NASA ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT 2

JEAN WRIGHT
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is May 28th, 2024. This interview with Jean Wright is being conducted for the NASA Oral History Project in Houston, Texas. Jean is joining us from her home in Titusville, Florida. Thanks again for meeting with me this morning. I appreciate it, especially just coming back from vacation. Last time we talked, you mentioned that you had a two-hour interview with the team at Kennedy Space Center [KSC], Florida. I thought that was really interesting. You said that they were amazed by your knowledge of fabric. What were they asking you? Did you have to bring any sort of demonstrations or do any sort of sewing for them?

WRIGHT: No. You would think so. I get asked that a lot. Did you have to show proof that you knew how to sew? I guess when you apply that's kind of a given. Though I know some of the girls who started there tell me, "Well, I sewed okay." But no.

Like I said the first time I applied, I didn't hear anything. I was told they only keep your resume for six months—I tweaked my resume—but in that six months I didn't waste my time. I got on the computer. I looked up thermal protection system [TPS]. Studied everything I could about the fabrics, the threads, anything I could so that I didn't sound woefully ignorant when I did my interview.

I was just fascinated by the sewing aspect of it. Obviously everybody knows about the space suits, and I knew when you would look at samples of blankets or even photos of rockets,

you could tell there's some sort of sewing involved. I knew there was sewing. I studied everything I could: what fabrics they used, what threads they used, the terminology.

I watched NASA TV incessantly. It's funny, and I know people won't believe this but it's true. When we had all the hurricanes that hit our building, it was in 2004. We had a really bad hurricane season. We had like four or five in a row within weeks of each other. That was the tornado that spun off the hurricane and blew the roof off our building, which is why I had to work at the hangar. I was interviewed there. They were just amazed at my knowledge. I'm watching NASA TV. I found out who my boss was going to be, Kevin [T.] Harrington, when I was watching a NASA video, when they were showing the effects of what the hurricanes had done to our building and doing updates.

I remember saying to my late husband at the time, "There's my new boss. There's my new boss." He laughed, and I said, "No. You're going to think it's funny. But I just know because now I have a name of who my boss is going to be." He thought it was funny. I said to him, "No. Deep down I know it is."

I even went as far—I was sending cards to the building. I didn't know there was a mail code that you have to have for NASA mail. I would just write Thermal Protection Systems Facility [TPSF], care of Kennedy Space Center, and the zip code. They kept coming back; I didn't know we had a mail code system. Now I know what the address is for the building. I was just trying to be encouraging because I just knew deep in my heart that somehow I would be there. I would say, "Here's the ladies I'm going to be working with." He thought it was funny.

They were talking about the cleanup of the area because our building took quite a hit. You see insulation everywhere upstairs—our sewing section was upstairs—pink insulation is everywhere. The ladies were saying that the machines had locked up because salt water had gotten

in the machines. The ladies were telling me that it smelled like cat urine in there because of the humidity with our Mylar patterns. They said it was awful. When they started moving things out to the hangar—they were telling me about the spiders that were there, occasional scorpions.

It's really weird. There's a lot that goes on faith. It was something that I really wanted. Now I'm going to choke up. The two-hour interview was asking all sorts of questions about my history and what I did and what my qualifications were.

But I liken it to, and I know people think it's odd—I pretended I was at a cocktail party, meeting people for the first time. Since I was a Navy wife, you get involved with a lot of people. Me, I always studied trivia. I always read a lot because I always wanted to be a good conversationalist. I didn't want to seem ignorant. I just wanted to study a little bit of everything. That's how it was that day. They were asking me about my life, what I did before. I just felt like—I know it's silly—I was at a cocktail party trying to keep myself calm saying, "These are normal people. You're just making conversation with them." They kept saying to me, "Gosh, we're impressed that you know the Shuttle schedule, and you know so much about this." I said, "I wanted to learn as much as I could on the chance that I got to be out here."

Like I said, I was amazed. I was the first one to interview, and there were a few ladies after me. As I was leaving Kevin, my boss, who was the one that interviewed me, said to a lady named Debbie Arsenault. She was—I guess you would say the first person you see when you walk into our building. She did a bit of all trades. I wish I remembered Debbie's official position. She used to be a Sew Sister, and then she became a secretary. I remember Kevin saying to her, "I think you need to get Jean a trip out to the hangar so she can meet the ladies."

Again thinking oh, that was just a courtesy that they gave us since they hadn't hired anybody in eight years. I remember talking my head off to Debbie in the car, telling her how badly

I wanted to be there and how nice and kind she was, and how I was anxious to meet the ladies. I got the tour. I remember being amazed at all the stuff there and wanting to touch but asking, "Can I touch?" Because I knew that's flight hardware. You don't want to touch unless you get permission. Some of the things they let me touch. That was nice. Getting back in the car with Debbie, and I'm just talking her ear off about how excited I was to be there. She said, "You know what, you really are really enthusiastic about this, aren't you?" I said, "I really am."

She wished me luck when she dropped me off at my car. I was so excited. I parked probably half a mile away from the building, because I knew where I was supposed to be, but I wasn't exactly sure. Debbie said, "Where's your car?" I said, "Well, I'm way over here." She said, "Let me drop you off."

When I found out that I'd gotten the job, Debbie was the first one I saw. The first thing she said to me, when I went in the building, is "Oh, they hired you. I was hoping you were the one." That was nice to hear.

It was like my whole life history, what I wanted. I remember, I know it sounds stupid, I used to use a purple ink pen. I made a comment when I was signing my paperwork that I would probably use an untraditional purple ink pen. Kevin laughed and said, "That's my favorite color." It really was relaxed, a little stressful at first. As corny as it is to say, you realize they're just normal people too.

What I didn't know is they were not only interviewing me to be a seamstress, but we had other divisions in there. Alex Peck was another manager, and she was there. She was looking at the possibility of maybe me working for her, but I stressed that it's the sewing part that I wanted to do.

That's basically all it was. I was there for a long time. There were other ladies that they interviewed. He told me afterward, "You were the one we wanted because we had a heavy heart and sadness in this building. It was really sad after we lost *Columbia* [STS-107]. You had a bright smile, a spark, enthusiasm. We knew it somehow. I just knew you'd be a perfect fit because it was really sad here in the building, and you were just the spark I was looking for." I think that's probably one of the highest compliments I've probably ever got.

ROSS-NAZZAL: Absolutely. That's wonderful.

WRIGHT: It just seemed like everything was perfectly aligned that day.

ROSS-NAZZAL: How funny that you had seen him on TV.

WRIGHT: I know. I did. It was so funny to put a face to a name because I had seen his name come up every now and then. This sounds phony, but it's true. I literally had just turned the TV on and you know how they always have a brief description of what's going to be on the NASA video, that's when I saw "TPS Softgoods Manager Kevin Harrington." I immediately focused in on that because they had that little brief description before the video actually started, and it was literally as soon as I turned on the TV set. I said, "Wow, it's divine intervention." The timing was perfect. Yes, that was neat.

ROSS-NAZZAL: It's meant to be. Right? You had mentioned you needed security clearance for your position. I wondered if you would talk about why that was necessary, and what did that involve?

WRIGHT: What's kind of ironic about that is you know how each building has a security access code or security number outside the building? Believe it or not, our building didn't have one until two years before the Space Shuttle Program ended. People always wondered why. Even I did. I'm not kidding you. It was just a couple years beforehand. We have our badges with all the numbers on it. Someone once mentioned, "Well, they make flight hardware in this building, and there's no security number for it." We didn't have one for the longest time. For the life of me I used to remember it, I don't remember it now, but yes, because it's flight hardware.

Of course after 9/11 [attacks on the Pentagon and World Trade Center in 2001] where were in proximity to the VAB [Vehicle Assembly Building] and the Orbiter Processing Facilities [OPF]. Literally one is to the left of our building, and OPF Bays 1 and 2 are literally across the street from our building. They said were a prime target. If we had any type of terrorist activity, it would be there, especially since we built flight hardware. Obviously, it was a critical position. In my position we were considered critical skills. In fact that's how we were able to stay to the very end of the program. We even got a critical skills bonus if we stayed. Shoot, I would have stayed and worked for free! It really was such an honor to be able to be out there.

I know some people would roll their eyes, but it truly was for me. It really was. Even when I would be crawling up into her, sewing thermal barriers in those landing gear. You're just looking around going, "I'm inside of a Space Shuttle." It's just awe-inspiring.

Because we were building flight hardware and it was critical to the mission, that's why I had a security clearance. It was a two-week background check. I don't know who they asked. My interview—I think was on January—I want to say the 24th. I could go back to my email, believe it or not. I even kept my emails even though that was years ago. I still have the original email asking me to go out there for the interview. I kept that.

It was the end of January, but it was on February 14th as I mentioned earlier that I started, but it was two-weeks. It was considered critical skills and flight hardware. I guess you could say national security because we used a lot of the Shuttle to transport spy satellites into space. It was considered a critical position, yes.

ROSS-NAZZAL: I thought that was interesting. You also mentioned that you inherited Ruby's workbag. I wondered what was in that workbag.

