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PRESS ROUNDTABLE
STS-107 MISSION MANAGEMENT
July 22, 2003

PRESENT:

KYLE HERRING, JSC PAO,
LINDA HAM, Chairperson, STS-107, Mission Management Team (MMT)
PHIL ENGELAUF, Mission Operations Directorate
LeROY CAIN, STS-107 Ascent/Entry Flight Director

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[TRANSCRIPT PREPARED FROM TELEPHONIC RECORDING.]

P R O C E E D I N G S

MR. HERRING: I will introduce the panel. Some of you have already been introduced, but since we are on the air and there is a lot of people listening, I'm sure, let me run down to my left here.

It is Linda Ham who is on STS-107, served as a Space Shuttle program manager for Integration.

Phil Engelauf, to her left, is the Mission Operations Directorate representative for STS-107. He is also a veteran flight director.

A lot of you know LeRoy Cain. He served as the STS-107 Ascent/Entry flight director.

All three, I think, have some opening comments, and then I guess before we start, just for the record, Tracy, why don't we start at your end, and you guys just quickly go around, so that they all know who you are, also.

QUESTIONER: Tracy [inaudible], USA Today.

QUESTIONER: Tod Halberson [ph], Florida Today.

QUESTIONER: Eric Pianen [ph], Washington Post.

QUESTIONER: Marsha [inaudible], Associated Press.

QUESTIONER: Bill Harwood, CBS.

QUESTIONER: Mike [inaudible] Centinnel.

QUESTIONER: Mark Karo [ph], Houston Chronicle.

QUESTIONER: Jena Trab-Gold [inaudible], ABC News.

QUESTIONER: Matt Wald [ph], New York Times.

MR. HERRING: I will ask when we get to the questions -- I know these microphones work pretty well, but make sure you speak up with your questions, so everybody can hear that.

With that, I will turn it over to Linda.

MS. HAM: I know most of you, but for those of you who don't know me, I will give you a little bit of history about my background here with NASA.

I have been here with NASA for 21 years. I did start in Flight Control in the Missions Ops Directorate. I was a propulsion flight controller on the Shuttle

flight, and then I became a flight director in early 1990, 1991. I was a flight director for 9 years. I had been lead flight director on several missions, including a Space Lab mission which is similar to the STS-107 science mission and also for the Hubble Space Telescope, one of the servicing missions. I also did Ascent/Entry flight director.

I have been in the Shuttle program for 3-1/2 years and was in the position as manager for Integration in the Shuttle program for the last 2-1/2 years, and that includes chairmanship of the On-Orbit Mission Management Team.

Most of you know, immediately after the accident on February 1st, I chaired the Mishap Response Team. I did that for the 6 weeks immediately following the accident, and then we turned that over to the NASA Accident Investigation Team, which was led by Randy Stone.

They began their investigation while I was chairing the MRT, and during the time when they were doing the investigation, we felt that it would be appropriate for me and the program managers not to come forward and talk to the press because we didn't want to interfere with their investigation, but now that they are wrapping it up and they are in the report-writing stage, we felt it would be appropriate for me to come forward and speak to you in particular about the Mission Management Team process in a generic sense and also more flight specific on what we did on STS-107 since.

So I am really happy to have this opportunity to finally come forward and describe to you the Mission Management Team -- [audio break].

[Pause.]

TELECONFERENCE OPERATOR: All participants, please continue to stand by. We are having technical difficulties right now. Please stand by.

[Pause.]

MS. HAM: [In progress] -- and we have members from different centers. Kennedy Space Center has members. The Marshall Space Flight Center, those projects have members, including, for example, the external tank. We do tie into headquarters. They are tied into every MMT.

The MMT, our responsibilities are to review the content, the mission replanning, any significant issues that come up, and to develop a future plan. So it is sort of, during the flight, kind of a pyramid of all the other meetings that are going on. There is a lot of meetings, a lot of activity in the control center that go on during the flight.

I did chair the MMT for 107 in particular. We do operate and we communicate, and everything that we do, we do it as a team. Like I said, it is kind of the top of the pyramid of all the activities that are going on during the flight. So outside of

the MMT, we are still -- I come into the control center, talk to the flight directors, talk to the MOD rep, talk to the MER. I go down there every day during the flight.

The MER, I will talk about that a little bit. The engineering hub in the control center on the first floor of the control center, they housed all the systems experts. These experts addressed the technical issues, and the results of their analysis are communicated to the MER manager and their management up to the MMT.

The MER manager is actually a NASA person, but all of the subsystem experts are a contractor. They are either the United States Alliance or Boeing.

If we have a specific problem that we are going to work, for example, we had the assessment team, we pull together a special team. We usually call them PRT, Problem Resolution Team, which I am sure you have heard of in the past. They will, again, meet, below even the MER management level, and they are accountable to the MER. They will brief the MER in meetings that happen in that room, and to MER managers, both NASA and contractor site, and the important things that come out of those meetings will be forwarded to the MMT.

So that is kind of generically how the process works, and one of those PRTs that was a specific team that worked 107, we called the Debris Assessment Team that you have heard about and we have read about in the papers.

That was it.

MR. HERRING: Okay. Phil?

MR. ENGELAUF: I will just keep my comments brief, just to give you a little background about myself.

As Linda indicated, I was the Mission Operation Directorate representative on this flight for STS-107. I am a flight director by discipline, started with NASA some 25 years ago at [inaudible] Research Center, but I have been here at JSC since 1982, started out as a flight planner in the Shuttle program.

I was selected as a flight director in January of 1990 and have been doing that job essentially ever since that time.

I have served as a flight director on 29 Space Shuttle mission, have been the lead flight director on 11 of those, and as most of you are aware, just before the first of the year, Wayne Hale [ph] accepted an assignment at Kennedy Space Center, and he transferred down there. Wayne was the deputy chief of the Flight Director office at the time, and when he went to the Cape, I moved up and took the deputy for Space Shuttle within the Flight Director office.

On this particular mission, I served as the Mission Operations Directorate

representative. As Linda indicated, the MMT has representatives from all of the various disciplines and responsible organizations. Mission Operations Directorate provide the Flight Control Team. We do the traditional mission control function that most of you think of when you see pictures of the Flight Control Team during missions. The flight director is the head of that team, and we are represented to the Mission Management Team by a single individual who is not a console operator for that particular flight.

It is traditionally the chief of the Flight Director office or one of his deputies, and in this particular case, that was myself.

MR. HERRING: LeRoy?

MR. CAIN: Thanks. Again, I will be brief, also, because I know most of you and have spoken to most of you at least once already.

My background briefly, I have been working here at Johnson Space Center for about 15 years. I also started in flight control. I had various different positions in flight control as well as flight control management for about 10 years, and in 1998, I was selected to be a flight director.

Since that time, I have served as a flight director on several missions in ascent/on-orbit phase as well as entry, and STS-107 was my fifth mission that I worked the ascent on and the seventh mission for which I worked the entry.

MR. HERRING: Thanks, everybody.

Like I said before, we will start at this end with Tracy and then just work ourselves around. If you would, limit it to one question, and we will come back ground. Go ahead, Tracy.

QUESTIONER: For Linda Ham, can you tell us when you heard -- what have you heard about any requests for imagery of the shuttle on-orbit and how you responded to those?

MS. HAM: That is an interesting question.

We have read reports that the Mission Management Team had declined a request for outside assistance, and if you read through the transcripts, you will notice that the Mission Management Team never addressed the request for outside assistance because it never came up in any of the meetings.

It never came up to me personally. What my involvement was, was I did hear about a possible request for imagery via a phone call. When I did hear about that possible request, I began to research who was asking, and what I wanted to do was find out who that person was and what exactly they wanted to look at, so that we could get the proper people from the ops team together with this people or group of people, sit down and make sure that when we made the request, we

really knew what we were trying to get out of it.

