

Senate Commerce, Science and Transportation Holds Hearing on Space Shuttle Columbia Accident Investigation Board Final Report

(JOINED IN PROGRESS)

MCCAIN:

... management and operations at NASA. It must serve as a wake-up call to NASA and to the nation that we have for too long put off hard choices and forced the space program to limp along without adequate guidance or funding.

As stated in the report, quote, "Unless the technical, organizational, and cultural recommendations made in this report are implemented, little would have been accomplished to lessen the chance that another accident will follow," unquote. That's a very chilling and powerful statement, and I hope all members of Congress will pay close attention to that statement if nothing else in this report.

The report reminds us that we are still in the developmental stage of space transportation and that space is an unforgiving environment which challenges our technical expertise. It also raises a number of important issues that will have to be considered as we plan for the future of the space program.

Most importantly, we will have to figure out where we want the space program to go and what we expect to get out of it. Then we will have to ensure that adequate and un-earmarked funds are provided for these missions. It is imperative that we eliminate wasteful spending and make efficient use of those resources we commit to space exploration.

The board worked tirelessly to identify and clarify the causes of this accident, and I'm deeply grateful to its members for their dedication. Although the technical causes of the accident have been suspected for some time, the board's findings concerning the role that NASA's organizational structure and culture played in this tragedy are as troubling as they are valuable.

As the board reported, quote, "Complex systems almost always fail in complex ways," unquote. The many factors that contributed to the accident largely demonstrate how far NASA has regressed: its incomplete and invalid impact analysis, its rejection to seek satellite images of the damaged shuttle, its reliance on past successes as a substitute for sound engineering practices, its organizational barriers that prevented effective communication of critical information and stifled professional differences of opinion, and its lack of integrated management across program elements.

The report further describes NASA's culture as including, quote, "flawed decision making, self-deception, introversion and diminished curiosity about the world outside."

We'll want to hear from Administrator O'Keefe about precisely how and when this culture can be changed.

MCCAIN:

I welcome Administrator O'Keefe and Admiral Gehman and look forward to hearing from them on the investigation board's finding and recommendations and NASA's plan to return the space shuttle program to flight. I'd also like to comment, I thank Admiral Gehman and his board members, again, for their outstanding work.

I also think it's appropriate to note that Mr. O'Keefe and his staff were completely cooperative and helpful in the board's investigation. That's not always true in the past, but I think they deserve credit for being helpful, even though sometimes it was, obviously, painful.

I'd like to turn to my friend of many years and ranking member of the committee, Senator Hollings who, as we all know, made an announcement that he would not seek re-election. I know that Senator Hollings, until the last moment that he's here, will continue to pursue with vigor, passion and always non-controversial issues that have interest to him. And I must say to my friend, he's not gone, but I and all members of this committee will miss him because of his long and outstanding and courageous service on this committee and as a member of the United States Senate.

Senator Hollings?

HOLLINGS:

I thank our distinguished chairman and my good friend John McCain.

When I left town in the 1st of August, I was a bum. I'd been serving almost - well, over 50 years in some public office. As long as you continue to serve, you're a bum. But as soon as I had said I was going to get out of the way, I became a statesman.

(LAUGHTER)

You ought to see the crap that they put out. I mean, you never seen such stuff. I mean, I've invented everything, I've thought of everything and everything else of that kind.

But it has been a distinct pleasure and seven times to the United States Senate is enough. But I'm delighted to have an additional year here to see if we can straighten out a few things.

For one, I commend Admiral Gehman and your committee, for example, I was only reading last night, oh, "Unsafe and Costly." The London Economist: "Why It's Time to Scuttle the Shuttle." And that's exactly what you recommend, that the shuttle be scuttled.

However, I'm, sort of, intrigued with the finding of a culture. As a Navy board of inquiry, as an admiral, you would immediately find responsibility. And whoever was captain of that ship would be cashiered. I don't find that in the report, the fixing of responsibility.

HOLLINGS:

That intrigues me. If you were the coach of a football team, they'd buy up the contract, having lost seven members of the team.

Let me get right to the point, I think this committee and the whole blooming set-up is part of a culture. I've been on here, as the distinguished chairman just commented, for years since we've had a Space Committee. Never have I heard anything about being unsafe.

I'll never forget when the Challenger went down. I talked to them out there at Morton Thiokol. If I remember the name it was an Alan MacDonald (ph). And he said, "We told them at the Cape it was unsafe with those O rings, particularly the cold around there, and they were taking too great a risk." And he says. "There we all were all gathered together in the hearing room there at Morton Thiokol up there in Iowa and when the Challenger blasted off, Jimmy said, 'There she goes.' And Henry said, 'Like a piece of cake.' And then, all of a sudden she blew and everyone in the room knew why."

I said, "Mr. MacDonald (ph), would you come and tell the committee that?" He said, "I'd be glad to." They headed him off and he never testified.

Now, we thought after the Rogers Commission had gotten into it that they'd cleaned it up and I don't find -- of course we didn't find it's been cleaned up or anything else like that. And we had come with an independent safety office, but the independent safety office within NASA itself has not worked; we've lost seven astronauts.

So rather than part of the culture that you get up here on the Hill - "Oh, we're going to get them, we're going to be back up in space" -- we're not going to get up there until we get a decent shuttle and it's certified safe by others than in NASA, in my opinion.

I would hope that we had learned a lesson here because we're the ones put the pressure on Mr. O'Keefe.

HOLLINGS:

I know we all had worked with him on the Appropriations Committee, and when he got appointed, that booming space station was -- or is, I think, about \$40 billion -- or \$20 billion -- that's right, it's about \$20 billion over budget and about only 40 percent complete. So when we had the head of the Office of Management and Budget go over there, we were all concerned about money; we weren't concerned about safety.

So we're part of the culture, right up there on this committee. And rather than praising each other how thoroughly the -- and it has been very thorough. You all have really done a way better job than I thought was going to happen and get done. You all have really worked hard and you've got a very comprehensive report, except the actual fixing of the responsibility.

Thank you, Mr. Chairman.

MCCAIN:

Thank you, Senator Hollings.

And obviously, I would ask my colleagues to make their comments as briefly as possible, since we would like to hear from the witnesses.

Senator Hutchison?

HUTCHISON:

Thank you, Senator McCain, Mr. Chairman.

First, I do want to commend the report, the open investigation that was done.

I thank you, Admiral Gehman, for doing a great job.

And I thank you, Administrator O'Keefe, for letting him do a great job.

That says a lot and it was very different from the Challenger experience. And so, we appreciate that, so now we have a blueprint of where to go.

One of the most important things in your report concludes that the present shuttle is not inherently unsafe, but it does call for a massive recertification process to ensure flight safety. I will look to Administrator O'Keefe for his commitment to the project of recertifying shuttles before they go back in the air.

The report is a devastating attack on NASA's procedure and lines of communication. I hope that the administrator regards this report as a blueprint for change and I hope that it is acknowledged that there can never again be business as usual at NASA.

You cannot have your most innovative research, your most technologically advanced challenge done with a bureaucratic mentality. This doesn't mean you open the treasury, but it means you lock your vision on a few very big goals and you them right: "faster, better, cheaper" should be thrown in the wastebasket.

When Senator Nelson and I particularly, along with the whole committee, ask questions of previous administrators, "Are we sacrificing safety?" we always got the answer, "Absolutely not; safety is the first priority." Now, we need to make sure that we have the vision, the scientific background and the total change in the bureaucracy at NASA from the very top to the very bottom, in line with the recommendations of the report.

Thank you.

Thank you, Mr. Chairman.

MCCAIN:

Senator Lautenberg?

LAUTENBERG:

Thanks very much, Mr. Chairman. I will be brief. And I ask consent that my full statement be included in the record.

MCCAIN:

Without objection.

LAUTENBERG:

And I would just like to make a couple of quick points. And my hats off to Admiral Gehman and you, Mr. O'Keefe, for that very tough task that you took on and the outcome that is described in your report.

LAUTENBERG:

I think it is understandable and will have an affect on how we think about things in the future. And I hope that we will learn enough directly about the safety requirements so that something as terrible as happened in the Columbia tragedy will never happen again.

But I would go to something of principle and make a note of the fact that the privatization program that we see in government almost began with NASA, and when we see that we have some 1,800 people, I believe the number is, who are overseeing private contractors in the multiple thousands, whether or not there is enough ability, enough structure to make sure that they're doing what they have to do.

And I'll close with this, that when -- on page 109 of your report, Admiral Gehman, "The major annual savings resulting from this Space Flight Operations Contract, which in 1996 were touted to be some \$500 million to a billion a year by the early 2000s, have not materialized."

And I just highlight that because throughout that paragraph it talks to the lack of success in achieving the cost efficiencies. And what is it that permitted the costs to be overrun and still this terrible thing to take place?

And I hope, Mr. Chairman, that we'll find out about the relationship of the private side of the force and what impact it had. And I thank you very much and congratulate you again for the excellent work you've done.

MCCAIN:

Senator Sununu?

SUNUNU:

Thank you, Mr. Chairman.

I simply want to thank Admiral Gehman and Administrator O'Keefe for their work and reiterate Chairman McCain's emphasis on the level of cooperation that was provided, the service of the members of the board. I can't imagine an emotionally or more physically more difficult task than the one that we gave to you. And we owe a great deal of thanks, of course, to the board members, but also to the staff, the staff at NASA and the staff on the board, that performed a lot of the more difficult tasks and probably spent at least as much time as the board members themselves. So we're very grateful for your service, and very appreciate of the work done.

MCCAIN:

Senator Wyden?

WYDEN:

Thank you, Mr. Chairman.

I think you, Mr. Chairman, and Senator Hollings have both put your hands on the central question, and that's looking again at NASA's mission. And my view is that you cannot resolve the issue about NASA's basic mission without looking carefully and in a fresh way at the direction of the manned space program. And toward that end, Mr. Chairman and colleagues, I'd like to make a modest proposal this morning. I believe that within 90 days, or at most six months, NASA should prepare and furnish this committee a cost-benefit analysis on the manned space program.

What I would like to learn, and what I think would be helpful to all of us in the Senate, is to learn more precisely what can be accomplished with manned space flight and at what price and what cannot. Once this information would be made available to the committee, then we're in a position I think for the first time in a long time to look carefully at how manned space flight fits in to NASA's future, and what can be accomplished with unmanned space flight that would also achieve the scientific discoveries that have been envisaged for the agency for some time.

WYDEN:

There are other issues that I'm going to want to explore, but I intend to ask the administrator about whether he will prepare a cost-benefit analysis quickly for the Senate on the manned space flight program.

The other areas that I want to explore, particularly how this time we would ensure compliance with the admiral's fine recommendations. I think if you look historically at this issue after the last tragedy, many of the same recommendations were made that Admiral Gehman is making now and clearly many of them were not followed up on. I know that the administrator, Sean O'Keefe, feels strongly about this as well and I intend to ask some questions about how it's

going to be different this time and if recommendations will be followed up on.

But I thank you Mr. Chairman, Senator Hollings, for convening this hearing. I think the country wanted us to do this quickly and you all have done that. And I thank you.

MCCAIN:

Senator Burns?

BURNS:

Thank you, Mr. Chairman, and I will submit my statement for the record. I'd just like to...

