

NASA OFFICE OF PUBLIC AFFAIRS  
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**Media Teleconference**

**"NASA to Discuss Hubble Anomaly  
and Servicing Mission Launch Delay"**

Briefing Participants:

**ED WEILER**, Associate Administrator,  
Science Mission Directorate, NASA  
**JOHN SHANNON**, Shuttle Program Manager,  
Johnson Space Center in Houston, NASA  
**PRESTON BURCH**, Hubble Manager,  
Goddard Space Flight Center in Greenbelt, NASA

Moderated by **J.D. HARRINGTON**,  
Public Affairs Officer,  
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## P R O C E E D I N G S

TELECONFERENCE OPERATOR: At this time, all participants are in a listen-only mode until the question-and-answer session, at which time you may press Star-1 to ask a question. Today's conference is being recorded. If you have any objections, you may disconnect at this time.

I would now like to turn the call over to Mr. J.D. Harrington. Thank you, sir. You may begin.

MODERATOR: Thanks.

Good evening. I am J.D. Harrington, Public Affairs Officer in NASA's Science Mission Directorate. I would like to welcome you to today's media teleconference.

We will discuss the situation involving the Hubble Space Telescope anomaly that occurred this past weekend.

It involves Hubble's ability to store and transmit science data to NASA's Goddard Space Flight Center in Greenbelt, Maryland.

Before we get started, a few housekeeping duties to take care of. We have three panelists with us today. They will open with a brief description of the anomaly and then open the phone lines for questions and answers.

We also have related information, images, and as such available on the Web that coincides with this telecon.

You can log-on at [www.nasa.gov/hubble](http://www.nasa.gov/hubble) to see this information.

This telecon will be limited to one hour. It is also being recorded. Media representatives can dial in anytime during the next 30 days to listen to the telecon again. I will provide specific dial-in information and number at the end of the telecon.

Because we have a large number of people joining us today, reporters will be limited to one question with one follow-up. If time permits, we will start a second round of questions.

As the operator said, the lines will be muted. If you have a question, you can push the Star-1 key to signal us that you have a question. We will then call on you in turn.

Finally, dial-in numbers are for the media's use in asking questions. If you are not a media representative, please hang up. You can listen to the telecon online at [www.nasa.gov/newsaudio](http://www.nasa.gov/newsaudio).

And now to the panelists. They include Ed

Weiler, the Associate Administrator of the Science Mission Directorate at NASA Headquarters in Washington, D.C. John Shannon is the Shuttle Program Manager at Johnson Space Center in Houston, Texas. We also have Preston Burch, the Hubble Manager at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

With these brief introductions out of the way, I would like to hand the mic over to Preston Burch. Preston?

MR. BURCH: Okay, J.D. Thank you very much.

Last Saturday evening, September 27th, around 10 after 8:00, Hubble's main on-board computer issued commands to safe the payload computer and the science instruments. The payload system is managed by a system called the "Science Instrument Command and Data Handling System," and what we have determined is that the Science Data Formatter Side A has failed in that.

This box is pretty robust. It has operated successfully for well over 18 years on orbit. It is fairly large. It weighs just a little under 136 pounds. I think there is a photo of it on the web for you all, and it is comprised of the NASA's Standard Spacecraft Computer No. 1, the Central Unit with Science Data Formatter, and a number

of to her boxes on board. It is fairly robust, and it has a lot of redundancy built into it.

We have done a fair bit of on-board troubleshooting in an effort to definitely figure out what the condition of the Science Data Formatter A is, and all of the testing and all of the efforts so far to restore it have indicated that it has totally failed.

Our only option at this point is to switch over to Science Data Formatted B, which is the redundant one. Unfortunately, switching to that side will require the switch-over of the Spacecraft's Data Management System to the B side as well, several boxes in that because of limitations and our ability to cross-strap the equipment. So this is a major event for Hubble.

In order to do the switch-over, we will have to first put the observatory into PSEA hardware safe mode. The PSEA is our fall-back computer that can operate the observatory when the main computer on Hubble is no longer available. We will have to do that and also turn on our last remaining gyroscope in order to conduct this, and then we will do the switch-over, and then bring the observatory up on Side B. And when we have done that, we will once

again be able to operate the science instruments and get science data from them.

The Science Data Formatter, very simply, is the device that takes the science data from the five instruments. There are four axial instruments and one radial instrument, and it formats the data into packets and puts a packet header on it and then sends it down to the ground at the rate of about 1 megabit per second. There is also the ability to store that data on board in the Solid State Recorders, which is normally what we do, and then we dump it to ground later.

Currently, the activities that are going on here at Goddard are, number one, to further explore the failure and definitely prove that there are no viable work-arounds other than switching over to Side B and/or replacing the entire Science Instrument Command and Data Handling System.

The second activity is preparing to switch over to Side B, which I mentioned takes a lot of work and a lot of commanding. Fortunately, we have a Life Extension Initiative, which is an activity here at Goddard that has been looking at things that we can do here on the ground operationally to extend Hubble's life, and this was an

activity that was identified quite a while ago. So we have a good leg up on getting the switch-over done.

Today, we started testing, using the replica that we have on the ground of Hubble called the VEST, the Vehicle Electrical System Test facility. We are doing operators acceptance testing of the procedures to do that switch.

The plan is later in the week to do a Test Readiness Review, and at that time, we will assess our readiness to switch over to Side B. We will also do an assessment of the risks to the observatory associated with switching over to Side B and try to reassure ourselves that this is the prudent thing to do.

The third activity that is going on is we are putting together a plan to take the back-up spare Science Instrument Command and Data Handling System that we have here on the ground and put it through a qualification program to ready it for flight. So what we want to do is assess its flight worthiness and in addition do the engineering and other preparations necessary to be able to carry it on board the Space Shuttle on STS-125 and change out the SIC&DH during Servicing Mission 4.