WRIGHT: Oh gosh. Like I said, that was the reason why I got the job, because she decided to leave and transfer to another department. I think they temporarily put her in my building. It may have been in tile. It was a while ago. But she left. In our workbag we have special rulers that go down to a hundred-thousandth of an inch. We call them rulers in the civilian world, but NASA calls them scales. It's a regular ruler called a scale.

I'm going to show you this. This is from my Shuttle days. I don't know if you can see that. Right here.

ROSS-NAZZAL: Looks like a little template or something you might use.

WRIGHT: It is. It's the template. Drafters use it, but this is the kind of template that we would use. We had them for squares and circles. When we were drawing our own Mylar patterns to build the flight hardware, looking at the blueprint we used these two, mainly square ones, occasionally the round. They're drafting tools. We had to use these. If I had an inch-by-inch piece of tape I had to cut in a little square—to hold the layers together—we had to make sure everything was precise. We always had these drafting templates that we used.

Special tapes, T-pins, regular pins, kind of like a regular sewing kit. We had special pencils that we had to mark our fabric with as well. You're going to think this is funny, but it's true. When we're building the dome heat shield blankets around the engines, we had a special number two pencil that we had to use. We were running low on them, really running low. I thought gee, I'm just going to go to our local art supply store in Melbourne. I have the name. It's a number two special pencil.

I bought a few of them for the building, and I gave them to my boss. Kevin says, "Sweet gesture, but we can't use them." I go, "But it's the exact pencils that we use." He goes, "But they didn't go through the NASA chain. Yes, I know they're the exact pencils. But we can't use them because they haven't gone through the NASA process." That was a little frustrating.

I still have my bag in my closet. I kept it. The bag had to stay, but I bought a special little toolbox to store my tools. I still have it, and people say, "Oh, I'm surprised you haven't thrown it away." I go, "No. It's in my closet." Every time I open it up it just brings back memories. It just does. Yes, I still have it.

ROSS-NAZZAL: You mentioned the patterns that you would create. I was curious about this, because when we think of patterns, people who sew, we often think of a paper pattern.

WRIGHT: Tissue patterns.

ROSS-NAZZAL: Yes. You mentioned last time they were made of Mylar and you marked it with a special number two pencil. How do you cut patterns for flight hardware? Most people would use scissors. Were you using some sort of special tool?

WRIGHT: Just a regular scissor. The only time we had special scissors was if we were cutting Kevlar. We had scissors that had serrated edges on them. They were very very expensive. To save the money they would buy us a lot of cheaper scissors. We could only use them a few times. They said it was cheaper for us to use multiple cheap scissors to cut the Kevlar than it would be to buy the serrated teeth ones. I remember seeing hundreds and hundreds of scissors in the trash pile behind the building. We didn't cut Kevlar very often though.

Mylar, if you've ever gone to Hobby Lobby, they have sheets of an opaque plastic that's really somewhat thin. It's quilter plastic. It's almost the same thickness only that comes in rectangles. Ours was on a giant roll. If we were making a pattern, we would just pull out the length that we needed and just cut it. It's just cut with regular scissors.

We had so many different blueprints that we built flight hard to. Each company used a different set of symbols to build the parts, but we did have a training class every year. We would have to sew each of the kind of blankets for our trainer who at the time was Karen Bishop. She started off as a tech too.

Knowing how to read blueprints. We had a blueprint reading class that sometimes they would do more often than a year at a time, because if we had a new company the keys that we

would look at for the symbols would sometimes change. We would have to go to a new class to see what this little marking or symbol meant to them.

The process was really detailed, the prints. I always tell everybody it was like thinking in 3D because I had to visualize as I was building my blanket looking through all the layers. It's funny. It's called shown and opposite. If we built two parts and one was this way and one was that way, it wasn't left or right, it was shown or opposite. Even now I still call anything that way—even marking where the ID tag went or the internal squares of tape would be. When we were making blankets that had three layers of batting, we would have to put a layer of tape on each layer and then we would have to take a needle and go through it and make tufts like you're tying the three layers together so they don't move around. All of that has to be marked, where the stitch line is going to go, where the ID part tag is going to go, where the inner tape pieces are going to go. Everything. Like I said it's like thinking through 3D. Outside is called the cover. Like you're visualizing. You're seeing through the cover. That took some time to try and get that concept in your mind to think that way.

ROSS-NAZZAL: Can you walk me through from step one till the end how you build one of those blankets and the pattern? How did that all work?

WRIGHT: Sometimes if it was a commonly used part, we already had a pattern for it in the file. We would first check in the file drawer to see if there was a Mylar for it. If not, we had a traveler, which is basically a fancy name for a folder. Each Shuttle had a different color folder. We knew which Shuttle we were going to be building for.

Trying to remember. This is going way back. I want to say *Endeavour* was a blue folder. I think *Atlantis* was green. *Discovery* was orange, I believe. I may be wrong out there, folks. But those are the three colors I know for sure. I just can't remember right now which Shuttle was which one.

ROSS-NAZZAL: That's okay.

WRIGHT: Whatever folder that you got you could tell what part you were building for. We had a rack with all the folders that needed work to be done. We'd pull out a folder. Our boss was good about that. Whatever you were good at, that's what you kind of gravitated to. Of course if we had hot parts that had to be built quickly, you had to grab any one of them.

From there we would open the traveler and see where it was going to go. The actual print had a parts list: what fabrics and threads you would have to use. Also we had to read what they call engineering orders or EOs as we called them.

As I mentioned earlier some of these Shuttle parts of course were built from day one, so we would have sometimes as many as 60 plus pages at least to read to see again if the thread had changed, the blanket thickness had changed, the technique to sew it had changed, the seam line had changed, anything. All of that had to be read before you could proceed.

Once I understood where it was going to go, then I would go to the roll of Mylar. Pull out what I needed. Put my Mylar on the table. Study the blueprint and literally just make the exact size pattern that I needed to do marking again where the stitch line would go, where the ID tag would go, all sorts of things like that. From there once I was satisfied with what I had done, then we would call Quality over. Quality would look at it, look at the blueprint, take his scale and

measure everything, and make sure I had every marking down. Everything was done correctly. He would stamp the Mylar. Then I would stamp next to it saying that everything was good to go. Only then could I start building the part.

ROSS-NAZZAL: That's a lot of work. How long would that process take you normally? Or would it vary by part?

WRIGHT: What got tricky was the Mylar. It was probably like 54 inches across and whatever length it was. What took time was when you had a big one to do. Sometimes we would have to actually tape two Mylars together to get the size of the Mylar pattern we needed to do because the part would be pretty big. Those were generally what we call the TCS blankets, thermal control system blankets, that would be inside the walls of the Shuttle. That would be the polyimide blankets that we would do. Those generally were really pretty big because those went in the walls and in the bulkheads, any nooks and crannies of the Shuttle, but you couldn't see it because all of those are underneath all the white payload bay blankets. Again we built over 5,500 of those that you wouldn't see. Half were a few layers of stacked batting. Half of them were multilayer (over 15 thin layers) insulated blankets that we would build two together and stack them. Two blankets the same shape and stack them on top of each other.

Those for some reason were abnormally large. I remember some we were building I would say were probably at least four and a half, five feet long. That's really big for us to build a blanket to. The polyimide is not all that wide. It depends on the width or depth. We sometimes would have to do special seams or tape and overlap the polyimide together so we could build the blanket to the size that it was supposed to be.

Some of the Beta blankets, the white blankets that you see in the payload bay, we would have to seam that too but not very often. The silver polyimide film blankets were blankets that protected the astronauts from radiation. As a seamstress I was always doing research. I don't know—I just had to know everything. There's over 400,000 square holes in that film per yard. The reason why is the blankets get air inside of them. When they're coming back to Earth and they're being exposed to gravity, they squeeze back down again and the air has to leave. That's why there's all those little microscopic little holes inside the film.

It almost felt like a plastic. It was kind of slick-feeling in a way, really pretty. Like I said the original blankets were a blend of 20 percent gold for the first four years of the program. The price was so expensive. We can date the blankets by their color. The first four years on *Columbia* and *Challenger*, they built tons of gold blankets way back then. Then as they would go to California to get their tune-ups—I want to call it the OMPD, the orbiter maintenance down period, or OMMP, orbiter major modification period. They would have to go to California every few years and get a "tune-up" or modifications. They would take out those old gold blankets, hundreds of them on a rack, which meant they all had to be rebuilt to silver polyimide. I love looking at the gold ones. It's a gorgeous film. Really pretty!

I've been told NASA designates those original gold historical blankets because we know those were installed in the first two Shuttles. They were probably built I would say probably late '70s. I have a couple that were given to me. They knew I valued them, because believe it or not, when the program ended they threw all of our flight hardware tooling away. They threw blankets and so many other things away. I just feel bad about the way it was disposed of. All that stuff. I know Smithsonian [Air and Space Museum, Washington, DC] has some of those items because I spoke there a few weeks ago. An example of the tooling would be special wooden tools that we

would wrap our fabric around to build the thrusters or horse collars that lined the leading edge of the wings for Shuttle. They almost look like little works of art in themselves, because they were put together on pieces of wood. One of our engineers created them in our building.