MCCAIN:

Without objection.

BURNS:

A small comment. I, like the chairman, appreciate the work that the director has done and this board has done. A great deal of courage to release the report that you did, it needed release, and it took a look at the inside of us and we're going to have to reexamine just exactly what we found in there.

I think we now have to redirect our focus now on the vision and the R&D that goes along with NASA. We know that going into space will always be risky at best. And so that work must go on. I think we will now look at different areas of a more moderate way to enter space and to move cargo. I think we'll take another look now at reusables and unmanned. I think our unmanned probes further out in space will be a very important part of this nation. And so we have a lot of work ahead of us. But again, I want to congratulate you.

And Senator Hollings, it may just seem like a year to you, but we'll miss you.

(LAUGHTER)

Thank you, Mr. Chairman.

MCCAIN:

Senator Nelson?

NELSON:

Mr. Chairman, I want to thank you for calling this hearing today. Thank you for your leadership and the oversight role that is going to be needed by this committee as we proceed.

And thanks to both of you gentlemen for the extraordinary leadership that you have offered.

Admiral Gehman, I particularly want to commend you who I have worked with over the course of the past several months. Having read a lot of your interviews, having talked to your very professional staff, talked to the members of your board, I think you have done an excellent work product.

I expected what you came out and talked about, the decision-making being influenced by the culture, and we need very much to attend to that.

NELSON:

What I did not expect , but was pleasantly surprised in your report that you addressed head-on the question of the funding and how over time I can draw my own conclusions, as I have railed in this committee on several occasions, that you can't do space flight on the cheap; that there are just too many things in a risky business that have got to be attended to, and particularly when safety is

overlooked because money is siphoned off of the space shuttle program to put it onto something else, which has occurred over the past decade. And so thank you for bringing up that aspect.

And, Mr. Chairman, I will close by saying, again, thank you for the oversight hearings. And I think this is going to be extremely important, that in our oversight capacity that, although we can't lead the space program -- that has to go all the way to the top, to the White House -- we can certainly let, as Senator Hutchison has already said, our expressions of concern be known of what is adequately funding the program so that safety is not sacrificed, like it has been.

We went through this drill 17 years ago, and safety was going to be number one, and it was for about two or three years. And then, the hard reality set in of siphoning the money off, of relegating the safety considerations -- because of the day-to-day financial decisions, they were being relegated to the back seat.

So thank you, Mr. Chairman.

MCCAIN:

Thank you.

Senator Brownback?

BROWNBACK:

Thank you, Mr. Chairman.

February 1 this country certainly suffered and the world suffered a terrible and tragic loss from the shuttle Columbia and her crew. The seven astronauts, they were explorers and they wished to serve their country and they did just that. All certainly saddened by the events that took place on that fateful day.

However, true to this country's resolve, we've been determined to find and correct the cause and move forward, and see that is what this hearing is about today.

I believe it imperative that America remains at the forefront of space exploration and discovery. And it's our job here in Congress to take this report, move forward expeditiously and getting America back into space safely aboard an American vehicle. I'm committed to authoring and working on reauthorizing a bill for NASA during this Congress, and use this report to provide some of the guidelines for that bill.

Also pleased to see that the board recognizes the importance of a vision for America's future in manned space exploration. And I believe it's time for us to step back and to really review that and to establish that vision. And I'm hopeful we can see created a presidential commission on the future of space exploration to establish a common vision for space exploration by America.

I've held several subcommittee hearings over the last few months with not only NASA, but other federal officials, but also with the private-sector companies and entrepreneurs, in an effort to ascertain what America's vision for future space exploration should be. In all these hearings one thing has stood clear: Americans continue to support human space flight and exploration. We cannot allow ourselves to give up and turn our backs on exploring space and the universe because we've suffered loss of life. Those are risk we acknowledge and accept for the opportunity to improve the quality of life here on Earth and beyond.

We are tasked today with moving forward to ensure America's return to flight, and I'm anxious to hear what NASA's response is to the board's report. But I'm also very interested in where they plan to go from here with America's vision and space exploration.

Thank you, Mr. Chairman, for holding the hearing.

MCCAIN:

Senator Breaux?

BREAUX:

Thank you, Mr. Chairman.

And let me join with all of our colleagues on the committee who, I think, have a universal agreement on the quality of the work that was done, Admiral, after this great tragedy and the cooperation, Mr. O'Keefe, that NASA had and the role that NASA played in working out this very detailed investigation of a very tragic set of circumstances.

BREAUX:

And it indeed is very tragic and is very, very high profile. If you think that every year we lose about 40,000 American lives on accidents every year on our nation's highways, this is an accident involving seven real American heroes. But it really speaks to the essence of what America is all about, in the sense of the quest for conquering outer space is really something that affects every American very deeply when you see something so visible as the shuttle tragedy that occurred.

So I have a number of questions about the recommendations and the culture that, Admiral, you talked about and how we change that. But let me just say now that the report, I think, is well done. And the cooperation, I think, that was exhibited is also to be commended.

And I thank you both.

MCCAIN:

Senator Snowe?

SNOWE:

Thank you, Mr. Chairman. And thank you for holding this hearing so promptly and responsibly.

And I certainly want to welcome Admiral Gehman and Administrator O'Keefe here this morning.

This report, as everybody's indicated, is about moving forward, but the question is how we do so in a manner that honors the memories of those brave astronauts who lost their lives and to prevent a reoccurrence of this tragedy from occurring in the future.

This report does, I think, represent a giant leap forward in understanding that which needs to be fixed. I think the question is the change that needs to occur and the implementation of that change.

And, Admiral Gehman, I want to congratulate you and the board for your extraordinary efforts that you invested in developing this report, but also, I think, reaching beyond and not just ascertaining the last thing that occurred, but also understanding the whole system and patterns of failures and shortcomings. I think that that is essential for understanding the complete picture in order to address the inequities and also the failures overall.

I would also say that we know that this -- as you indicated Admiral Gehman, complex systems always fail in complex ways. So obviously, the solution is going to be equally complicated.

I think what becomes abundantly clear in this whole process is that the execution and the perpetuation of comprehensive changes must occur in order for the manned space flight program to continue in order to save lives in the future. And I think we were all shocked by the revelations of the shortcomings of miscommunications, obviously the bureaucratic misfirings. And I think as a result, we have to know how and what must be done.

But more importantly, is establishing a perpetuity of vigilance in making sure that these things are implemented for the long haul and the longevity that it's going to require. We cannot allow our outrage or concern to atrophy. You know, we have seen past reports, many of which were overlooked, and that cannot occur again in this instance.

And so when the spotlight is off, I would hope that we will be able to be assured that what has been recommended in this report is going to go forward. It's not a question of just depending on previous successes, however tenuous, to predict future success. The question is, how do we create a permanent management structure that will enable NASA to succeed in the future with this program?

And I know we have a lot of remarkable people at NASA, and I know with your leadership, Administrator O'Keefe, and your extraordinary work at the board, Admiral Gehman, that it is possible. And that when we look back at this time of tragic loss that we can view it as a turning point in the history of America's manned space flight program.

Thank you, Mr. Chairman.

MCCAIN:

Senator Inouye?

INOUYE:

Thank you very much, Mr. Chairman.

I wish to commend Administrator O'Keefe and Admiral German for this careful, candid and courageous report. Thank you very much.

I ask that the complete statement be made part of the record.

MCCAIN:

Without objection.

Welcome to the witnesses.

We'll begin with you, Administrator O'Keefe. Thank you for appearing today.

O'KEEFE:

Thank you, Mr. Chairman. I have a statement I'd like to submit for the record, if you would, and I'll briefly summarize.

Over our 45 years as an agency -- when NASA was founded in 1958 -- we have found in the course of the history that our time has been defined by the great successes and the great failures. In each of these defining moments, our strength and resolve as professionals has been tested, to be sure. This is one of the seminal moments in our history. It is defined by failure.

On February 1, we pledged to the families of the Columbia seven that we would find the problem, fix it and return to exploration objectives that their loved ones dedicated their lives to. The Columbia Accident Investigation Board's report completes the first of these commitments. We are indebted to Admiral Gehman and his board members for their exceptional public service and extraordinary diligence in this difficult task. We wanted an unvarnished answer and we got it.

As we begin to fulfill the second commitment to the families to fix the problem, our first step -- critical first step is to accept the findings, comply with the recommendations and embrace this report. There is no equivocation on that pledge. This report, as many of you observed, is a blueprint. It's a road map to achieve that second objective.

And in the course of the proceedings in this investigation, the board has given us an extraordinary head start by their candor, the openness and the release of findings and recommendations during

the course of the investigation. This has all been conducted in a very open setting. And they have telegraphed all along the way, in the course of their public hearings, commentary, exactly what their findings were, as they found them and moved forward. And we've been listening.

So we're going to start, thanks to their good work and the manner in which they conducted it, in developing an implementation plan. And the implementation plan will be released here later this week with the intent to be updated all the time on the findings and recommendations -- and you'll see that in this initial effort at it - and divided into two primary categories: the 29 recommendations of the Columbia Accident Investigation Board, and a second approach which is raising the bar to a standard higher than that. And we will include in that category everything and anything that's going to improve this process, as well as the capabilities and the hardware itself.

As we work through these recommendations, we have to choose options to implement them very wisely, in order to be fully compliant with those recommendations. And we've got to continually improve and upgrade the plan itself to incorporate every aspect we find along the way in our implementation effort and any other observation, from wherever it may come, that needs to be addressed as we work our way through that in our commitment to fix the problem.

The report covers hardware failures and human failures and how our culture needs to change to mitigate against succumbing to failures of both kinds. We must go forward and resolve to follow this blueprint and do it in a way that is our very best effort to make this a stronger organization; there is no question about that.

It will require all of us in the agency -- not just the human space flight effort, not any one center, not any one program -- all of us at NASA to recognize this is an institutional set of findings. It has application to everything we do. And that's a profound set of

recommendations. We wanted that unvarnished assessment and we got it.

It's a very different NASA today than it was on February 1st. Our lives are forever changed by this tragic event, but not nearly to the extent that the lives of the Columbia families have been changed for the rest of their time.

In taking inspiration from their approach, we must be as resolute and courageous in our efforts as they have been in working through this tragedy in committing ourselves to accepting these findings, complying with these recommendations and embracing this report. We know that how we respond in the days, weeks and months ahead will matter as much as what we decide to do, and whether it be a lasting change that will withstand years from now, I think has been observed by so many here as well.

We must also resolve that definition and be a definitive in our acceptance of our failures and in following through on our commitment to the families to fix the problem and return to the exploration objectives their loved ones dedicated their lives to. And in that effort, we know we've got a lot of work ahead of us and we've accepted that.

Thank you, Mr. Chairman.

MCCAIN:

Thank you very much.

Admiral Gehman, I want to extend not only our appreciation to you, but all members of your commission for the outstanding work they did. Welcome.

GEHMAN:

Thank you, Mr. Chairman.

Good morning, Mr. Chairman. I'll just say a very few comments and ask that my opening statement be entered for the record.

MCCAIN:

Without objection.

