NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

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INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is March 22nd, 2012. This interview with Tony Carp is being conducted at the [Smithsonian National Air and Space Museum] Steven F. Udvar-Hazy Center in Chantilly, Virginia, for the Johnson Space Center Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Rebecca Wright. Thanks again for taking time out of your schedule today to meet with us.

CARP: Thank you.

ROSS-NAZZAL: We certainly appreciate it. I'd like to start by asking how you became involved in the preservation of [OV (orbiter vehicle)-101] *Enterprise*.

CARP: When we opened the Udvar-Hazy Center aviation hangar we were all very involved with the buildout. We had one large assembly project, which was the *Enola Gay* [B-29 aircraft that dropped the atomic bomb over Hiroshima, Japan in World War II], and we brought a core team of people together to do that work. Prior to that, we had not had to deal with a project on that scale. Part of the idea of *Enterprise* coming into the space hangar was that we would be able to do the work we needed to do in front of the public. That appealed to us as restorers, to be able to show what we're doing right in front of people who would be interested to watch it.

It was also the scope of the project [that appealed to us]. Rather large aircraft—spacecraft in this case—[we] really needed to have a handle on how to sequence all of that. We had a limited timeframe in which to work, and that was the same case with *Enola Gay*. A lot of the people who were involved with *Enterprise* had also been involved with the *Enola Gay* assembly project, so that's how I think we were tagged as individuals. "Let's put you on this team because you have some experience dealing with a rather large artifact and sequencing of events needed to do this type of work."

We were selected and that occurred probably January of 2004. We started to work in earnest in March of that same year. By that time *Enterprise* was in its display position in the [James S.] McDonnell Space Hangar, but none of the other artifacts were yet installed around it. The public had access to the aviation hangar, the Udvar-Hazy Center was open, but there was a barrier between us working in the space hangar and the main aviation hall. It was a barrier that simply, from safety concern, kept them out of dangerous areas. They were able to actually see us doing the work we were doing.

One thing I recall is no matter how few people were in the museum, there was always a crowd of people right there at the barrier watching what we were doing, because it was a very dynamic thing for them. The unfortunate thing about a museum like ours is everything's very static. To actually see something happening, something going on, I think the public appreciated that.

ROSS-NAZZAL: What was the state of *Enterprise* when you started working on her in March?

CARP: We pulled her in, I think it was November of 2003. When the Udvar-Hazy Center opened she was already in place but not accessible to the public. In its then current condition, [deemed] not what we felt as displayable. Most of the damage [that] had occurred to the vehicle because it was stored in uncontrolled environments and in some cases outdoors for a period of time. So our task was, in very simple terms, to ready it for display.

ROSS-NAZZAL: I understand that you were heavily involved in repairing the foam that was on the orbiter. Would you tell us about that process and what you found?

CARP: Yes, that was a surprise to all of us. Its last place of storage was in an enclosed temporary hangar on the [Washington] Dulles [International] Airport facility, which was environmentally uncontrolled and was not sealed in any way that would keep pests or birds out. During that timeframe, we believe woodpeckers had gotten in and started doing what they do on our simulated foam tiles, which completely cover *Enterprise* in any of the areas where the flown orbiters actually have the silica tiles. We just have the foam pieces.

Interestingly, the birds would peck for a while and get through to the substrate, and then once their beaks contacted that solid metal, they would stop and they'd find another area and try it again. I counted nearly 80 individual areas of damage, spread fairly evenly between the two sides of the vertical tail. Most of that damage was also up high, so repairing it required the use of an 80-foot personnel lift just to gain the access. Assessing the damage and coming up with the repair methodology was all part of my undertaking.

What I decided was that the birds were not very conscientious of creating symmetrical damage, they tend to just create damage. So the first thought was we need to make this

symmetrical so I can actually do effective repair. I decided to core out the damaged areas. The amount of pecking they had done went from about one quarter in diameter—literally, a monetary quarter—to about three and a half to four inches in diameter. I chose those sizes and used hole saws and set the depth to core out the damaged area in each of those locations, the size depending on how much [damage] the birds had done there.

