HUBBLE SPACE TELESCOPE OPERATIONAL ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

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VIA SKYPE FROM GODDARD SPACE FLIGHT CENTER
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The questions in this transcript were asked during an oral history session with Preston Burch. The text has been amended for clarification and for publication on this website.

GAINOR: Okay, it is June 7th, 2017. I'm Chris Gainor and I'm talking to Preston Burch. So, Preston, tell me all about what we were talking about in terms of control of Hubble [Space Telescope, HST] being over at the [Space Telescope Science] Institute for a while.

BURCH: Okay, so the STOCC [Space Telescope Operations Control Center] historically has, for the most part, always been at the Goddard Space Flight Center, except for a brief period of approximately a couple of years or so, when it was moved up to the Space Telescope Science Institute. So, even as far back as well into the '80s, the STOCC control center was planned and implemented at Goddard in Building 3, and it's existed there for a very long time. And the reason is that we wanted the flight operations team to be in close proximity to the systems engineers, who had responsibility for closely monitoring the health and safety of the observatory, in addition to the flight ops team. But they do the detailed analysis of the observatory performance, assessment of any anomalies or failures, development of work-around solutions, which sometimes involves making modifications to ground/flight software, or the onboard flight software, and various parts of the observatory, and verifying those. And in addition, the flight operations team and our system engineering team at Goddard worked closely with what was then known as the flight systems and servicing team that we had here at Goddard that was responsible for developing the new

instruments and getting the orbital replacement units ready to be installed on the observatory with the servicing missions. [As well as] participating in the verification of the new flight hardware and new flight software, which was verified over in the VEST, the Vehicle Electrical System Test facility here at Goddard. We would always do end-to-end testing to check out the databases, the ops procedures and the control center systems, etcetera. So, there was always the very tight coupling between the two. And of course the flight operations team is intimately involved in all of the servicing missions, because we work in close coordination with the astronaut crew, [while] they are out in the cargo bay doing their repair work, exchange of what we're using—instruments and whatnot. We don't want to injure an astronaut because the observatory isn't properly configured. So, just trying to convey a sense of the close relationship between the flight ops team and all the other system engineering and the integration of test work here at Goddard, during the servicing missions.

So what happened was, back in the mid-'90s, there was a perception by the then-NASA Administrator, Dan [Daniel S.] Goldin, that NASA was spending too much money on operations. That there were a lot of operational inefficiencies across the Agency, and he tried various ways of reviewing the various projects that were doing operations, including Hubble, in an effort to liberate money from those budgets that could then be used for other work at NASA—mainly development of other missions and so forth. And in the spirit of no good deed goes unpunished, right after the enormously successful first servicing mission, which was really a watershed moment for the Agency, because we not only had the spherical aberration obstacle to overcome with the observatory, and really the salvage of the Hubble mission depended on Servicing Mission 1, but there was also concern that if a successful servicing mission to Hubble could not be performed, that that would not bode well for the assembly on orbit of the International Space Station [ISS].

So, the Hubble servicing mission really pioneered a lot of the EVA [extravehicular activity] processes and techniques, and indeed, some of the tools that were later used on the Space Station. Those were pioneered with the advent of the Hubble Servicing Mission. And, so that was really, really key.

Shortly after the first servicing mission, after everybody was done patting themselves on the back and congratulating each other, we suddenly found ourselves with a boarding party, who we were told was directed by the administrator, to review the Hubble operations budget. The perception being we were spending too much money on operations, and there was probably a lot of pork there. So, we had to do a zero-based budget review, where we had to account for every nickel and dime, and every tenth of a labor year that was being employed for that. And our budget was substantial. The Hubble Operations and Ground Systems Project (as it was known in the early years) accounted for half of the Hubble budget, which at the time was around $250 million a year. Doesn't seem so bad today. But roughly about $125 mil was going to the Operations and Ground Systems Project, and the other $125 mil was going to the Flight Systems and Servicing Project for developing new instruments: all the protective enclosures, crew aids and tools, training of astronauts, developing and maintaining integration and test infrastructure on the ground.