GEHMAN:

I thank the committee for their compliments to the board this morning, and on behalf of the board, I accept your compliments. And I also know that the members of this committee share the feelings of the board that the price this nation paid on the 1st of February was so dear that it demands now that we do our parts to do everything possible to ensure that an accident like this never happens again.

I would like to return the compliment to the Congress. As the Congress is aware, we were not a presidential-appointed commission, but due to your oversight, guidance and cooperation with this board, the issue of our pedigree was removed from the table early on and all the comments around the town this week are about the merits of the report and not the process by how the report was written. And the Congress shares in the credit for turning that situation into a very positive situation, and I thank every member of this committee for assisting us.

I also would like to join in thanking my 12 colleagues who essentially gave up seven months of their life to do this report, and the over 100 full-time investigators and the thousands of NASA engineers and scientists who helped us with this project.

When I appeared before you on the 14th of May of this year, I made a commitment that our report would put this accident into context. There are many contexts, of course. There's the context of history, of budgets, of management, the context of what previous reviews of NASA have told us, and the context of our nation's vision about

human space travel. I believe that our report satisfies that requirement and has put this accident into all these contexts.

First of all, of course, we did establish the physical cause of this accident: The foam did it.

And by the way, for those of you who have never actually seen one of these objects, I brought it along. This object sitting on the floor beside me here, this is the famous left bipod ramp made out of the actual foam, and the little black line is approximately where the fracture occurred that caused this accident. So if you've never seen one, this is what one looks like.

The board was very deliberate in coming to the conclusion that the foam did it, and the time that it took us to come to that conclusion allowed us to look rather introspectively and intrusively into management at NASA. While we were working on the physical cause, we had many other people that were looking at how NASA did their business, particularly the space shuttle program. And we had to ask ourselves, if the foam did it, was this a legitimate surprise, a new event that caught everybody by surprise, or if not what is the history behind attempts to understand and fix this event if it was not a legitimate surprise?

What we found, of course, was that this was not a surprise. NASA had experienced this foam coming off many times in the past. And then when we got into the issue of learning how they dealt with this in a scientific and engineering point of view, we got into the business about how the shuttle program handles unknowns, how they handle risk, how they provide for research and development to understand the processes that they're dealing with and how they learn as an institution.

GEHMAN:

We were concerned with what we found, and that is really what -- about half of our report, is about what we found.

Being concerned with what we found, we then embarked upon two paths of investigations simultaneously. The first path was an academic review of how high-risk operations ought to be conducted and judged. And simultaneously, we conducted a review to see whether or not there were practical instances where high-risk enterprises around the United States are being managed reliably, successfully in other areas. And we found plenty of cases where people deal with high-risk technology and high-risk enterprises, and do so successfully.

We took, kind of, a menu or a recipe from the academic review and some examples from the best safety practices around the country, put them together in a template, and then judged NASA's space shuttle program by that template and found it to be wanting.

Our report then documents extensively in detail each of the issues that we are concerned about, along with documentary evidence, interviews, statements, pieces of paper, reports that support our conclusion. And also, our report, we feel, concludes with specific, actionable recommendations to make this shuttle operation more safe.

I'll conclude, Mr. Chairman, by adding one comment because it was brought up by the members several times, and that is the issue of accountability. The board does not feel that there is -- that people should not be held accountable for their actions. The board does believe in accountability. And we believe very strongly that we have included in our report plenty of documentary evidence to support accountability if the proper authorities want to hold people accountable. It's all in the report.

We decided long ago, made it public, and I have defended the position before this committee before, that we were not going to make those judgments, but we put it all in the report. It's all there. If somebody, the administrator of NASA or this committee, wants to find whose performance was not up to standard, it's all in the report. And it should be fairly easy to sort that out.

We just elected that in order to pursue the issues that we wanted to pursue, we would be better off if we let the proper authorities take care of accountability, and we did not come to the judgments. But we put all the stuff in the report.

Thank you, Mr. Chairman. I'm pleased to be here and ready to answer any questions.

MCCAIN:

Thank you, Admiral.

Mr. O'Keefe, it's a perfect segue into my first question: accountability. Culture needs to be fixed; how and when, and what accountability do you expect to enforce here in light of Admiral Gehman's statement that there's ample evidence of individuals, as well as institutions, that should be held accountable?

O'KEEFE:

Yes, sir. As I mentioned in the opening statement, the manner in which the board conducted its activities was so open, so clear, in terms of their approach to it, and again the approach we used of releasing all the information in support of that investigative activity, has led to this result, and it's pretty clear in terms of what's involved here. And we've been acting on that as we have moved through.

The shuttle program management team is a completely new team today. Started from the program manager all the way through all the key players, 14 of 15 of the senior folks are completely new folks in their capacities just in the last couple of months.

MCCAIN:

Seems to me that's half of accountability, Mr. O'Keefe. Have you held others accountable?

O'KEEFE:

Yes, sir. As we've worked our way through, yes, there are range of other participants in this. And I think what you see is a management team in place that's different today than it was a year ago, to be sure, and certainly very different than it was seven months ago.

MCCAIN:

Does that mean those who are replaced are accountable?

O'KEEFE:

The folks who are in positions today will lead in the future and be accountable for this activity. Those who are not there, I think, you can draw the conclusion from that.

MCCAIN:

When do you expect this culture to be fixed?

O'KEEFE:

I think Admiral Gehman and the board observed in the report this is going to be a long, long haul. There's no question about it.

Again, the first step has got to be without equivocation that we accept the findings, we'll comply with the recommendations and will embrace this report. That's the first critical step in moving toward the role of, I think, a full acceptance of a culture change.

And in doing so, I think that's going to take time. We've got to be very consistent in that message. We've got to be very consistent in the direction we're going to go. And any equivocation to that point I think is going to falter that effort.

So we've got to be on the long haul, proceeding in that direction. But I fully anticipate we will see the beginnings of that change within six months to a year, to be sure. And we've begun that process as immediately as the day the report released to assure that everyone

understands there is no equivocation on accepting these findings, complying with these recommendations and embracing this report.

MCCAIN:

Admiral Gehman, would you describe how congressional earmarks and NASA's transfer of funding from the shuttle program to other programs and the declining NASA budget affected space shuttle operations and safety?

GEHMAN:

I certainly will. And we included in our report the plain facts of the matter, just so that anybody who wants to do the research can come to the conclusion that over a period of about a decade the buying power -- the purchasing power of the shuttle program has been reduced by over 40 percent.

Really though, what has happened, in the board's opinion, is the very insidious, powerful, but nearly invisible force of dissatisfaction. Dissatisfaction among several administrations, dissatisfaction among several committees of Congress and even the administrator of NASA on the extremely expensive cost of operating the shuttle. It costs much more to operate the shuttle than everybody will ever admit.

And over the years, what has happened is that, for one reason or another, people have tried to wring money out of the shuttle program in order to pay for other projects. NASA has essentially been operating under a flat budget, that flat top line. In order to do other things, there has been a steady, consistent attempt to wring money out of the shuttle program; some of it legitimately by efficiency and effectiveness. But nevertheless, since the shuttle program is so expensive, there have been efforts to squeeze money out of the shuttle program.

It is the board's opinion that the effect of this is that for a number of years after the Challenger accident the management scheme of the shuttle program has been changed to a very vertical scheme, in which the program manager, over a period of years, has now -- had become responsible for schedules, manifests, costs, budgets, personnel assignments, technical specifications and requirements, the waivers for technical specifications and requirements and safety.

GEHMAN:

And because people were naturally trying to get money out of this very expensive program, the program manager began to make trades in that trade space. And he began to trade things like research and development into why foam comes off for measures to make the schedule. And he began to make trades like that and the board was very concerned that that was too much power in one person's hands.

If it is your goal to know who to blame if something goes wrong, having a scheme in which all of that responsibility is placed in the program manager's hands is a really good scheme, if you want to know who to blame. But if you want to operate safely, our study of both the theory and the academics and the best business practices indicates you need to separate the engineering and the safety from the guy who's responsible for the cost and schedule, because inevitably they're going to fight with each other and you're going to get a conflict, and the person who is being hammered over cost and schedule is going to trade safety and engineering in order to achieve cost and schedule.

MCCAIN:

And congressional earmarks?

GEHMAN:

Congressional earmarks do a couple of things. One thing they do is they give an over-inflated number of the total value of NASA's budget because there might be \$400 million or \$500 million worth of earmarks, but that's not really NASA's money to spend because they can't move it around. The administrator loses his flexibility; he can't buy more safety and all that good stuff.

Probably most of the earmarks that we looked at are actually adds, most of them but not all were adds. But even if they were adds, it makes the NASA budget look bigger than it is and it reduces the administrator's flexibility for moving money around.

MCCAIN:

Senator Hollings?

HOLLINGS:

Admiral Gehman, Mr. O'Keefe appointed you. Did you find him accountable?

GEHMAN:

I did find him accountable and I did find him to be cooperative and I found him to take full responsibility for everything that happened on his watch.

HOLLINGS:

And by that answer, what you find him responsible for this disaster, let's call it?

GEHMAN:

I find that leadership -- all leaders -- including Mr. O'Keefe, including the Congress, including the White House, are responsible for the conditions that they set and that set for the conditions for the performance of their organization.

Almost everything that we complain about, every management trait, every communication problem, every engineering problem that we complain about in this report was set in motion between five and 15 years ago. so it didn't happen on his watch.

HOLLINGS:

It didn't happen on his watch?

GEHMAN:

That's correct. Almost all of these traits that we're talking about are traits that happened from two to five years after the Challenger accident. That is, right after the Challenger accident as Senator Nelson had indicated, all the energy and zeal and vigilance associated with the tragedy causes everybody to do their job really well.

Let me give you a case in point. The management of the human space flight program, which used to be in Washington, D.C., in the mid-'90s was shifted back down to Houston again and Mr. O'Keefe brought it back up to Washington, as Rogers had recommended. That's an example of how we, kind of, migrated away from the Rogers recommendation.

HOLLINGS:

Admiral, I understand that you've taken over a ship as Navy admiral time and again, perhaps at a different rank ,and you didn't put off what happened 15 years to the ship and 10 years ago to the ship.

I'm not trying to embarrass anybody -- we're all friends -- but I'm trying to break pass this culture finding and fix responsibility. And you have categorically said, you didn't attempt to do that -- fix responsibility. You got enough facts where it would indicate they didn't hold them up to standard. Now, Mr. O'Keefe has made a very categorical and convincing statement about, "We've got the message," and everything else that Mr. O'Keefe -- right after this

occurred, Chairman McCain and myself were informed immediately that they had tried their best to take images, to take pictures of the damage done of the shuttle in flight.

HOLLINGS:

And I think it was two, perhaps, three times they -- that is the Defense Department -- was ready to do it, but that there was a formality about requesting it. And a request was made and then was canceled.

In fact, I understand that Linda Ham (ph), the chairman of the management team, was responsible. She consulted with Ralph Role (ph), the manager of the space shuttle vehicle engineering office, and that the imaging request, having been made to the Defense Department, was canceled by none other than Linda Ham (ph), who's now been just reassigned over to Houston in another office.

And of all things, when you say, "I get it, we're going to do it categorically, we're going to take every issue, we're going to do everything," we've put Mr. Role (ph) as number two at the safety office. That doesn't indicate to me that you've got it.