I don't know. It's just a shame to me, such a feeling of loss. When I go back to the TPSF building every now and then they tell me, "Oh, we threw all that away." I said, "Oh, I would have taken some of them home." I still can't believe that it's been 13 years since the program has ended. I'm getting a little loose on the memory here.

ROSS-NAZZAL: You mentioned the tools, and I know last time we talked about the sewing machines and we talked about some of the scissors. What was some of the other hardware that you were using to build all of these items?

WRIGHT: That's a good question. I'm describing parts that most people would have no idea what they look like. We built horse collars. Horse collars go on the leading edge of the wing underneath the black tile, but there's a support structure. You'll see about three or four black tiles, and that's roughly the length of the support structure. It's another rectangle. Depending on how long that piece of wood tooling would be would be what panel it was going to go under. We had 22 panels on each leading edge of the wing. Each panel was slightly different in length. We had these long wooden rectangles of wood that we would build our horse collar on.

We would have to sew Inconel rectangles inside the horse collar and get that done and then drape that over. We'd have to cut it probably, oh, I don't know, maybe 10 inches high. Then we would fold the fabric in half and then put it on the top of the wooden tooling form. They're anywhere from four to five feet long and maybe four or five inches high.

Then we would baste it on the edges to the tool. Then Scotch tape and wrap it all the way around the fabric and encompass the wood tooling. Then we would hand-stitch through the tape where we had marked it at.

It had depressions in the wooden tool. We would take our fingers and press it down in the fabric so we could get that imprint of it. It's hard to describe. Then we would take a permanent marker and mark where we would be sewing at. It's got a cord sleeving at the top. It's like a tube sleeving that we fill with batting. That would be hand-sewed on the top. Again it's all wrapped around in this rectangle when we're finished. That was the wooden tool we used for that.

Those are pulled down into place. We could always tell when they were putting horse collars in because after the horse collar is done and it gets wrapped around the rectangular structure that it's going on, the support structure, we would have to take hundreds and hundreds of strings and tie little knots at the bottom of the horse collar and that part would be pulled down into place in the wing leading edge. Do you remember the show *Addams Family*? Cousin It had all that hair. We used to say we could always tell when we had installed horse collars because the Shuttle, all the way along the leading edge about a foot in from the end of the wing, was all this string hair, coming down, because we had pulled it down into place; it was very hairy. Just like Cousin It!

The other wooden tool that we pretty much used when we built the thrusters, those were oval. They had a 45-degree cut at the top and then we would take a spring tube; it's a mesh tube. Fill that with batting. Put that at the very top of the thruster. Take our fabric and pull it up and then drop it down into the center of the tube and hand-sew two rows of stitching around the top of the part encompassing the spring tube. Then from there we would paint RTV, room temperature vulcanizing, at the bottom of it. We used it for stiffening, to prevent fraying, to glue the tiles on and the blankets. We used it for everything.

We would paint around the circumference, about six inches deep. Then it would go into what we called a reverse mold. It was a giant heavy plastic mold that we would drop and wrap around the thruster and tighten. Again that was with finesse, with skill, to see how much you tightened it. We had only a 5 percent failure rate on our Shuttle parts. But when we were building thrusters, someone told me we went as high as 12 percent as our failure rate for those parts, which sounds pretty high. The finesse was when you're putting it in that reverse mold and you're squeezing it, you're feeling if the tension is even and correct. If you squeezed it too hard RTV would come up over the stitch line. We were allowed that, but I think it was less than 5 percent. We'd call that bleeding, when the RTV would bleed up over the stitch line. We were allowed to do that but the percentage that was allowed was very very small. The part could be scrapped if you squeezed it too tight, and it would come up too much over the stitch line. The other way it would be scrapped is Quality would take calipers and would measure the thickness of the RTV at the base. If it was too thin it got scrapped, if it was too thick it got scrapped. It had to be just right in that perfect, I guess, Goldilocks thickness. That's why it was a part that we scrapped more.

But it's so frustrating because it would take between three and four days for the part to dry, before we could take it out of the mold. You're wondering okay, is it going to pass inspection. Most of the time it did, but sometimes again it's if that finesse was incorrect, it wasn't. It was a tricky part. The Shuttle had 44 thrusters of various sized openings.

From there if it passed all that then it would get trimmed to roughly four to five inches from the bottom. From there it would have to be painted with emittance coating. When you look at a Space Shuttle and you see the thrusters, they look gray, that's emittance coating. We used to affectionately call that process our Pillsbury certification because each step after painting on the

emittance coating required it to be baked at two different temperatures. Emittance coating is a powdery gray glaze we would paint on to make the fabric virtually fire resistant. We would weigh the part after we put the first layer of emittance coating on and then bake it. If I remember right at 375 degrees for roughly—I'm losing track here—maybe a half an hour. Then we would take it out of the oven, put a second coat on it and weigh the part again. I think it was 175 degrees that we baked it on the second baking.

After it got the two layers of emittance coating on it, then it would get a final weigh. Quality would say, "Okay, your part at this size should weigh this much" to know that we had transferred enough emittance coating on the fabric. Again working such little detail. The part had to weigh a certain number when we were finished with it, so you know you had painted enough coating on it.

Since you like to sew, one of the things I get asked, and I love talking about this, is whenever I say sleeving, most people in the civilian world know that as piping or cording. Piping/cording is stitched into a seam for decoration. Ours were hollow tubes of ceramic fabric that we filled with batting. The tricky part was we had a fluffy batting or we had a stiff batting. The stiff batting we generally would use because it was cuttable. We could cut it to whatever thickness that was required. If the spring tube or sleeving was a half an inch around, we cut the batting to a half an inch or a quarter inch if it was a quarter-inch tube.

But the thing is I tell everybody it was a really technical process how we did it. They think ooh, it's really technical and were curious to see how it was filled. We had stainless steel worktables. We would take deionized water in a spray bottle, spray our table, put Saran Wrap on the top of the table, get out all the air bubbles, and then we would take the batting, cut it to whatever thickness it needed to be, lay it horizontally, and roll it like you're making cinnamon rolls. Roll it

that way really tight. Then we would take burnoff tape as NASA calls it, but really it's just Scotch tape. We used to joke, "Oh, it's just regular Scotch tape; NASA is probably paying $10 a roll for it, and it's only like $1."

After we put the batting in and the plastic wrap around it and wrap it as tight as we could get it, we would take the burn off tape and wrap it all the way around the plastic, encapsulating all of it until it was nice and tight, and then we would take a wire hanger, just unroll a wire hanger, tape it to the end of the roll, and then slide it through our sleeving. I say, "See how technical that was?" It's about as rudimentary as you can get, but that's how we did all of them. You would never think it was done that way, but that's how we did it.

ROSS-NAZZAL: What would you use that sleeving for?

WRIGHT: In most cases, it was to fill a gap of some sort. Every square inch of the Shuttle's surface had to be covered. We would use it if we were doing the top of a horse collar, or if we were doing a gap filler. Gap filler, when you see the white spaces between the tile, that's the batting-filled sleeving that you see. All of that work was done by hand, to sewing the sleeving onto it. The reason why we had to do that by hand was again it's little details. Even I didn't realize we went to that detail. The grams of batting were determined by what tile it was going in between. We had a formula for each gap filler. If I was putting it between two nine-pound tile I had a certain number of grams per nine-pound tile. It got complicated if I was making a gap filler between a nine- and twelve-pound tile. I'd have to add both of the numbers up and divide it by two to know how many grams of batting I would put in the gap filler.

The sleeving at the top was again done that original way that I told you. That was hand-sewn on. You're catching it with a loop stitch to sew it to the top of the gap filler. Pretend this is a gap filler [demonstrates], sleeving would be stitched on here. We would have to take it from the bottom and catch it at the bottom of the sleeving, and just continue, like a ring binder. Every inch we had to put a French knot, which is an embroidery knot.

You're probably wondering why the French knot. Quality used to call it "preventing the banana peel" effect. If I'm having wind or drag on the top of the gap filler surface, conceivably, the sleeving could peel off exposing the Shuttle skin to high temperatures. They were looking for that knot every inch because if the wind caught it and started peeling it off and it would tear—not likely but it could—having a knot every inch would prevent it from peeling and peeling the sleeving all the way off.

The sleeving is the most important because that's the thermal protection between the tiles. The side of the tile is called the sidewall. That gap filler would probably go down about three-quarters, all the way down. Say this is the tile. [Demonstrates] The gap filler would be sticking up through here, just the sleeving part of it, the cording part. Then it would come down the side of the tile. The tiles, they're vibrating as they're coming home, so it's not only padding, it protects the sidewalls of the tile but also doesn't allow heat to go in between the spaces of the tile. We made thousands of those. Some of them as teeny as maybe an inch and a half. On average some were probably I would say five, six, seven inches long. But every square inch of the tile, whatever little crack or cranny, had to have something in there to protect it from the heat.