So I went to our contractor, United States Alliance, to see if they were making a request. I went to the Space Shuttle engineering office to see if they were requesting, and I also went to that Mission Evaluation Room where all the engineering work was. So I am thinking if anyone knows it, they will know that there is such a request out there.

I couldn't find any requests. So we did not pursue that.

MR. HERRING: Todd?

QUESTIONER: Todd Halberson of Florida Today.

Given the hostile environment that the Shuttle flies in, I am wondering if you can tell me why you guys did not meet over the holiday weekend, the Martin Luther King holiday weekend.

MS. HAM: I wanted to say some more about this picture. You know, I had absolutely not reluctance to ask for outside assistance, nor did the program. We certainly would have done that if we could have got the right information together and the right people together and done that.

The people -- now we go to 20/20 hindsight -- several weeks after the accident, I did find out who was asking, and these folks that were asking were actually in the MMT and never brought it up. They were in the MER meetings before the MMT and never brought it up. So, for some reason, they didn't feel comfortable bringing it up in the MMT. We certainly think they would have done that at those other meetings or in the hall or at any time, and it never, never came up.

After that one day that we are referring to where I did hear about it, I never heard of another thing, and to my knowledge, it has never come up as anyone again, the request.

Okay. Now, your question?

QUESTIONER: My question was, given the dangerous nature of orbiting shuttles in this environment, I am wondering why you guys did not meet over the Martin Luther King holiday weekend.

MS. HAM: In my judgment and the judgment of the Mission Management Team, we didn't feel it was necessary to hold a meeting every day. Each of the MMT members are highly involved in the flight.

Phil comes in even when we don't hold MMTs, and we get our work done. The engineering team will still continue with their analysis. In fact, they asked if they could have over the weekend to finish the imagery analysis. They wanted through the weekend to do that.

The astronauts are still involved in contacting their people, their CAPCOMs [ph] and the Mission Control Center and the other folks. Safety is in the MER. I came in over the weekend. So, in our judgment, we felt like we didn't need to hold a meeting to continue with the work and processes that we were doing during flight.

It is not uncommon, if you look back even on Space Station flights where they are highly complex. We do not meet every day.

In fact, the last two Space Lab science kind of missions that we flew in 1998, in those two flights we had five MMTs on one and seven on another. We are also on call, 24/7. Within 2 hours, we can be in the control center having a meeting.

One of the subjects that we talked about at one of the early MMTs during the STS-107, where we were talking about a possible in-flight maintenance procedure to repower a [inaudible] that could have shorted, I said, "We are not going to do that until we hold an MMT. If you guys decide you want to pursue that path, then we will get together and meet as a team because we don't want to do something without everyone's concurrent." So it is easy for us all to come together if we need to.

MR. ENGELAUF: I'd like to add something to that, though, and you guys are familiar enough to understand.

The Flight Control Team with the flight rules, which are essentially the charter from the program, had a lot of latitude on how we operate in a real-time environment.

The Mission Management Team is exactly that. It is a management team and not a real-time flight control function. So it is important to distinguish there that the flight control time on console is there and ready to respond to any [inaudible] situations, and we really only look to the management team for direction when we get outside the envelope of predetermined objectives for the mission or if we have a phenomenal case where we call in a lot of outlying support.

As Linda pointed out, if we come into a situation like that, the Flight Control Team can engage the MMT within a matter of an hours to get additional guidance, but it is important to realize that the management team is not necessarily there to supervise the day-to-day, minute-by-minute operation of the flight. That is not the intent.

MS. HAM: Plus, the MER could call the MMT to come in.

I have people that -- actually program people support the mission, 24/7, also, in the customer support room, and they can call to invoke the MMT. We have a standard procedure on how to do that.

MR. HERRING: Eric?

MR. CAIN: Tom, to complete that answer, it wouldn't be complete without saying that as a flight director on console in real time, regardless of the frequency of the Mission Management Team meeting schedule, we are in place to manage the team.

As Phil said, beyond that, we have at our ready disposal a list of names and phone numbers and direct lines of communication with folks that we can get in contact with, and as Linda and Phil mentioned, we are prepared and trained in such a way that we will call up. And whether it is for a notification or whether it is for a request for a meeting or whatever it might be, we are at the ready to do that as it becomes necessary, if it becomes necessary, and that is regardless of the frequency of the MMT meeting.

QUESTIONER: Given all of the uncertainty about the nature of the foam strike, why was it that you folks decides to quickly that it did not really pose a safety-of-flight issue, given the fact that the Crater model perhaps wasn't the best of all models available to you and given the fact that there was a lot of uncertainty about precisely how large the foam was, where it hit on the wing, whether it was on the tiles or the RCC?

And what did you mean when you said January 21st that, "Really, I don't think there's much we can do"?

MS. HAM: Well, let me answer the first question, first, about why did we quickly [inaudible], why did we come to the conclusion that it was not a safety-of-flight issue based on the Crater model.

Again, we were trying to give the technical community sufficient time to do an in-depth analysis. They did do their analysis. They did use the Crater and these other tools that they have available to them.

I do trust that the Mission Evaluation Room with their systems experts would bring forward their results of that, and they did come forward on that Friday the 24th and said that they did not believe that there was a safety-of-flight issue and that there would be no burn-through, and at most we would have a potential turnaround issue from work on the Orbiter that we have to do post-flight.

I did trust that their analysis and the work they had done was correct.

Now, back on the other question about on the 21st which when I made a statement about what we could or couldn't do during the flight, when I first was alerted to that, I couldn't even recall making that statement. But, of course, I did go back, re-read the transcript and listen to the tapes, and sure enough, I did say that.

Now, if you put that in context to what the MER manager was talking to me

about and the things that I was thinking, the way I recall this is I was thinking out loud, and, of course, I do know that we do not have TPS repair, tile repair or RCC repair capability that we fly as a kit on the Orbiter. That was part of what I was thinking.

The other thing that I was trying -- thinking about was having the engineering community go back and get a flight rationale from STS-1. If you recall two flights prior to 107, we had the foam come off, a pretty big chunk of foam from the same area that we were thinking came off the 107, the bipod ramp, and it struck the SRB.

I was trying to remember back to October when we were at the flight writing review for the STS-113, the next flight, trying to think about what was our flight rationale, was it based on the fact that the density, the properties of that foam could not do any damage to the Orbiter. I couldn't recall, and I wanted the engineering to go back and pull that data, so that we could confirm that.

If that was what the flight rationale was, then we would feel pretty comfortable about this mission being safe. It didn't end up being what the flight rationale was. That is where I was going with that.

MR. HERRING: Marsha?

QUESTIONER: For Linda, I was struck by reading the transcripts that the topic of foam doesn't even come up until halfway or two-thirds through the meetings, and frankly, it looked a little skimpy, the discussion.

I am trying to understand why it wasn't at the top of the agenda because it was a potential flight safety issue, and how is it that it seemed to have got buried under a lot [inaudible]?

MS. HAM: We usually start our MMT with mission ops director just to give us a status of what who is doing, where they are in the mission, and then we go to the Mission Evaluation Room, the MER, and then he will bring things up in whatever order that he happens to bring them up on that particular day.

You will notice on that first MMT, I believe I asked about it because I did know, you know, the times that I visited the MER and talked to my office with people -- I did know we were doing the analysis. We were still looking at the ascent video. We were doing the transport analysis, which is based on where the foam comes off, where could it potentially hit on the Orbiter and at what velocity. Then the third piece would be the Orbiter piece on what could be the potential damage to the Orbiter.

It wasn't lengthy discussions, that first meeting. We knew they still had the analysis in work, just wanted to make sure it was all underway.

A lot of the things that we discussed were in the MER and in other meetings and

rooms. This is sort of the top of the pyramid with senior management there. We don't actually do the analysis. So we don't get a real in-depth discussion of all the nuts and bolts that went into that.

MR. HERRING: Bill?

QUESTIONER: Let me ask him a lengthy question because I am not sure how to phrase it.

