ORAL HISTORY TRANSCRIPT

RANDY H. BRINKLEY
INTERVIEWED BY RICH DINKEL
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DINKEL: This is Rich Dinkel. The time is 7:52, Sunday the 25th of January, 1998, at 37,000 feet [unclear] that I have with me Randy Brinkley, and we're going to talk today about STS-61 and the first Hubble Space Telescope Servicing Mission. I'm going to break with normal format here, and read from a news release of the National Aeronautic Association of 1 March 1994 entitled "The Hubble Space Telescope Recovery Team Wins the 1994 Collier Trophy," which includes the following information: "In March of 1994, the National Aeronautic Association announced that its 1992 Robert Collins Trophy would be awarded to the National Hubble Space Telescope Recovery Team for outstanding leadership and [unclear] and a renewal of public faith in America's space program and a successful orbital recovery and repair of the Hubble space telescope. Representing the [unclear] 1,200 men and woman directly involved in the mission, the seven-person astronaut crew sent on Mission STS-61 and four ground managers were named as the recipients. It is true by all assessments of the participants and the observers, [unclear] greatest achievement."

Well, Randy, I know that you were one of the recipients, one of the ground-people recipients of that prestigious award. Let's come back to that a little bit later.

You were the mission director of Space Shuttle Flight Number STS-61, the first servicing mission to the Hubble Space Telescope, and this is very important to NASA. Can you reflect back and tell us why it was so important in that particular juncture in the history of NASA?

BRINKLEY: Well, there was a great deal of public skepticism because of the state of the optics on the Hubble, and it was characterized in the press as NASA's big challenge in terms

of credibility. The new administrator, [Daniel S.] Goldin, and the [unclear] to fix the Hubble was critical in terms of reestablishing NASA's credibility with the American people, as it was described. So there was a great deal of public interest and a great deal of skepticism and criticism going into the flight itself.

Mr. Goldin, as a newly-assigned NASA administrator, wanted to put together a different team, a team that would pull together the resources across centers and institutions. In sessions with Tom [Thomas P.] Stafford and George [W. S.] Abbey and the folks who had been involved in the Apollo Program, the recommendation from General Stafford, who had been tasked to head the review group for the Hubble mission, was that they needed to go back to the establishment of a mission director as was done in the Apollo Program in order to bring to bear and focus the resources for this critically important mission for NASA.

I was selected as the mission director for that, and my responsibility was to coordinate the efforts across centers and institutions to ensure the safe and successful execution of the mission. That was a broad charter, but my job was to make sure that the telescope itself was ready for the mission and would successfully operate on orbit, as well as ensuring that the crew was trained on the Shuttle and the Shuttle Program had done everything to ensure mission success.

The mission director really was the coordinator of efforts across Code M and Code S, Space Science and the Office of Space Flight and across centers—Marshall [Space Flight Center, Hunstville, Alabama], Goddard [Space Flight Center, Greenbelt, Maryland], Johnson [Space] Center, Kennedy [Space Center, Florida]—and across programs, both the Hubble Program as well as the Shuttle Program, to ensure that we were bringing to bear all the resources and priorities that would ensure mission success.

DINKEL: As I read through the literature, I get the distinct impression that there are many people inside of NASA that really strongly felt that the future of the agency depended upon the success of the first servicing mission. Would you care to comment about that?

BRINKLEY: Well, [unclear] Washington, and sometimes it may not have been fully appreciated. At the lower echelons, when I first went into the mission, it was viewed as just another mission, and the Shuttle Program is very proud of their success in each and every mission and felt like that there was not a need to have this additional focus. However, Major General Jeff Pearson [phonetic] was the associate administrator for Code M, and he directed it based on Mr. [Daniel S.] Goldin's insistence that we need additional focus, and that was what transpired.

The additional focus was required to pull together the efforts of the geographically displaced and different jobs and different programs worked at different space centers [unclear], as opposed to what happened previously in the Hubble mission, why it didn't work the first time it went up or [unclear] the mission was the number of EVA [Extravehicular Activity] or space walks required to be able to make the changes in the on-orbit equipment. That in itself was unprecedented. We had six EVAs, which far exceeded anything NASA had ever done before. The previous experience on the [unclear] was somewhat disturbing to Mr. Goldin, and so we knew the task ahead was going to be very challenging.