So we successfully passed that review. This was led by a fellow by the name of Gael Squibb from JPL [Jet Propulsion Laboratory, Pasadena, California], and we were able to very successfully defend out budget and our plans. I think that left the people at [NASA] Headquarters [Washington, DC] kind of frustrated, because I guess similar things happened with other programs that were being reviewed. So, somebody came up with the bright idea of, "Tell you what, we can't shake these guys down individually for money; here's what we're going to do. We will combine all of the satellite operations into one enormous contract under the responsibility of a single office

at the Johnson Space Center [Houston, Texas], because these guys really know how to do space flight—you know, mission operations." So a new organization called the Space Ops Management Office, or SOMO, was created, and they were challenged with combining all these operations not only for the human space flight program, but also for the unmanned satellite programs, including Hubble. The contractor support for this would be provided under a contract called CSOC, the Consolidated Space Operations Contact. So that was what we found ourselves facing.

It had sort of a top-down approach to operations budgeting at NASA, and they lopped off whatever it was they wanted to save, which was several hundreds of millions of dollars. I think I even heard one number as high as a billion. They lopped that off of the top of the operations part of the budget, and they said, "Here's your budget to work with, SOMO. Figure out how to do all these missions with the resulting money."

Now we knew that this would not bode well for Hubble, and so my boss at the time, Anne [C.] Merwarth, was the project manager for the contract, and I believe John [H.] Campbell was the HST program manager. I was the deputy project manager for the Hubble Operations and Ground Systems. We collectively agreed that we needed a strategy to prevent this from happening. And the strategy we exploited was a little clause in the charter that went to SOMO that said that all satellite operations that were being conducted by academia, by various universities—and there were a number of satellites operated from universities—those would be off limits. Those budgets would not be touched. And truth be told, they were typically pretty lean, tight budgets, and I guess there was recognition from the outset that there wasn't going to be much coal to be mined there, and they should be left alone.

So we very cleverly decided on a sort of a poison pill strategy. We said, "Tell you what. We move our flight operations team up to the Space Telescope Science Institute, which is located

at Johns Hopkins University [Baltimore, Maryland], on their campus, and it's run by AURA [Association of Universities for Research in Astronomy], which is an academic-based organization." We can say with a straight face that Hubble operations are being done at an academic institution, and that should provide protection for our budget. So that's exactly what we did. Fortunately, the ground system lent itself very well to being run with workstations that were located offsite. We already had some high-speed data links between Goddard and the Space Telescope Science Institute, but we may have augmented that for the use of the operations team. We found a location at the Science Institute, and we built a Missions Operations Room, with the consoles that were needed. I guess at that point maybe we weren't using dedicated consoles. I think at that point we had gone to just tables with display screens and keyboards and whatnot. We had a separate mission operations room up there that then interfaced with the rest of the system that was down here at Goddard.

Of course the down side of this was that our system engineering team was not as close to the day-to-day flight operations, so we required some of these people to travel up there regularly to interface with the flight ops team to better understand what kinds of challenges they were encountering day-to-day in operating the telescope. But it served the purpose of protecting our budget, which was needed, because the Hubble Operations and Ground Systems Project was responsible for the Space Telescope Science Institute contract, and they had anywhere in the neighborhood of 4 to 500 people working at the institute, doing all of the science operations work at the institute. That's a substantial contract, and that was a substantial fraction of our budget.

We also were responsible, obviously, for the Hubble ground system and the flight ops team, and also for all the system engineering support for the ongoing support operations. But in addition, we had substantial effort involved with the development of the servicing missions. We had a

system called the Servicing Mission Planning and Re-planning Tool. We were responsible for developing the integrated mission timeline of all the activities that went on from the Hubble perspective, of what happened, not only in the cargo bay with the EVA astronauts, but all of the operations work that had to go on during the mission in the STOCC.

We had to develop operations procedures, contingency plans. We had to conduct simulations. Some of the simulations were simulations just with the Goddard team just to shake everything down in terms of the systems and procedures and the team and whatnot. But then we also got in later on, leading up to the mission, integrated simulations with Johnson Space Center.

The other thing we were responsible for, of course, were all the test beds that we have for the flight computers and the embedded microprocessors in all of the Space Telescope Science Instruments. There's a tremendous amount of flight software development, maintenance, and validation that went on here as well. That's why our budget was the size that it was. And really, all of this work managing it did not lend itself well to a one-size-fits-all kind of contract like CSOC, which had to provide operations support to a host of other satellites that were much smaller and very dissimilar.

We recognized from the beginning that this was a bad concept for Hubble, and indeed it was a bad concept for Goddard. Goddard operates a lot of missions in any given year. Even back then, I think the space science missions numbered on the order of somewhere in the range of 15 to maybe 18 missions, which it still does today. And in addition, we have all the Earth science missions, and there are probably more of those today than there were back in the day, but those numbered probably on the order of somewhere around a dozen or so missions. A lot of us had backgrounds in operating those missions before we came to Hubble, and we felt strongly that the CSOC SOMO concept was not going to work well for those for a whole bunch of reasons. And

predictably, CSOC and SOMO were a failure, and eventually the whole thing imploded on itself and ultimately went away.