The SIC&DH is located in Electronics Bay No. 10, which also houses the three Electronics Control Units that control the gyroscopes, and the astronauts typically train for access into that bay on each mission as a contingency thing in case we have to change out one unexpectedly, and so they are familiar with that bay.

This box hangs on the door. It is relatively easy to access. It is held on with 10 bolts and has a single connector, a blind mate connector to disengage. So we think it is a relatively straightforward activity that would probably require up to maybe as two hours of EVA time.

So that is where we are. We are proceeding very rapidly to bring all this together, and we will keep everybody apprised as we go forward.

That is all I have at the moment.

MODERATOR: All right. Thanks, Preston.

John, do you have an opening statement?

MR. SHANNON: Sure. Well, good afternoon to everybody.

I would just say from a Shuttle Program standpoint, the Hubble team has kept us really well



informed of all of their troubleshooting. We have as a team discussed various options, but I would say it is very early in the investigation of this anomaly.

HST, we are waiting for them to complete their troubleshooting, and at the completion of that, I believe they will be able to determine when they will be ready to go fly.

To that end, we have discussed various flight options that the Shuttle team can support. I think it is very obvious that October 14th is off the table. We will not be having our agency Flight Readiness Review that was planned for this week, and that mainly stems from the fact that the Hubble team needs to do their troubleshooting and reconfigure the telescope and understand exactly what they have and then do their troubleshooting on the ground to understand the viability of their replacement units, and then we would work to integrate that into the Shuttle payload.

What I would stress is there is plenty of time to make a decision on when we do fly the Hubble mission. If HST is significantly delayed for several months -- and right now, it sounds like that is the most probable

scenario, although we are, again, still troubleshooting -- I believe what we would decide to do is that we would fly STS-126, the next ISS mission first, and we would look at flying that around November 14th time frame.

Right now, it is November 16th. There is very little opportunity for us to accelerate that, but we would look at that, and then we would look at opportunities to fly Hubble, depending on their readiness level, sometime maybe next February. We would have another flight opportunity in April, and we would use just the follow-on ISS mission as the launch-on-need rescue flight, just like we did for STS-126.

Right now, 119 is scheduled for February 12th. 127, the next flight after that is in May, and we will just see where the Hubble team ends up, and then we will respond appropriately.

And that is as far as we have gotten on our planning right now. We will not be working towards October 14th, and we will be following along with the Hubble team to understand their needs, and we will be able to adjust our flight schedule appropriately.

That's all I had, J.D.

MR. WEILER: J.D., this is Ed Weiler. I actually have something to open with, if I could.

MODERATOR: Go ahead, Ed.

MR. WEILER: Preston gave you a pretty good description of where we are, but I think one thing needs to be added, and that is the reason why we are looking at the SIC&DH on the ground, the Science Instrument Command and Data Handling unit.

One could ask the question. We could bring Side B up, and that would solve the problem with the Science Data Formatter, and theoretically, we could go operate and put in the new instruments on the October 14th mission, and that theoretically is one route we could take, but I think what we left out was the point that if we go that route, just go to Side B, we would be left with a system that had several single point failures, and that would be a risk to the mission for the long duration.

By going ahead and accepting a delay of perhaps several months, we can actually get our SIC&DH spare units, the full-up spare, test it and ready to go, and if we could put that in there sometime in the winter, we would now have an observatory that was, again, doubly redundant; that is,

it would have back-up systems. It wouldn't have single point failures in it. So that is the reason we are looking at accepting this several month delay, to buy back that redundancy that we used to have with a fully functional Side A.

That is just the one point I wanted to make, J.D.

MODERATOR: Thanks, Ed.

With that, we will start the question-and-answer session. A few quick reminders, if you just joined us, you need to push the Star-1 key on your telephone to let us know you have a question. We will call on you in order.

Finally, please direct your question to a specific panelist, if possible, to eliminate confusion.

With that, I will hand off the mic to our operator, Melanie.

TELECONFERENCE OPERATOR: Thank you, and like J.D. said, that is Star-1 on your touchtone phone, if you have a question. One moment.

I show Dan Vergano with USA Today as our first question. Your line is open.

MEDIA QUESTIONER: Hi. I guess this is for John or Ed.

Do you have any cost estimate for how much this is going to cost if you have to wait several months until February?

MR. WEILER: This is Ed. I will speak to the Hubble side, the payload side.

Going beyond October 14th, the servicing program of Hubble runs about 10- to \$11 million a month. So you can do the math. If we split three months, it would be about \$30 million or so out of the Hubble program.

MEDIA QUESTIONER: On the Shuttle side?

MR. SHANNON: On the Shuttle side, there would not be any delta cost we would anticipate for this. It would be the same number of flights in the fiscal year. So it would just be covered by our normal costs.

MEDIA QUESTIONER: As STS-125 rolls back to the shed at this point, you don't leave it out until February?

MR. SHANNON: Well, that is under discussion. I think the leading candidate, if we are in extended hold time, would be to remove the payload from the payload bay, put it back in the canister, take it back and let the Hubble team keep it under totally controlled conditions.

We would not want to leave the stack out on the

pad for an extended period of time. So we would bring it back to the Vertical Assembly Building and store it in High Bay 3.

MEDIA QUESTIONER: And that doesn't have any costs associated with it?

MR. SHANNON: No.

MEDIA QUESTIONER: All right. Very good. Thank you.

TELECONFERENCE OPERATOR: Our next question comes from Marsha Dunn at the Associated Press. Your line is open.

MEDIA QUESTIONER: Yes. Thank you. Probably for Preston Burch.

It sounds like if the back-up unit is going to be ready to test out good, you are going to fly it. Is this a done deal that if it tests well, you are going to fly it whenever the mission does fly, and what are the early thoughts about whether this component, which I understand is pretty old, is going to be able to be flight-ready and still working appropriately?