Once the damaged area was cored out and made perfectly round, I went back in with a small electrical Dremel tool to clean out the residual bits and get down to the clean substrate. Then, using a fly cutter mounted on a drill press, I was able to create plugs using the original type foam that NASA had provided to us. Those plugs were then sized to give an interference fit into the corresponding areas that I had already [prepared] on the vehicle.

At that point I applied the RTV, the room-temperature vulcanizing adhesive, onto the back side of the plug, and then press fit a plug into each of the holes, and just repeated that process over and over and over. How well I fit the plugs to the cored holes varied a little bit, but I think overall the results were pretty pleasing. Certainly from the display positions you can't really pick out those areas, and there were a lot of them.

Of course the last step was to go back and paint those foam pieces to match the existing faded paint. It's not as simple as just matching to original paint. That [bird damage repair] tasking took several months, but that was toward the end of the project.

ROSS-NAZZAL: When we were talking with Ed [Edward M. Mautner] this morning, he talked about how NASA set specific guidelines for what you could and couldn't do on the orbiter, and what type of tools you could use. Was that the same with the foam?

CARP: No, because the flown orbiters don't utilize that foam, they're only dealing with the actual silica tiles. They had no real recommendation for us. They were just adamant about not going through and damaging the substrate beneath the foam. I was careful to set the depth of the hole saw so that I would stop short of hitting the actual aluminum structure, and then cleaned those out by other tooling means. The concept of how to do the repair was really my own, there was really no guidance there. I asked many of my coworkers, "What do you recommend?" and nobody had any clue how to deal with this, because frankly we just haven't had to deal with woodpeckers in any fashion before.

ROSS-NAZZAL: Have you worked on other aircraft or spacecraft restoration before?

CARP: Oh yes, I have. The underlying problem we have here at the museum as restoration specialists is you will work a project and you will learn a lot of things, and you take that knowledge and you try to apply it to your next project, but we only collect one of each [of these artifacts]. If you were doing production-type work and you find a process that works, you continue that process down the line. Not so here. You may learn some lessons from the last project, but they usually don't apply directly to the next project.

You really have to think intuitively, and each situation is so incredibly different. You're just not going to find the answers in a manual or a procedure, you really have to come up with it on your own based on all your past experiences. It's an accumulation thing. As we go along, we all tend to get a little better at our job because we remember what did work on some things and what didn't work, and you try to refine your processes.

ROSS-NAZZAL: Tell us about cleaning the orbiter. Were you involved in that?

CARP: Yes. In the beginning we started with the cleaning process as step one, which is pretty typical. I myself volunteered to deal with the vertical tail and that area. We removed a panel at the base of the vertical tail, an access panel, which allowed us to get to the mechanism which controls the combination rudder/speed brake. We hand-cranked the gearbox and allowed the torque tube to open up the speed brakes and gain access to the inside, which was really pretty filthy too. We were able to clean inside of that, then once we were done, closed it back up.

It's not really visible to the public, but our idea isn't to sweep things under the carpet. We don't just clean what you can see, we clean inside and out. We clean areas the public will never see, and the reason is longevity. You're trying to decontaminate as much as possible and make these artifacts last as long as they possibly can. Getting contaminants off is a big part of that.

ROSS-NAZZAL: Did you each take a specific part of the orbiter?

CARP: Yes, we divided into smaller teams. I worked with one volunteer, and we did everything at the tail end, including the body flap, the tail cones, and the exhaust nozzles, which are not real pieces in our case on *Enterprise*. She, [the volunteer], had a term for what we were doing, but it's not really an appropriate term—cleaning the back side [sounds nicer].

ROSS-NAZZAL: Were you involved at all with the OMS [orbital maneuvering system] pods, which I understand have really degradated quite a bit?