Internally, about a quarter of the flight hardware we built had small sheets of Inconel foil in them. That would be the space equivalent of interfacing that would normally be used in home sewing. Interfacing is used to stiffen a collar or a cuff when you're making a garment. Our Inconel

"interfacing" is made of cadmium and nickel and was really thin-sharp too! We would have to wear gloves when we cut that. It's on a big roll. That's what we would use to stiffen our parts, not all of them but the majority. It's just funny using like an aluminum foil. It's a little thicker than aluminum foil, but that's what we would use for our interfacing to stiffen our parts that we built.

ROSS-NAZZAL: You worked with so many unique tools and different fabrics and threads. You were working on production, but it sounds like you were also working perhaps in the vehicle and the Orbiter Processing Facility. How much time were you spending in those locations? What were you doing over in the OPF if you were there?

WRIGHT: We didn't get called over across the street to install because they had people that would do that. But for some reason sometimes the guys across the street or the ladies would have a hard time getting the horse collar to fit and again the size is determined by the panel it was going under. So they would call us over there, and we'd have to literally take it apart on an end and try and either hand-stitch an addition on to make it a little longer or sometimes we would have to trim it to make it a little shorter. Because we built the part, they weren't comfortable with doing that so they would call us across the street. "You guys built it. We'd feel better if you lengthened it or shortened it for us." We would do that. Also, due to time constraints in schedule, we'd be called over to help.

My boss knew I was a quilter, and that I was used to working with tiny little stitches. Occasionally he would ask me to go over. The chin panel blanket is right underneath the nose; it is the hottest area on the Shuttle, a very critical blanket. It has two spring tubes on

it. Sometimes when the people would install it across the street, they would trim it too much, and the fabric would fray. He would ask me to go over there and try and see if I could selvage it. Sometimes I could; sometimes the fray-out was so bad the blanket had to be scrapped. You feel bad because you know one of your TPSF Sew Sisters built it, and all that work went for naught. It's like it passed all inspections. Then it gets across the street and—through no fault of anybody, somebody trimmed it the wrong way—it would have to be pulled out and be built again. You'd be afraid your coworker would be upset with you because then you'd think, "Oh, Kevin sent me over there to fix it," but I couldn't. I would be like, "Mea culpa. Really, I tried my best. It was frayed out so much, I just didn't have enough to sew on. There was nothing left to do."

On occasion if the OPF got a little bit behind—schedule time is important! If you're working forward or back aft, everything is timed. They have certain milestones. Things have to be done by a certain hour or day. They would ask me, another TPSF lady, to come across the street to install the thermal barriers. Now that's a long time because like I said there's 12 in each wheel well. Each of those parts take us at least three to four days apiece to build/handsew one. Then we also have to install them by hand.

I was talking to you earlier about that AB 440 neon pink thread that's the high-temperature thread that melts at 3,250 degrees; it's high melt. You'd think a high-temperature thread would be strong, but it frayed a lot. I could only stitch an inch at a time as I'm stitching the thermal barriers. I have a curved needle that I'm using. You have two spring tubes that run the length, and if you took your curved needle too deep the thread would catch on a metal a spring tube and fray inside the part, which is not good. You'd have to start all over again. Even if you didn't go that deep, and you're stitching them, the thread was so fragile that I could only stitch an inch at a time before it would fray out to almost nothing. Then I'd have to stop, knot it, bury it into the part,

and continue on. It's basically stitching an inch, stop, stitching an inch, stop, stitching an inch. These thermal barriers are four feet to four and a half feet long. Some of them are even longer than that. We have three of them: small, medium, and large widths that we're stitching all around three layers. It would take two of us roughly 18 hours to stitch them in. It's a time-consuming job.

They felt more comfortable either having me or one of my ladies at my building and one of theirs to sew in conjunction together so we could get them done. The thermal barriers would fly roughly three times. They were changed out depending on how light brown they got. We didn't want any discoloration on them at all because that shows heat is getting through a crack, and we don't want that. Again, the chin panel under the nose and the nose landing gear door area is critical and the hottest area on the Shuttle!

I mentioned earlier how we had shim plastic that I would say is probably as thin as a piece of posterboard. After we installed all the thermal barriers, the OPF crew would tightly shut the landing gear doors. Then they would place the shim plastic between the door panels to test for a tight fit. If Quality noticed any movement when the shim was being moved back and forth, we'd have to readjust the thermal barrier. If the plastic didn't move at all when they shimmied it then the thermal barriers were good to go. But you're talking something that thin [demonstrates]. That's how tight everything had to be. It's kind of awkward when you're working there because you're on a platform. I'm in a seat. I have my arm overhead, and I'm stitching. Engineers are walking all around you. You're trying to get the work done, and you're up pretty high. When I'm on the platform I'm probably up seven, eight feet in the air, not including the seat that I'm sitting in so that I can stitch.

When you're on the downside of the landing gear doors, it's easy to stitch. But then when you're standing up and you're in a really little tight area and you're trying to stitch them in it's just tough. I used to joke with people it felt like I ran a marathon after stitching them in. Because sometimes you're half crouched in there. But you're thinking wow, look where I'm at. It was exciting.

Yes, we got called over to the OPF every now and then. But it wasn't a high percentage of the time. I would say maybe 15 percent of the time, 20 percent of the time. Again it was only because we got behind in the flow schedule. But on occasion, we had odd jobs to do. I had the opportunity to repair the GOX [gaseous oxygen] hose on the pad. The pleated hose that was affixed to the beanie cap. It looked like a dryer vent hose that needed patches sewn on it as the fabric was constantly being exposed to the salt-water elements. That wasn't done very often.

Later, three of us from the TPSF were sent out to the parachute facility. As we were working on Project Orion test chutes, we jokingly referred to ourselves as the Mod Squad because we had a Black woman, Betty; Kim, who was a Native American; and me. We were a diverse group. The parachute facility asked specifically for additional help because they were getting behind in creating the chutes. We were all there for about a year working on the Orion test parachutes. That was quite a challenging time learning how to mark the ribbons and sew parachutes that were huge! So yes, on occasion we would be asked do odd jobs like that.

ROSS-NAZZAL: That's interesting. Did you ever work on the Shuttle chute?

WRIGHT: Yes, we did repair work on that. Those working over at the facility, that was mainly their job. But occasionally we would be asked to help with that. The Shuttle parachutes are forty feet across. They're bigger than what most people think.

I don't know if I mentioned earlier. We'd all be watching NASA TV when the Shuttle would be landing. Roughly 20 seconds before touchdown, the explosive pyrotechnics ignite and pull the parachute door off the back and then the chute comes out. *Endeavour* was the first one to ever have one. Everybody thinks the Shuttles had chutes from the very beginning.

Having the parachute actually helped it stop it much quicker. It actually cut, by half, the length of time it took for the Shuttle to stop. The tires from what I understand didn't hit near as hard because of that parachute. But yes, we had to repair it. We'd be watching the video or the tape of the Shuttle landing. Members of the convoy are dragging it across the runway. All of us are yelling at the TV, "Pick the darn thing up. You guys aren't the ones that have to fix it." At the parachute facility the parachute would come in a cardboard box. They would just unceremoniously dump it by the back door. That's how we knew it needed to be repaired.

Speaking of parachutes, that was interesting too. It depended on the season. It was either hot or cold. In the heat down here when we were outside rolling up the SRB [solid rocket booster] chutes we were allowed to wear shorts to work because it was very hot working outside in the summertime. Those parachutes—it almost looks like when you see a telephone company how they have their wires on a giant, it looks like a giant spool, but they're made out of wood, and they would wrap the parachutes around that. They had water constantly being poured on them. I asked why they were constantly soaked with water and was told by having them soaked with water it cuts down on the amount of abrasion when the lines rub against each other. The process was so interesting. We would go outside and watch them take the giant spools off the truck platform and

unwrap the parachutes from the spools. They would stink to high heaven, especially in the summertime, because you would find bits of wood, seaweed, dead fish, dead crabs, everything. In the summertime the work was kind of nasty because it stunk. In the wintertime our hands froze because it was so cold. People think it doesn't get cold down here. But I remember one January we got down to 19 degrees here, and that's pretty cold for Florida. That's cold anywhere, but that was fascinating.

When people ask me is everything on *Atlantis* original? I have to say, "Well, yes, except for the parachute blanket underneath her tail." We had to build a new blanket every time because of course explosives blow the door off, and it literally tumbles down the runway. That blanket would have to be rebuilt. Actually there's one main one, two, three, four, probably about six blankets total. One big one and then ones that go around the door that all would have to be rebuilt every time we had a Shuttle landing there.

Atlantis and all the Shuttles on display had to have that whole section rebuilt and put on. Those blankets are the most pristine on her. The rest of them are kind of dirty. That's the cleanest one. When I point with my pointer to that door, I'll ask people, "So what do you think that door is?" I've actually had people say to me, "Is that where the waste from the toilet comes out of?" Can you believe that? I tell you. When you're working with the public you hear everything. I was asked, "Why is Canada on the arm? Did Canada build the Shuttles?" Then I would point to the American flag, and I would say, "No. It's made here in America." Yes, you hear everything. Generally you get asked how do they go to the bathroom in space, but I didn't hear that very often. I do love hearing questions. It shows people are interested!