MR. BURCH: Okay. This unit, the spare SIC&DH was last used on the ground in 2001 to support testing of

the NICMOS cooling system, which is controlled on orbit by the SIC&DH.

So it worked fine. It has been stored carefully, and I would also point out that these older style electronics are pretty robust in the way that they are built, and the unit, of course, in orbit lasted 18 and a half years. So that is pretty darn good.

It also shares a lot of components that are used in other NASA spacecraft. You may recall the Multimission Module Spacecraft series of satellites. It uses a lot of the same command and data handling components in that, and an example is Landsat.

The Landsat that was launched in 1983, all those components are still running just fine. So we have a lot of confidence in this unit, and we just have to run it through the normal qualification testing of thermal vacuum and vibration and acoustics and that sort of thing to make sure that it is ready to fly.

We don't anticipate that we will have a lot of problems, but we need to take this path one bridge at a time.

MR. WEILER: Marsha, if could add something, this

is Ed.

MEDIA QUESTIONER: Sure.

MR. WEILER: Yeah, it's old, but you got to remember the duplicate of this system has been in orbit for 18 years. It has been exposed to a high radiation environment. It has been thermally cycled every 90 minutes.

The unit we are talking about replacing that unit with is identical, but it has been sitting on the ground in a very carefully controlled environment, no radiation, et cetera.

So accepting the fact we have to test it out, we would fully expect it to be a pretty solid unit.

MEDIA QUESTIONER: Thank you.

And any idea what happened to the unit in orbit?

MR. WEILER: Preston, I will leave that one for you.

MR. BURCH: We do not really understand the precise location of the failure inside of the Science Data Formatter and the cause of it.

We do know that that unit does run at a relatively high temperature compared to other components,



and high temperatures tend to accelerate any kind of degradation process. So it may be thermally related, but once again, after 18 and a half years of on-orbit operation continuously, that is a pretty good performance, but no, we do not know the precise location and the exact nature of this failure, and we probably won't know until we bring the unit down to the ground.

TELECONFERENCE OPERATOR: Our next question comes from Rachel Courtland. Your line is open.

MEDIA QUESTIONER: Yeah. Hi. This is a question for John, I guess. Do you have -- I guess the space walk schedule is already pretty tightly packed. So are you anticipating you are going to have to make room in that schedule for this other instrument? What are you anticipating will happen?

MR. SHANNON: Well, Preston can answer that as well.

My input would be yes, it will be a trade-off with something else. All five EVAs were completely subscribed. Obviously, this will be a very high-priority task, and it will fit into the EVAs at the most appropriate time.

MR. BURCH: We are actually hopeful that, you know, given the fact that we think this job can be done in under two hours, there is a possibility in the payload commander. Dr. John Grunsfeld has been studying this the last couple of days. If he is allowed to -- or I should say if he is able to complete the ACS repair on EVA Day 3, that frees up a substantial amount of time on EVA Day 5.

So, in theory, this may be a doable thing for us to have our cake and eat it too, but a lot of things will have to go right, and we certainly don't want to overextend the crew. And we will have to revise our mission priorities list. That could have an effect on the packaging of the various EVA tasks.

We really want to minimize the changes to the EVA days because the astronauts have trained to that, and it is very important not to undo all the many months of training that have gone on, but clearly, there is work to be done in assessing that and trying to optimize the mission to accommodate this.

MEDIA QUESTIONER: And then a follow-up for Preston.

You mentioned that you are going to be evaluating

the start-up Side B and conversion to Side B to see whether there are any risks to the telescope. Do you have a sense of what those risks might be?

MR. BURCH: Well, one can postulate a number of things. Engineers are great at worrying about one thing or another. You know, there's concerns that throwing a switch or a relay to turn something on, you might blow a fuse, that sort of thing, and that is why we want to do this testing on the ground with our Hubble replica, the VEST system which has all of the electronics boxes that we have on orbit. So we will check that out and see if we note anything unusual in the way of high-current draws or any difficulty in doing switching, and that will go into our risk assessment.

TELECONFERENCE OPERATOR: Our next question comes from Bill Harwood with CBS News. Your line is open.

MEDIA QUESTIONER: Thank you. Two quick questions for John Shannon, or I should say one and a follow-up, I guess.

John, when do you have to formally decide 126 is, in fact, up next? I mean how much time do you have to talk about that?

And then the second part of my question is looking downstream, if this Flight 125 is delayed until next year, can you talk a little bit about the Soyuz cutout and whether or not it would make more sense to launch 119 first and then launch Hubble versus launching Hubble in February and perhaps slipping 119 past the Soyuz mission? Can you just give us a sense of what sort of options are on the table with that discussion?

Thanks.

MR. SHANNON: Bill, it sounds like you were listening to our discussion earlier today because you're right on.

The 126 decision point, Ground Ops, the folks that do all the work at Kennedy Space Center, they looked at the timeline for removing the payload, to put it in the canister, bringing it back, rolling the stack, the 125 stack back to High Bay 3 and then moving the 126 stack that is currently on Pad B over to Pad A. If we gave them the go tomorrow to do all that, they could have it done and be ready to launch on November 2nd.

Our crew training would not support that day. It doesn't look like the cargo delivery would support that day

either. Both of those are coming in about November 14th.

So, if you think about that with no contingency, we have 12 days to make that decision, and then everyone would be able to meet the November 14th date.

Internally, we set a milestone of next Friday. We would like to discuss it internally. I think the Hubble team will have enough information at that point where we can -- at least if we don't know when Hubble would go, we would know it would not be in the near term, and we would make that decision for 126. So I expect at the end of next week, we will make that decision.