I have thought a lot since this happened. I was around after 51-L, and I remember joking with other reporters after the management changes that were put in place, I would joke it will never fly, you know, there are just so many checks and balances that will have to happen.

And yet, the system that a lot of the media and outside of Ascent have criticized that very system. I mean, you guys are in that very system that was put in place after 51-L, that everybody unanimously said in this case did not work properly, somehow missed the significance of the foam strike, continued flying, the flight rationale was not correct for whatever reason, Crater was wrong, and the analysis was not correct.

So my question is: How did NASA get from the STS-26 mind-set when this management system was fresh? I have no doubt just based on experience that when STS-17 rolled around and big chunks were falling off the bipod, you guys would have stopped and fix that. I just don't have any doubt about that. That is personal opinion.

But how did you get to this point where this system failed in the way that it did? I mean, if anybody has any thoughts about that, any one of you.

MS. HAM: I think there's huge differences in the way we work today than in the Challenger time frame.

QUESTIONER: Post challenger. I'm talking post challenger.

MS. HAM: Right.

QUESTIONER: The changes that were made in the wake of Challenger.

MS. HAM: Well, we have had foam off since STS-1 from the tank. So I am not sure if the thinking before, between STS-1 and STS-26, -27, -28, that foam off was different than it is today.

QUESTIONER: This was the biggest piece ever, and when 12 was the biggest piece ever, by far from all the previous experience. I am just trying to see how this evolution took place.

MR. ENGELAUF: I don't think that the fact that this was the biggest piece ever

was really -- there wasn't a lot made of that during the mission in the MMTs. I am telling you now as an observer sitting in the MMT from the ops perspective.

I think Linda's point is correct. We operate by a series of methodologies that I think have been tested over a long period of time, and we did put a lot of changes in place after the Challenger accident.

I think the way we do business today is largely representative of what we -- the changes that we moved to after Challenger.

As Linda pointed out, we have had foam come in off the tank at various intervals during the program, and I have seen this characterization, I think, that this group of management got comfortable with foam coming off the tank or that Ron or Linda or somebody got comfortable with foam coming off the tank.

And I think that is a little bit unfair because foam has been coming off the tank periodically, not -- you know, I don't want to characterize this as just constant, but we have had instances of foam coming off the tank throughout the history of the program, and the same management processes that I think got us comfortable that that was not really being a safety-of-flight issue have been allowed to continue, rightly or wrongly.

I don't think you can point to individuals today and say that that person got comfortable with it because we have sort of inherited this from the time Linda and I were back as front room flight controllers and there was a completely different set of people managing the program.

But I think the intent is that our process has tried to cover these sorts of things, and we tried to put all of the checks and balances in place and we try to do all of the analysis. On this particular case, I don't think that the problem was that we didn't do the analysis or didn't take notice of the foam. I think we got the wrong answer on the analysis.

MR. CAIN: Bill, from my part, I would just add that, to get to your question, part of the answer has to be the fact that we don't know today why we didn't have good flight rationale, and we are going to go back and certainly try to understand that better.

The board is doing a lot of work, and they will have some good suggestions and recommendations for us. We look forward to hearing their evaluation from their perspective. They have a very unique and valuable perspective that we intend to pay very close attention to, and I suspect that they will help us with that question.

My impression is, though, that at least part of the answer has to be that, fundamentally, we are dealing with an incredibly complex system, and it is the most complicated machine that humans have ever built and intended to operate. Over time, we are going to make some human errors, and that has got to be at

least part of the answer.

We do everything in our power every single day in this business to manage the systems to minimize that, and over time, with as complex as a system as we are talking about and the risk environment of space, that has to be at least part of the answer and I suspect we will learn more as we move forward.

MR. HERRING: Mike?

QUESTIONER: My questions are for Mr. Engelauf and Ms. Ham.

There was an exchange between the two of you in the MMT meeting, the 24th I believe, when you talked about informing the crew of the debris strike, in light of the fact that the media has found out about it, and it gives the clear impression, at least it did to me, that if we hadn't -- we the press -- hadn't found out about it that the crew never would have been told. Is that true, and why or why not?

MR. ENGELAUF: I would say that is probably true.

At the time that we sent that up to the crew and the ultimate determination that we made in the MMT, was that this was not going to be a safety-of-flight issue and, therefore, because the crew could not do anything with that information, it wasn't going to change the way that they would conduct their operations on board the vehicle. It wasn't going to change the flight plan. It was going to have no bearing on the conduct of the mission.

Over time in dealing with the crews, they are extremely busy on orbit, and bothering them with information that really doesn't bear on the conduct of the mission is just something we don't normally do.

Because we did get questions here on the ground about that and there was an upcoming press conference on board with the crew, we decided there was a possibility that they were going to get a question about it. Rather than have them be blindsided by a question that they didn't have any background on, we simply told them that, hey, there has been this issue discussed on the ground, we think it is a non-issue, and by the way, here is a little MPEG file, so you can see what we are talking about. It was very innocent.

MR. HERRING: Mark?

QUESTIONER: I am Mark Karo from Houston Chronicle, and mine is for Linda Ham.

Can you tell us when during the mission in your mind, you were satisfied the foam wasn't an issue, and was there any single thing that was sort of a clincher?

MS. HAM: I believe that would be the Monday. I don't remember the date of the MMT where they closed out the last open area where they had analysis.

At the MMT on Friday -- I think it was the 24th -- they had closed out five of the six areas, had one remaining open area, and that was the main landing gear door and needed to wrap that analysis up. So I was pretty comfortable that Monday that there was no issue for the mission.

MR. HERRING: Dana?

QUESTIONER: For any of you, how should the request for imaging have been handled? You make it sound like a very casual off-the-cuff process, but what should the process have been to formally request imaging that didn't happen?

MS. HAM: Well, the formal, I can explain. There is a formal route, but even an informal route we typically work. If we hear about the request, we can certainly act upon it, if we need to meet or just pursue it.

The formal process would be that if someone brought it up at the MMT or brought it up to someone when we would hold the meeting, they would share with what we wanted to do, and then we go through the Mission Ops Directorate to a [inaudible] position they have, flight dynamics officer. He had some standard procedures that they work with the Department of Defense or whoever it is to ask for the outside assistance.

MR. HERRING: Matt?

QUESTIONER: Matt Wald.

Linda, on the transcript from the 24th, you say that you had had a discussion with Calvin Shomberg [ph], who is not in the room, about damage to tile from -- potential damage to tile from foam.

Why a tile expert and not an RCC expert, and could you describe that conversation? All you did was allude to it in the MMT.

MS. HAM: Right. First, why the tile expert. I cannot recall if the RCC expert was in the room or tied in, and you would have to go back and ask that person if he was or wasn't.

The Mission Evaluation Room, with all the systems expertise, they call in the right people. I will bet he was tied in, either downstairs or in the room.

I will say that the RCC was one of the ones that was closed out early. They had done the engineering assessment and evaluated it. He said that the worst case on the RCC would be a coating damage, which would not be a flight safety issue whatsoever. So that was closed out earlier.

The tile discussion that -- yes, Calvin was in the MMT, and he did speak from the back of the room. You couldn't hear him in the -- so it didn't come out in the

transcript. He was reiterating something that he had talked to me about in my office saying that at worst case that the tile may have sort of a slope-shaped kind of damage and at worst case they would go down -- it would still have a layer at the FIP [ph], a layer of tile remaining.

So he did not believe that there would be any burn-through completely all the way through a tile, that tile, and did not believe there was any safety-of-flight issue. And he had been in my office describing this to me, a couple of days prior to that. I think it was the Tuesday or -- Wednesday of that week.

QUESTIONER: Do you know who the MMT person -- did you get a report from an MMT person that said surface which can only stand .007-foot pound [ph] -- excuse me -- excuse me -- from an RCC person who said that this surface that could only -- it is only designed for .007-foot pound was going to come off with nothing more than coating damage from [inaudible]?

MS. HAM: I did not get a report from that person specifically, the MER manager -- from the MER manager.