ROSS-NAZZAL: When the Shuttle would come back, did they ever call you over to the OPF to look at blankets? I know you said that they don't replace them that often. But would they call you in to get your guidance on whether or not they should replace a part?

WRIGHT: They were expert enough I think pretty much on that. I was not called, probably someone a little more senior was. But our boss, just as part of the benefit of the job, sometimes he would say, "Why don't you guys just go over, look at your handiwork?" He would let us go within four hours after the Shuttle had gone down Tow Way Road, which is the road from the Shuttle Landing Facility, then it would just pull into the OPF, and he would let us go over there just to take a look.

Kevin was a really good boss. He would let us go over there and just look. Sometimes, about an an hour and a half before launch, he'd say, "I want you guys to see your work. Be proud you had a part in it!" I would say, "Gosh, the launch is not for an hour and a half." He goes, "You know what, that's one of the benefits of the job. Go out there and take pride in what you did and go out there and stay out there an hour and a half." He let us do that. He was very good about that.

But to answer your question, occasionally. One time, and I'm so afraid of heights. My friend Kathy and I built a lot of the dome heat shield blankets. Those are the big blankets around the engines. They were having an issue. I don't remember specifically when, but they wanted Kathy and I to go to the pad, which was rare for us. Once it's installed and rolled out there then pretty much everything is done. They wanted us to go underneath the Shuttle, which was kind of cool. There's like a five-foot little ladder that we had to go up, and we were supposed to go underneath the Shuttle itself and inspect those big rings. Literally we were both were afraid of

heights, and we were kind of tossing a coin, so to speak, over who was going to be the one that would have to do that final climb up there.

It hadn't been determined yet when all of a sudden, these alarms go off while we're up on there. Kathy and I are looking at each other because we seldom did work on the pad itself. We're looking at each other and somebody said, "It's a fire drill; it's a fire drill. You guys are going to have to run all the way down." We're probably at the three-hundred-foot level. You got all those steps you need to run down. Apparently, they must have taken care of the issue. But Kathy and I never really got up there because literally as one of us was about to get up there the alarm went off and we both are looking at each other going, "Yes." We were scared to go up that high.

I've worked on the pad itself; I mean at the very top under the beanie cap, and that's tough enough. I don't know why this bothered us. I guess it's because you're underneath the Shuttle. You don't have a lot of space. There was not a lot of space for us to work. In fact I remember looking at it. I think we only had maybe a three- or four-foot clearance which is not that high because you have to get up there and get on your back and do the work. But someone was looking out for us because before we made the final decision who, the alarm went off. We had to get off the pad. That was kind of funny.

I found out later one of our Quality inspectors who was up there, she was probably eight and a half months pregnant, running down the steps. She went into labor the next day.

ROSS-NAZZAL: One of the things that I've read about some of the Apollo seamstresses, they talked about how they really worked as a team. When you're sewing, it's sort of a solitary effort. It seems like in your experience it was really a team effort. Would you talk about that?

WRIGHT: Yes, it was a team effort. Some of my fellow Sew Sister colleagues had been out at KSC from the very beginning of the Space Shuttle Program installing tiles when *Columbia* arrived from California. For the most part, they were very helpful. Some of them really went out of their way to help you understand the process if you didn't know what to do or how to proceed. One of our ladies downstairs used to be a tech but later became an engineer. If we really couldn't figure things out, we would go down to her in her office, and she would explain things to us. I think it was a team effort. Like I said if we're doing an MLI [multi-layer insulation] blanket, we need two of us to make the layers. For the most part like I said if I had a question most of them would be helpful.

ROSS-NAZZAL: Would you talk about the paperwork that was involved with your position? I assume there's a lot of paperwork. Maybe I'm wrong. But you're building flight hardware. I know so many people have to sign off on different parts. You mentioned the stamp that you would use. I wonder if you would talk about that.

WRIGHT: From what I understand earlier everything was done basically handwritten orders and things like that initially. Way before I started, I would say years before I started, they went to a computer system and everything was entered into the computer. Even something as basic as logging in the part you're fabricating. We had all these codes at the top of our traveler. Our paperwork was called a traveler or the part list or the paperwork we were working to. At the very top it would have these certain specifications, for each process that you need when you're making RTV or whatever.

For example, if I was building a gap filler, even something as basic as that had a lot of lines that needed to be stamped. We would have to enter each step into the computer. If I was painting RTV on it I had to go to the spec, the specification, then look at the number. I'd have to log my part into the computer to say, "Yes, I'm sending it to be RTVed. I'm RTVing it." I would have to buy it. Stamp it then. Then I'd have to go to another sheet of paperwork that had the specification: what RTV was, what mix.

So many little things. Even something like making RTV. We had two different formulas. As we built the part and we're getting ready to paint the RTV on, we had to make a mix, a pot of whatever, and mix it. We would take a little teeny aluminum pan that was maybe a half inch high. Mix up the RTV, pour a little sample of it in the pan. Then I would have to put a little parts tag on it and say what day I made it, what date, and everything else. Then we would paint the RTV on the gap filler and encapsulate everything in a vacuum bag. The little test sample to cure it so that we would know by the next morning if the RTV was properly mixed.

Every one of those steps had to be bought on the computer before I stamped it, every little thing. It depends on what process I was working. Heat cleaning even had a stamp. We're sending it to heat cleaning. Then you put it in the computer again to say, "Yes, this part now has gone to heat cleaning." There was a lot of computer steps.

But before the database they tell me all of that was done by hand and you're running up and down the steps and getting it stamped. We just had to log things into the computer to say, "I got this part done. I'm sending it to heat cleaning." Then it would go in the computer.

Sometimes you'd forget and it would clog up the system, and they would say, "Oh." It would be down to be heat-cleaned and they would go, "Oh, Jean, you forgot to stamp. Put in the computer that you had RTVed it." It didn't happen often, but like I said, there's so many little

steps. Sometimes you forget. They remind you if you forget. Sometimes the computer would not let you go past a certain line if you missed a step. It's nice to know that everything was constantly being watched, that bad parts didn't go through. We really wanted our astronauts to safely return.

ROSS-NAZZAL: I don't think people realize just how much attention is paid to each part and each step. It's not just like, "Oh, I'm just going to make this." There's so many details.

WRIGHT: Oh, there really is. Like I said, the weight of the thread to the part you're creating the fabric that you're using. Everything had to be correct. Even when we were building those horse collars, we had a gauge that we had to stick them through, and it was almost like a vise. It almost looked like a vise. Quality would be up there watching you after it was finished to make sure—because it also had RTV—to make sure it was a consistent even thickness through the whole length of the part, and you're talking five feet long.

I remember one time; I was only there for a short time, because I was working on nonflight hardware for my first two months. Soon after that I started building flight hardware. I remember probably about maybe nine to ten months working there I built my first horse collar. We built a bunch of them. We were constantly laying them on the table for Quality to put them through that vise to see if they were consistently the right thickness.

I remember I went downstairs for break, and I came upstairs. I remember Janet who was our lead saying, "Wow, someone built an amazing horse collar. It was perfect all the way across." I thought wow, that's impressive. It turns out it was mine. Maybe it was beginner's luck.

Everything had to be as perfect as you could get it. When you're talking that length to be consistent in thickness all the way across, that really is quite an achievement to be able to do that. But again it's little things like that that people have no idea. The simplest parts have a lot of steps for it to go through. I'm sure that made the astronauts happy. I mean really it did. They knew that we worked hard. We worked hard for them.

ROSS-NAZZAL: How much time did you spend with any of the flight crews? Would they come in and visit your space?

WRIGHT: They would; they would, especially towards the end. They have a tradition that they go to all the NASA centers. They usually do anywhere from a half an hour to an hour presentation of a video showing the highlights of their mission. It was at our NASA auditorium here at Kennedy. Then from there they always would come by our building afterward. It was just tradition for them to come by our building, shake our hands. That was really nice.

Steve [Stephen K.] Robinson, I really wanted to meet him because he was the one that plucked those two little gap fillers from underneath the vehicle. That's a different type of gap filler than what we built. Ours were all sewn. If you're doing an Ames gap filler like he pulled for the first time beneath a Space Shuttle, it's just ceramic fabric with ceramic paint. They're really really thin. He pulled those two. We were all anxious to talk to him because never had an astronaut been taken underneath the Space Shuttle to retrieve anything like that. They were afraid that the arm might hit the Shuttle and damage tile. They were really nervous about that, but everything was easy-peasy as they say. He just went right underneath there and pulled them out.

The thing that always gets us is whenever there's a flaw on a piece of flight hardware. In our building the first thing people will say is, "Who built the part? Who built the part?" We'd say, "It's not who built it, it's who installed it." Because all of those issues, it's installation. That's the one thing I was a little disappointed in, because to me you do the best you can. I don't like people pointing out fault. Both cases when we had the peel back on [STS]-117 of the blanket, that was probably because there was not enough RTV on it. Also in the case of Steve Robinson pulling the Ames gap fillers, there probably was not enough RTV.