Also, the change-out of the various instruments is very critical, with literally hundredths-of-an-inch clearance between the instruments, and each instrument was very, very sensitive, sensitive to light, sensitive to dust or any kind of orbital debris. So there clearly were challenges that NASA had not really had to deal with in any prior mission. So it represented a major, major challenge for NASA and also represented activities that had before not been nearly as expensive as what was successfully executed on that particular mission.

DINKEL: I know you can't mention everybody, but let's run through a list of the basic players that you worked with or who you felt were instrumental in the success of the mission.

BRINKLEY: Well, first and foremost, it would be Joe Rothenburg [phonetic], who was the Hubble Space Telescope project manager. Joe has done a superb job in terms of his understanding of Hubble and what needed in preparation of the replacement [unclear] and the science instruments that had to replace the instruments on orbit.

Frank Cepollina, who was chief engineer at Goddard and is an institution in himself, was someone who was very colorful and I'll remember very well and fondly.

On the Johnson Space Center, Milt [J. Milton] Heflin, who was the flight director, Milt now is the deputy of the EVA Project Office and certainly continues to use his expertise in EVAs in preparation for EVAs on the International Space Station. In fact, the whole EVA team is now focused in that office and focusing on the unprecedented EVA task ahead of us on the International Space Station.

The crew, Dick [Richard O.] Covey and Ken [Kenneth D.] Bowersox, Claude Nicollier, Kathy [Kathryn C.] Thornton, and Story Musgrave, also Jeff [Jeffrey A.] Hoffman, and, certainly not least, Tom [Thomas D.] Akers, who's the heart and soul at NASA, as far I'm concerned, I spent a lot of time with them. Someone else that I will never forget is Rick De Leon, who was responsible for processing of the Endeavor, who now works for me in Space Station Hardware Integration Office at JSC. Tip gave us a great Shuttle and took me under his arm and taught me a great deal about the Shuttle and about getting ready for flying the mission. So there were a lot of people involved across centers.

I would be remiss if I didn't talk about the folks at Marshall with their NBL [Neutral Buoyancy Laboratory] and the [unclear] preparation and how critical that was to being able to do [unclear] and integrated sims in the water, [unclear] with the folks at JSC.

DINKEL: Okay. That's great. We've got a lot of area to cover here, so what I think I'll do is I'll just mention a few memory joggers here and you could make a few comments. We do a report at the end of the mission [unclear] breaking into [unclear] subcultures. Would you like to comment on that?

BRINKLEY: Well, one of the things we found, that everybody was building their own EVA tools. We had tools being built at Goddard. We had tools being built at Johnson Space Center. So we had more tools than we knew what to do with and more than the crew could [unclear]. So one of the lessons learned from there is we established an EVA Project Office at Johnson, responsible for EVA tools. That clearly was something that I got in the middle of, as, you know, establishing priorities in terms of which tools were going to do what and bringing to bear a better coordination between the various centers in support of the mission itself.

There were also a lot of other activities, interrivalries between institutions—the Johnson Space Center with [unclear] and Neutral Buoyancy Facility [unclear] Marshall, and we had to overcome a lot of institutional issues in order to focus all the resources across NASA on the success of the mission.

DINKEL: A very related subject, the importance of mission planning.

BRINKLEY: Well, I think, first of all, the EVA end of it was new, and we needed to establish facilities. There was a reluctance to dedicate the resources to fit an arm in the tank, the water tank, at Marshall, and I insisted on that. And also I insisted on establishing an audiovisual link back to Johnson so that when we did integrated simulations, we could do so with the

crew in the water, processing the task with the Hubble mock-up to get a better fidelity of time lines and procedures and training as an integrated team.

For me, this is something that I have learned in my previous life. It was something that had not been done. It's something that we have since built on with the development of the [unclear] Training Facility and neutral buoyancy lab that gives us the capability to do truly integrated and end-to-end training. And that, I think, was a great contributor to the success of the mission itself.

The other thing that we did is, our simulations included participation by top-level management, by myself, and formalizing the debriefs of the simulations in terms of lessons learned, things that had not really been done in the past, and actually exercising the mission management team during the sims was not something that had normally been in the Shuttle Program. It's something that we did for the Hubble, including Jeff Pearson, who came down as the [unclear]. Joe Rothenburg, as the project manager, always participation in the sims. We even had the center director at Goddard come down.