Your question on the Soyuz was very good. There is a time starting on March 13th really, ending May 28th, where we have two Soyuz launches and a significant beta cutout. Of course, the Hubble mission is not constrained by any of that. So we will consider that once we know more about the Hubble need date.

If we could put the Hubble in and fly STS-119 before that 18 Soyuz, that would be good. If it looks like Hubble needs a little more time than that, then it is very possible we could fly 119 first, let Hubble fly sometime in that Soyuz and beta cutout with the 127 stack as the

launch-on-need. So all of that is still to be determined, but you are thinking exactly like we are.

MEDIA QUESTIONER: Thank you.

TELECONFERENCE OPERATOR: And our next question comes from Tariq Malik. Your line is open.

MEDIA QUESTIONER: Thank you. This is Tariq Malik, Space.com and Space News for John.

John, if you could just kind of, I guess, clarify what the targeting is right now because it seems like you are pretty well on the way to saying several months to February is kind of doable, but are you preserving the chance that if they get this spare ready to go and they say yeah, it's okay, that you could fly even, you know, in late October or November? I mean if you can kind of clarify that for me, so I understand it, that would be great.

Thanks.

MR. SHANNON: Well, the only one we have any clarify on is when we could fly 126, if Hubble slips significantly.

For Hubble launch dates, I would rather let Preston or Ed give you their best estimate on that at this point.

MR. BURCH: Okay. Do you want me to respond to that, John?

MR. SHANNON: Yeah. Go ahead, Preston.

MR. BURCH: Okay. Well, in order to fly the spare SIC&DH unit, we have to complete our check-out of it. We have got some ground equipment that we need to pull together to do more rigorous testing of it.

We have vibration tests. We have got thermal vacuum testing to do and a lot more functional testing. We also need to get the run time up on it, and basically, it won't be ready to be delivered to Kennedy until about the first week in January.

Concurrently with that is the manufacturing and assembly and fit checks of the hardware and the design of that hardware to accommodate it on the mule carriers where we are thinking about installing it, and there is also the analytical integration, you know, the loads analysis that needs to go on with the Shuttle Program. And we work closely with the Shuttle engineers at Johnson on that.

So there is a lot of work to get us to the point in early January where we are then ready to ship all this hardware down to Kennedy, and then we need to install it on

the mule and get the payload back into the cargo bay of the orbiter and get ready to fly.

So mid February is looking to be a reasonable time frame to do that. I think we would be hard-pressed to be ready any earlier than say January. I mean I think mid January is out of the question, and so it is looking more like a mid-February time frame is the right time for us.

MEDIA QUESTIONER: Thank you.

TELECONFERENCE OPERATOR: And our next question comes from Todd Halvorson from Florida Today. Your line is open.

MEDIA QUESTIONER: Thanks very much. I guess I have one for John Shannon and one for Ed Weiler.

John, I am wondering if you can give us an idea of what the crew's reaction was to the news of this delay.

I mean they have had the hurricane to deal with, and now, you know, they were gearing up for mission, and now it is off.

And for Ed, I am wondering if you could just philosophically talk about the ups and downs of the Hubble program. I mean, this just seems to be another big knuckleball that you guys have been tossed, and I am



wondering if you could talk about that.

MR. WEILER: Go ahead, John.

MR. SHANNON: Okay. Well, Bill, let's see. The crew right now is in an integrated sim -- I'm sorry. I mean Todd, but you know, this is just one of those things that comes with spaceflight, and I think the crew is very stoic. They will be ready to go fly when the hardware is ready to go fly.

MR. WEILER: Yeah. Todd, I don't want to get into too much of a philosophical discussion. Yeah, there's been lots of ups and downs on Hubble, but you know, one way to look at this is not necessarily a knuckleball. It was a high hard one that we maybe could get over the fence.

I mean think about the other option. Think about if this failure had occurred 2 weeks after the servicing mission. We had just put two brand-new instruments in and thought we had extended the life for 5 to 10 years, and this thing failed after the last Shuttle mission to Hubble.

We'd have been singly redundant on the SIC&DH, would have several single point failures. We could have lost the mission in 6, 12, 18 months.

So, in some sense, if this had to happen, it

couldn't have happened at a better time, and on the other hand, we are very lucky that were foresighted people back in the late '80s to decide to make an SIC&DH, a fully redundant and replaceable unit. This isn't the kind of operation where you have to take out 111 screws and rewire something. This instrument was designed to be taken out and put in by astronauts.

So I am trying to look at the glass is half full today, and I think it is half full for us.

MEDIA QUESTIONER: Thanks, Ed.

TELECONFERENCE OPERATOR: And our next question comes from John Johnson with the Los Angeles Times. Your line is open.

MEDIA QUESTIONER: Thank you. I am not sure who to direct this to, and this is maybe in the category of wild speculation, but I mean can we just assume that this mission is going to happen, or is there any talk, any possibility that things could go badly enough in trying to get ready for this that the Hubble may have to be abandoned?

MR. BURCH: Don't all jump at once on that one.

[Laughter.]

MR. WEILER: Why don't you start, Preston?

MR. BURCH: Okay. I get paid to think about all the possible things that can go wrong. Certainly, that thought has crossed my mind, but I'll tell you, we have been here before. I think just about every servicing mission has had some kind of a hardware failure in the immediate period prior to the launch.

We had this happen on, let's see, Servicing Mission 2 and Servicing Mission 3B where we had reaction wheels that failed. We had gyros that failed just prior to Servicing Mission 3 that caused us to split the mission in half to Mission 3A and 3B.

We had a SADE, Solar Array Drive Electronics, I think failed shortly before Servicing Mission 1. I am not sure exactly the time frame there.