O'KEEFE:

Sir, again, the approach we've taken here is to completely designate for the management effort the folks who are prepared to lead in the time ahead. And in dealing with the range of folks who participated in this activity -- and clearly, the report lays it out, as does Admiral Gehman's commentary -- I think the approach we've got to take is put the best judgment to picking a leadership team for the program management office, as well as all the efforts we're engaged in here in Washington and across the centers, toward this activity of picking the best people to do that. That's who's in place today. This is the best leadership there. And that's the approach we have taken to this and that certainly is a measure of accountability.

On that point, there is no question -- and I appreciate Admiral Gehman's observation on this point -- I am personally accountable for this. I view this as my personal responsibility. I serve at the pleasure of the president. At which point, he decides that is no longer at his pleasure, I'm certainly ready to adhere to that. And my obligation between now and the time he may reach that decision is do my level best to assure that we accept these findings, comply with these recommendations and embrace this report, and we intend to do just that.

HOLLINGS:

Well, if that's the best you can do is take Mr. Ralph Role (ph), who failed in safety, said, "I don't want the pictures, I don't want to find out about the safety at all" -- in fact, we all saw this on TV. They kept dissembling and -- I forget that fellow Dittimore and everything else like that. We found all kind of defensiveness. We mentioned this last February when we had the hearing. And now, we find out, having got it and going to do this and going to do that, because I think it was Senator Inouye and Senator Stevens and myself were the only three here at the time of the Challenger. We heard all this before.

So there's no education in the second kick of a mule. I mean, I'm finding out and listening to the same thing I listened to 17 years ago and we've lost seven astronauts. Now -- and they talk about an accident, but it was an avoidable accident. And you talk about failure, but, it was an avoidable failure. And here, to make sure that we don't have that same failure again, you take the man who failed in safety and appoint him the number two in the safety office.

O'KEEFE:

Well, sir, no. Just to be technically clear about this, he -- that's not the position he's assuming here. We have set up and we are creating, as of this time next month, is a engineering and safety center which will perform at least, at minimum, among these

recommendations of the 29, trend analysis, in other words be removed from the operational conduct of the activity and look at what the prior trends would be to see if we can identify those cases in which we had missed things. And we clearly missed the foam on this one. That's the point that's raised in this report very clearly.

It was seven instances, and had we conducted that trend analysis, independent the operational imperatives of flying the shuttle, we might have caught it.

And that's what this new organization is going to do. And in that regard, we're trying to assemble engineers who'll be removed from that operational activity, to be able to step back with a fresh set of eyes who are knowledgeable about the mechanics of this process.

O'KEEFE:

And at the Langley Research Center organize all those disciplines among structures and aerospace engineers in order to look at those observable trends and see if we can identify what that next instance might be. And you need the folks who've got the experience to do that.

And in my judgment, to borrow a page from Wernher von Braun, when you make a mistake, you become that much more valuable the next time around to seeing exactly where that'll never be repeated again. There's great value in some of that, and it's something we'll certainly test.

And let the measure of what we do be the final conclusion of your assessment on this, as opposed to what we say. If we follow through what we're saying we're going to do, let that be the measure of proof.

And in that regard, Senator, I view that as a very high standard we need to meet.

MCCAIN:

Senator Sununu?

SUNUNU:

Thank you.

Administrator O'Keefe, could you talk a little bit about the return-to-flight team; the make-up of the team, the time line that they're going to operate under, and what you think their biggest challenges will be in getting the job done before we can even entertain the idea of the shuttle returning to space?

O'KEEFE:

Yes, sir. Thank you very much for the question.

The return-to-flight team is composed and led by Colonel Jim Hausel (ph), who's an Air Force colonel and an astronaut of four different flights previously. He is slated to be the commander of the STS-120 flight, which is six flights after the return-to-flight activity -- had been slated before the accident. So he has a very, very strong vested interested in making sure we get this right.

He's ably assisted by a very extensive team throughout the four space flight centers -- Johnson, Marshall, Kennedy and Stennis -- in the effort in order to assure that we have pulled together all 29 of these recommendations as well as, again, the raise-the-bar objectives that we've established. And it'll be included in this report, which we'll be releasing here later this week, early next, which encompasses and covers all of those recommendations, plus all the observations and every other issue that we have come across to raise the bar, raise the standard that we're anticipating before we return to flight.

That's overseen by an internal senior management team of Bill Readdy, who is also a veteran astronaut, who is the associate administrator for space flight, and Michael Greenfield, who is the associate deputy administrator for technical programs. And they're

managing across the entire agency. So we gather all of the information from the other six centers that are not space-flight related in dealing with this particular set of objectives. There's a range of capabilities we have across the agency, all of which will be brought to bear and employed. And there isn't any ambiguity, I think, among the leadership of the agency. This is all of our agency objective.

Finally, the oversight of our activities will be reviewed by an external panel, led by Tom Stafford, a veteran Apollo and Gemini astronaut, and Dick Covey, who was the pilot on the flight immediately after Challenger in September of 1998, and 25 other experts in the fields of engineering, of management change, of culture change, academics, industry folks, the full range of background of management, as well as technical expertise, to assure that we have implemented these recommendations and that we have selected options that are compliant and will make this agency stronger.

All of those folks are experts in that regard. They have already met once. They've got the framework of the implementation plan. They'll meet again early next week. And they'll be working through this all the way through that time and beyond our return-to-flight efforts.

So we've got this at three different levels in order to assure that we are not singing ourselves to sleep on any individual solution here or picking our favorite option at the expense of what may be a better approach.

SUNUNU:

Will their focus be on the 15 or so return-to-flight recommendations, or are they going to have a broader task of looking at all 29 recommendations plus the ones that, in your words, would raise the bar for NASA?

O'KEEFE:

Yes, sir, the entire package, everything. And we certainly -- you know -- I mean of taking the board's statements absolutely literally, it says, "These 15 must be implemented prior to that time."

O'KEEFE:

We take that as being a fact, a finding that we are not going to dispute, and will certainly move toward.

But nothing is being done on those 15 at the expense of all the others that are engaged in there. Because we may find, and we certainly have dealt with, a number of different aspects during the course in aiding this investigation that we believe rise to that same kind of standard of the 15 as well that we will be implementing prior to the return to flight.

SUNUNU:

Admiral Gehman, you talk about in the report -- I think it's pretty clear -- about identifying the causal relationships between the foam striking the leading edge of the wing and that leading to the accident. And just following this through the press and through the work of the board, it's clear that a lot of technical effort went into assessing the cause of the accident.

My question, however, is where are the greatest uncertainties? I mean, we can't know everything about the accident, so where in the mind of the board -- collective mind of the board, are the greatest uncertainties with regard to the physical causes of the accident or the physical findings of how the shuttle came down?

GEHMAN:

Well, the board deliberated long and hard, and we had quite a wrestling match over the words that we would use to describe the physical cause. By that I mean, we could have used words, like "All the evidence supports that the foam did it," or "The most probable cause is the foam did it." We elected not to do that. We elected to

say the foam did it. And that is based on overwhelming, confirming evidence, multiple different avenues of investigation; all of which point to the same thing.

We do not have a picture of a leading edge system with a hole in it. That would have been nice. That would have been confirmation that the foam did it. We don't have any such a thing as that. But we're absolutely, positively convinced beyond a shadow of a doubt of the physical cause of this accident, and there's no doubt in our mind whatsoever.

We were concerned, though, that in order for us to reach that conclusion, we had to do some physical tests and conduct some tests that we thought NASA should have been doing all along.

SUNUNU:

There is no element of the system or the technical work that you did that frustrated the board members?

Again, absent the picture, but where there any other areas of technical investigation where you had to walk away saying, "We don't have all the information we would like about the nature of the failure, damage inside the wing, the way that the shuttle eventually came apart"; no uncertainties there?

GEHMAN:

Only one, just one, and that is -- it's in our report. There's a nice little chart in there that shows the roll and yaw moments that are reconstructed from the very extensive data recorders which are on board the shuttle. And both of the roll and yaw moments show the shuttle left wing losing lift due to damage, and the roll and the yaw starting in one direction. And then, for some reason one of them, roll moment reverses. And we can't explain why that happens. It's probably due to a deformation in the wing of some sort.

But of the hundreds of pieces of technical data that we looked at, all of which point to a hole in the left leading edge, that's the only one that we can't absolutely, scientifically explain.

O'KEEFE:

Mr. Chairman, could I add just one point very quickly?

The approach that the board took that I found to be very impressive was they never fell in love with one scenario. They, by process of elimination, worked their way through a fault tree analysis that included every possible permutation, and then closed those avenues to reach the conclusions they did.

So we're as informed by the things that they examined that have nothing to do with this accident in their judgment, as we are about the things that they claim do have a specific contribution. Because there are a number of things they found that are equally problematic on some future activity unless we correct it.

O'KEEFE:

And so this a very thorough, extremely extensive investigation that I believe in our 45-year history has never been conducted to this depth, ever. And so it has uncovered a number of things that are extremely helpful in our pursuit of the return to the flight, which is then inform that raise-the-bar set of standards of where we intend to go in our pursuit of return-to-flight, when we're fit to fly.

MCCAIN:

Senator Lautenberg?

LAUTENBERG:

Thanks very much, Mr. Chairman.

And I'll start by saying to our friend and colleague, Senator Hollings, that your commentary this morning just confirms that we listen and listen carefully. You have good things to say. And just because you're out of here, doesn't mean you have to go quiet and just remember that.

And to you, Mr. Chairman, for holding this hearing and the hearings that we've traditionally had here and have been very informative and very open.

And, Admiral Gehman, I commend you. I haven't had a chance to fully read your report, but it's sprinkled with the candor that we rarely see in reports to government, because there's always a program to make sure that we don't offend this party or that party and I think that you went right to it. And how this particular tragic accident happened is critical because of the loss of life and the loss of confidence and all of those things.

But more importantly is how did we get there in the first place? And when I look at the executive summary of your report and you say that, "The organizational causes of the accident are rooted in the space shuttle program's history and culture," that means there are things that have been going on for a long time, at least you thought so, and so did your colleagues on the report who approved this statement.

The fact of the matter is that, in some ways, it was a tragedy waiting to happen, because I see in reports -- and Mr. Chairman, I want to submit a report that comes from the International Federation of Professional and Technical Engineers. It's their report on the effectiveness of NASA's work force and contractor policies. And I think there's something to be learned from this. And I, again, ask a request that this be included in the record.

MCCAIN:

Without objection.

LAUTENBERG:

And one of the things that they noted in their report was that when a previous administrator -- I can't be delicate here, and it's not in criticism, it's just the information that I looked at -- Daniel Golden, NASA's administrator from 1992-2001, appointed and directed to cut NASA's budget and bring fiscal discipline of the business world to the nation's premier science. The agency was then put under a management plan called, FBC: faster, better, cheaper.

And I wonder if you'd make a comment about the availability of resource. Did the 1,700 NASA employees have the capacity -- and I mention this in my comments earlier -- to supervise 18,000 contractor workers? Was there any failure, in your view, that lay heavily at the doorstep of the contractors who provide the kinds of service that might have averted this catastrophe?

GEHMAN:

Thank you, Senator.