All of that changed after those two incidences that it went to a higher pull they had to do. I think it used to be a five-pound pull on the gap filler and then they brought it up to eight- or nine-pound. They had mock-up sections of the Shuttle doing pull testing on different gap fillers and blankets to see. They tried to alleviate that from ever happening again. Again, it always takes something going wrong for a little bit and then they fix it. We never had issues with tile falling off really after that or gap fillers coming off or even blankets pulling back because they tried to fix all that after that happened.

ROSS-NAZZAL: Your first mission, remind me, was it [STS]-114? Was that your first mission?

WRIGHT: [STS]-114, Return to Flight. I remember hugging my boss. He probably thought what is this. I remember hugging him after my first launch, and I said, "If it wasn't for you hiring me, I never would be here." Shortly after that, maybe within a day or two after 114, there was little talking going on around. I asked a couple of my engineers, "What's going on?" They said, "Well, apparently we've lost seven small pieces of foam of the external tank again." Which of course had brought *Columbia* down. We were told there would be a hold in the program. I think it ended

up being almost six to nine months while they redesigned the ET [external tank]. I remember going up to my boss with tears in my eyes. I said, "Does that mean I'm out of a job? Because if it is, it's okay, because at least I got to be here, and I did one Shuttle launch. I'm fine with that. If I have to go, I'm fine with that."

He goes, "No, no, it's just down. We don't know how long it's going to be down. Things have got to be redone. But no, you're not losing your job." That may sound silly to somebody. I honestly thought hey, if they're stopping the program, they don't need me. We were continually building parts that whole time. It was okay. I know that sounds silly but I really thought it was going to be my first and last one.

ROSS-NAZZAL: It doesn't sound silly at all because in so many industries that's what happens. People get laid off until things ramp back up again. It makes sense.

WRIGHT: I remember how frustrated I was because when we were building parts, we got time and a half on Saturday and double time on Sunday. I think two and a half on holiday. I don't remember. But I remember Kevin would say, "Hey, we have extra work that has to be done. You guys have to stay for the weekend. Or at least Saturday." I would volunteer, and he'd go, "Well, hate to break this to you, Jean, but you're not fully certified. USA [United Space Alliance] is not going to pay the money, time and a half, for you to work on a Saturday. We need people that are fully certified. I appreciate the gesture that you want to be here." He didn't want to say, "It's a waste of money to have you here." But you know how it is. I would feel bad because I couldn't. I wanted the ladies to know it wasn't because I didn't want to. It was because he said, "It's not feasible for you to."

ROSS-NAZZAL: Did you get a chance to watch that launch? Do you have any memories of seeing that? Or were you just busy working?

WRIGHT: Yes! Never too busy to not go outside and watch a launch! Again that's where our boss would let us go. We had a tradition at our building. We have a small balcony in the back of our building. Some of us would either watch it there, and even now when I go out there, I'm always taking pictures of the balcony. I picture all of us being up there. If you go out the front door and make a left and walk down to the end of the road the VAB would be to the right, bay three would be to the left. We would walk down to the very end of that road. Even though we're probably within less than three miles there, just walking to the end of the road made you that much closer. It's silly, isn't it? You're not that much closer, but you're closer.

I remember people being in their pickup trucks, standing in the beds of their trucks. Some people would fly American flags and wave them. I remember because that was our Return to Flight. People sitting on top of their cars in the truck beds. Everybody was cheering.

I literally was just in awe because I figured I built something for her, and she's going into space. It was just the whole attitude. You'd see a few people trickle out. Then all of a sudden, you'd go out of the building, and there'd be scores of people walking to the end of the road. Like I said standing in their pickup truck beds waving flags. It was just memorable, really memorable.

ROSS-NAZZAL: I bet. What was that last mission like for you, STS-135? I think in the book [*Sew Sister: The Untold Story of Jean Wright and NASA's Seamstresses*] it mentioned that you had all signed something that went up into space on that mission.

WRIGHT: One tradition was before our work went in the Shuttle—we had the white rooms, and we all signed our names. I have a picture somewhere, and I hope I can find it someday. I remember the last time we signed inside the white room. I remember writing my name and then Sew Sisters in big letters so that everybody would know that we all had a part to do with that.

It's funny. I had to be to work at seven o'clock in the morning. I remember it landed before daylight, and I lived an hour away. I was feeling kind of sad, and I'm thinking I should go there for the last landing. But I thought you know what, I'll have plenty of time when I get there to say goodbye. I physically did not see the landing. I watched it on NASA TV before I went to work.

That day it was kind of weird. We all had on special shirts that day. We were using our big machines that day. It was really a slow day. Nothing really to do, but some of the ladies were asking me to readjust the necklines of their T-shirts to make them V-neck. I could redo their T-shirts that they were wearing that day.

It was sad and yet, I don't know, I remember they had a band out there. They were playing patriotic music, and they gave us each American flags. We had a podium in front of our building. When the Shuttle came back, they stopped it right in the road in front of our building. The astronauts all got on the platform. I was only three or four feet away from them. That was exciting to see, because they talked to us that day.

Charlie [Charles F.] Bolden was our NASA administrator then. I remember he was walking up and down shaking hands and talking and the band was playing. A lot of us ladies were out there dancing. I asked Charlie could he stop and dance with us. He looked a little shy and put

his head down and kind of shook his head no. Then he walked away for a few feet, turned around. Then he came back and danced with us. I remember that.

I would say there was sadness, yes, but it did seem like a carnival atmosphere. We stayed. We were all lucky enough to stay to the end of the program. It was successful. We didn't lose another one. It was just a feeling of accomplishment I would say. We were offered critical skills pay and paid to stay to the end. The majority of us felt like whether we didn't get paid or not, it was just an honor to be part of the program and finish it out. There was a feeling of pride and accomplishment I'd have to say, that some little girl from Michigan who never had a chance would be there. There were tears because our boss made sure all of us had our contact information, and they passed out three or four pages of email addresses and phone numbers so that we could keep in touch with each other.

But realistically as a Navy wife you're saying to yourself, "Oh yes, we'll keep in touch," and then you do for a while, and then you don't. Unfortunately a few of my coworkers have died since then. I'm still NASA-badged. I'm still allowed to go back into my building. I don't go often, maybe two or three times a year. It's kind of sad because I don't know some of the people there. Heat cleaning is still there. A couple ladies upstairs are still there, but for the most part it's all new people. I don't recognize them anymore. Half of our sewing room has been turned into an area where they mix the tile formula together which is weird because we never built tile upstairs and now they do.

That's kind of sad. When I go up there, I envision it looking the way I remember it and it doesn't look that way anymore. But the multi-needle machine, the big machine is still up there. Unfortunately, he's covered in plastic. For my book they were really nice—they actually uncovered it and got the machine all set up so I could take a picture of it to be in my book. That

was nice for them to do that. It's just sad to see that she's covered in plastic. They tell me they haven't used her in such a long time. We did use it to make SRB solid rocket booster skirts for Orion underneath that. Kathy and I worked on some of the development for that where we put Kevlar fabric and thread in the machine for the first time to build skirts for inside. Because the thought was when the SRBs kicked off it would hit the water at a much faster speed and velocity and they were afraid it would bend the metal in the SRB skirts at the bottom. We built special blankets on the inside. That was the first time we put Kevlar fabric and thread in the machine, which took to it just like a champ.

When I spoke at the Smithsonian a month ago, I ran into this woman named Christine who now is the head curator and I said, "I have a picture of the sticker on that machine. I had them look it up and there's no record of it. But they put the sticker on it about two years before the program ended."

I told her, "I really want the machine to stay here because we started building blankets and tile in our building in '87 or '88. That machine has been there since. It's a heavy heavy machine." I said to her, "You guys have enough artifacts up there. I think this machine needs to stay here at Kennedy. I know the perfect spot where it should go at the *Atlantis* exhibit." She said, "Well, you know what, yes, it probably would be expensive. We'll just consider it on loan." I said to her, "Do I have your promise? Now I need to convince the Visitor Complex if they want it."

I think that the machine is so unique. Like I said it's like ten feet tall, thirty needles. It's a machine nobody has ever seen before. That's the machine that made the quilted blankets for the exterior of the Shuttle, so I really think it ought to stay here. It ought to stay here.

ROSS-NAZZAL: It's got a great history and since you're a docent I think that's even better.

WRIGHT: It does.

ROSS-NAZZAL: I know that you're big into STEAM [science, technology engineering, arts, and mathematics]. I wondered if you would talk about why it's important for NASA to hire people with different skills, not just engineers and scientists and technicians. Why do we need seamstresses and other people to work at the Agency?