Of course, our rationale for putting the mission operations room up at the institute—we couldn't advertise our real reason for doing it and we had to come up with a story that sold with everybody. The story we sold, of course, was that the institute doing science operations but bringing the flight operations up there seemed like a logical thing to do. They had a major chunk of the planning system up there, and we felt that the integration of the flight ops with the science ops made a whole lot of sense for a whole bunch of reasons.

GAINOR: Right.

BURCH: And that made everybody happy. Ultimately, when CSOC and SOMO failed, we were very interested in bringing the flight ops team and the mission operations room back to Goddard. The reason why was because of the servicing mission where, again, the flight operations team works very closely with the engineering team that's in the STOCC during the missions, and there's very close coordination required in order to safely conduct these missions. So we felt there was a very good reason to bring them back.

The other thing that happened was people became a lot more concerned in general in the public about security. And to be quite frank, the security at the Space Telescope Science Institute left a lot to be desired. Almost anybody could walk in off the street, and it would be very easy to get to the Missions Operations Room and interrupt the operations.

GAINOR: This is about the time of 9/11 [attacks], right?

BURCH: Yes, and what's a little hazy in my mind are specific dates, and exactly when we moved the Missions Operations Room up there and when we brought it back. But I think it was after 9/11. And I used that as the guise—I said we needed strong security. This was a national asset, and a highly visible asset, and we needed maximum physical security as well as data system security. And bringing it back here made a lot of sense. I didn't get any pushback from anybody for doing that. And like I said, CSOC and SOMO had disappeared, and the pressure was off in terms of having to have our budget administered by some other entity within NASA.

So that's a little bit of a long-winded story, but that was all the thinking behind it. My boss retired in '98, and that was when I took over the project managership of the Operations and Ground Systems Project. I think it was around that time it became known as just the Hubble Operations Project. But we had the same responsibilities for the institute, and all the data systems and whatnot.

GAINOR: Was it John Campbell? Was he the one who retired?

BURCH: No, it was Ann Merwarth.

GAINOR: Oh, okay.

BURCH: Ann Merwarth was the head of Code 441, the Hubble Operations Project. The Hubble Operations and Ground Systems Project—they simplified the names of our two projects. The Hubble Operations and Ground Systems Project just became the Hubble Operations Project, and the Flight Systems and Servicing Project just became the Hubble Flight Development Project.

That was headed up by Frank [J.] Cepollina.

But Campbell was the overall program manager. He had taken over from Joe [Joseph H.] Rothenberg, shortly after Servicing Mission 1. Rothenberg went off to do other things, and John Campbell took it over and he ran it for several years. And I ultimately took it over when John was director of the Flight Projects Directorate here at Goddard. We had an acting program manager, Dave [David] Scheve, who ran it for about a year or so. I'd report to Dave, and then Dave decided he, for whatever reason, wanted to step aside, and I took over as the program manager. He wound up being the project manager for the Hubble Operations Project. So he and I sort of swapped tasks.

They put me in to become an SES [Senior Executive Service] in '98, and that became effective in 1999, so I was an SES and Dave Scheve was not. Then they selected him as my successor in the Hubble Operations Project, and that's when he became an SES'r.

GAINOR: Okay. Were there any servicing missions that took place during that period when it was run out of the Institute?

BURCH: I'd have to look at a specific timeline. I tend to think that there might have been. I'm not totally sure. You know what, I think we brought the flight operations team back to Goddard. We still had a Missions Operations Room down here at Goddard, which we used for all the integration and test and training activities leading up to the mission. And for the mission, we brought the team back to Goddard. That's what we did.

GAINOR: Okay.

BURCH: So the mission operations room at the institute was only used for steady-state science operations, with the observatory. So that was what we did. So, that was pretty straightforward.

GAINOR: In the demise of SOMO and CSOC—you said, they experienced problems which led to their demise. Did any of those problems impact Hubble?

BURCH: No, we were totally immune to it because they left our budget alone, and we were such a large, visible project, nobody was going to mess with us. So no, none of the problems associated with CSOC or SOMO affected us.

GAINOR: I take it those problems were basically trying to do something with too little money.

BURCH: Yes. You're right.