The board found -- and we looked at this extraordinarily hard -- we interviewed hundreds of people, we walked the shop floors of all the centers all over the country where components are made, and we did not find cases where the contractors were taking shortcuts or were cheating or weren't doing their job well. We didn't find any cases like that.

GEHMAN:

The board did find, however -- and it's in our report -- that the management level, that is the vertical level that the program has decided to contract to seemed to us to be a little too high. By that I mean it appeared to us that they were contracting out management functions. They were almost to the point where they were contracting out government functions. And it appeared to us that we didn't find anything wrong -- I mean, we didn't find anybody doing

anything wrong in that case, but what we found was that when the government had to make a decision, they no longer had the technical expertise, because the function that they were supposed to be supervising was being done by a contractor.

And if you look at the mission management team decision making, you see them consulting people that are experts on whether or not this is a problem, and they're all contractors. And there doesn't seem to be a government person who has the technical knowledge anymore, because they contracted it all out.

So we didn't find any wrongdoing, but we did find that perhaps it did appear to us that the government had -- because so many of the oversight functions were being done by contractors, the expertise goes with the function. And we found that the U.S. government was short -- seemed to be shortchanged.

LAUTENBERG:

So if there isn't blame and I understand very clearly what you said, then structure certainly was one of the problems and I assume therefore it's a continuing, or might be a continuing problem. The question is whether or not we're prepared to devote the resources to building this organization's capacity to the point that it needs to go on these relatively dangerous missions. We know they're dangerous, and we try our best to protect everybody involved with this program. But is there enough resources?

Senator McCain's question about what earmarks do, well, it robs the program of its appropriate funds to get this job done.

Mr. O'Keefe, what do you think about the resource on this?

O'KEEFE:

Again, it is a very subjective matter, and it is one that...

LAUTENBERG:

That's why we hired you, to be subjective.

O'KEEFE:

Yes, sir. I fully understand that.

And my judgment on it is that we have the resources necessary to continue operations in a way that is responsible. The points that Admiral Gehman has raised, I think, has been echoed in a Congressional Budget Office report -- that, if you permit me, Mr. Chairman, I'll submit for the record as well -- released just last month that compares this effort and the resources and the way it's conducted relative to other major -- what they refer to as technologically complex tasks performed similarly at other agencies and departments across the federal government and find no remarkable distinctions in that regard.

Having said that, the observations -- again, the depth of this investigation is deeper than any I have ever been involved in in my public service time. And as a consequence, the observations of the board and the findings of the board are going to inform us as we go through the examination of the Space Flight Operations Contract, which comes up for renewal in a year, in order to figure out exactly how we change that alteration based on the findings, recommendations and basic views expressed in this report.

There's a lot to be learned from that, and while the surface coverage even from CBO says not a lot of comparability difference between other major systems integration programs, that's not good enough as far as we're concerned, because the findings of this board are fact, and we intend to run that to ground to find out how we alter the contractual arrangements, as well as our own conduct, in order to do this stronger and in a better way.

LAUTENBERG:

Thank you.

Thank you, Mr. Chairman.

MCCAIN:

Senator Hutchison?

HUTCHISON:

Thank you, Mr. Chairman.

Mr. O'Keefe, were you ever advised or aware during the Columbia mission that there was a serious problem or any problem from the foam strike on liftoff?

O'KEEFE:

No.

HUTCHISON:

I'd like to pursue the issue of resources again.

HUTCHISON:

Mr. O'Keefe, you had a scientific advisory board that you asked to come together and determine what the resources of NASA should cover, what should be the mission. You got the report back. I would ask you if you think you have the resources to implement that report and establish a vision that not only is scientifically viable, but that the American people can see the necessity to continue.

O'KEEFE:

Yes ma'am. The very specific review that we asked and I think you're referring to is the scientific prioritization to be conducted aboard the International Space Station. That was conducted last summer and early fall. We have, in fact, assessed that. The prioritization is the scientific objective agenda that we will pursue on International Space Station. And the funds necessary to conduct

that activity is contained in the president's budget that's before the Congress pending now to pursue that for fiscal year 2004 through 2008 as a projection. So that clearly is our intent, we're going to follow that prioritization. That's what the findings of that scientific group was and representing all the disciplines of what could be conducted on International Space Station and proceed from there.

To the larger question you posed though, I think the issue we're trying to codify and is part of this year's strategic plan, and is released along with the budget as well, is an effort to be very selective about the areas we intend to pursue and apply those resources as extensively as need be in order to do an extraordinary job in those areas. And then for those areas that don't fit within the category of our three primary mission areas, that we simply not attempt to do them, you know, passingly, but just elect not to do them at all, and instead be very selective about what we do. And I think the budget and the strategy that's before you is our attempt to try to pursue that.

Certainly things changed on the 1st of February, and that's what we need to assess and go back and continue to relook this relative to the board's findings and the approach that we intend to take.

HUTCHISON:

So if I could summarize, you think that you have set the priorities and you have the resources necessary to accomplish those top priorities and leave the ones at the bottom by the wayside?

O'KEEFE:

In scientific objectives, the answer is , yes.

And again, in terms of our performance of those activities, we're going to be guided by other additional views that the board may have found here as we go through this to upgrade, update and improve this approach toward it.

But in terms of the science priorities, I think you're exactly right. That effort a year ago was the first time we'd ever had a prioritization set that began with the number one and moved progressively through two, three, four and five. Prior to that, everything was a number one priority, which therefore meant nothing was priority.

HUTCHISON:

I'd like to ask Admiral Gehman, it's clear from your report that there was insufficient resource and that NASA was stretched too thin to achieve its multiple goals. Do you believe that the agency is more budget-driven than mission-driven, in the past? Not going forward, obviously, because we're indicating that there is going to be a change, but do you think it was too budget-driven rather than mission-driven?

GEHMAN:

We believe that the budgets had a lot to do with what happened, with how the management system morphed over the years. And we believe that budgets are one of the constraints on the program, yes ma'am.

For example, I was just looking through the report -- I was going to try and quote the page to you; normally, I'm like a bible pager I can quote the page of where everything is and I just couldn't find it -- there's a little sidebar in there which talks about their shuttle upgrade program. The shuttle upgrade program is essentially unfunded. There is a recommendation in here that if you're going to fly this shuttle beyond about 2010, you should completely requalify or recertify the shuttle. It would be a very expensive proposition; not funded.

We suggest that we need to reestablish the independent technical review authority or reestablish the position of engineers as being

independent from the program so engineers can do engineering work independent from the program.

GEHMAN:

So engineers can do engineering work independent from the program. And then when you ask for engineering evaluation or an engineering decision you're getting an evaluation from people who don't care anything about the schedule, for example, or the need to make a launch. That requires a couple of hundred people or couple thousand people to be funded from someplace, which is currently not funded because now everything is charged against one of the programs.

So budgets are a big issue, yes, ma'am.

HUTCHISON:

Let me just ask Administrator O'Keefe, in my last couple of seconds, he's talked about the upgrading of the shuttles and the recertification of shuttles, which you have said you're committed to doing. And we also have the new space orbital vehicle that will replace the shuttle. And I would like to ask you if you think -- you've said you have the resources to do your high priorities. Have you taken into account the upgrading of the shuttles? And do you have any intention of speeding up the process of the space orbital vehicle that would replace the shuttle?

O'KEEFE:

Yes, ma'am.

Two out of three of those -- again, our discussion a moment ago was on the science priorities, but as it pertains to the three specific items he's mentioned, again, those now are findings and therefore they're treated as fact.

And the three issues, two of them, they are resources set aside -- whether they're sufficient or not is something we have to evaluate. For the upgrading of the shuttle there is a service life extension program budget line item that's in the budget the president presented to the Congress on February the 3rd. We have to assess exactly what those upgrades are that need to comply specifically with these findings, and whether that comports exactly or whether additional resources are necessary is something that time will tell.

In the second area, in terms of the independent technical authority, Admiral Gehman's exactly right. Whether that takes 200 or 2,000 additional engineers; don't know yet. We're going to have to assess all of those options. And indeed, he's right, that's not something we anticipated, that's not something that is contained in this budget. But we intend to do it and we'll assess what those resources requirements are as we work our way through this.

So the approach -- and as far as the orbital space plane is concerned, there is an additional amount - there's amounts in the budget before the Congress now, that was proposed in 2004. The initial funding was...

HUTCHISON:

\$500 (inaudible).

O'KEEFE:

... agreed to by the Congress as part of the president's amendment, November of last year, to last year's budget.

HUTCHISON:

It's not enough to increase the...

O'KEEFE:

That's exactly right. And I was just about to say that. You're exactly right.

The issue of accelerating its delivery is something we need to look at. And the issue is not so much of how much more it will cost, but how much more resources you need earlier in order to achieve that. And that's something we've really got to assess now and make a determination of whether that is in the best interest overall to pursue that particular approach.

But we're working that diligently and have got some answers on what it would take to accelerate this for an earlier delivery of whatever ultimate design would come out of this competitive effort that we're pursuing right now.

HUTCHISON:

Thank you, Mr. Chairman.

O'KEEFE:

Thank you, Senator. Appreciate it very much.

MCCAIN:

Senator Wyden?

WYDEN:

Thank you, Mr. Chairman.

Let me begin, Administrator O'Keefe, with this question of my sense that you really can't define NASA's mission now without getting on top of the question of manned space flight. And I think we're about to start a whole array of commissions and studies and the like, and I would like to ask you whether you could furnish us within 90 days, or at most six months, a solid cost-benefit analysis with respect to manned space flight.

I think that's what the Congress really needs. And I know that what I get asked all the time, certainly there are a lot of critics who say, "Look, they give the bulk of the money to manned programs but most of the research seems to come from areas that aren't manned."

What's your reaction to the proposal I've made this morning that you give this committee a solid cost-benefit analysis of manned space flight within 90 days, or at most six months?

O'KEEFE:

That is a very intriguing idea. I'll give it my best shot.

O'KEEFE:

I think that's a very thoughtful way to go about approaching it, and I'll do my very best to provide such a document and an analysis that would demonstrate that. That's a step forward, I think, in proving this.

Two things though to observe as well though, that just to be clear on the facts, a third of the budget is really dedicated toward space flight activities, of which 25 percent is shuttle, additional amounts are for International Space Station, and then the other two thirds is toward earth science, space science, all the things that are not specifically related to space flight activity. So it already is skewed heavily toward activities by a factor of roughly two to one the kinds of functions that are performed by robotic and distant means. So that's an approach.

The other thing we've got to really assess here, and again, in the pursuit I think earnestly to answer the question, the very thoughtful proposal he put forward on how to conduct such an analysis, we've got to find some way to factor in what is the cognitive skills that human beings bring to the occasion in these cases. There are some things you simply can't do without a human intervention. And we've

got to be selective in the cases in which we expose humans to those risks, and that's essentially what I think you're posing, and it's a very interesting way to go about doing it and I'll give it my best shot, Senator.

WYDEN:

Mr. Chairman, I would just like to follow up with you and Senator Hollings. I made the proposal, but obviously I'd very much like to do it within the bipartisan approach you followed in this committee. But to me that is the bottom line: We have got to get a cost-benefit analysis with respect to what is done in the manned versus unmanned area. And I'll be following that up and look forward to talking to my colleagues about it.