QUESTIONER: From the MER manager.

MS. HAM: Yes.

QUESTIONER: And who is that?

MS. HAM: McCormack.

QUESTIONER: McCormack. Okay.

MR. HERRING: Tracy?

QUESTIONER: Tracy [inaudible] again.

You mentioned earlier that there were people on the Mission Management Team meeting as well as in the MER who had wanted imagery. Did you ever [inaudible]?

MS. HAM: No. The people -- now, in hindsight again, once I found out who they were that were members of the assessment team that wanted them, they were tied -- they were in the MMT, yes, and they were in that MER meeting, yes. In fact, I think they briefed the briefing to the MER manager.

QUESTIONER: So who were they? Can you tell us the names?

MS. HAM: The co-chairs were Rodney Rojo [ph] for Engineering Directorate, and United States Alliance, Pam Adore [ph].

QUESTIONER: Pam Adore?

MS. HAM: Yes.

QUESTIONER: Pam was on the MMT, and Rodney was, too?

MS. HAM: He was tied in from downstairs. I asked him that several weeks after the accident, and I asked him, "Were you at the MMT?" He said he was in the MER -- its telecon. So he didn't -- he just didn't walk off, and he was there, downstairs.

QUESTIONER: But you asked him from the MER whether imagery was wanted, and that person could know that Rodney --

MS. HAM: I did not ask in the MMT. I asked on the phone. I called the MER up as soon as I found out, which was on a Wednesday, and called the MER manage and said,"Do you know of anyone asking for outside assistance?" They said, "Well, we'll check around and make sure, and we'll call you back." They checked around, called me back and said, "No, nobody was looking." You're right. At their meetings, it never came up either. At the engineering meetings held in the MER, the request never came up.

You can confirm that with the MER manager.

QUESTIONER: Do you think that that indicates some kind of problem, though, in people's willingness to speak up? Because it's obvious some people did [inaudible].

MS. HAM: If it was, it was, you know, down at the lower level of management.

I really can't put words in their mouth or I cannot speculate on why they didn't feel it was appropriate to bring it to the MER manager or the MMT.

QUESTIONER: I was curious as to why the Boeing analysis, the so-called "Crater assessment," why that wasn't more formally -- or either formally briefed during the MMT. It seems like there was a brief discussion about it, I think, on the 24th, but I am curious as to why the head of that team did not come in and brief the MMT on that issue.

MS. HAM: The MER manager will brief -- uses his judgment, the MER manager and his management team, on deciding how much, the level of detail he needs to bring forward to the Mission Management Team.

I believe that the engineering community didn't feel it was a significant enough issue to bring forward a great deal of information.

What do you think?

MR. ENGELAUF: I agree. He presented, essentially, the results of the analysis

and not necessarily the details of it, I think probably because the result indicated that he didn't believe we were going to have a problem. Had he decided that we had a problem, we would have talked about the underlying assumptions and the details and so on and so forth.

Crater. As an observer, again, sitting in the room, my interpretation of the conversation was that Crater was the tool that had been accepted up to that point as the standard tool for doing that kind of analysis, and they had run essentially what would be the norm for that kind of analysis.

MS. HAM: Another thing is that you also noticed that nobody asked questions either. You can ask John Rutts [ph], the safety rep, and all the folks on their contractor team who also supports the MER meetings, their management [inaudible] in the MER when they have those. Nobody had any technical questions. Everyone seemed to feel comfortable with what we were being told.

MR. HERRING: Eric?

QUESTIONER: This is for Linda Ham. Let me just sort of come at this question from this direction. Is what you are saying, that throughout the mission while there were all of these conversations going on at various levels among engineers and contractors and all that about the need for imagery, that you didn't know anything about those concerns and questions, and therefore, you never really responded to them until you found out after the fact?

And secondly, how much responsibility do you personally feel you bear for what proved to be faulty decisions on the severity of the foam strike and the need for the imagery?

MR. HERRING: The answer to the first question on the imagery, I was never alerted to the concerns that were expressed by the engineers working the issue. Neither the severity, the potential severity of -- some of them felt -- of the damage or the fact that they wanted the [inaudible] image, again, it came up to me that there may be a possible request on Wednesday. I forget which day that was.

MR. ENGELAUF: The 22nd.

MS. HAM: The 22nd, that is when it initially came up to me. That is when I went and spent a large part of my day trying to find out who was requesting it, so we could get the proper information, and it ended that day. It never came up again, never, not in the hallway, not in the Mission Management Team. None of my MMT members had heard about -- heard or brought forward to me the fact that someone had been asking. So that was the beginning and the end of it.

QUESTIONER: Could you do the second part of my question?

MS. HAM: The second part, could you repeat it?

QUESTIONER: How much responsibility do you personally feel you share in what proved to be faulty decision-making on the foam and the need for imagery?

MS. HAM: Okay. Well, first of all, on the imagery, I will take responsibility for being the chair of the Mission Management Team. You know, I am the team leader there, but we are a team.

We all heard the discussions. None of us felt that the analysis was faulty. I said, first, imagery, but I am actually addressing the analysis.

I personally, nor does the MMT, do the analysis. We must rely on our contractor work force who had the systems expertise to go off and do that analysis. We don't have the tools to do that. We don't have the knowledge to do that or the background or expertise to do that kind of thing. So we do rely on the systems experts. That is the way that we operate. We have to rely on them to bring that forward.

On the imagery, as a team leader, I am accountable for that team, but again, no one came forward and asked for the imagery on my part and that of program management. We had no [inaudible] in going forward in asking for external help.

MR. HERRING: Marsha?

QUESTIONER: Some people with the board have told me that in listening and reading your transcript [inaudible], and other board people said the decision-maker should be [inaudible]. And I'm just if -- do you consider that overly harsh criticism?

I am just wondering. I mean, you have been reading and listening to all of these various comments, too, I'm sure. How do you address these comments?

MS. HAM: Well, it goes without saying that we were all trying to do the right thing. All along, we were basing our decisions on the best information that we had at the time. Nobody wanted to do anything harm to anyone. Nobody wanted to -- obviously, nobody wanted to hurt the crew.

These people are our friends. They are our neighbors. We run with them, work out with the gym with them. My husband is an astronaut. I don't believe anyone is at fault for this.

MR. ENGELAUF: It really is amazing to me, Marsha. It is unconscionable to me that people can attribute to the members of the MMT or the Flight Control Team or the rest of the folks who are in these missions anything other than the best of intentions. These are people of good conscience doing everything in their power to get the right answers.

This is what we do for a living. When LeRoy sits at that console and his job and

my job when I am there is to keep the crew safe and get them home in one piece, that is everything we do here, and when we come to work, that is all we are focused on.

So, in the end, yes, we lost the crew and we lost the vehicle, and we can't escape that. And nobody feels worse about that than every one of us who has our hands on these missions every day, but it is not because of lack of good intent or lack of effort on anybody's part. If the system fell down, we will fix the system, but it is really difficult for me to attribute blame to individual personalities or people.

We can find mistakes in analysis, and we can find places where we weren't good enough, but it is not because of malice or ill intent.

MR. HERRING: Bill?

QUESTIONER: Bill Harwood.

LeRoy has already done this in a previous briefing, but with Linda and Phil, just for the record, kind of, A, I know you were in mission control that day. Where were you? And I was wondering what your first reaction was when this telemetry came in, when you realized that it was the left wing, and maybe give us some insight into what you were thinking at that moment.

I mean, LeRoy had said that he immediately thought of the impact when he first heard [inaudible], and I have got a million more, but I will stop there.

MS. HAM: I was in the mission control center. We were up in the room where management overlooks the control center.

When we first lost the transducers and the MACS [ph] officer reported that to LeRoy and then he had -- I think he [inaudible] some more, and he was looking to see if there was any kind of common electrical box or common MDM, multiplexer or demultiplexer, and when he commented that there wasn't anything common that he could find, then I began to worry and I thought yeah, it is a left wing, and once the ECOM [ph], another flight control position, began to report some loss of parameters, again, I was thinking about it being the left wing now.