WRIGHT: You got me pegged because when I started speaking, I would have engineers come up to me and go, "I'm a good engineer." We had some. There were a few that seemed unimpressed by the technical skills or creativity we needed for our job. Maybe, because we were seamstresses, they were uncomfortable with the traditional aspect of that. I'm a big supporter of the arts. Like I mentioned earlier how they said anybody could draw. Downplaying our skills as if science and engineering was the most important skill. Honestly, there were some, very few who felt that way. Thank goodness!

I guess maybe in their eyes they don't see the relation to that. You feel a little put down when they say, "Oh, it's just women who sew." I would remind them, "Hey, we had skills. We had to know grams and precise measurements. We had to know math. We had to know a bit of everything. So no, we're just not women who just sew." My boss used to tell us all the time, "You ladies make me look damn good every day." We ladies were asked to do many challenging projects and test articles. They asked us to do special things. We won awards for NASA.

I was all right with math and science. I know some people are wired for that, and they're interested in that. But I've always been creative. I always drew. I always painted. I sewed quilts. I want people to know that NASA is all-inclusive. When I do my presentations and I show the pictures of a Black seamstress sewing an Apollo suit I have people come up to me afterward and say, "NASA actually hired Black people to work there in the '60s?"

I try to let them know that even if you're foreign-born, because my facility manager, Martin, was from England. I always tell them because even if you're foreign-born, and they want to work for NASA, "It may take a bit longer in the security clearance process, but you can work there." It's just things like that.

I think well-rounded people are, number one more interesting. I think in this world you need to know a little bit of everything. I guess part of what it is is because I didn't finish college. When I have parents come up to me and say things like "Tell us what university you graduated from so my daughter can work for NASA," and when I tell them I didn't, "I had a year but I didn't finish." They literally collapse and go like, "Oh." You can tell on their face. "She's the worst example that we could have picked." I got that often enough when I was doing my docent work at *Atlantis*. But then I would say, "But look, we need artists who draw these rockets, who draw the blueprints. We need people like me who sew to build this."

All of us have skills. Even going back to the Apollo seamstresses, if you read up on their history, the engineers had no problems with their saying, "We can do it." The ladies would say, "You can draw the prints, but we're the ones that have to sew it." They were actually schooling the engineers. You come up with this concept, but you don't know how to get that concept made. We know how to make it. You give us the idea, but we know how to do the skill. You don't know how. But this is how we relate with each other."

I guess it's because I kind of felt like an outsider. I know math and science. You have to know that. I know it's important. I do think the arts are kind of like that's usually one of the first programs that gets cut in school. I think it's just as important. They always say you can judge a society by the art in their culture, and I really believe that. Again it blows my mind that a skill I could do that's been around for thousands of years to clothe people and things like that can be used to build spacecraft. I just find people who are creative are more interesting. I think, I dare say more open-minded. Engineers are interesting in their own way. I just think the perspective is different. I want kids like me who thought "Oh gosh, I'm all right in math but it's not an interest," I want them to know that NASA looks for everybody and that even if they think they might not have a chance like I did. Obviously, it was a needed skill.

When I give my talks, I always tell them that it's not just about me. I said, "I want to open up eyes to somebody that yes, there is a possibility. Don't think you can't because you can." That's what I say.

ROSS-NAZZAL: I had read about the Apollo seamstresses working with the engineers and telling them, "This is how fabric works. This is your idea, but this is the reality of how this is going to work." Did you ever have those kinds of conversations with the engineers? Or were things pretty much set by the time you worked on the program?

WRIGHT: Kind of already set. But I think if we were finishing something as basic as a gap filler, some of them would question why we did something. Some of them didn't know of the need for a knot. We had some young Quality guys—basically we were teaching them. Their fathers had gone on ahead of them, but we would explain to them why a certain sewing technique was

used. Like if we built a part, and we had to close it with like a ladder stitch. At the end of the horse collar it's a ladder stitch, and it looks like a ladder. They would question how you would do that, or they would say, "Describe the process to me. I get what a ladder looks like, but I don't know what a ladder stitch is." We would have to show them this is how you do a ladder stitch, because some of them didn't even know. Not very often but yes, on occasion we would.

ROSS-NAZZAL: You also mentioned you won awards for NASA. Can you talk about some of the awards that your group received?

WRIGHT: A couple that immediately come to mind is when we had the issue on STS-117 and an OMS [orbital maneuvering system] pod blanket peeled back. Talking earlier, we literally had to replicate four samples of that Shuttle area for NASA—I think it was two blankets and four tile to replicate that exact section on the OMS pod that had the damage to it. That had to be done overnight. We had to refire up the multi-needle machine because we hadn't made a class 11 blanket in a while. That had to be done.

It's just funny because Kathy and I had been working on the machine at the latest part of program. It was just odd for me. I felt a little uncomfortable because I would have to tell the ladies who'd been there a lot longer than me, "Okay, this needs to be done, this needs to be done; we need to get the machine fired up again." I don't know if there was a little bit of animosity because here I was instructing them. But Kathy and I had been working on the multi-needle machine longer than any of them had towards the end of the program. Here I was saying, "This has got to be done. This has got to be finished by then." That was a little uncomfortable.

We won an award for that because our division got awards for that. We were getting emails saying, "You came through in NASA's finest hours." They said, "We can always count on you." We got awards for that.

But one in particular. Kathy and I, we worked on the Glory mission. It was CubeSats that they had. They found out this one university's CubeSat was going next to the engines. I don't know how it happened, but they realized they didn't have enough thermal protection around their CubeSatellite. It was like two months before the launch, and by that time everything is precisely weighed and balanced. If you add something that throws it off.

They came downstairs. We used to call that our R&D, our research and development, section. Kathy and I would be downstairs away from the ladies, because we had a special quiet section that we would work on. They came down and asked us to design a special blanket that would wrap around the CubeSat that would give it special thermal protection.

Because it had been balanced and weighed, we only had, I think, 130 grams. It was a very very lightweight blanket. NASA let us, I wouldn't say slide it under the specs. They realized we had to keep it close to specifications as we could. But they allowed a little flexibility shall we say. The blanket was very very thin—less than quarter of an inch thick. I would say maybe even three-sixteenths. It was very very thin. We had to build it to wrap around the CubeSat. The CubeSat is about this tall. [Demonstrates] It had to weigh very very light.

It had a door that opened. It's a container. We had one string. We had to make a flap cover. It almost looked like a mailbox. The blanket had to go over the front. We could only tie it with one thread. It had to be enough force, not tied too tight, that as the CubeSats were coming out of this structure it would pop the thread and open up the blanket.

The thing was we had to take in mind the gram weight, the thread weight. People don't think you have to keep the thread weight. We had to add up the fabric, thread, and batting weight. All had to be less than 130 grams. We did it! Just barely, but we did it. Kathy and I were able to get right where they wanted it to be the protection and the thickness and everything and the weight. Kevin our boss said, "Well, one of you two are going to have to go out to California at Vandenberg [Air Force Base] to stitch it on, to tack it onto the structure. But I don't know which one of you two I'm going to send." Finally after a couple of days he said, "I've made up my mind." I said, "Who?" He goes, "I'm going to do it."

ROSS-NAZZAL: Oh no.

WRIGHT: He went. He has pictures of him installing it. The only bad thing that happened—they had problems previously with that type of rocket. And once again, the fairing didn't come off. We didn't know if our blanket was successful because when it launched the fairing didn't break away again. It wasn't able to expose the CubeSat or the blanket. The mission was a failure.

But Kathy and I got an award because we were able to keep it to the weight that they wanted. I know some people say, "Oh, that's not a big deal." They don't know how hard it is when you're measuring everything and the seams had to be a certain width. Again I even had to figure out how many grams of thread I used. You don't think like that. But we had to for that one. Kathy and I won an award for that project. Very proud to have been able to accomplish that! We got a little check for it on our desks, so that was nice.

ROSS-NAZZAL: That's wonderful. Yes. What do you think was your greatest contribution if you had to look back over your career at NASA?

WRIGHT: Oh, that's a toughie. I don't know why that makes me want to tear up. It just does. I guess even now that some girl who thought she never had a chance at all to do that was able to reach for something that she dreamed of for so long and it actually happened. I just want kids to know that. When my son was a teenager, he would tell me, "Oh, everybody tells you if you work hard enough and whatever you'll get it." He goes, "I never believed it until the day you came home from work and said that you got the job." He said, "I never believed that until it happened to you."

The biggest accomplishment. I think whenever I look at the Shuttles, I'm able to know when I'm looking at them and I say in my mind, "Ooh, I built that part; I built that part." That's kind of cool to say. When I give tours of *Atlantis,* I can point out with my pointer which blankets I built for her. That's kind of a rush too. People ask me all the time, "Did you sign your parts?" I go, "No, we couldn't." You can tell by my stamp who built it. Again with the engine blankets when it launches and you can see her rear end Kathy and I did the majority of the blankets towards the end of the program. Yes, I say, "You can see a big blanket. Kathy did half, and I did half." That was kind of cool.