Second question, Admiral Gehman, if I might, involves the compliance issue. I think Senator Hollings touched on this. I mean, the whole history here is tragedy and recommendations made and then somehow they don't get followed. I'd like your recommendations with respect to how it could be different this time to bring about compliance.

For example, just on a, kind of, basic level, I mean, we could ask Administrator O'Keefe to come on in here every 90 days and basically say, "Look, this is what we've done in the last 90 days." I want to give you a crack at how you'd approach it, but what I think you want to do and the dedicated people who staffed this effort want to do is make sure we're not sitting here in the face of another tragedy. And your thoughts with respect on how to make sure that there's compliance this time I think would be another area I'm interested in.

GEHMAN:

Thank you, Senator.

As I indicated in my opening remarks, I agree with your concern and as I said in my opening remarks, I think we owe it to the memory of the seven heroes who died to make sure that we do everything we can to prevent this accident from happening again.

The history of NASA, which we studied very carefully and documented in our report, indicates that NASA, like any other big bureaucracy, responds to the forces that are acting on it, and unfortunately, over a period of -- a long, long period of time budget, schedule, cost forces became very important to NASA and they started to affect the program.

The question about how to prevent this from happening again is a very intriguing one. The board has spent some time scratching their heads about it. We have a couple of examples that have worked well in the past. In the case of the Challenger accident, you may recall the Rogers Commission required that NASA redesign the solid rocket booster joints and O rings. It wasn't just the O rings; it was the whole joint. And they also recommended that an oversight committee be established to supervise that -- a non-NASA oversight committee. And that oversight committee was in existence for almost three years, and they disapproved the first couple of NASA redesign efforts.

You could appoint some kind of a panel or a committee to advise the Congress as to whether or not these management steps have been taken and whether or not they're really working, and all that sort of stuff. There is a precedent for that.

There is -- and I think the members of this committee are very much aware, there is a congressionally appointed or a congressionally created oversight panel already in existence called the ASAP, Aerospace Safety Advisory Panel, created by Congress.

GEHMAN:

You might want to charge them with some duties and responsibilities, or maybe reformat them, reformulate the membership to get at the issues that you're concerned about.

WYDEN:

Admiral, if I might because I know that I'm just about to run out of time, and I want your opinion on one other area, the technical engineering authority that you have talked about strikes me as a way to bring about some of the independence and oversight that's important. I would like to hear your thoughts on ,sort of, the nuts and bolts of how that would work, and also yours, Administrator O'Keefe, whether you accept the recommendation and, in effect, how something like this would work.

I mean, the first thing that strikes me is if NASA puts up the money for it, then you'd say to yourself how does that facilitate the kind of independence that you're talking about. But given the fact that you put great weight on this technical engineering authority, tell us how you think it would work. And I'd like both of your reactions. I know my light is on, but I'd like the reaction of both of you gentlemen on that.

GEHMAN:

Senator, thank you for that question.

That question probably gets to the most important recommendation and probably the core of our report. And that is that we have found that over the years that a legitimate system of checks and balances has been lost in NASA, in which there are independent and resourceful and robust agencies that, kind of ,check up on each other within NASA. We don't -- the board does not feel that we need to create another entity or an anti-NASA or something like that.

But what's happened is, is this independent, robust system of checks and balances has been lost, and it's been lost in the name

of efficiency and effectiveness and all that kind of stuff, but nevertheless it's been lost. And the manifestations of that are really what our report is all about, all the e-mails that didn't get acted on and the inability of engineers to affect things, and the overwhelming power of informal chains of command by people in the program, things like that. All those things are fixed if you create an engineering world in which engineers can have a robust and honest difference of opinion, and you don't do management by view graphs, you use technical papers instead of view graphs and overheads and all those bad things we talked about.

What this organization would do, what we think the key ingredient to the success of this scheme is that this organization must, in fact, own a function. By that I mean, simply creating an organization that sits on the sideline and kibitzes or second-guesses other people is not good enough. Our suggestion is that this organization actually has to own part of the process. And the part of the process we suggest is that they have to own the technical requirements and specifications and all waivers to them.

Now that implies that they have to understand those technical requirements and specifications, they have to understand why they're there. If anybody wants a waiver to them, they have to understand the rationale for the waiver. And if they don't want to grant the waiver, they have to understand why they're not granting it. So that suggests an engineering enterprise of some size.

It used to be that way a long, long, time ago, and that really gets to the core of our recommendation, because many, half, 60 percent of all the ills that we list in our report are immediately fixed because of this enterprise that we recommend. It could be within NASA. We don't necessarily suggest it has to be outside of NASA.

MCCAIN:

Senator Brownback?

O'KEEFE:

Sir, I'm sorry.

MCCAIN:

Doctor, go ahead.

O'KEEFE:

The request was that I respond as well.

The short answer is it's a finding and therefore it's a fact. It's a recommendation so therefore we're going to comply with it. No further debate on that issue.

And what Admiral Gehman and his colleagues on the board have pointed to is an organizational characteristic that I recognize from my Defense Department experience years ago, particularly the Navy Department experience, which is to have a severability between that institutional force which owns and, kind of, takes control of specifications and engineering requirements, and those that are faced with the program operational considerations of cost and schedule and all the other factors that go into the day-in and day-out kinds of work, and make a very clear severability of those functions.

O'KEEFE:

Got the message, that's a clear recommendation. We're going to sort through the options of what is the best approach to do it.

And again, the oversight function that we have put in motion is the Stafford/Covey team of Tom Stafford and Dick Covey and their 25 colleagues in all these different disciplines of management, engineering, technical change, organization change, culture change, all those different experts will then be the judge of whether we pick the appropriate option to do that. And we will not proceed

until such time as we're satisfied that we have selected an option that is not only compliant, but really does follow through on the point that's being raised here.

The final observation is, I concur wholeheartedly in Admiral Gehman's view that there is a statutory board in place right now, the Congress enacted 30 years ago after the Apollo fire the ASAP, the panel that is focused on these, you know, safety objectives. I think the charge that I'm hearing here as well as the approach that needs to be taken is, take that statutory oversight function and reinvigorate it. And we'll have to kind of cogitate on what the right ways are to do that, and certainly we would appreciate your support and help in that pursuit as well.

MCCAIN:

Senator Brownback?

BROWNBACK:

Thank you, Mr. Chairman.

And thank you gentlemen for being here today.

Admiral Gehman, in the report it's replayed about there is a need for a change of culture. And I think there was one news account that put it accurately that technology is easy, people are difficult. How do you change a culture at an institution without changing the people involved? I mean, this seems to me that if you're talking about a cultural issue here, you're not talking about moving boxes or organizational charts around, you're talking about changing whole mentalities and whole attitudes. And that seems to me, you're talking about major wholesale changes in personnel within the NASA system; is that accurate?

GEHMAN:

Senator, we anguished over this issue for a considerable amount of time and we also did not start our investigation with this position, we, kind of, came to it.

And I think that in order to answer your question directly I have to make it clear that the board made a clear distinction between management problems and management fixes and culture. In our minds, in our framework, we view these two things as two separate things. Management can easily be fixed by wiring diagrams and changing rules and regulations and moving people around and changing functions and all that good stuff, but the cultural issues are much more difficult to get at. We had a little saying that you can fix a management problem by reorganizing, but you can't fix a cultural problem by reorganizing.

Cultural problems are going to have to be driven -- bad culture -- there's good culture to, by the way; there's a culture of safety and a culture of honesty and a culture of openness and all those kinds of things which needs to be reinforced. But bad cultural traits, which we tried to list specifically in our report, so we weren't just waving our arms and beating our breasts here, need to be driven out of the system by active, proactive leadership. And not just leadership from the administrator, he can't do it alone, it's going to take -- he can affect probably two levels below him and then the people below him can affect two levels below them. But it's going to have to take active leadership on behalf of several layers of management in order to get at this problem and it can't be done in a few days or a few months. And therefore, we did not make it a return-to-flight thing.

BROWNBACK:

Let me -- because my time's going to be limited on this. Isn't what you're describing, though, that you're going to have to make major personnel changes to change those attitudes in the culture, up and down through the organization?

GEHMAN:

My experience has been that you can change the behavior of people -- you can't change the attitude of people, but you can change your behaviors. I would suggest to Mr. O'Keefe, that after trying as hard as he can and repeating the message over and over again, if there's somebody out there who doesn't get it, he has to be replaced.

BROWNBACK:

And quickly.

Mr. O'Keefe, in looking at the comprehensive list of recommendations in Chapter 11, it takes me aback a little bit. The return-to-flight requirements are extensive. How long do you think those would take to get implemented and at what cost?

O'KEEFE:

There are 15 very specific recommendations that that must be implemented -- you're exactly right -- prior to any return-to-flight activity, and the answer is it will occur when we have determined we are fit to fly. Because not just those 15, but anything else we determine that falls into the category of issues which would otherwise compromise successful mission accomplishment is going to have to be accomplished. That bar has to be much that higher. It can't be just those 15.

BROWNBACK:

No time frame then? You don't -- you can't establish any time frame? I think you've said that in other interviews. What about the cost?

O'KEEFE:

Again, we have to assess that because it really turns on which options we select to implement each of those -- particularly those 15 and then all the other recommendations, as well, and the other things we've included in the raise-the-bar kind of inputs area. So as we work through with the Stafford-Covey team exactly what options we're going to choose, that will then yield the price tag which will give us a better judgment of exactly what that's going to take.

BROWNBACK:

Let me build on that, if I could. And this is, I think, along the line with what Senator Wyden was saying. As you appraise that, there's going to be a cost associated with that. I hope you also look at it and question whether it would be just a better thing to invest in the different technology if, at some point we look at that sooner rather than later, maybe even much sooner, we ground the shuttle and go to a different system, if the cost of implementing this is so high, relative to going to a new technology or a new system.

And I would hope that, as you appraise this that you look at, "This is the amount of time it would take us to get the shuttle back to flight. This is how much it would cost. Are we throwing good money out for bad?"

There's a fair feeling that this is an older technology, it's a complex technology; that we may just be at a point it's time to say scuttle the shuttle and we move on to the next technology. And I hope you would be making that appraisal, rather than just saying, "Well, we're on this line and we're going to go that track."

O'KEEFE:

Yes, sir. As we review the implementation plan which, again, will be released late this week, early next, and you -- that's going to continue to inform the debate of what the scope and magnitude of return to flight's going to require. I'm certain we're going to have a spirited debate, in terms of what exactly that will entail, what it'll

cost, what the tradeoffs are. And again, we intend to be under multiple levels of oversight review in that process.

BROWNBACK:

And I can assure you, Congress is going to be looking at question.

O'KEEFE:

Certainly.

BROWNBACK:

How much time...

O'KEEFE:

Absolutely.

BROWNBACK:

... what's its cost, it is just time to go to a new technology? Which, I have to tell you, my leaning is, clearly, that that's the way we should be going at this time. There's two major disasters, it's a complex system, it's an older design. This is a 30- year-old design that we're into now.

I just can't help but to think that we would do much better -- and it may also be a cultural issue. When you go at a new technology, we can bring a new team in to design where we're going to next and that new team will have a different cultural -- are you going to be able to shape the attitude of that culture?