At that point, we were just wondering what was going on and what could this potentially mean to us, not that it wasn't that this could be catastrophic, but as we progressed, once we lost com with the crew and then we never got radar tracking and then, you know, it was past [inaudible], obviously all the managers up in that room, probably 20 of us, knew that we needed to get the MRT set up.

We needed to get this investigation team set up. So I immediately started calling the MIT chair, Dave Whittle [ph], so that he could get his [inaudible] and we could have the meeting and start sending people out.

QUESTIONER: Tell me kind of on a personal level. I mean, that is business level, but there had to be some personal level in your mind as you heard this stuff coming out.

MS. HAM: Well, yeah. I mean, it is not a fun situation to be in. Very difficult.

MR. ENGELAUF: Mine is really similar. Linda was up in the viewing room. I was down on the floor at the console, immediately behind LeRoy's, and similar to Linda's, when Jeff Kling indicated that he had lost the four transducers, my first -- I made a mental connection there to the impact during the ascent, but at that point, I wasn't even close to thinking about a catastrophic outcome. I thought maybe a connector had been jarred loose by the impact, and even though at first blush, Jeff couldn't find any commonality, kind of deep down inside I was expecting him to come up with "Oh, I found it now, and now I know where the commonality is. They all go through this connector," or some similar sort of thing.

When we lost some more transducers, part of it was this was a difficult puzzle we were trying to figure out, and I was waiting to get some more data, so we could figure this puzzle out.

We lost com with the crew. At first, that wasn't unusual. We take hits periodically. When we didn't get com back, you sort of get that sick feeling in your stomach that this is not good, but in my heart, I was still holding ont hope that, yeah, com will come back in a minute and then we will know why we were out of com and we will have some more data, we can solve this puzzle.

When we got to the point where we should have had radar data and we didn't, it was, in my mind, pretty clear that we had -- we were having a real bad day and we probably had lost the vehicle. It wasn't 100-percent certain, but I was pretty sure.

John Shannon [ph] was sitting at the console with me, another one of our Ascent/Entry flight directors at the time, and he reached down. He was sitting closest to the book shelf, and he reached down and he had the contingency procedures out and handed them to me. And he said, "You need to turn the right page here."

He left the room and went up to talk to the managers and sort of informed the managers, who -- not Linda, but some of the other folks who were up there observing, that we were going to have a real problem here.

I did get a phone call then from one of the other flight directors who was involved in the mission, and not to reveal his name, but indicated that he had been observing the over-flight and saw multiple objects overflying the area.

I got that call. It really confirmed what we already knew, pretty much. I mentioned that Eleanor Cho [ph] who was standing beside me there leaned over

the console, got LeRoy's attention and told him. And again, I don't think I told him anything he didn't already know in his heart, but it was sort of a final confirmation. And about that time, we were getting video pictures from Dallas and at the control center as well. So we had pretty clear indications by that point.

We called for the securing at the control center. At that point, it took me a minute. A couple of the crew members were people that I knew fairly well, and, you know, I reflected on that for a minute or two.

But then your training does take over, as LeRoy said, and everybody is going to want to know what happened during the accident, and our piece of helping that happen is to secure the data in the control center and make sure we don't lose anything.

In addition, I think -- I have a real focus on the Flight Control Team members, having been here during Challenger, not on console, but I had just finished the flight just before Challenger. I remember how a lot of the people were really severely affected, and I looked out at the Flight Control Team and looked into the eyes of some of the people sitting at the consoles.

And I think the rest of my focus for that day was playing back-stop for LeRoy and helping him through with the procedures, keeping the people in the control center engaged and focused on what they were trying to do and, quite honestly, looking at the next day and trying to figure out where we were going to go from there and what to do with the people.

MR. HERRING: Mike?

QUESTIONER: My question is for Ms. Ham. I would like to revisit the on-orbit photography question, if I could, briefly. My understanding is that the first request for on-orbit photography did not come from the Damage Assessment Team, but it came from a fellow who was part of the inner center photo working group at Kennedy Space Center, and that he contacted his boss or someone -- Wayne Hale [ph], who in turn contacted Mr. Austin and sort of got the process informally revved up.

And that when you responded to the photo request, it was not to the Damage Assessment Team's request, but it was to the Kennedy Space Center request. It has also said that these requests have collided in Ms. Batique's [ph] office when Shaq [ph], Mr. Roach's [ph] superior, went to talk about getting possible on-orbit photography.

Can you talk about that for a minute? Which requests were you responding to when you turned it down, and how did that whole thing unfold? And specifically, what were your conversations with Mr. Austin and Mr. Hale?

MS. HAM: Okay. That was the first phone call I received was from Lambert

Austin on that Wednesday morning. He said that he had heard about a possible request for imagery, and we talked about it some. And I said, "Well, who has asked?" He said it was United States Alliance Systems Integration who said that USA Orbiter wanted the picture, and I said, "Who?" He said, "Well, I really don't know." I said, "Well, Lambert, will you go see if you can find out, and I will see if I can find out, also."

So I did call Lawrence Driver [ph] for United States Alliance to see if he knew of anything, and he checked around and reported back that he hadn't heard of any request for imagery.

I talked to Space Shuttle, engineering office, and I talked to the Mission Evaluation Room, and I could not find a facility.

So then I did call the Cape, and I called Wayne. And I said, "I know you talked to Lambert, and Lambert was asking about a possible request." I said, "You know, I have been spending the day trying to find out where it is coming from, and I really can't find a source. So I don't think we need to pursue it."

QUESTIONER: Did Mr. Hale inform you at that time that the source that had originated had canceled?

MS. HAM: Not that I can recall. I cannot recall that.

MR. HERRING: Mark?

QUESTIONER: Mark Karo from Houston Chronicle.

I wanted to go back to the minutes and to January 21st, and you made a comment, "I hope we had the good flight rationale then," referring back to the outcome of the flight readiness review for the 112 mission.

I guess I wondered what you were thinking and how much did you know because you really are asking, as I interpret it, the other people to find out and refresh you. How much did you know about that incident, and how much did you know about it then, and what -- I guess I was also curious from that what you wanted these other experts to respond to you with and what did you want them to come back, not the answer, but the information that --

MS. HAM: The information I was asking for was both the information for the -- it was actually the STS-113 flight readiness review after 112, what was our flight rationale. That was even -- and I also wanted to go back to the STS-87 where I knew we had some foam loss on the inner tank flange where it was popcorning off to smaller pieces, what was our flight rationale there.

What I wanted to do was pull those two pieces of data. What I was searching for is our flight rationale because I couldn't recall it. It had been, what, 3 months prior when we did the STS-113. It was for our rationale based on the material

properties of that foam, so that even on the bipod ramp, if that foam would come off, that it would do no damage to the Orbiter. That is what I was hoping for because, if we had done that kind of analysis before we launched 113 and say even the biggest size of bipod foam that could come off and mass properties of that, so that it won't be enough kinetic energy to hurt the Orbiter anywhere, anywhere hit.

Well, that wasn't what the flight rationale was, but I was hoping it would be because then we could certainly -- besides the assessment we were doing for this mission specifically, with that other piece of information that would back the assessment that said we don't have a safety flight issue, we could say -- feel even more comfortable that we were safer this way.

QUESTIONER: I gather that is not what they came back and told you, and I was just trying to close the loop on --

MS. HAM: That's true. They did not brief that out back at the MMT. What they came back with was a charge from the FARs for both the STS-113 and also the 89 which was the flight following 87, and, of course, that was a whole different case. It was a different kind of foam loss, and the 113 story could not support the flight, the flight that was 107. What we needed to do was rely on them completing their analysis to indicate whether we would have a problem during 107.

QUESTIONER: So, I just wanted to make sure. This sort of fed in, then, to eventually the credibility of the analysis you had going on with --

MS. HAM: It would, yes.