GAINOR: And did the end of those things have anything to do with the change of administrator?

BURCH: No. No. Are you talking specifically about Sean O'Keefe?

GAINOR: I'm just saying when Goldin left. Because Goldin was there for like 10 years, practically.

BURCH: He was one of the longest serving NASA administrators, and he served under three different presidents. I think he's the only administrator to have served under three different presidents.

GAINOR: Of different parties.

BURCH: There was a lot of noise in the system. Goldin was the champion of better, faster, cheaper, and there were a number of failures and problems that caused everybody to learn that when it comes to better, faster, cheaper, you can have any two out of the three and be reasonably successful. That was, I think the big lesson learned.

Fortunately Hubble was not afflicted with that. We were able to maintain a healthy budget. We had our challenges. That was one of my main jobs—defending our budget every year—and it was not easy. When I took over, that was in 2001, I ran Hubble from, it was roughly January of 2001 until February of 2010, but we were always under the gun. They were always trying to take money away from us, trying to cut back requirements, trying to micromanage us, and it was a very big challenge, not only for me but my predecessors.

So, I would say that Joe Rothenberg, I'm sure he had his challenges, but his major challenge was making sure that Servicing Mission 1 was a success. Joe and I had worked together back at Grumman, we both belonged to what was then known as Grumman Aircraft Engineering Corporation. He and I had gone to work there in the '60s, and we had stayed in touch with each other over the years. And both of us had been in the satellite operations business down here at Goddard. We had worked on the Orbiting Astronomical Observatory, which was sort of the forerunner of Hubble in a number of ways.

So when I finally decided to leave private industry in '91, I talked to Joe about coming to work at Goddard, and he hired me on the spot. And I had one question for him. I said, "Tell me what kind of support you're getting from Headquarters. Particularly when it comes to having a

healthy budget or having sufficient resources to do Servicing Mission 1." And his words back to me were, "Headquarters will not let us fail." That was all I needed to hear, and Headquarters gave our program everything it needed in order to do a successful Servicing Mission 1.

But from then on, it was kind of a steady slide downhill. We had the big boarding party and budget review after Servicing Mission 1. And then every year after that, it was a constant struggle. I think, to be fair, from a Headquarters' perspective, they look at us as a 900-pound gorilla that needed to be controlled, and they weren't just going to let us go crazy. Not that we were proposing crazy stuff, but I think they felt that as part of their responsibility and due diligence they couldn't just let us have whatever we wanted. But they didn't make life easy for us, and the relationship actually got a little contentious in the later years.

GAINOR: Now just one thing that's kind of interesting about this to me is that I notice that the institute is going to run JWST [James Webb Space Telescope].

BURCH: Yes. I noticed that, too! And do you want me to comment on that?

GAINOR: Well, if you think there's sort of anything relevant to the experience with Hubble.

BURCH: I'm not responsible for JWST. I had some involvement in the very early stages of planning for it, but it would be inappropriate for me to offer any comments or criticisms or anything about that.

GAINOR: Okay.

BURCH: I have total regard for Bill Ochs, who worked for me on Hubble. He was in Code 441, the Operations and Ground Systems Project. He's a very competent manager. He was project manager for the SORCE [Solar Radiation and Climate Experiment] mission, which is a satellite that's still up there and operating, and he's done some other things, which I can't think of right off hand. But he's very intelligent, very competent, and he has an excellent team with him. And Alan Johns, who's his principal manager on the ground systems area—another person I know going back to the gamma ray observatory days when Alan Johns worked on the ground system for that. I have a lot of respect for Alan.

I don't know what to make of that, to be honest with you.

GAINOR: Okay, fair enough.

BURCH: I can't really say anything good or anything bad about it. It's probably not appropriate for me to do that.

GAINOR: Okay.

BURCH: I'm a little surprised, to be honest with you. It's not the path I would have taken, but it seems to be working for them. It seems like the development work on the ground system and their preparations for the mission have gone well. So, there's certainly no room for criticism that I know of.

GAINOR: Right. Okay, well I think that pretty well covers it. I thank you very much for your time.

BURCH: And I hope it was of some help to you.

GAINOR: Yes, absolutely.

BURCH: Okay Chris. It's always good to hear from you, and glad to help you any way that I can.

GAINOR: Okay, thanks a lot, and good luck with your work there.

BURCH: Okay. Best wishes to you, too.

GAINOR: Thanks a lot.

BURCH: Right. Bye-bye.

GAINOR: Bye-bye.

[*End of recording*]