filled with water, so it slows that roll down some. Instead of allowing it to be quick, it just damps it down. That was a really good change.

We had a bow thruster that was a complete mechanical drive, and you'd have to reverse, shift gears, go forward and aft, forward and aft, which took time. It'd start responding and then oops, we got to go the other way. So you'd have to lower the rpm [revolutions per minute], shift the transmission. We lost control; it was very very hard to keep up. We got a dynamic positioning system for the boat, which is basically a computer system that controls the bow thruster, the stern thruster, the rudders, and the main engines. The main engines, you have a set rpm but the propellers are reversible, the pitch on the blade. So you can have a propeller going forward and a propeller going aft at the same speed and make the boat turn.

We have real big rudders on the ships, so we have the ability to hold station fairly well. If you want to be over a specific spot in the bottom of the ocean you basically need a dynamic positioning system or you need to anchor. There's a lot of places you're not allowed to anchor, then there's a lot of times when we're supporting the Navy down south and it's too deep to anchor. There's a current running and a wind blowing, and the boat won't stay there. A human can't sit there and control it and keep it in spot, but the dynamic positioning system can, and it works really really well.

We went down and did a project for the Navy off of Fort Lauderdale [Florida]. We were probably in two knots of current, but the water was really really clear. We were putting devices on the bottom and aligning them going east to west. As we were doing it, it got to where you could look over the side of the boat and actually see we were drawing a straight line. The system on the ship, you dial it, tell it to move 50 feet to the east, and it moved a straight line 50 foot to the east. We'd lower the hardware down with the crane, and you kept looking back towards the shore and you could see every piece was just lined up perfectly. It was pretty interesting. It's nice to see the ship could work that well.

We've done some work up here using dynamic positioning also. It's been a great asset for the crew and for the ships, it's allowed us to do a lot of interesting things. When they go down to Key West [Florida] to support the NASA-NOAA NEEMO [NASA Extreme Environment Mission Operations] project, you can't anchor there in the park. It's a national marine sanctuary and they don't want anchors, so to be able to put people and mini-subs [submarines] in you have to have a ship that can dynamically position itself. There is a current moving down there, there are winds 20 knots or so, and it'll really move the boat. If you're not anchored, which they won't allow you to do, you have to have dynamic positioning.

WRIGHT: You began by saying that you had worked in safety for a while. What kind of safety measures or safety training do you put in place to ensure all of these operations can function efficiently and safely at the same time?

MULLEN: I guess the first way of looking at it is that we're one big happy family, so you don't want any of your people hurt, period. You just don't want people hurt. We get everybody safety briefings prior to any operation. It really doesn't matter how small the operation is, if we're getting ready to do something that has any potential to be hazardous, there's a briefing involved. People are given assignments and we ensure everybody has the proper PPE, [personal] protective equipment, to ensure that they won't hurt hands, fingers, toes, eyes, ears or heads, whatever the case may be. We do do a pretty good briefing.

The other part of that is that we look at it and try to do everything safely. If there's a way of doing it that doesn't involve a hazard, we're going to try and do it that way. When you get out in the ocean and you're lifting up heavy weights, which we do on occasion, pick up some very heavy weights and bring them on board, you're in a position where we have a safety observer that watches what's going on. And he's proactive. He's not a reactive guy. He's supposed to be, "Wait, wait, wait, wait, did you guys see this? Before you go any farther—." That's his job.

He's not supposed to, "I knew that was going to happen." That's not his job. His job is to be proactive. Everybody gets tunnel vision. You get focused in the job that you're doing, and you might not see something that's happening to the sides of you. That guy is an asset to have. All of our people are multitalented, I think; pretty well all of them are multitalented. So they know what the other guy is doing, they know what they're supposed to be doing, and they look out for their coworker, buddy, however you want to describe it.

We probably are a little on the overprotective side. If it says this thing is going to weigh 5,000 pounds, we'll have a sling good for 10,000 or whatever the case may be. We don't push the limit. We try and be as cautious and safe as we can, because other than the fact they're our friends, we don't have enough people to lose people and still complete the job in a lot of cases. We can't get somebody hurt and still finish up our job. We've got to take the same number of guys out, and the same number of guys back when we do a job. It's not fun.