QUESTIONER: -- Boeing?

MS. HAM: That was the goal.

QUESTIONER: It made it more crucial.

MS. HAM: Yes, it did.

QUESTIONER: Okay. Thank you.

MS. HAM: Rather than have the analysis in, the analysis we had done two flights ago, we only had analysis we were doing during 107.

QUESTIONER: Thank you.

QUESTIONER: Linda, what is your next assignment at NASA? What is next for you?

MS. HAM: I have some opportunities. Some people have suggested jobs I

could do here at NASA. I haven't made a decision. I am leaving for vacation the end of this week, and I am not going to decide what I am going to do until I get back.

You know, I have -- my family is here. My husband is an astronaut, as I said. So he would like to see me continue with this career here. So I need to figure out what I am going to do.

QUESTIONER: But you are going to stay here at NASA?

MS. HAM: I am going to stay with NASA.

QUESTIONER: Linda, reading through the transcripts, there's a couple of places where you ask [inaudible] issue only and we have seen pieces of this size before, haven't we. McCormack says that you sort of fumbling about what the size of the damage is and that the analysis isn't complete and [inaudible] jump conclusions. You sort of cut him off and say no burn-through means no catastrophic damage, localized heating damage [inaudible] tile replacement.

In hindsight, 20/20 hindsight, were you sufficiently open to the idea that this was a really serious problem?

MS. HAM: In 20/20 hindsight, you are asking 20/20 hindsight or what my thought was then?

QUESTIONER: Well, it sounds like you were just kind of seeking reassurance that everything was okay as opposed to digging in and saying how do we know this, are we asking the right questions, do we have the right people on this, have we [inaudible] this properly.

MS. HAM: I was asking to make -- I was trying to reiterate what Don McCormack had already said to me, so that everyone in the room could understand what he was saying.

When he said -- would make statements like no burn-through, that that meant no safety-of-flight issue, I wanted -- I was trying to reassure even myself that that was a true fact. I couldn't really [inaudible] or jump to a conclusion that there could be no damage until they came forward and -- catastrophic damage, until they came forward and complete that analysis and tell me what the analysis showed.

Again, I don't have the engineering expertise, nor do I have the tools to do that kind of analysis. So I didn't have a preconceived notion on the damage or the possible consequences, and I needed to wait for them to complete their work.

MR. HERRING: I have time for one more round. So try to keep them fairly brief.

Go ahead, Tracy.

QUESTIONER: I have a quick question, then a follow-up.

I have heard from a number of engineers that when they saw the ascent video, they were very worried and instantly feared loss of vehicle. Did any of you hear about those fears?

MR. ENGELAUF: I will tell you first that I did not. I was not aware of anyone having any concerns, much less significant concerns. Certainly, for safety of flight, what I was aware of was that we had a potential for some reflight turnaround schedule or manifest type issue only, if you will, if we had some kind of minimal damage to the tile or the TPS. I was not aware of anything of that nature until well after the accident when some of these reports started to surface.

QUESTIONER: Since none of you seemed to have heard that, do you think that indicates some kind of communication difficulty that should be addressed?

MR. CAIN: Let me follow up first, and then I will let Phil and Linda answer.

We foster a culture here that very much encourages folks to talk, to communicate. The lines of communication are always open. We encourage people to -- if we think we have an issue or a problem, we stand up and talk about it. We debate it. We will bring the data forward. That is the culture that we very much encourage and we foster around here.

The reason we do that is because, as you had heard Linda mention earlier, not the least of the reasons we do it anyway, is because we have the safety of a crew, the success of the missions at the forefront of our mind every single day when we come to work.

So, in order for us to be able to do our jobs effectively, it is crucial that we have open and clear lines of communication. It is absolutely critical, and it is, frankly, expected of every single person in every organization, from the engineer all the way up through the groups in the management of the programs and throughout the agency, but certainly for human space flight endeavors, that is the culture that we foster and I believe that it is alive and healthy today.

MR. ENGELAUF: I would have to agree with LeRoy. There is not a lot else I can add there. From the standpoint of the Flight Control Team culture, I think that is so inherent and embedded in the psychology and operating standards that it really is second nature to us.

I think more often, people pick on us when there is disagreement or discord, and I think it is just because we take all the inputs and we talk about everything. We spend our days when we are not flying missions in rooms having heated technical debates over how we do this or that or what this particular data means.

So I don't think there is a resistance or a reluctance, and I will tell you that at no time during the mission from the first time I heard about the foam strike until the end of the mission did I ever hear anyone express a concern for loss of the crew and the vehicle as a result of the debris strike.

MS. HAM: I can also say that I was never alerted to any concerns expressed by the engineers, and I do -- I am in the MER a lot. I am down there and I wander around in the Flight Control back rooms and others areas, and I did not hear any concerns.

Now, obviously, there are formal methods for getting things and communicating through the MER and the MMT and all that, and there is the informal way. For some reason, we didn't get it either way, which I think is also of interest. So whatever happens somewhere, we probably need to figure that out and see if there is a way we can improve that, but I would also agree that we have wide-open communication. Our doors are always open, and we are more than willing to hear what people have to say.

It is the only way we can operate. It is the only way are going to hear about these kind of things and the only way we can continue to fly safely. So we really do need these people to feel comfortable and come forward with their issues.

QUESTIONER: In terms of the MMT meetings during the STS-107 mission and how this all played out, Linda, is there anything that you in 20/20 hindsight would do differently?

MS. HAM: In 20/20 hindsight, there are things the MMT could have done better. There are things the analysis team could have done better. There are things the whole NASA team could have done better. 20/20, perfect-vision hindsight, I would go back to the STS-113 flight readiness review, and we should have done more analysis on the foam loss we had on 112 and we should have really come -- look back, done the engineering and done the work to see if we were safe to fly with the bipod [inaudible] foam coming off. I think, you know, going back that far was where we really needed to go to solve this issue.

MR. HERRING: Eric?

QUESTIONER: Could you tell me who from NASA headquarters monitored these MMT meetings, particularly the three where foam was discussed?

MS. HAM: They tie in every day to the MMT, and I probably even have with me exactly those locations. I can't tell you who was in the room.

QUESTIONER: But somebody from headquarters was monitoring all of these?

MS. HAM: Yes, that's correct. They --

QUESTIONER: All [inaudible]?

MS. HAM: Yes.

MR. HERRING: That is probably a question for headquarters, if you want to know who actually was there.

You can have one more, Eric, since that was [inaudible]. That was my answer, and I don't count.

QUESTIONER: Talking about 20/20 hindsight, again, do you think that perhaps there was too much emphasis placed on the need for following proper procedures and going through correct channels and somehow some of these concerns were not -- did not filter up to the top of the pyramid, as you described it?

MS. HAM: My initial answer is no, I don't believe that is the case because we are, again, more open-door policy, more than willing to take anything, any information we get either formally or informally. That is why I do go into the MER. That is why I do talk to people in my office. That is why Calvin Shomberg came to my office. I talked to Rolf Roll [ph], the head of the vehicle engineering office. We are always talking. It's part of the job. That is why I come into the Flight Control Team. We would take an input anyway that someone was willing to give it, be it phone, e-mail, anything.

MR. HERRING: Marsha?

QUESTIONER: In the few days after the accident, many of the -- Ron Dittimore [inaudible] people from Washington kept saying how the crew was being kept abreast of every little development during the flight about [inaudible], engineering analysis, and that is certainly a disconnect to reality. Were people that badly informed?

Also, every mission, you read the execute packages, and there are all these little nits and all these little minor, seemingly minor and big things, and yet, this one, you say was would never have even been mentioned if reporters hadn't been curious, and I just don't understand. Doesn't the crew have a right, a moral right to know about problems being worked, even if they might be later proved not to be a real problem?

MS. HAM: I am going to let you answer the last half of that question, Phil, but for the first part, I can't really speculate on what Ron was thinking when he did his press conferences or whoever else that you were referring to.