CARP: That was one of the other key elements of the project that I took on. Again, really no precedent for it. We knew the pods would have to be removed and taken to our [Paul E.] Garber [Preservation, Restoration, and Storage] Facility in Suitland [Maryland] and refurbished. How to do that was very unclear to us because our pods are unique. They're only mockups from the orbital maneuvering system pods; in fact they're not even capable of ferry flight. They were just simple mockups, mostly comprised of a thick aluminum base, probably about an inch thick. Then to that are attached brackets, and to the brackets are simple two-by-four [wood frames] and plywood. The outer surface was just shaped foam to get the basic shape of the OMS pods. That's what we're dealing with, but the exposure to the elements for those several years really really wreaked havoc on those [mockups] and did a lot of damage.

We knew they'd have to come off, there was no way we could properly process them in place. Fortunately for us, *Enterprise* in its aft propulsion bay is pretty well void of components. It's mostly empty. The thrust structure is in there, which is very impressive in itself, but it does allow you the access to get in there and get up to areas you need. I needed to find out exactly how our mockup OMS pods were attached to the vehicle proper. Once I determined that, started looking at methodology for removing and for slinging, attaching a rigging [system] and actually lifting the pods off the vehicle.

We did contact NASA—several locations. We talked to NASA Goddard [Spaceflight Center, Greenbelt, Maryland] as well. People thought they knew what we had, but it turns out no one could really come up with where our pods came from, who made them. "We're not even sure what you have, so we have no guidance for you." I could see that there were two lift points on the pods, so utilizing the only knowns I had, I came up with a rigging scheme to lift them,

which comprised two vertical cable drops, [one] to the forward fitting and [one to] the aft fitting. Using a spreader bar to keep those cables separated, and then bring them at the top of the spreader bar to additional cables coming into a central pick point.

The other problem was we did not know the CG [center of gravity], the weight distribution of these pods, so we weren't sure what would happen once they came loose. Would they want to tip forward or back? From the get-go we were fairly close, we were within the ballpark. We came off with the first pod, made some tweaks, came off with the second pod and got a little better. By the time we went for the installation about six months later, we had it down right and got the balance proper and they went on without any issues at all.

Because they mount at about a 45-degree angle on the vehicle, we knew there was going to be a problem lining up the bolts. For our particular pods there's four attachment bolts, one at each corner. There's just no way to hold the pod in position and get those bolts to go through, so my solution was to take two of the original bolts which were not serviceable to be used again—I replaced the hardware—and have our machinist turn them down and create alignment pins out of the original bolts. I slipped the alignment pins in the two [smaller] fittings as we came down at that 45-degree angle, and those alignment pins guided the pod onto the vehicle structure and allowed the alignment to take place. Then we attached the two upper bolts, got them in place, and then pulled the pins from the lower fittings and put the proper hardware in there [as well].

The system was untried, and no one really knew how effective it would be, but it worked out beautifully. I wouldn't change a thing. NASA Kennedy Space Center [Florida] and USA [United Space Alliance, I think] were pretty appalled at what we showed them. We showed them pictures of the installation and how simple our rig was compared to how they deal with the actual flight pods. They have a huge birdcage type structure that fits over. It's a strongback, and

it attaches at various points and allows for all sorts of adjustment. Well, we didn't have that, and we just went with the bare minimum. In the museum we always strive to do things safely, but at minimum cost, because we're not doing production. We're going to do this once, then we're never going to see it again.

ROSS-NAZZAL: Did NASA give you any schematics or manuals or anything attached to *Enterprise* when she arrived? Was there something that you could go to when you were looking at the structure to figure out how things were attached, or was it just going up and looking at the vehicle and assessing it on your own?

CARP: I think most of what we found on *Enterprise* surprised everyone working at NASA now. When that vehicle was built and when it was used for the Approach and Landing Tests, none of the people who were involved in that still work at NASA today. I know NASA is pretty good about keeping records, but putting their fingers on those records can sometimes seem to be difficult.