Then the other part to go along with that—we're safe as we can be, but we also try to be efficient. The two are sometimes hard to put together. Everybody's, "You're pushing the schedule, you're pushing the schedule." Well no, we don't. We're trying to do it as efficiently as possible, but we want to be safer than we need to be too. Everybody in the team looks out for everybody.

WRIGHT: That's a good way of looking at it. You all are also very much hands on, in everything you do. You have lots of potential for lots of accidents.

MULLEN: Oh yes. We get in situations—recent particulars, we're working with the Navy picking up components from a simulated minefield. The boat is rocking and rolling, the wind is blowing, the seas are moving around a pretty good bit. You're picking up anywhere from 1,000- to 3,000-pound weights and bringing the stuff on board. It's not something you just grab ahold of. You've got to figure out how to get it safely over here and get a line on it, or get it tied down, because everything's dynamic. It may be round and roll around real easy, and you don't want to smash somebody's feet. Have somebody standing by with a piece of dunnage to block it so it can't roll, or a rope to secure it and stop it from swinging. We're very safety-conscientious.

WRIGHT: How does your role change when you're contracted out to the Navy or NOAA, or doing jobs that aren't part of your normal routine?

MULLEN: I shift from working in the air-conditioned bridge to working down on the deck and keeping an eye on the guys and everything that's going on down there. I've got a good mechanical background from having been in the Navy, and it carries forward here. The guys, again, are on the whole multitalented. I got crane operators, I got mechanical techs, that's the same guy. I got welders and crane operators and mechanics, same guy again. They're multitalented, and we learn a lot from some of the folks we work with. We carry a good deal of experience with us.

You get down and do a briefing on a particular job, tell the guys what you expect of them, and then things start. We may be picking something up off the bottom and they bring it up with their ROV, and then we've got to transfer that particular load from that ROV to our crane without smashing fingers or toes. Then we have to finish recovering our ROV and take that load and bring it on board the deck. There's a lot of coordination, a lot of trust. It goes back, again, to looking out for your buddy.

When you're giving directions, in a lot of cases people that are giving directions and supervising don't know that they have two ears. You only got one mouth, but you got two ears. If you got talented people and you're doing hazardous work, you need to be listening to what they say too. One guy with an ego problem that doesn't have enough sense to listen may get hurt or may get one of his people hurt.

WRIGHT: I was going to ask Jennifer, do you have a couple questions?

ROSS-NAZZAL: I have a couple that I thought I'd throw out there. When did you start planning for that next SRB retrieval? Was it as soon as you brought back the last set?

MULLEN: Yes. We do a lessons learned, figure out what we did right or wrong. Earlier on we'd take a look at our documentation, our operating procedure, and see if we had to make any changes to it. At the same time we come back in, the disassembly process starts. The disassembly process took just about every one of our people. All the mechanical techs were involved in disassembly, so we weren't doing any maintenance on our equipment, we weren't getting the ship [ready].

The ships kept the engineers down there, and they kept the officers. They could get a little bit done on getting the ship ready, but all the ground support equipment that was used for retrieval was sitting there in whatever kind of condition it was in until we got some people broke free to start doing maintenance. In the old days with the older parachute reel drive systems, the older crane, the older power blocks, stuff was broken when we came in. We had to finish up disassembly, get down there and start doing maintenance on that and get it ready to go. It was usually real close to, "Okay, we're going to get under way tomorrow," when we just finished the maintenance.

ROSS-NAZZAL: Can you walk us through your process of determining that you were ready to go out to sea and pick up those SRBs?

MULLEN: We had a checklist that we had developed. The maintenance procedures for the equipment had to be completed and bought off, then all the consumables that we had to have to support it, which was rope and lines, etc. All our hardware back on board—the parachute reel spools come off and they go to the parachute facility, so you got to get that stuff back and get the maintenance done on it, put it back on board and check it out. Had to get all your equipment back, make sure everything was ready to go.