But anyhow, I don't see this failure as putting us over the fence and causing NASA to want to throw up its hands and say, "Hey, all the hundred millions of dollars we have spent on the hardware and readiness for this mission, we are just going to chuck it because, you know, this is just a little too much for us." We have got a lot of options here, and even if we are a little over-subscribed

on the EVA activities, the space walking, and we had to give up, let's say, one of the instrument repairs, that is far from the end of the world to get two premier instruments operating again.

So I don't see Ed Weiler and Mike Griffin or myself throwing in the towel because we have got to spend a few more tens of millions to pull this mission off. You know, I think we are definitely going after this.

MR. WEILER: One of the advantages of having worked on this program for three or four decades is the fact that, you know, this is nothing compared to collaboration. I mean this whole program was declared dead in 1990, that we would never survive it. Not only did we survive it, but we came out, the great American comeback story.

Hubble has a habit of coming back from adversity, and the Hubble team, which includes the Shuttle team, works miracles, and you know, I am not too concerned about this.

We will find a way to get this fixed.

Luckily, we have got a spare. I mean many times we have to come up with ways to fix things on Hubble that weren't designed to be fixed. This particular failure was

anticipated, and we have a spare car. We are ready to go.

We have to test it out and do due diligence to make sure it is still working fine and all that, but we do have a spare on the ground. We anticipated this kind of problem 20 years ago.

MEDIA QUESTIONER: Thank you.

TELECONFERENCE OPERATOR: And our next question comes from Nell Greenfield Boyce with National Public Radio. Your line is open.

MEDIA QUESTIONER: Yes. Hi.

Did I understand you correctly that the Hubble folks absolutely, definitely want to send this spare up, and there will be no Hubble Servicing Mission before that spare is all qualified and checked out and made ready to go, as was said sometime after mid January?

And I guess my other question was what is happening with the Hubble now. I mean can any observations be made, and they are just being stored on board, or scientists do nothing? I am just wondering what the current status is.

Thank you.

MR. WEILER: I will take that question. This is

Ed.

Barring some unforeseen circumstance that, you know, the SIC&DH that we have got on the ground for some reason doesn't, you know, check out, I really don't see any scenario where that is going to happen.

One can say that our plan right now is to take the delay and put up the new hardware, the fully redundant hardware, so that we can keep Hubble going for as long as possible.

If we are going to spend the money and take all the risk involved in the Shuttle mission, we want to be sure that we leave Hubble as healthy as we possibly can and potentially lasting for 5 or 10 more years.

On the science side, if we successfully get Side B up and there is no reason to believe that we can't, that would enable us to use the Wide Field Planetary Camera 2 that is still operating and use the Advanced Camera for surveys, the ultraviolet channel of that system to do science, and of course, we can continue to use the Fine Guidance Sensors to do astrometry.

So we could continue to do science for the next three or four months, however long before the next

Servicing Mission. That is assuming we can bring Side B up, and again, we anticipate that shouldn't be a problem, but we are going to do due diligence to be sure that we do it carefully.

MR. BURCH: Yeah. Just one minor point to add to what Ed has said, and that is we do astrometry science using the Fine Guidance Sensors. Those are not controlled, and the data from them is not handled by the Science Instrument Command and Data Handling system, the SIC&DH.

So, in fact, we are doing astrometry right now, and we can move up some of these astrometry observations that have been planned for some number of months down the road. We can conceivably move some of those up and doing more astrometry in the near term while we are completing the troubleshooting and getting ready to switch over to Side B.

TELECONFERENCE OPERATOR: And our next question comes from Mark Kaufman with The Washington Post. Your line is open.

MEDIA QUESTIONER: My question has been answered.

TELECONFERENCE OPERATOR: Our next question comes from Robert Zimmerman. Your line is open.

MEDIA QUESTIONER: Yes. You are saying that the two-hour space walk doesn't seem like -- you might be able to squeeze that walk in without sacrificing any other action. The unit, the spare unit on the ground does weigh something. Is there something else going to have to come out of the cargo bay to fit it into the Shuttle? Will you have to sacrifice something else in that context?

MR. BURCH: No. This is Preston Burch from Goddard.

We have sufficient reserve space on two carriers. So we have a choice of places where we could potentially carry it.

Our initial thinking is the mule carrier, which is the small carrier all the way at the back of the cargo bay, is the most desirable place to locate it. So there is plenty of capacity, and we have enough lift capacity with the orbiter that this is not going to be an issue.

As a matter of fact, by putting it on the mule, we are locating this hardware behind the center of gravity of the orbiter, and so we can offload some of the tail ballast that we have in there. So, really, the net impact to the orbiter's uplift weight capability is not adversely



impacted at all. So we don't see that as an issue.

MEDIA QUESTIONER: Thank you.

TELECONFERENCE OPERATOR: And our next question comes from Rushmore DeNooyer with PBS NOVA. Your line is open.

MEDIA QUESTIONER: Yes, thanks. This would be for Preston, I think.

Are your CATS engineers going to have to design any new tools to put that box on? You said it is just 10 bolts on a door. It sounds like maybe they won't.

MR. BURCH: No new tools. There should be no need for any new tools on this.

MEDIA QUESTIONER: Thank you.

TELECONFERENCE OPERATOR: Our next question comes from Mark Kirkman with Interspace News. Your line is open.

MEDIA QUESTIONER: Yes, thank you. This question is probably for either Preston or Ed.

I just want to know is there any constraint to being in this configuration that you are currently in with regards to the science packages or Hubble itself, and in particular, if you can't bring up the other channel, do you have a time constraint to stay in this configuration?

Thank you.

MR. WEILER: Go ahead, Preston.

MR. BURCH: Yeah. No. There is no time constraint for staying in this configuration.

We do have very limited telemetry on the instruments, and so we are rather keen to want to switch over to the B side, so that we can get the NSSC 1 computer, which is the payload computer that operates, supervises the five science instruments and whatnot. We would like to get that up and running, so we can have more insight into the condition of the instruments and how they are performing, but right now, we could stay in this condition indefinitely.