No one really could come up with a lot of information for us. When we said, "Hey, guess what, we found this," the reaction was usually, "Really? Wow, that's not how it is on the flown orbiters." It was more we're finding things that they were unaware of, rather than they telling us what we're apt to be seeing. There's many differences between this prototype pathfinding vehicle as opposed to the flown orbiters.

But to make it perfectly clear, this is a real Space Shuttle. It is built the same way that the other orbiters were built, has all of the structure, including the thrust structure. From my perspective, being an aircraft structures person, that vehicle not being outfitted, it's [so] unique

[that] to me to go in there and see how it was assembled. I can see how things were put together and see the structure itself, which is incredibly impressive from my point of view.

ROSS-NAZZAL: Would you talk with us about working with NASA and USA? You mentioned that you were finding things that they were surprised by. How did that relationship work?

CARP: Well, a few people from NASA came up during the course of our refurbishment. We had good rapport with them, they were very interested in what we were doing. Most of my interaction with NASA, USA is more recent, when they were here to do the preps [preparations] for *Enterprise*'s ferry flight to the Intrepid [Sea, Air & Space Museum in New York City]. For the most part we were the support team and they were doing the primary work, so that was a reversal, but we were able to offer up some information. "Did you think of this? This might be a problem for you because we encountered it as a problem," that kind of thing. There was some good interaction, very professional people. I really like the camaraderie they had and the let's focus and get to it kind of attitude.

We were the same way on our restoration team. I remember that very fondly. The core group we had—which was just four of us initially—we immediately developed this camaraderie and this feeling of we all realize the significance of what we're doing, and we're happy to come into work every day and turn to on it. As that project went on, we did have to add a few more individuals in order to keep our timetable, mostly when it came to the paint prepping, which was rather tedious.

ROSS-NAZZAL: Why don't we talk about prepping the vehicle for paint and some of the challenges that you may have encountered.

CARP: Dave [David] Wilson is our paint specialist, and he really has all the good information about the process that we used. I was more involved with the prep work, which we found to be surprisingly difficult. As it turned out, *Enterprise* had an original primer and paint coat on it when it came out of the factory at Palmdale [California]. Then subsequently, as it was moved between particular locations and put on temporary display, it got repainted several times. The very last coat we surmise was just a simple latex house paint, which was very thick and did not adhere well to the underlying paint surfaces.

I think they just needed to make it look pretty for temporary display, but when it came down to it, we had to get rid of all of that material. We're using DA, which are dual-action sanders. These are air-driven tools, and they have dust collectors attached to them so that we could do this in a fairly safe environment. As we were working we're still in bunny suits and wearing respirators, but bear in mind that this whole time we're still [in view of the] public. The public is standing off and seeing what we're doing, so we couldn't have materials flying about and getting into the air handling system. We did have to contain that very carefully.

It was a tedious process. We started out with a more mild grit paper. It didn't seem to do anything, the vehicle just seemed to laugh at it. I kept calling back to the Garber facility and talking to our paint expert, "Dave, send us more coarse paper." Eventually we wound up with 80 grit sanding paper, which is incredibly aggressive paper. He kept warning, "Well, we don't want to go dig into the substrate." I said, "Believe me, we're not going to get there."

It took a big effort to get through those layers of paint and finally get down to the substrate, and then go to progressively milder grits of sanding papers until we got a smooth finish—[this was] on the [vehicle] sidewalls, by the way—then prepped the metal and eventually painted. We used a different technique for the payload bay doors, because rather than a thick aluminum skin, those doors have a very thin facesheet and then a core and another facesheet on the other side. They're a composite. In fact NASA was rather adamant at the time—they considered our payload bay doors on *Enterprise* to be flight spare, so they didn't want them damaged in a way that they couldn't make them flight-ready if need be.