QUESTIONER: I think General Kostelnik and maybe Bill Readdy even. There were quite a few people saying the crew had been kept abreast of everything.

MS. HAM: You will have to speak to them about what they were referring to in their press conference, but I will tell you that Ron and I, we talk every day. We

do during missions. We do when we don't have missions. It is several times a day, no matter where he is or where I am. We communicate all the time, and every -- most everything I know about what is happening during the mission, he does know.

Now, about execute package and the other information the crew gets, I will let Phil answer that.

MR. ENGELAUF: I got a flavor of the question, that somehow people believe that we on the ground thought there was something gravely wrong with the vehicle, but kept it from the crew. Nothing could be further from the truth.

The reason we didn't do anything different than what we talked about here today is because we did not believe that there was anything seriously wrong with the vehicle, certainly nothing that the crew could have any impact on in the sense of taking any action. We weren't going to send folks out to do tile repair because we didn't think -- I mean, we didn't have tools to do anything, but we also thought that that was going to be a ground turnaround thing.

When you talk about the really trivial things that you see in the execute packages, the typical standard is if there is anything that affects either telemetry that the crew is going to have insight into when they call up a display, even if it is a redundant transducer that has failed offscale low and doesn't affect anything, if they might ever call up a page on the computer and see a bold "L" for offscale low next to that transducer, we will call and tell them even if it is something that they can't see. But if they ever had to select an alternate system, they might see something different in the performance or they might want to be aware that we have limited capability on a certain function, even if it is not the primary function. We put that in the failure impact workaround summary, everything that is wrong.

In this particular case, if we told the crew to look out the window, there was nothing to see because we believed that any damage was on the bottom of the vehicle. We were very certain that if the crew had looked out the window and seen anything wrong with the top of the vehicle, we would know about it and we wouldn't have to tell them, they would be telling us.

We just did not believe that there was anything that we could tell the crew that they could do anything with, and at the time, we had no indication or belief that we were -- that there was anything here that was going to affect the crew, even in the long run.

QUESTIONER: So was part of it, then, you didn't want to unnecessarily worry them and have them distracted?

MR. ENGELAUF: With a non-issue, that is exactly right, and had we not expected that they were going to then be subsequently asked a question in a press conference and not know the question, that is the more severe consequence of being asked a question you don't know something about even if,

in fact, we really don't think it is a problem. So the fact that we anticipate that they might get some questions, we went ahead and told them because that was then the least-distracting thing was to have them know in advance that they were going to get a question like that.

QUESTIONER: And do you think this is something they are going to rethink? I mean, obviously future crews are going to want to be more on top of what is happening.

MR. ENGELAUF: Knowing what we knew at the time and in trying to translate that into a future scenario, I am still not going to tell the crew about things that I don't think are any impact to the mission.

Another example, on STS-112 when it talks about the foam strike, in that case a piece of foam hit one of the solid rocket boosters. We never told the crew. It didn't hit the Orbiter. It wasn't going to affect the Orbiter. It wasn't going to affect anything else that happened during the rest of the mission, and there was no reason to trouble the crew with that.

Given the same caliber of circumstances, I think I would do the same.

Now, are we going to turn up the gain on our sensitivity to what might be a problem or not a problem? I think that is going to be natural for every human being that works in the agency.

As was pointed out earlier, when return to flight, STS-26 was probably the most intensely scrutinized flight we have flown, more so than even STS-1. I would probably speculate that STS-114 will be even more intensely scrutinized before, during, and after the mission.

MR. HERRING: Bill?

QUESTIONER: You guys have eloquently stated your views of how this all went, and that the communications, the channels are there, and really -- I mean, I am not trying to make this sound offensive in any way -- it sounds like you guys are saying this system is fine, but something clearly didn't work. So I guess I am wondering.

The board is obviously going to come out and force changes on you guys. I guess, A, is there any concern that they are going to fix things that aren't broken? What do you guys think was broken? Because something was. And a third part of my one final question, on a completely different topic for Phil, is there -- based on what you guys have said, the way information was flowing during this post -- when you finally saw film, there was no way in the world you could have saved this crew. Right or wrong?

MS. HAM: I will start with the first question.

QUESTIONER: Fixing things that aren't broken and you guys think everything is pretty good the way it is.

MS. HAM: I believe we should wait until the CAIB report comes out and find out what they are going to say, so we can fix what they have told us we need to go address.

I think we will take a good hard look at every one of the recommendations and findings. NASA and the return-to-flight team will determine how they are going to disposition each of those.

On the communication problem, most of us feel that it is open. Obviously, there was some kind of a problem because it never got from some level of engineering management to either the program. Somewhere, there was a breakdown.

We have a formal route, and you don't have to go that route. There is an informal route. It didn't make it until there is something we need to do about. We just need to figure out what it is.

MR. ENGELAUF: I go back even one step further. Like I said earlier, in the final analysis, every night when I go to bed, we lost STS-107. We lost the crew. We lost the vehicle. Clearly, that is not the way it is supposed to happen, and that is not what we do here.

So, no matter how you look at the arithmetic, whether you can find a mistake or not, we are getting the wrong answer, and we have to fix that. We all know that.

I will go with Linda's answer. We are going to have to wait until we get some recommendations from people who will look at this from a different perspective than the one that we do.

It is very difficult to pinpoint the details. I think it may be even something that just isn't obvious to us. I certainly don't want to leave it to the easy answers and fix something that isn't the thing that is causing the problem.

The rescue mission, I think it is an impossible question to answer. I really do. Folks have done a hypothetical case study. The precepts of that study require you to make assumptions that were not present at the time on this vehicle, on this particular mission.

They are also predicated on specific circumstances of where the next vehicle was and the flow and things like that, and I don't think that those -- you know, short of imposing a requirement, that those are going to be the generic case in all cases.

I also don't think that you can get the right answer without all of the circumstances that were present at the time and their real adrenalin factor. Could I go over and run a simulation with a Mission Management Team and a

Flight Control Team? Sure. Would it look like what would have happened on that day if we had really tried to do this? I doubt it very seriously. So I would stop short of trying to answer whether we could have saved the crew or not.

MS. HAM: But had we known that there was a catastrophic situation on orbit, we certainly would have done everything we could --

MR. ENGELAUF: Absolutely.

MS. HAM: -- including, you know, is there anything we can do for the tile repair, and we certainly would have pursued rescue. There is no doubt.

MR. ENGELAUF: I don't say we wouldn't have tried. We pulled out all the stops, we had done everything within human capability, I don't know whether we would have succeeded or not.

MR. CAIN: I showed up on February 1st, and really, the only job I had to do that day was to get the crew and the vehicle home safely. And we weren't able to accomplish that.

So, similar to what Phil said, that is what we come to work to do, and I have a tremendous feeling of something went wrong in our system, in our team, in our processes, and again, as I said before, I think it is important for us. We will look forward to what the action board has to say.

I do think they have a unique perspective, and they have done a lot of really hard work with some very capable individuals, and we are going to take that work very seriously and I think we are going to learn a lot from it.

We already know some things that we want to go do to make ourselves better, and with regard to looking in hindsight, 20/20, if we had known that we had a problem while we were on orbit, I certainly agree and echo what Phil and Linda have said. We would have loved, literally, no stone unturned, and as to whether or not it would have made a difference, I think, again, as Phil said, it is an impossible question to answer, but certainly, it made for an interesting academic exercise that has raised some interest, but beyond that, I am not sure we can say much about it.

MR. HERRING: Mike?

QUESTIONER: For Ms. Ham. Since the accident, as the chair of the MMT, you have received a lot of criticism, individual criticism in some cases, and have been sort of a lightning rod for a lot of the bigger pictures, criticisms that have been leveled against the organization and the NASA culture. Do you think those criticisms are unfair, and what has this been like for you personally the last few months as this whole thing has unfolded?

MS. HAM: Well, based on information that I had at the time that I made those

decisions in the MMT and information that we as a team had at the time, we were really doing the best we could.