So when we went to fly, everybody was very familiar with what it is that we were going to do. They didn't sit up and drink coffee. They knew each day, each EVA, what the team was trained to do, and that is the same approach that we want to apply to the International Space Station.

DINKEL: The Marshall neutral buoyancy simulator, [unclear] which you've already discussed, and the [unclear] issue.

BRINKLEY: Well, one of the problems there was we needed to use [unclear] in order to be able to stay underwater for six hours, and that's what we would do on orbit. Using the conventional means, we only could stay at that depth, at the depth required of the Hubble, about 42, we could only spend two and a half hours. So we really couldn't do [unclear]. We

couldn't really get a good fidelity on the time lines of each EVA. So I insisted the incorporation of a new [unclear] system, which would allow us to do [unclear] and validate our time lines. I think, as the mission turned out, that also proved to be something that contributed to the success of the mission.

DINKEL: Next item on my checklist is [unclear] certification and fit checks [phonetic].

BRINKLEY: That goes back to what I was telling you earlier, that Goddard was doing their tools and Johnson was doing their tools, and it turns out that nobody was responsible for checking those tools, that the crew was not necessarily involved. There was not the discipline, and there was a gap in roles and responsibility between the tool developers in engineering and the safety guys and the crew. So we reviewed all that and established a process whereby we decided which tools were going to fly or were not going to fly, and we ensured that all those tools went through a systematic check with the crew. And that had not been done in the past. In fact, previous missions manifested tools that had not been certified, had not been fit-checked and on occasion didn't work on orbit. So that was a blinding flash of the obvious to me, and it was something that we were able to improve into clearly something that we have a really good handle now in the EVA Projects Office in terms of making sure that we have the right tools and the tools are considered the right tools by the crew, and that we have high confidence that they're going to work on orbit, which includes testing in [unclear] chambers as well as in ambient conditions.

DINKEL: The next one on my list is sleep shifting.

BRINKLEY: The sleep shifter was something that the flight crew had always done to get their [unclear] hooked up with the time that they were going to be on orbit, but there had not been

any thought of doing that with the ground team nor with management. I was concerned that the ground team mission flight directors, etc., over a period of time—and this was a long mission and very demanding—that it seemed to me that everybody should be adjusted to sleep shifting, and that we should all, with the crew, address and address our flight readiness reviews in all the times that we're doing everything based on that time shift.

That was met with a certain degree of resistance. However, we, in fact, did that and made sure that flight readiness review and L-minus 1 and L-minus 2 took into effect and ensured that both from top-level management as well as the flight team, that they had adjusted their sleep [unclear] and that they were fully rested when they went on console.

I also insisted on having additional people on console because of the criticality of the mission and the length of the mission, and so we brought on an additional shift of folks. We also, because of the importance of EVA with Milt Heflin, the lead flight director, Milt got brought on another flight director to handle the normal orbiter kinds of activities, and he focused his activities on the EVA tests themselves.

So there are a number of things that probably, in looking at it, were blinding flashes of the obvious, but they were things that had not been done and things that were instituted that I would contend that helped the success of the mission.

DINKEL: The next one is an interesting topic that's been talked about quite a bit. It involves Story and his frostbite episode. Why don't we talk about Story's frostbite episode in conjunction with the cold orbiter attitudes that we looked at initially, then the further cooling of Story's chamber.

BRINKLEY: There had been a thermovac chamber run on a number of tools and components, and over a period of time he had some, as it turned out, slight damage to his fingers in the [unclear]. He was fully suited in the thermovac run simulating the conditions on orbit, and

those conditions, on the cold side, were [unclear] because we had to keep some of the instruments out of the sunlight, colder than what had been experienced. So Story's slight injury in the thermovac chamber led us to realize that we needed to make some modifications to the gloves to ensure that the crew was not going to have the same type of thing on orbit.

Frostbite on orbit would have terminated the mission. We couldn't have gone on. So that was also very insightful and a lot of lessons learned as a result of that particular incident on the thermovac chamber and something that we're [unclear] today on the International Space Station, that as we continue to develop better gloves, that ensure that we can deal with the cold environment that we're going to experience at [unclear] orbital plane for the International Space Station.