Gosh. That's hard. Like I said that I actually got to do something that I always wanted to do. I know that sounds cliche. I guess my biggest accomplishment is knowing that even though it was a small part, that I had when the astronauts would thank us for bringing them home safely you realized you did have a part in that. I would say to people, "It sounds like we're bragging, but thermal protection is the most important system on the Shuttle. It simply is." I know other people

who did other systems would kind of get upset with us. I get that. But we would always say, "Yes, but you do your engineering and that's cool. But if it can't come through the atmosphere safely then it's kind of a moot point."

I guess it was just having a part of bringing them home safely I would have to say. That's about it. Trying and studying and doing what I could do to do it. I worked hard to accomplish that every time.

I have a twin sister Joan, and I said, "My sister lives in North Carolina. She'd never move." But she used to ask me, "Do you think Kevin would have hired me?" I asked Kevin once, and he said, "Well, if she wanted to work second shift and would be willing to move yes, I think I probably would."

Again it still amazes me when I think that something that I built actually went into space. It gives me a thrill even now. Even though I know they're retired now. But sometimes if I sign something for a kid I'll say, "Keep your eyes on the stars," a child that's really made an impression on me. I have pieces of flown payload bay fabric that I bought from a collector from all the Shuttles. I will cut out a little square, and I'll say to them, "This fabric danced among the stars and someday you will too." I'll mail them. I had one woman who visited me when I was at *Atlantis* and her daughter wanted to work on the Shuttle. She said, "Is there any way possible you could send my daughter a piece of fabric for Christmas?" I said, "I'd be happy to do that for you." She lived in England. I sent it. It's okay with ITAR [International Traffic in Arms Regulation] by the way. I haven't forgotten about ITAR. Only because they tell me the program has ended and that fabric is pretty common. The Beta cloth is fairly common.

The most wonderful gift she gave me was a videotape of when her daughter opened up the present for the first time. It's nice getting thank-you notes and things like that, but to see a

videotape. She's looking at the fabric, and at first she doesn't quite realize the significance of it until her mother tells her what it is. She literally starts jumping and dancing all over the living room. She's just so excited. It's getting recognition like that that even though the program is ended. I still have people write me. I try to be encouraging when I can. When they say, "It must have been amazing to be part of the program." I tell them it truly was. It truly was.

When people ask me, "Why didn't you continue onto the other programs?" I said, "Well, there was a little bit of a drawdown." I would say, as cliche as this is, "I don't think anything could ever top my time working on the Space Shuttle. I wanted to end my working career right then with my memories."

My boss invited me to come back, but I said, "No, I'm getting older now. I've got things I wanted to do. But really, I don't think I could top my time working on the Space Shuttle." I'm content.

ROSS-NAZZAL: Did you have any major challenges in your position that when you look back over your time you would point out to folks?

WRIGHT: I'm trying to think of the phrase. They talk about imposter syndrome. Even though I was sewing for a long time and you're thinking wow, out of all these people that applied or all these people that have worked here I was selected. I'm thinking you know how to do the calculations. You know how to sew. There was just a part of me that thought after I'm there for a few months they'll say, "Oh, I made a mistake in hiring you." I even asked my boss once, "Did you ever think you made a mistake?" I think one time I goofed up on a part, and I said, "Did you

ever regret ever hiring me?" He kind of joked, tilted his head, and went, "Nah, you were one of the best decisions I ever made." That made me feel good.

I guess it's constant. You realize even now, even when the program was going and I went to the Hard Rock Cafe with my daughter and we're talking outside and she's asking me things. She said, "So how did work on Shuttle go today?" I would start talking about the Space Shuttle and literally I would say to people it was like an EF Hutton moment, the commercials where everybody stops and listens. Because as soon as I would say I worked on the Space Shuttle or talking about the Shuttle people would stop and listen. Then you'd get all sorts of questions.

The impact of that that still even kind of blows my mind. Or even now when people find out you work on the Shuttle you have a thousand questions. How was it like working on it? I like to say I really do think I'm a good ambassador for NASA. I know she gets her share of knocks. There's some things I haven't been happy with, decisions on some of the things that they've done. But overall they hire people from around the world, and they give people like me a chance. Like I said it's just you look out on the stars, and it's just amazing the things that NASA has done. To have a small part of that I still can't believe it, just amazing to me that I had a little teeny part to that.

ROSS-NAZZAL: I wonder if you would talk about why sewing is so important to NASA's space program. I don't think most people know that this art form is used.

WRIGHT: That's what it is. That's truly what it is. Like I said it's frustrating because I hear all the time, "Oh, you sewed for NASA." Ninety-nine percent if not one hundred percent of people,

"Oh, you built the space suits." I'll go, "No, that's Massachusetts and Delaware. That's not us. We built flight hardware."

But it is a good opening because they at least realize the fact that there is sewing involved. I'll give them that. I think part of what it is is again you go back to how can a skill that old and ancient be used to build rockets. Literally sewing by hand. I tell them, as I've said before, a lot of the materials we use are just too fragile to go through a sewing machine, so that's why we do a lot of handwork. The threads we use, some can't go through a machine.

We had a special Shuttle patch that was designed for us. It's shaped like the Shuttle, and it has a woman sitting, and she's hand-sewing. When it was designed for us, we asked what the meaning of it was. "You see five gold stars coming down and it's almost touching the top of the seamstress's head. Each golden star is a Space Shuttle." We say, "Our love from our hands go up to the stars to the astronauts, and their love for us comes down to touch our hands." Because when we sew, we sew with love. We know that what we're doing is important.

But I think part of what it is is it's like anything else. When my kids were little, I just wanted them to wear something different and unique. Like you said it's an art form. I just think it's just the love that you put forth. There's just an intimacy I think that when you're working with your hands whether you're a sculptor or someone working with fabrics there's just a part of your soul I think that goes into your work. I think that it's as close to transferring that to somebody else that you can.

I knew this was an important job. That's why when I bought my part (stamped) the first time it hits you like a ton of bricks that man, this gravity of it. This is official flight hardware! This is it. You know it has to be perfect.

I look at sewing as a transferable gift. It's just something I want to continue. I even tell boys who say, "I don't want to learn how to sew." I often tell them things like well, you know what, when you leave home even if you don't think you'll be sewing on a machine it's a skill to hem a pair of pants, to sew a button on. It's just a skill that's needed. It's not male or female. It's a lifetime skill.

Which brings me to a story that just hit me. I was talking to a woman at *Atlantis* and she was from England. She was a teacher, and she told me some of the boys in her class were very sexist for lack of a better word, who thought women weren't good at anything, just being a wife, whatever. She said, "I can't wait to take your picture and take a picture of the Shuttle and one of the blankets that you have. I'm going to tell him, 'Look what this lady built for the Space Shuttle. There's plenty of ladies who do this, who sew for NASA.' I'm going to make my point to him that women have skills and that they have important jobs too. Because he says that women were dumb. I can't wait to show him what you've done." It's moments like that that you think oh, maybe I am making an inroad to something. It's important to me.

Unfortunately I think in our society, I'm all for college, I am, but I'm all for trades too. If you're a plumber, plumbers make good money. Anybody who works with their hands there's skills. Yes, technical is good. I think working with your hands is just as important, whether people agree with me or not. I do think working with your hands is important work. It is, at least to me.

ROSS-NAZZAL: Do you have a copy of the special patch? Can we get a photo of it?

WRIGHT: Yes. As a matter of fact I have a box up here.

ROSS-NAZZAL: I was thinking it would be nice to attach to your transcript.

WRIGHT: In fact Valerie Neal, who was head curator, I gave one of these to her when I spoke at the Smithsonian in 2016. She has since retired. Christine, and I've got her business card, is the one who took her place. Valerie is the one that stuck the sticker on our multi-needle machine. I gave one of these to Valerie and I have a picture of her giving it to her. She says, "That's perfect because I have a bunch of patches in my drawer. I'd like to do some investigative work because I think we should do something about you guys for the Smithsonian." It never came to fruition because she retired shortly after that. But it's nice to know *Discovery*'s at the Udvar-Hazy!

ROSS-NAZZAL: I think we've exhausted my questions. But I wonder if there was anything else that you wanted to chat about.

WRIGHT: I'm just honored that I was even noticed and even got picked to do this. When I think of NASA oral histories I suppose they're just people like me because they are. But I think of people like Herb Baker and all of those people. He's from Houston. Astronauts and scientists, people like that. Careers were both of. I'm just really honored. I mean truly, as cliche as that is, that Pam [Pamela A.] Melroy thought my story needed to be told. Again getting the word out about what a special skill sewing is. It really is.

ROSS-NAZZAL: It definitely is. I really appreciate your time. I very much enjoyed both sessions. I appreciate you taking time especially right after coming off of a cruise. I'm sure you're tired.

WRIGHT: That's fine. It beats going to a doctor's appointment. I have a couple next week. I'd rather be doing this. You take care.

ROSS-NAZZAL: Thank you so much, Jean. I really appreciate it.

WRIGHT: Thanks, Jennifer. Thank you. You take care.

ROSS-NAZZAL: Have a nice afternoon.

WRIGHT: Bye-bye.

ROSS-NAZZAL: You too. Bye-bye.

[End of interview]