We tried several techniques that they had recommended, one of which was plastic scrapers, which did nothing. They had a few recommendations, and we tried everything they asked and really got no results so we came up with our own technique—to apply heat. We were able to use heat guns—not dissimilar to what you would blow-dry your hair with, but a more powerful version of that—and two-inch-wide metal scrapers. As we would heat the paint just in front of the scraper and push the scraper forward into the heated paint, it would bring it right off.

It actually worked very well, but as you can imagine, doing the payload bay doors with two-inch-wide scrapers meant that we needed a few more people and a lot of time. That process took weeks and weeks and weeks. We try to do all of our processes with a minimum amount of intrusion, least aggressive as possible and still get the results we need. That's what we had to come up with.

ROSS-NAZZAL: And the painting went well, after all of that effort?

CARP: It did. We were all very unsure about that. Normally these types of paints, which were donated to us from PPG Aerospace-DeSoto, are sprayed on. We did not have that option because we're already in a display facility, we're not in a restoration hangar. We knew we'd have to do the work at night anyway, but we decided that the best way to contain the fumes and eliminate overspray would be to roll the paint like you would roll the paint on your wall in your home.

Fortunately there was a material that was referred to as a roller additive that was added into the paint mix and allowed that paint to flow better using just rollers. The end result of that was, to our minds, fairly impressive. From certain angles with certain lighting conditions you can see roller marks, but if you step back, most times you cannot realize that that paint was rolled on. It does look sprayed.

It's a polyurethane paint I believe, and we used an epoxy primer. It's very durable, [and the] proper paint for the job. But also bear in mind that everywhere we paint on *Enterprise*, that is thermal blanket on the flown orbiters. So again, NASA said, "Well, we don't have painted orbiters, so we can't help you there." A lot of it we just basically had to pull our resources together and come up with solutions for these issues we were facing. It was a fun time, because that's exactly what we did. We worked as a team and bounced ideas off of one another, came to a consensus, and kept moving forward.

ROSS-NAZZAL: Tell us about working in front of the public. Normally when you work on a plane are you working in front of visitors or are you doing that in the back room?

CARP: No, unfortunately most of the restoration work does take place in an area that is inaccessible to the public. That will change soon when we reestablish our restoration shop here at the Udvar-Hazy facility, because there is now an overlook where the public can look down upon the restoration work taking place. It was different, we were all very aware that we were on public display. Myself, having come from an environment where I worked in a clean room and no one but people working on spacecraft were allowed into the clean room—it was like a fishbowl. There was always people standing around looking in, gawking.

That type of thing didn't bother me whatsoever. I can't really speak for my coworkers, but I think we liked the public engagement as a whole. There was questions. A lot of times we had to stay focused on what we were trying to do and we couldn't spend too much time answering questions, but it was from moms bringing their little kids in during the week [or] school groups. And of course die-hard aerospace fans, [who tend to] know everything about the vehicle and ask a lot of technical questions. It was all very good to see.

Our primary concern was keeping them at bay, keeping them away enough so that they weren't in any sort of danger from an OSHA [Occupational Safety and Health Administration] standard [viewpoint] as to the type of work we were doing, and I think we were effective at that. It was an enjoyable time.

ROSS-NAZZAL: You had a pretty strict deadline, I understand. How did you deal with that, since you were trying to determine some solutions to challenges you had come across and NASA didn't have the answers?

CARP: When you plan a project, you usually have a better sense of the steps that are going to be necessary. *Enterprise* was a little awkward in that regard because we didn't have a good handle on what was going to be necessary to make it "ready for display." Three simple words, but what does that mean? We did come up with a plan that outlined what we thought, the processes we would have to go through. Once we got into it, that plan had to be modified quite a bit.

The two things we did in order to maintain schedule was add more people to our core team during certain phases, mostly the paint prep phase, and we also deferred some of the actions. In fact we did go on display prior to me completing the work on the top of the vertical tail where the bird damage had occurred. I was still working nights, coming in to continue that effort to finally get that wrapped up. That did extend a little beyond our deadline.