But it's also made a difference in the way we actually think about the attitude of the orbiter as it orbits and does its work, it can [unclear] the EVA people out there. It's a lot more solid in our brains these days because we know how many EVAs we're going to have to do for the International Space Station.

DINKEL: The next item on my list is the public affairs planning item.

BRINKLEY: That was one of the challenges of the mission, is trying to get from a reactive mode as a negative press to more proactive in terms of dealing with the press. There was a reluctance on NASA to do so. They were afraid to raise the expectation of the public, in case we failed. So there was an ongoing dilemma and debate within NASA public affairs as to what we should say and couldn't say. I found it somewhat disappointing from my perspective that we did not have a better focus.

So what we tried to do at the mission director's office was to focus our resources and deal with the press in a very proactive way, which included a Press Day at Johnson Space Center, showing them all the hardware and all the training, access to the crew, and basically

an approach that the more informed they are, the more they will appreciate the complexities of the mission and be able to put a more balanced spin analysis in terms of whether we'd be successful or not. So at least as the mission [unclear] in terms of being proactive and keeping the press informed, being open, giving them status reports on here is where we are, here's what some of the concerns are, here's what we're doing about it. In retrospect, I think that was well served, and I try to do the same thing with the International Space Station. It's better to get bad news out in front, rather than somebody else to report on bad news with their own spin.

DINKEL: I couldn't agree more. Let's talk now about the back-up EVA crew member.

BRINKLEY: Well, this is again something that came out of Apollo with their back-up crews, and we looked at what would happen if, as we saw where Story hurt his hands in the thermovac, and I asked myself the question, "What if this had occurred on orbit?" We would have to come home. If that had happened later in the [unclear] and Story had not recovered from that, we wouldn't be able to launch on time.

So, as a result of that, I insisted that we start training a back-up crew and not configure it all the way to launch like was done in the Apollo, but a back-up crew that would be capable of conducting all the EVA tasks and would participate in all the training and would evaluate with the other astronauts that were doing EVA, so that if something happened to any one of our astronauts along the way, that we would be able to replace that person and press on with the mission. And that's the same situation that we're dealing with now with back-up crews on the International Space Station, and again, the EVA is critical to the success of the assembly of International Space Station. They need to have contingency alternative plans and other people trained that can fill in if something happens to one of our primary crew members.

DINKEL: How about a few words about safety and mission assurance regarding the need for a single coordinated safety process?

BRINKLEY: One of my frustrations was that the safety community did not seem to accept the responsibility for mission success of EVAs. So when I would talk to them, they would talk to me in terms of they were responsible for the orbiter and making sure that nothing happened to the Shuttle or the orbiter. I said, "Well, who is responsible, from a safety perspective, of mission success of all our space walks?" And that was something that had not really been nailed down very clearly. [unclear] was not sure that there was any responsibility with MOD [Mission Operations Directorate].

Since then I think, there has been a much clearer delineation of responsibilities with the EVA Projects Office and SR&QA [Safety, Reliability, and Quality Assurance]. That was an area that I was concerned about. I wanted to make sure that we were going to be successful, and I found that I didn't have anybody that I could look to that really stood up and said, "I am responsible for ensuring mission success in terms of our space walks."

DINKEL: How did you wind up doing that, then? Have things [unclear]?

BRINKLEY: Well, I think [unclear] did, but clearly my office weighed in, and I assumed personal responsibility for the mission success of all the EVAs, whether it was adding [unclear] at Marshall, the robotic arm at Marshall, I considered that my responsibility, and rather than trying to get somebody else to stand up to it, my office assumed the responsibility. And in the after-action report, I highlighted that as an issue and subsequently has been addressed. I think we have a much clearer delineation between the EVA Projects Office and in SR&QA at JSC.

DINKEL: I'd like to talk a little more about we just briefly touched on before, and that's the establishment of the mission management team. As I studied for this interview, I noticed that the MNT was designed to get upper-level management ready to make real-time decision-making. I think that's significant. Would you care to comment on that?