I think cultures are critically important and it is to the country and I think it is to the institutions. I know it is in my office. And this may be the answer to both the cultural and the technology.

O'KEEFE:

Well, Senator, you've asked me to keep an open mind, I'll just ask that you do the same. As we work our way through this implementation plan, my plea would be let's all keep an open mind, in terms of where the options need to go.

BROWNBACK:

That's fair enough.

I hope you also will think about creating this presidential commission on the future of space exploration.

BROWNBACK:

The Congress can do that, but that's really an executive branch function and the report noted that we lack a comprehensive and engaging vision. The way I've been looking , it seems we're stuck mentally in low space orbit, our thinking is. And I think you need to get and I think the country wants to engage in a discussion on what's our vision for space. It's not just NASA, it also involves - I mean, there's discovery and exploration but it's also commercial and military to engage that broader discussion of where are we going as a country here. I think the country wants to go but they need that vision that really unites and says, "This risk is worth it, this cost is worth it."

So I hope you'll consider that presidential level commission to work with establishing that. I know there are difficulties with it and there's not a simple answer, but a vision really is a critical thing to unite a country.

I'll be chairing the hearing the rest of the way out. And Senator Nelson is next up.

NELSON:

Thank you, Mr. Chairman.

Gentlemen, everybody up here wants this program to be successful. And so I'm going to ask some very specific questions. We have heard the admiral say -- in his excellent report, he has stated, "Buying power has been reduced 40 percent over the last 10 years." The admiral has said here today that, "Money has been squeezed out of the shuttle program."

And I'm doing exact quotes from what you said, Admiral.

You talked about how, "The program manager had made trades on the cost," how "looking ahead that you should separate engineering and safety from the cost and schedule part of the evaluation." And you talked about, "All leaders are responsible for the results -- the administrator, the White House, the Congress" -- you specifically stated that.

So realizing that that has been part of the problem in the past, now I want to ask some very specific questions, Mr. Administrator, as we go forward. This is not partisan. The space program is not partisan. A lot of these questions have been addressed by Senator Hutchinson as well.

I would like to know if you have had discussions -- you or any of your immediate people -- with the White House -- OMB is part of the White House -- about the increased expenditures that you're going to come to the Congress to ask for.

O'KEEFE:

We are pursuing an interagency discussion on the larger U.S. space exploration objectives. The result of that will yield a very specific answer to your question, that will be manifest in a request from the president in whatever period of time that takes.

NELSON:

It's a request for supplemental that you're talking about?

O'KEEFE:

No, sir. I'm not specifying exactly what form it will take, whether it's an amendment or supplemental or part of a regular budget request, all that's being vetted now.

NELSON:

Well, as the admiral said, the leadership problems involved everybody, as in the past. So if we're going to fix this problem, the Congress is going to have to help you and the White House fix the problem, so we're going to need to know how much we're going to need to help you fix the problem.

So can you give us any kind of idea about what we're talking about, because right now decisions are being made in the Appropriations Subcommittee on the '04 budget?

O'KEEFE:

Indeed, and that process is under way and as soon as we can get an answer, that's precisely what I have an obligation to you and your colleagues to deliver. Yes, sir.

NELSON:

OK. You said you said you had ongoing discussions. Have you had ongoing discussions in the range of a billion and a half dollars of return-to-flight additional monies?

O'KEEFE:

We've had ongoing discussions. I really don't want to get into the current state of play is or what the numbers might be because they really run the gamut.

O'KEEFE:

I think, again, as I mentioned in response to Senator Brownback's commentary, the cost of this is going to depend on which options we choose. There are 29 recommendations, and a whole range of raise-the-bar objectives we're going to have to do.

So each of those options is going to have a price tag, and the answer to that very specific question will come from the total of how much it takes on the options you select for all 29 of those, and every other issue contained in the raise-the-bar inputs that are equally important in our judgment.

So I can't give you answer to that until we can do that math.

NELSON:

Mr. Administrator, you have heard me be very critical of past administrations, both parties, on the way that they use budgetary sleight of hand over the years to get us into the fiscal condition that we are finding where NASA has not given the specific money directed at safety. You've heard me talk about how the space shuttle budget and the space station budget were lumped together back in the '90s, and then money was transferred around.

Now, it is very much the responsibility of the Congress as we look at your budgets, to know specifically what has happened. Now, for example, maybe you can share this with us. Of course, as Admiral Gehman said, not only have the budgets been flat with regard to the space shuttle, the budgets have actually -- in real buying power there's been a 40 percent drop over 10 years, and indeed, where I see the difference in what the administration has requested in '03 for the space shuttle, roughly \$3.2 billion, you would think it was an increase going to the '04 request of \$3.9 billion. But, in fact, the institutional account, which includes a lot of the infrastructure, that was \$1.2 billion in the past, is zeroed out, so a number of those institutional costs, including things like infrastructure, are part of that additional funding increase.

So where is the increase in your '04 request that specifically gets at the problem of safety and safety upgrades?

O'KEEFE:

There is a budget line item within the shuttle program for service life extension program, and of that we have to identify the prioritization that's under way that was started before the accident to begin to work through exactly what is the prioritization of selection of those upgrades and their timely implementation.

So the answer to the question is that's the funding stream. It's there, it's not one year, it's in '04 and each successive year thereafter. There's a continuing funding stream that follows thereafter, and as a consequence this is an enduring program that we intend to put specificity to which upgrade, implemented at which time, based on which prioritization set, and again informed by a lot of what we will learn as we implement these findings and recommendations.

NELSON:

OK, I see my time is up.

BROWNBACK:

Senator Breaux?

BREAUX:

Thank you very much, Mr. Chairman.

And once again, thank you Admiral, for a very fine report.

And also thank you, Mr. O'Keefe, for the cooperative effort that you've showed in producing this report.

I'd just ask you with regard to the Lockheed Martin facility in Michoud down in New Orleans, what kind of cooperation did you

get, Admiral, in working with them and finding out what they did and everything else?

GEHMAN:

Senator, we got outstanding cooperation at Michoud. And in particular we did a lot of work down there because we and the workforce at Michoud wanted to understand the properties of foam better than had been understood in the past.

GEHMAN:

And therefore we asked them how to go about that, and they worked right alongside us in devising and conducting various experiments. And certainly the best commentary I can give you is the dissection of the already built bipod ramps that we did. This showed some problems inside those bipod ramps that were unknown beforehand, and it took a considerable amount of courage on those people to help us do that.

BREAUX:

Has the separating of the foam from the external fuel tanks become an acceptable risk in NASA?

GEHMAN:

The categorization of separation of foam changed over the years. It migrated from a very, very serious category to a category that was not so serious until it absolutely disappeared off the radar scope altogether, and yet it was the same physical event, and that's a mistake.

BREAUX:

It seems to me that we've had the separation of the foam from the very beginning -- that we've had separation of foam. The first known incident was back in 1983. The most recent incident, other than this

tragic accident, was only three months before this final accident, and your report points out that photos exist of foam separating for 65 of the 79 missions for which we had imaging that was available. And then the regulations of NASA on external tank debris limits said very clearly that, "No debris shall emanate from the critical zone of the external tank on the launch pad (inaudible) set, except for such material which may result from normal thermal protection systems recession due to ascent heating."

So we've had foam separation from the very beginning throughout numerous launches, 65 of 75 that we saw pictures of, and as recent as three months before this incident, plus a regulation of NASA itself that says no debris separation is acceptable and should be allowed. And yet we were still launching shuttle missions knowing that this was continuing, and knowing that we had a regulation that said, "Don't allow this to happen." To me that seems like a monumental breakdown. Can you comment on that?

GEHMAN:

Yes, sir, and it gets to the core of our recommendation to have an independent technical authority.

The adjudication of whether or not the foam anomaly should be treated as a showstopper or not is made by a board, a board of engineers and managers at the space shuttle program office, and the chairman of that board is the space shuttle program manager. So what we have is a case where the program manager, who has pressures on him for cost and schedule and manifests and lots of other things, having to determine whether or not this anomaly which is now before the board for adjudication, whether or not he should make a big administrative deal out of this or make a small deal out of it.

He knows that if he makes a big deal out of it, it might jeopardize or slow down future launches. He also knows that if he doesn't understand why this is happening, it will cost a couple million dollars

to do some research and development, a couple million dollars that he doesn't have, find out why foam is doing this and what are the properties of it and how to fix it. And so this one person who's got all these pressures on him is making these decisions, and we found that to be not a good system.

BREAUX:

I'm not sure how an outside board is going to help you on this particular degree of investigation or supervision, because we already knew it was happening. We have a rule that says, "No debris shall separate or shed," and we have numerable instances of launches where this was occurring. It was in spite of a rule that said, "Don't let it happen," it was happening and we were continuing to launch vehicles knowing it was happening. An outside board's going to tell us the same thing we already know.

Mr. O'Keefe, was it a matter of cost? I mean, we have a regulation that says it should not happen; it was happening and we were still launching knowing that it was happening as much as three months before this launch. Is the reason that it was allowed to continue a cost reason, or was it simply people ignoring the regulations and ignoring what was happening?

O'KEEFE:

I don't discount anything that Admiral Gehman has offered here. And again, I think those are all contributing factors. But I think there are two overriding reasons why this happened.

First one is we -- the rule which you cite and properly...

BREAUX:

Exactly.

O'KEEFE:

... very precisely that we set is viewed in the agency and within the shuttle program as a goal.

BREAUX:

As what?

O'KEEFE:

A goal, not a requirement, not a hard, fast specification. And that's a fool's errand, heading down the road towards saying, "Well, we'd like to achieve this," because that means we regularly rationalized why we would waive something we view as a goal, not as a requirement, as a specification, and that's a big mistake.

So we've really got to look back -- and so that's the first issue is we really have to make that rule as firm as you just described it, to have folks understand what is it that's inviolate that you simply cannot transcend and where are those cases in which there's a desire and objective that we have to continue to achieve and find a way to get there or else simply define this as a goal that's not achievable.

The second case is what we're dealing with here is human nature. It is, like everything else in life, when you see something repetitively, it begins to fuel a rationalization of why that's not a problem.

BREAUX:

That's the cultural problem.

O'KEEFE:

Yes, sir. And it's among the two issues of more -- and they go hand in hand, but I think they have to be viewed compatibly. And that human tendency -- we shouldn't be surprised to see in engineers when we see it in every day life. We all know, anytime you walk down a metropolitan street, anytime there is a homeless person sitting inside of a doorway, there are some number of people who

are stunned by the fact that people walk by with absolutely no cognizance of the fact that's going on and ignored it.

If we were -- if anybody came from a South Pacific paradise island and walked down that same street, there'd be a gasp at seeing how humanity is being treated and would be amazed by how it is. We, as a people, could tolerate that. And so, it's that first occasion in which you see it that raises that interest level.

We shouldn't be surprised when engineers act just like the rest of people do. When they see something repetitively, they begin to rationalize and begin to look at things and assume what it is they think they know about it.

And in every other instance -- and here's the big mistake, and Admiral Gehman and the board pointed to this very, very clearly -- this human nature says, "If nothing happened previously, it probably won't happen again in the future."