MEDIA QUESTIONER: Thank you.

TELECONFERENCE OPERATOR: Our next question comes from Anne Minard from National Geographic News. Your line is open.

MEDIA QUESTIONER: Thank you.

I just want to make sure I understand, first of all. Just to clarify, your immediate plan is to switch to Side B as you prepare the Side A replacement, so that you will be getting data back all the while. Is that accurate?

MR. BURCH: Let me clarify. The Side A and Side B are all mounted together on a single tray. So you are right. We will switch over to Side B, and that should work, and we will be getting science data down, but once we go up to replace the failed equipment, we will change out both A and B. They are all mounted together as a single integrated set of electronics on a single tray. So we will be getting a brand-new Science Data Formatter A and a brand-new Science Data Formatter B. We will be getting a brand-new NSSC 1 computer, new power supplies, the whole nine yards. So it is a pretty big package, but it will all be new hardware.

MEDIA QUESTIONER: Okay. And a follow-up to that, do you anticipate the recovery of the data that you have not been able to get because of the failure, and if so, when, and what other data is at risk? What other experiments are at risk while you have these delays?

MR. BURCH: This is really a science question. Maybe Ed can answer it better than I can, but you know, the data that we have taken so far, obviously, on the Solid State Recovers has been dumped to the ground, but in terms of future observations or lost observations, generally

there are opportunities to conduct those observations at a future time.

So we would anticipate that most of the observations that had been planned will simply be rescheduled once we have our Side B capability implemented, and I think there will be very little in the way of lost science ultimately.

I mean, certainly, a target of opportunity that comes and goes and cannot be seen again would be something that would not be recoverable, but those are pretty rare, and I am not aware of any that we have missed so far or that are anticipated.

So it is a rescheduling thing. I think we can reschedule all the observations that we're playing.

MR. WEILER: Right. This is not an unusual circumstance. Over the 18 years of Hubble, luckily Hubble has safe modes. That is, when something is wrong, the system protects itself, and that has happened many times over 18 years, and during those periods, you lose a few days of science or perhaps even a week, but for the critical observations you lost, they get rescheduled, and they get done eventually.

MEDIA QUESTIONER: Whose science got lost?

MR. WEILER: There are thousands of users of Hubble, and believe me, in the last 24 hours, I don't think we have done that particular piece of information up, but if they were critical observations, high priority, they would be rescheduled later, you know, in a week or two or whenever.

MR. BURCH: There is a Hubble daily report that comes out in the morning, and it lists all of the scheduled observations each day, and if you have been following those, you will see that there are a lot of observations per day that Hubble does. So we do have a list of things, but we would have to go back to the Space Telescope Science Institute to get a comprehensive list of all that.

MR. WEILER: Right.

MEDIA QUESTIONER: Okay. Thank you.

TELECONFERENCE OPERATOR: Our next question comes from Andrew Lawler with Science Magazine. Your line is open.

MEDIA QUESTIONER: I guess this question is for Preston.

Obviously, the failure comes as a surprise, but I

am curious. Was there any discussion in the past couple of years as to whether or not this spare should be included in the upcoming mission, or was it assumed that this would continue operating?

MR. BURCH: Well, we never talked seriously about changing it out. However, we were concerned about the lack of the ability to cross-strap the two sides, the A and the B sides of the SIC&DH with the A and the B sides of the Data Management System, which is the other electronics on board the observatory that handles all the various subsystems and whatnot, and so we did some extensive engineering on building a cross-strap kit which would further enhance the redundancy we thought of the observatory.

Actually, this was looked into when the observatory was originally being designed, and it was tossed out because it started making the electronics far too complicated, and in fact, that is where we wound up about a year or so ago after doing a lot of engineering on this. It became very complicated, very expensive, and we thought we might be doing as much harm as good in trying to cross-strap the units, but there is still the fundamental

problem that when you lose one of the Science Data Formatters, you now only have one left, which you are hanging the whole science future of Hubble on, and that is not the position we want to be in.

But you know, there are other components on the observatory. I mean I don't want to go into, you know, a discussion here to try to scare everybody, but you can postulate a lot of things that could fail that would seriously impact the program.

Hubble does have a lot of redundancy, and as Ed has pointed out, what we are trying to do here is restore redundancy. We are trying to make Hubble at least one fault tolerant and not have it be zero fault tolerant as we leave Servicing Mission 4.

MR. WEILER: Yeah. I think to add to Preston, Preston actually alluded to this earlier, but there is kind of an old saying in the Space Program, especially for electronic components. If the unit survives infant mortality, that is, you turn it on and it doesn't fail in the first month or two, it is going to probably last for a long, long time, and in this case, if your radio has been running consistently for 18 years, do you really want to

unplug it to try a new one?

So things like Voyager lasted 40 years. Landsats have lasted 20 years. So this is not the kind of thing that you would replace just for the sake of replacing it.

MEDIA QUESTIONER: Well, to follow up on that, obviously it is a gamble to postpone a mission to Hubble given that the telescope is aging and given, as you point out, there are a lot of systems that could go wrong. So are you weighing that, or is the decision that if this spare works, that we are going to delay the mission and fly it? I mean is that a pretty set decision? Have you already done the analysis of that essentially?

MR. WEILER: Well, you know, we more or less made that decision, but it is based on what Preston has alluded to and I have also alluded to.

You have got an option. If you go to Side B and Side B works, okay, then you can do the Servicing Mission, and you can operate your new instrument, but at that point, you have several single point failures that there is no redundancy for versus a two- or three- or four-month delay to get a brand-new instrument that has been sitting on the ground in a pristine environment which has full redundancy.



So, if we are going do to this final Servicing Mission and spend the money involved and launch seven astronauts, we thought it would be proper due diligence if we ensure that this mission would leave Hubble with a good solid five- or six- or seven-year future.