ROSS-NAZZAL: But you were able to open to the public, and a good reaction?

CARP: Yes, and we often will do night work. As I mentioned before, the painting all had to take place at night. There were very long nights, [until] 2:00 [or] 3:00 in the morning, we're up there painting the vehicle. That's so that the paint would flash off enough so that the fumes would be contained prior to museum opening the next day. We really really wanted to be able to do the bulk of the work during public hours and let them see the process going on. So I think that was a good call.

ROSS-NAZZAL: That would have been interesting to come in and see people on the vehicle.

CARP: At that time we had scaffolding. We had contracted to have a scaffolding company come in and erect scaffolding up both sides of the vehicle and bridges across the top, so we had full access all around the vehicle. It gave it an interesting look because you can barely see it behind all that scaffolding, but there was a vehicle being worked on.

I think once all that was removed and the paint was dried and when we officially opened to the public, people were really pleased to see it. For most people they had never had the opportunity to see an orbiter at all, because the orbiters that were still being flown by NASA were never in public view. Everyone had seen them through pictures, but to actually walk up close to the vehicle and get a sense of the size of it—which is about the size of a DC-9 jetliner, [but] much heavier.

ROSS-NAZZAL: You had mentioned earlier you offered some advice to NASA as they were preparing to ferry *Enterprise* up to New York. What advice have you offered?

CARP: I needed to develop some special tooling in order to remove our OMS pods. I had taken a basic tool, which you could buy at any hardware store and had it machined to certain dimensions so it would fit into a fitting inside the vehicle. I needed to actually physically hold a nut while the bolt was being turned from the outside. I did mention that to the USA group. We looked over what they had, and as it turns out the hardware they use to attach their pods was different.

Standard tools would work for them, would fit into that little cup of a fitting inside the vehicle, which just didn't work for me. You would think common tools would be okay and

you'd be fine with that, but in those cases that's what we do, we have to design our own tooling. As I mentioned, we designed our own rigging setup to do the job.

The other issue I recall USA having recently was the fact that there was a crack in one of the false engine nozzles installed on *Enterprise*, and they didn't understand the construction of it. Helped them through that process, telling them what we found. [We] talked about the repair process, and came to a consensus about how to go about that repair. They deferred a little of that to us, just because we do more of that sort of thing than they do, and we did provide the paints for the touch-ups for that nozzle because we'd already premixed those [for] doing the touch-ups we had done back in 2004.

ROSS-NAZZAL: Are you helping in any way now with the *Enterprise*, now that you're getting close to ferry ops [operations]?

CARP: All of the preparations have been completed. I was here on site during that timeframe, which was just last month. Mostly in a very supportive role, logistically driving forklifts and moving crates, so I was not at the forefront by any means. Acting as escorts for them and answering any questions they may have had. And keeping the public at bay, although we would allow as much public access as practical given whatever operation they would have to be doing that particular day. We were always moving barriers around to allow the public to get as close as practical.

Also we, as the museum staff, were engaging the public so that NASA and their contractors weren't having to answer a bunch of questions. There seemed to be a lot of interest

being built up. My feeling is when this transfer takes place that it's going to be a really big deal, maybe the biggest deal that's happened here since we opened back in 2003.

ROSS-NAZZAL: How do you feel about *Enterprise* leaving now that you've done so much work on it?

CARP: That's the big question, that's the question I've been asked more than anything. I feel good about it. Yes, it was a big effort, and I put a lot of time and blood, sweat and tears into it. But I think as a museum, as a repository for everything that NASA has flown and human spaceflight endeavors and wanting to preserve those for posterity, the Smithsonian is the proper place for that, and [OV-103] *Discovery* is certainly the flagship of the flown orbiter fleet. I think we're getting the right vehicle to replace *Enterprise*.