Other than the planned maintenance that was required by our computer system—Maximo, AMOS-D, whatever the computer system was we had at that particular time—you had to verify all your equipment was in proof load if it was lifting or pulling, that all the required maintenance was on it. That's in the computer database, which was something that NASA and our guys looked at. All the maintenance had to be completed, or it wasn't certified to be ready for mission. Anything that was broke, in a lot of cases had paper written on it. We had to clear the discrepancy on that paper and certify that piece of hardware. 75% of our time was involved in doing this disassembly process, and then we had to go do the maintenance on the retrieval equipment.

We had a checklist that we would go through. There was a dive checklist, a retrieval GSE [ground support equipment] checklist, a ship checklist, then after all those were gone through you'd buy off and say that we're ready to go to sea for each ship. It was pretty complete. Every now and then something dumb would happen, like a shackle that'd be missing that shouldn't have left the boat to begin with, so why is it missing? The checklist would get more and more and more added to it. For anything new you've got to build your own checklist and hope you got enough stuff, you don't have the historical memory to look back on.

ROSS-NAZZAL: Were you guys part of the flight readiness reviews for a Shuttle mission? Was someone at the table?

MULLEN: No, we were post-flight. Our purpose in life is post-flight, so we had no impact on stopping a launch. They would consider us if it was like 25-foot seas out there. They'd say, "Well, you're not going to be on station." There's been twice since I've been here where they've sent aircraft out to spot the boosters.

ROSS-NAZZAL: Do you remember which flights those were?

MULLEN: No I don't, I'm sorry.

ROSS-NAZZAL: I just had one other question, kind of a fun question. You guys are known as the "NASA Navy." What do you guys think of that term?

MULLEN: I don't know, I never paid a whole lot of attention to it. We're also called the Yacht Club sometimes.

ROSS-NAZZAL: I hadn't heard that one.

WRIGHT: This operation is very unique. You spent so much of your life in marine operations. This one is a lot like what you've done, yet different. What do you find to be the most challenging part of the job?

MULLEN: That's a fair question. It's all good, I don't know how you'd look at it as a challenge. When the Air Force Titan blew up with an NRO [National Reconnaissance Office] payload on it, we're all sitting in class and you get the call, "Hey, you guys may be going to sea." That afternoon it's, "You're going to sea," and we're steaming out of here and heading off shore.

Everybody here is up for a challenge, so the challenge in rough seas and getting the operation done safely probably was one of the biggest things. You can get real wound up out there trying to watch people and hope people weren't getting hurt. We went from when I was first here, the little soft-bottom inflatables with outboards on them, to hard bottom boats that are heavy. The other boats you could drag around by hand, these boats weigh 2,500 pounds.

Somebody could get smashed up against the ship, fall in that hard aluminum hull, a bunch of different things.

You've got to worry about a guy falling out of a rubber boat, but he's not going to get hurt. A guy in a rubber boat calls you up saying, "Hey, the boat is sinking. What do I do?" "Get out of the boat." "Huh?" "Get out of the boat, it's not going to go anywhere." These aluminum hulls with the flotation around them, they're hard. People can get hurt. You worry about that sort of stuff. You worry about people getting hurt. I think that's probably the most challenging thing for me, is trying to ensure in the operations we're doing that none of our people get hurt.

WRIGHT: You've been here for a number of years. How many missions did you actually work for the Shuttle program?

MULLEN: I don't have any idea.

WRIGHT: The barge, did you make that journey?

MULLEN: I wasn't involved in that.

WRIGHT: Is there anything else that you can think of that we hadn't thought about asking you about that is part of your job or part of the operations that maybe we just haven't thought about asking?

MULLEN: No, it's been a unique job. It's been a lot of fun. We've had some wonderful people here, some very talented people. A lot of ideas and a lot of different work. As I said, I don't think there was a single retrieval mission that was the same as the other one.

WRIGHT: The good thing was that they all came back safe, and you got your hardware back.

MULLEN: Yes, got the hardware back in good condition the whole time.

WRIGHT: That's a good way to end the program.

MULLEN: Absolutely.

WRIGHT: Well, thank you for giving us your time today.

MULLEN: My pleasure.

[End of interview]