MR. BURCH: Just to amplify on what Ed is saying, when we switch over to the B side Science Data Formatter, as I mentioned earlier, we have to switch over several components on the DMS. There is about five electronics boxes over there that need to be switched over as well. Those now become additionally single points of failure to the science mission. Okay. So, if we lose those, then the game is over. So we have now introduced five more potential single points of failure into the system. That is why we are looking at the cross-strapping kit was to try to avoid bringing in those additional single points of failure.

But at this point, we feel the prudent thing is buy a little extra insurance for ourselves and do everything we can to make SM-4 productive for the next five years.

TELECONFERENCE OPERATOR: And our next question

comes from Irene Klotz with Reuters. Your line is open.

MEDIA QUESTIONER: Thanks very much.

I just wanted to know if you had an idea of how long the telescope operations will be suspended while the changeover to the other side of the equipment, of the computer is done, and then I have a follow-up.

MR. BURCH: Okay. We originally plan to be in a position to switch over the observatory to the B side around the end of this week. That is probably going to be delayed a day or two, something on that order, while we complete the engineering and risk assessments and review the ground test data, et cetera.

The actual switch-over takes approximately a full day to accomplish. Once that is done, then we need to bring up the instruments again, and we will be back doing science within -- I don't know -- a couple of days of having accomplished the switch-over. So it is on that order.

So, hopefully, I would say within two weeks from today, we will be back like we were on the A side, producing as much science as we were.

MEDIA QUESTIONER: Thanks.

And the second question is if for some reason, the spare doesn't check out properly, would flying the Hubble mission then kind of move up again in priority to kind of get it serviced as soon as possible if it looked like flying the spare wasn't going to be an option?

MR. BURCH: If flying the spare turns out not to be a viable option, then yeah, we would want to go ahead and fly as soon as we can, but that is really a question for John Shannon.

I think one of the options that John and his team were considering was possibly a one-month delay to launching our Servicing Mission, but we can't obviously keep them hanging.

So, John, that is really a question for you, I think.

MR. SHANNON: Well, again, for Irene, there is more to come in the troubleshooting, and if it turns out that they are unable to flight-qualify the spare, then we would just adjust our schedules.

TELECONFERENCE OPERATOR: Our next question comes from Peter King with CBS News Radio. Your line is open.

MEDIA QUESTIONER: Thank you, and this is for

Preston.

I think you told us that the replacement box weighs in the neighborhood of 135 pounds. I am just wondering about the sheer size of this and if you can compare it to an everyday object. Like is it as big as a refrigerator, as big as two refrigerators, anything like that, that would help?

MR. BURCH: Okay. Well, it is 21-1/2 inches by 32-1/2 inches by 9-1/2 inches. So it is a little less than 3-feet long, a little less than 2-feet wide, and about three-quarters of a foot or less than a foot thick, and it is a relatively easy box to manipulate in space.

Of course, that is easy for me to say. I don't have to do that job, but certainly compared to things like science instruments and FGS's and batteries, the battery modules are pretty heavy. They weigh almost 500 pounds, and so there is much more mass to manipulate there.

So this is one of the more easier boxes for the astronauts to manipulate, in my view.

MEDIA QUESTIONER: So it is like a small, small ice box. Thanks a lot. That is all I have got.

MR. WEILER: Very small.

TELECONFERENCE OPERATOR: Our next question comes from Clara Moskowitz with Space.com. Your line is open.

MEDIA QUESTIONER: Hi. I am just wondering. After you replace this box, if you do go ahead and do that, and after all of the servicing missions that have come before, how many elements of the original 18-year-old Hubble will be left, or is it almost a brand-new telescope at this point?

MR. WEILER: Preston, did you keep track of that?

MR. BURCH: Yeah. Well, now, that's a great question.

MR. WEILER: That is.

MR. BURCH: You know, the power system, the electrical power system has been almost totally replaced. We are on our third generation of solar arrays. We have a new power control unit which is really Hubble's heart that was changed out on the last Servicing Mission, and we will have six brand-new batteries. So the only thing that remains are the power distribution units, and knock on wood, they seem to be doing fine. We have changed a few fuses here and there.

There are an awful lot of components. Hubble is

very big, and there's a lot of components on board, and there is a tremendous amount of stuff that hasn't been changed out, but you know, we have changed out the tape recorders. We originally launched with reel-to-reel tape recorders. We had three of those for recording science and engineering data. We have got one left, but they were replaced with Solid State recorders that have 12 times the storage capacity of the original mechanical devices.

Hubble got a brain transplant on Servicing Mission 3A. So the main computer, although it is old by desktop computer standards, it is still very advanced, very capable for our application.

I am trying to think here what else.

MR. WEILER: Gyros.

MR. BURCH: Yeah, the gyros. Well, we have replaced those just about every other Servicing Mission, and we have got some enhancements that we have made to these that will make them even longer-lived. You know, the trend has been for increasing life because we have improved the manufacturing processes with that, which have helped a lot. This time around, we are using silver-plated flex leads to resist the corrosion and brittleness problem in

the suspension fluid. So the gyros are much better. We have got a couple of reaction wheels that we changed out, two out of the four.

So, yeah, Hubble in many respects, you know, because it has been renewed and upgraded and its capabilities improved, it is a far better, a far more robust observatory than when it was launched, and as a matter of fact, in the early days, we had hardware hooping out left and right.

This gets back to Ed's comment about infant mortality. I mean at one point, we were beginning to wonder if there was ever going to be an end to this, but things settled out, and over the years, with all the various upgrades, it has been remarkable.

Of course, I haven't even touched on the science instruments. The capabilities of the new instruments is just astounding.

So a lot of stuff has been changed out.

MR. WEILER: All of the original instruments have been changed out.