Enterprise has a unique story in itself, especially with the Approach and Landing Tests. Back then you couldn't do it all on the computer and just know it was going to work the first time. You actually had to go out and fly the vehicle and say, "Well, it's a 150,000-pound glider. Is it really going to work, are we going to be able to do this?" *Enterprise* validated that process. I'm proud to have worked on it, [to have been given] the opportunity to work on it. I was very excited to get the assignment, and I'm excited that it's going to be going up to New York and be seen by millions more people. Though they won't know it, they'll be looking at my work. I'm quite pleased about it.

ROSS-NAZZAL: Do you plan to travel up to New York at some point in the future to see her in her final resting place?

CARP: I think that's a good idea. I have no immediate plans for that, but I think I'll have to make a go of that. Of course it may be some period of months or years before they actually have it on permanent display.

My understanding is they will keep the Approach and Landing Test configuration, which is the tail cone and the ALTA pods, the Approach and Landing Test [Article] pods. I had to once again remove our mockup OMS pods just last fall, so that NASA could install the Approach and Landing Test ferry pods. They dug those out of someplace in [NASA] Dryden [Flight Research Center, Edwards, California], which no one had seen in decades.

I think the Intrepid may have a little work to do because the paint on those, especially on the tail cone, is a little tattered and doesn't match up with the paint effort that we put forth on *Enterprise* proper. If we'd had those pieces I think it would have been a nice display for us, but at the time no one really put forth any effort to find them. They literally didn't know where they were for the longest time.

ROSS-NAZZAL: Do you anticipate that you'll be doing any work on *Discovery* when she comes in? We know you're not going to restore her.

CARP: No, I think *Discovery* will be ready to display. It's just a matter of pulling it in, situating it. The one thing we as the museum need to do is get it up on its display stands, and we do that to keep the rubber of the tires off [the] concrete. That is for long-term preservation of the tires themselves, the rubber. Not having the weight of the vehicle loaded onto the tires, we can decrease the pressure of those tires and make them last that much longer. Other than that, the

exhibits design department will have a lot of work to do in creating new signage and so forth, but as far as vehicle prep it should be pretty well ready to display.

ROSS-NAZZAL: Rebecca, do you have any questions for Tony?

WRIGHT: I just have a couple. You were talking about getting all of the old paint off before you put the new paint on. Did you have to treat that surface in any way?

CARP: Yes, we used an Alodine [chromate conversion coating] process to treat it. On the payload bay doors it was a wash which required no rinsing, and on the side panels in some areas we were down to the bare metal substrate. In other areas we got it to the basic first coat of primer and it was smooth, so we didn't feel like we had to strip right down to bare metal. We just needed a good smooth surface. The bare areas of the metal were prepped with an Alodine process before we reprimed everything. Of course everything got the epoxy primer coat prior to the topcoats.

WRIGHT: We understand the decision was made to restore it back to how you received it and not its original paint, is that correct?

CARP: Yes, Ed was our lead on this. We were all pretty equal as restorers, but you have to tag somebody as the lead, so Ed got that. He dealt with those kinds of issues. I can't really say with any authority how that decision process came about.

WRIGHT: I can see there'd be some discussion.

CARP: Oh yes, absolutely. Mostly through the curator. Ed represented us on that discussion, and there may have been others involved as well.

WRIGHT: When *Enterprise* leaves, will she have a tool bag of specially designed tools to take with her?

CARP: Yes. We'll offer Intrepid our knowledge, our documentation—I have outlined all of those processes step by step—the special tools that I had used. Although our mockup pods won't have to go. We have no idea what to do with those, they have no use for us anymore. We're donating some of the leftover paints we had and the special mixes. When we mix paint to match our simulated tile, we're mixing it to match the faded paint. It's unique to that, so it's good that we can provide them that if they need to do touch-ups.

ROSS-NAZZAL: Is there anything you want to look at in your report? I think we've answered all the questions that I had come up with.

CARP: No, I think that covers most of my tasking.

ROSS-NAZZAL: Well, thank you very much for your time this morning.

[End of interview]