Like we said before, our goal is to launch and, of course, keep the crew safe -- that is our number-one goal -- and also bring the Orbiter back safely and accomplish missions, but that is our job. That is our number-one job.

I think we all take some personal responsibility for this, and I certainly feel accountable for the MMT. So it has been very difficult through this. I know that the important thing to do right now is to get the program back on their feet, get back to the flight, and get back to flight more safely than ever.

My husband being an astronaut and having two kids, we have all gone through this together.

MR. HERRING: Mark?

QUESTIONER: Mark [inaudible] with the Houston Chronicle.

Boy, there was sure a lot of activity coming ahead this year after this flight with Space Station assembly, and I wondered, Phil, if you thought that the Mission Control Team was preoccupied by looking ahead, there wasn't the kind of focus maybe on this flight that you might normally have given if that issue has arisen from time to time. Was that at all the case?

MR. ENGELAUF: I don't perceive that to be the case.

The flight rate that we were flying in terms of historical flight rates really wasn't all that high. Now, we have gone through some staffing-level changes over the years and that sort of thing, and we always seem to be operating pretty much at our limit and folks work hard, but that is kind of why people come to work here. We love what we do, and people are motivated and they come here and they sort of thrive on that kind of challenge to some degree.

This was a Shuttle stand-alone mission and not a Space Station assembly mission, and so I don't think it put the same level of strain overall on the personnel and that sort of thing that sometimes we do when we are doing a joint assembly kind of mission. But I don't perceive that has really having been a factor here at all, Mark. I really don't.

QUESTIONER: LeRoy, really you guys have gone through a process here, and you have had to go through a very public grieving process. And you have had to keep silent for a number of reasons, waiting for the report. What has helped you through this process? How has it worked for you?

MR. CAIN: Well, I think the things that have helped me the most is really my family and the community that we surround ourselves with, both the great individuals that we have the pleasure and honor of working with here, but once

we get away from here and we are just with the family and the friends and the people that we are close to, like any difficult situation, I think that has been a great help to us. For me, that includes my spiritual life as well, and that has been very important to me. So there are a number of things that me and my family specifically have been able to turn to.

With respect to the rest of my peers and our colleagues here, we, I think, have prompted each other quite a bit because we are in this together.

As you know, we enjoy the successes of this business together as a team and really more like a family than a team, and similarly, when we have problems, we deal with them sa a team and as a family. That family is our extended family, and so, at times like this, I think we have been able to help each other out. We have been able to talk about the fact that this is a difficult business to be in.

The highs are really high and the lows are really low, and that is the way it has been since the first time I walked in the control center and the first time I was a young man, was a mission control, flight controller.

I can remember leaving late at night after long 6-hour simulations, and I had made a mistake on one of the cases. I had to tell you that all the way back then is when I learned that the highs are really high and the lows are really low, but we are here because of the passion that we have for it. That extends to the rest of our peers and colleagues, and it flows out into our families and our communities. At a time like this, that becomes very important because all of those same individuals and structures that you have around you come forward to help.

So, for me personally, those things have been very important and critical, and we have a ways to go yet, but we are getting there, day by day.

MR. HERRING: One final quick one.

QUESTIONER: A question for any of the three of you who would like to answer. Rodney [inaudible] is presumably like you, a person of good intent, best of intentions. He said that he feared for his job if he pushed too hard on his concerns.

What is your level of confidence that that is an aberration, that nobody else feels the same way? If others felt the same way about bringing things forward during a mission, how would you know that?

MR. ENGELAUF: Maybe it wasn't clear. Somebody down there in the ranks said "I am afraid to raise my hand and say, 'Hey, boss, I am worried about this and you are not paying attention.'" He was afraid, he said. Are there others who are actually afraid? How would you know if others were afraid? How would you know if you are not getting the benefit of the people who work under you?

MR. CAIN: As I stated before, we are very serious about the culture and the environment that we foster here. It is steeped in open communication, and how do you know? The only way you know is by going around and talking to people, and we have great individuals at all levels of management who are responsible for their individual working troops. We rely on them, and the way we raise up the culture and the system, we rely on people to keep the lines of communication open.

So the only way you would know is by being in contact and in close contact with the respective levels of management, which I believe we are, but we are talking about thousands of people. I guess if I look at it that way, if it really is only a couple of people, then percentages-wise, that is pretty small, but it is more than what we want. We want that number to be zero.

So part of what we will do is go back and reexamine our practices, and we will reexamine ourselves. We will make sure in every way that we can that if there are things that we can do to ensure that that doesn't happen that we will put those in place. We will do that, again, via opening up the lines of communication at every level, having discussions we have already had and will continue to have in the various directorates.

We have had open, if you will, all-hands meetings to talk about some of these kinds of things, to really open it up to every level and let people know, "Hey, we have had some things happen here, and we all want to put our best foot forward. So help us understand how we can do that." So we will continue to do those kinds of things.

MR. ENGELAUF: I think I would add to that. LeRoy hit on the idea of the number of people we have here and the strength and the breadth of our organizations. That strength and numbers also comes from sort of the checks and balances system.

There are very few occasions here in this business where an entire outcome of a major situation depends on one individual who has the only right answer and everybody else in the room has it wrong.

I wouldn't look at this case as being all of NASA was wrong except one guy who had the answer. There has to be a more fundamental structural problem with how the communication broke down here.

I don't believe if a multitude of people disagreed with the outcome that not a single one of them is going to feel comfortable coming forward. That certainly isn't the environment that we foster, as LeRoy indicates, with the Flight Control Team. I think that our culture of having free and open discussion before flight gets people to know each other and understand the technical issues and understand how to have those debates in a forum that isn't threatening.

I have trouble accepting the idea that this flight failed because one individual

was afraid to say something in one particular meeting.

QUESTIONER: More than one individual?

MR. ENGELAUF: I'm not sure I understand.

QUESTIONER: [Inaudible] e-mail back and forth to a variety of individuals. In hindsight, you seem quite worried about this. Is it possible that more than one individual felt too timid to come forward?

MR. ENGELAUF: If you are referring to the e-mails among the MACs discipline, I personally went and talked with the managers in that organization, not the individual themselves because if, in fact, they felt threatened, it wouldn't do much good to go to them and say, "Gee, do you feel threatened?"

So I went and talked to their management because the flight directors have a relationship with the flight controllers, and if any one of us becomes too overbearing, we will hear about it through their management, no doubt about it.

I talked with Bob Deremus [ph] about those e-mails. We were sure that there is no lingering bunch of people down in the trenches that really had a serious concern and didn't feel they could come forward. They truly were doing that "what if?" thing that engineers do. If you don't have a problem to work on, you will work on the non-problems that you've got and you turn it inside-out and you look at it from every direction.

Here again, people seem to miss some of the details. People talking in those e-mails about the loss of a landing gear tire due to potential penetration into the wheel well, eventually we lose -- you know, we had a penetration in the wheel well here, but the thing that took this vehicle out was a penetration starting up at the leading edge of the wing.

QUESTIONER: Right.

MR. ENGELAUF: So they were looking at a scenario which people purport as "Oh, that is what happened," and I don't think that is accurate.

They were doing what if and what happens, ultimately kind of like what they were talking about in the e-mails, but that is not what took this vehicle out of the sky.

MR. CAIN: Just to add on that real quickly, ultimately it is my understanding, anyway -- and as the entry flight director, I certainly again will reiterate I wasn't aware of any of those, anybody being concerned, and my understanding is that ultimately every person that we are aware of, every single person and individual and group and part of the team in the organization was in agreement that we didn't have a safety-of-flight issue.

So, in the end, even those folks who -- or parts of the organization, purportedly, anyway, who may have had a concern and were reluctant to raise it in the end didn't have a concern is the way I understand it today.

MR. HERRING: Okay. We are now out of time. I want to thank you guys for being here. I want to thank all of you for coming. We appreciate it.

[End of press conference.]