MR. BURCH: More than once.

MR. WEILER: More than once.

One thing we still have though is the primary mirror.

MR. BURCH: And the secondary.

[Laughter.]

MR. BURCH: But yeah, there is the DMS. There are the gimbals on the High-Gain Antennas. Those are electromechanical devices. We do have a spare for that. We worry about that.

We did replace one S-Band Single Access Transmitter. The other one is the original. We do have the two MA transponders, which provide the engineering data. So we have worried about losing an S-Band Single Access Transmitter, but we could lose both of those and still get science data down through the MA transponder, believe it or not, admittedly a much reduced rate, but we still have a number of tricks up our sleeves to cope with failures in other areas.

TELECONFERENCE OPERATOR: And our next question comes from Ben Moraski with Madill News Service. Your line is open.

MEDIA QUESTIONER: Hi. I had one question. How confident are you guys that the Side B packaging is



actually going to be able to run when you switch over, and that it hasn't been caught in whatever failure has plagued Side A?

MR. BURCH: Well, Side B, the Side B Science Data Formatter and the associated electronics have been off. So, really, it has been in the world's best storehouse or warehouse that you could imagine because we haven't had engineers and technicians that could doodle around with it, drop it on the floor and stuff like that. So it has been powered off, and although as Ed pointed out, it has been in the radiation environment, with all the discrete components, et cetera, they are fairly robust to that kind of degradation.

It was checked out extensively on the ground. We did the switching to Side B and back to Side A and back to Side B on the observatory prior to launch, and so it was all checked out.

So we are pretty confident. I hope I am not jinxing us by saying all that, but it should work.

MEDIA QUESTIONER: Thank you. That's all I had.

TELECONFERENCE OPERATOR: The next question comes from Robert Pearlman. Your line is open.

MEDIA QUESTIONER: Hi. For John.

If you decide to fly Endeavour first, are there any constraints or any particular challenges defying the launch-on-need mission for STS-125 with Discovery?

MR. SHANNON: Robert, it would take a rebuild of the flight software specific to Discovery to fly that mission. We did kick off that work today just to protect that option.

If the rescue mission were 127, that would also be on Endeavour, just like the current launch-on-need rescue mission is, and we would already have the software built for that. So that is all it would take is just a new software build.

MEDIA QUESTIONER: Okay. And also just quickly, if you have talked about it at all, it is going to be holding Pad B longer than what was originally expected. So it probably will have an effect on Ares 1-X. Can you allow for additional changes to be as you wait for this mission to launch?

MR. SHANNON: We have been in discussions with the Constellation Program all day today about that very question. If we delay using Pad B, I think there are some

things we could do, like continuing to build the lightning towers out there.

The bigger concern really is the Mobile Launch Platform that STS-125 is sitting on. That is the same Mobile Launch Platform that we expect to use for Ares 1-X.

We are discussing if we delay Hubble, how we can work around that constraint.

MEDIA QUESTIONER: Thank you.

MODERATOR: Hi. This is J.D. We are coming up on the one-hour block. We have still got two people in queue that haven't asked questions. We are going to extend it just a moment or two to let their questions come in. Then we are going to wrap up.

Melanie?

TELECONFERENCE OPERATOR: Yes. Our next question is going to come from Phil Berardelli with Science Now. Your line is open.

MEDIA QUESTIONER: Thanks. My question has been answered.

TELECONFERENCE OPERATOR: That would make our final question coming from Matt Phillips from the Orion Review. Your line is open.

MEDIA QUESTIONER: Thank you. This is for Ed or Preston.

First of all, did you notice any signs of malfunction prior to this past weekend?

MR. BURCH: No, we did not. There was no indication of an impending failure, and even, you know, we have looked back over the telemetry that is available to us to see if perhaps we missed something, and again, there was no trend information that pointed to anything that was about to happen.

MEDIA QUESTIONER: Okay. And then kind of a follow-up to questions that were asked earlier, since we knew this was going to be the last Servicing Mission for Hubble, I am surprised that steps weren't taken for the back-ups. You had mentioned the back-up data, you knew that it could be replaced, why it wasn't already in stability or tested for these things, and I think you mentioned also some of the other components that you know you have back-ups for. Why wasn't this stuff studied or tested and prepared for launch, just in case of the back-up plan?

MR. BURCH: That would take a tremendous amount

of money and time to do that. We would have to add a substantial number of engineers to do all that, and you know, if you did that on every mission, the total cost of the program would have been substantially higher, and of course, you have to weigh that off against the risks that you are taking of a delay, but there is a huge inventory of hardware that potentially could be changed out on any mission.

So it just becomes really unaffordable. Well, it is basically a question I think of resources to be able to do something like that.

Ed, you might want to add to that.

MR. WEILER: And priorities. I mean, you know, if you wanted to replace everything that is working now on Hubble with spares that we have on the ground -- I am just taking a crazy guess -- you would probably need another three, four, five EVAs, which is another Shuttle mission.

So each time we go up there, we have to evaluate what problems we have and that we know we can fix, what new science instruments we want to put on, and it is all put in a priority.

If we had only filled up three EVAs on this

mission and had two left, then maybe we would have done some of that stuff, but just to do what we had to do with the highest priority, we filed all five EVAs, chock-full, six hours each.

MODERATOR: All right. Well, thanks, Ed and the panel.

That is going to do it for today's media telecon.

I would like to thank the panelists for their time. If you have still questions, if you could e-mail Don Savage or myself, J.D. Harrington, we will see about getting the answers to you as soon as we can.

Don't forget that this telecon was recorded. You can dial in at 1-866-415-2342, or toll free, 1-203-369-0687, any time day or night in the next 30 days to replay the telecon. Those numbers again, 1-866-415-2342, or toll free, 1-203-369-0687.

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Again, thanks for joining us, and have a great night.

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