BRINKLEY: Well, I thought that things were going to happen, and they were going to be very time-sensitive, and, number one, upper-level management needed to be knowledgeable of what was planned and needed to be able to make very quick decisions if things didn't go as planned, and that was somewhat different from the normal missions, where everybody would go think about it for a couple of days and work their way through.

Because of the criticality of the EVAs and how much we had on our plate, I insisted that upper-level management be exercised, be trained, be knowledgeable before we went to fly, that they couldn't get there the first day of the mission then we start learning about it. So I insisted on the mission management team per se, which included center directors and [unclear] to be involved, and we incorporated that into integrated simulations to make sure that we actually exercise those top level kinds of decisions that would deal with both the survivability of the Shuttle as well as the survivability of the Hubble mission, and exercised that management decision-making process.

DINKEL: Thank you. This particular mission, rightly or wrongly, received the attention of many review teams, both internal and external to NASA. Can you name a few of those, [unclear]?

BRINKLEY: Well, Tom Stafford was involved in the beginning, and Dr. Joe [Joseph F.] Shea from Apollo also had another review group. There were several others. I can't remember the

numbers. The closer we got to flight, the more review teams we had, and that was a distraction, and the lessons learned from that and things that we tried to apply to the International Space Station is that if you're going to have review groups, have them involved early, have them become ongoing so they're knowledgeable, because we spent a heck of a lot of time educating people from ground zero, and that was distracting for the team.

As we got closer to flying, I spent a great deal of my time trying to buffer Milt and the flight crew from these various review groups and deal with them myself rather than have our ops team diverted from the focus of getting ready to fly. And clearly, International Space Station has a number of review groups, but we've made it so that at least they're ongoing and the knowledge base of various members hopefully will be such that they really can contribute, rather than being a detriment to the team itself.

DINKEL: As we talked about before, this mission included a record number of space walks. Would this not cause resource problems for NASA, and, if so, how were they solved?

BRINKLEY: Well, again we looked at the need for back-up crews, and we asked yourself what happened if the various EMUs [Extravehicular Mobility Unit] failed or bits and pieces failed, how would we do that. We spent a heck of a lot more time asking ourself "what if?" Before, space walks were just kind of a novelty. They really had not been something that was considered part of the space business. And again, I think Hubble was critically important to the International Space Station because the success of the Hubble was directly related to success of EVAs, just as the assembly of the Space Station is. So we learned a great deal about that and what are the things you need to do that reduce the risks, that enhance mission success. What can fail? What can go wrong? How will it go wrong? When will it go wrong? How can you minimize the impact of that? We see now where we

have more interchangeability between the various sizes of EMUs that allows us a lot more capability than we had four or five years ago.

DINKEL: I'm going to set you up for an opportunity to brag here, if you want to. How did the flight turn out?

BRINKLEY: Well, we exceeded all our primary objectives and we also exceeded all our secondary objectives. So, from a NASA perspective, rather, from a mission perspective, I guess you'd have to say it was an A-plus. But I guess, for me, more importantly is what has the Hubble been able to do since we were successful and the science that has been derived from the Hubble Space Telescope since we first repaired it has far exceeded anyone's original expectations. So you certainly don't hear anyone now making jokes about the Hubble, and you hear very little about the failure of the spirit of cooperation. So it's been very rewarding for me, not as a scientist, because I'm a layman like most of us, but to see the breakthroughs in science and discoveries that have been achieved as a result of that mission really gives me a great deal of personal pride and personal satisfaction to have been a part of something that was so successful and has been so beneficial to mankind.

DINKEL: I think that's a very accurate assessment technically. I think it's also significant to mention from the political arena that Senator Barbara Mikulski, who, when the Hubble was launched and had a cataract, as she called it, she was quoted as saying after the mission at the Cape, NASA is well on its way to fix the culture that created some of these problems. Would you like to make a comment about that?

BRINKLEY: Yes. Early on after my selection, I was invited to her office to meet her staffers, and it was made very clear to me personally the importance of this mission and the

skepticism that was held. So I very well understood personally what was at stake for NASA and that particular mission. As it turned out, we were able to be successful. You know, when you recognize the importance and you've got the support of the administrator and the [unclear] to bring to bear all the various resources, there was no excuse for our failure.

DINKEL: Okay. I'm going to flip the tape over.

[End of Interview]