That's the wrong direction. It ought to go in the opposite approach, which they have said repetitively in this report, which is we've got to prove that it's safe, not prove that it's not. And that's a point that really has to be driven home.

And as a consequence, we really have to take that same mindset and understand that while this is a human nature, human characteristic, that when we see things repetitively that we take it for granted or begin to make assumptions or whatever else, it simply can't be tolerated here because the stakes are too high.

BREAUX:

Well, we all know what happens when we assume.

O'KEEFE:

Yes, sir. And we do it in every discipline. Every single discipline and every walk of life there are assumptions that are considered to be

inviolable and we got to go back and question what those assumptions are. That's a real tough order and it's one that's going to take us a lot of time and discipline.

DORGAN:

Admiral Gehman and Administrator O'Keefe, thank you for your testimony this morning.

I was thinking, as I was sitting here, having read recently about the December 17th, 1903, 59-second flight by the Wright Brothers at Kitty Hawk. And in the 100 years since, we have had all manners of tragedy and exhilaration and success. And especially the space program, it seems to me, is the one aspect of -- going from leaving the ground to walking on the moon, the one aspect of walking on the edge of the envelope with technology and science. And one would expect that there will always be those who suffer the consequences of tragedy in those circumstances.

But these tragedies that have occurred -- this one especially, and the investigation you have completed, tell us that there are certain things that can and should and must be done to prevent this from happening again. I mean, the fact that we're dealing on the edge of the envelope in science and technology does not in any way excuse tragedies that could have been prevented. And those heroes, as you describe them and as our country understand them to be, in the space shuttle should have expected then and certainly the future astronauts should expect everything possibly has been done to provide for their safety.

I want to ask you just about two issues, quickly. And let me say, first of all, Admiral Gehman, I'm not a scientist. I don't have the technical ability, perhaps, to have fully digested everything that your report includes, but it seems to me you have done a massively thorough job.

And, Administrator O'Keefe, you have, I think, been a very stand- up administrator here in this circumstances.

I raised questions immediately about the proposition of whether NASA could create its own investigative board reporting to NASA. Others raised the same questions. You responded immediately by changing the board's charter, removing references to requirement that the -- that NASA oversee and review the board's investigation and so on. I think the result of that, Administrator O'Keefe, give us a report that does have true independence. And I think your working with it the way you have has been admirable and I appreciate that leadership.

O'KEEFE:

Thank you, Senator.

DORGAN:

I want to ask you some things. One, the requirements of the mission management team meetings every day during the shuttle flight, those NASA regulations required such meetings every day. And my understanding is, from your report, it occurred - those meetings occurred only five times during the 16-day mission, and that discussions regarding the risks of the foam strike and the need for additional imagery -- the request for imagery did not surface at all at these meetings that were held.

So 15 of these or 16 of these meetings should have been held, I guess, and five of them were held. And at the five that were held, no discussions were developed in those meetings with respect to the request for imagery, despite the fact that beneath all of that these discussions were occurring.

Can you describe that? Perhaps both of you, describe that for me. Is that part of the culture issue or part of the assumption issue that

never came to the attention of those who should have been attending to it?

GEHMAN:

I'll start off by saying that the characterization is correct that you made. They held five MMT meetings in the 16-day flight. They're required to meet every day. We went back to the three previous missions and counted up the number of times the MMT met. And guess what? They don't meet every day. They have been meeting every third day for as long back as we can find records.

And this is an example of culture at work. What happens is you got a regulation, you got to do it this way. Over a period of years and years and years you, kind of, atrophy to where you do it this way. You're violating your own rules and regulations and now you're sending all kinds of informal messages though the system that it is OK to violate your rules and regulations.

And that the top-level managers are doing it. "We don't need to meet every day. We can meet every third day. It's good enough. E-mails are good enough." And we're not sure what e-mails count for. I mean, are e-mails official communications, or not?

And so this is a classic case. I wouldn't blame the fact that there were only five meetings on this mission as being causative. In other words, that's the way they've been doing it for years. So, there is nothing different about it.

Now, we made the point in our report that these meetings were very short. Some of them were 30 minutes long. The longest one was about 50 minutes long. And if they had really had met every day maybe they would have inquired into some of the more minute details of what was going on and this subject of imagery might have come up. Pure speculation.

DORGAN:

Mr. O'Keefe?

O'KEEFE:

This report very clearly indicates that the rules and regulations that we have promulgated over the years are treated much the same way as stop lights in Naples: They're advisory. That's not tolerable. We cannot have that. We've got to go back and really look at what those operational procedures call for and put in motion that which we believe.

And that's part of the recommendations, that's part of our raise-the-bar input standards that we really have to implement and have a very clear understanding of how those operational rules will be promulgated and followed as we go through this.

Because the intent behind the MMT I think is a good one, which is to coordinate views and positions, inputs and then serve it up for decision making. Well, there was an awful lot of stray voltage, is what this report indicates, of lots of communication going on, but to no particular point in some cases, or to no particular decision-making alternative.

That's a failure really to understand the purpose of the rules. And over time, I think, as the chairman of the board observed as well as all of his members, that over time, if these things are viewed as advisory, what's the point, why are they there? And that's something we've really got to take back as a strong indictment of the culture and we've got to correct it.

DORGAN:

And, Administrator O'Keefe, the reason I asked this specific question is the mission management team meetings -- I don't know much about this at all, except that my assumption would be that mission management means just what it sounds like, managing the entire mission, and the fact that it didn't meet -- not only in this

shuttle flight per regulation every day, but in other shuttle flights as well -- but more than that, the fact that when it did meet, it did not have the information flowing up to it of questions being raised in the organization about the question of whether they should have additional imagery to determine whether this foam had caused some damage to the wing -- I mean, that's an organizational issue, it seems to me, and a structural issue of very significant importance to the future operations of NASA.

O'KEEFE:

And it's an important process question that must be resolved, no question.

DORGAN:

And I wanted to ask just briefly a question about the next generation launch vehicle. The return to flight for this shuttle one hopes will occur at some point when we have satisfied all of these issues and there's much work to be done, but my understanding is that the next generation launch vehicle is meant to complement rather than replace the shuttle.

And as I read the investigative reports, what you are saying, Admiral Gehman, is that this shuttle vehicle is yesterday's technology. It needs to be replaced rather than to have some other vehicle complement it at some point.

And this gets back, I think, to the question that my colleague, Senator Nelson, was asking as well. I mean, all of that costs an enormous amount of money. Replacing this launch vehicle completely will be a significant capital requirement, will it not?

When we go back to return-to-flight with the space shuttle, will you by that time have made a decision about what your next generation launch vehicle is going to be and whether it's going to fully replace it in a certain time period or whether you're going to

continue to try to complement it as your current plans would indicate?

O'KEEFE:

Yes sir. The short answer is yes, indeed, by the time we return to flight we really have to have an answer to those questions. We're in the process right now very hard of trying to resolve precisely what the composition of this will be, using as the baseline the integrated space transportation plan that we have presented to the Congress as part of this year's budget, and was endorsed last year as part of the president's amendment in November.

I'd ask Admiral Gehman, though, on the characterization of this particular finding. I read it a little differently. And rather than have us go through mutual interpretations here, let's ask the oracle to render exactly what was the intent behind the words that are used here, in terms of Chapter 9, and where we should be going.

GEHMAN:

After we'd studied this system in such great detail, the board felt that we owed it to the public and to the United States and to the nation to editorialize a little bit on the safety and the longevity and the life span of the shuttle as we know it.

In Chapter 9, we opined that the board was surprised and disappointed to find ourselves at -- here we are at 2003 and we don't we even have a replacement vehicle on the drawing boards. I mean, we're still debating -- we're having a debate about the replacement vehicle.

The board found that the shuttle is not inherently unsafe. It can be operated for another number of years if the recommendations of this board are followed through on. But the board finds that operating it for another 20 years or something is beyond our -- beyond the scope of our imaginations, and that sometime in the period of

something like 10 years from now, if you're going to operate it more than about 10 years you're going to have to fully recertify and fully requalify the vehicle, which would be extraordinarily expensive.

DORGAN:

From what I understand your answer to be you, if you were an astronaut and if the recommendations of the board were followed you would not have difficulty joining the crew and flying the shuttle.

GEHMAN:

That's absolutely correct.

DORGAN:

You would fly it yourself?

GEHMAN:

That's correct.

DORGAN:

I expect you won't get the opportunity unless...

GEHMAN:

I asked.

(LAUGHTER)

O'KEEFE:

Fortunately that was not a finding and recommendation which we intend to accept and comply with, so as a consequence that's a debatable point, and I think he wants to get back to his sailboat.

DORGAN:

Well, this is obviously deadly serious business, and the work you have done has been long and labored, but I think you've accomplished much with it. And I think that the chairman has done a real service for this committee and for the Senate in calling this hearing today at this time. And you've done some significant benefit I think for this country and its space program in your testimony and in the work you've done prior to that.

Let me just make one final comment and say that I come from North Dakota. I mean, I don't have a space launch pad in the middle of my state, as does Florida, Texas. But I really believe that a society that stops exploring stops progressing.

DORGAN:

I think space exploration has been very important for this country. I want it to succeed; I want it to continue. I think the benefits are very substantial.

But it will only succeed and continue if we understand that these tragedies require an enormous amount of work to understand what has happened and prevent it from happening again. Again, we're operating on the edge of the envelope of knowledge here, and some wonderful men and women -- heroes in my judgment, one of whom served with us here in the Senate, Senator Glenn -- have been the pioneers in space travel.

But I really think we're just at the beginning phase of understanding what the rest of our universe is and how to explore it and the benefits it can provide for us.

So let me again thank the chairman who had to depart. And Senator Nelson has a final question and he will close out the hearing.

Senator Nelson?

O'KEEFE:

If I could just quickly observe, on your point, I think you've got it spot-on. I mean, we are really in the equivalency here, in space exploration, of the age of sail. We have really just gotten started. As human kind has pursued this approach, it is very early in this process, and we've got a long way to go, and the expanse to what we could conquer by this really is just unimaginable in its expanse.

And so as a consequence, exactly the way you characterize this is precisely the way I look at it. This is a daunting challenge and we're at the very beginning of it. It's a tremendous responsibility and it's one we take very seriously.

DORGAN:

Thank you very much.

Senator Nelson?

NELSON:

Senator Dorgan, I want to pick up on your question about the next generation vehicle.

Mr. O'Keefe, you and I have talked many times, both privately and publicly, about how you could get some more money with regard to this next generation vehicle. And one of the things we have discussed is that other agencies of the federal government could share in the expense of developing the technologies, that NASA would oversee the research and development, because those technologies would be of value to other agencies.

Would you share with the committee what is happening there from a financial perspective in the future?

O'KEEFE:

Well, the current ongoing effort we have under way for example on the X-37 technology demonstrator is a good example of the kind of

arrangement in which there are advantages that may be derived for multiple purposes. And so as a consequence, NASA and the Defense Department, Air Force particularly, are really examining where that approach is going. We are financing with them the overall expense related to the launch and test phase of that particular technology demonstrator.

The orbital space plane, which is again the follow-on effort that Senator Dorgan referred to, we are right now in the process of inviting the industry to respond to the requirements, which again can be summarized in one page -- this is what we want them to do, and these are the capabilities we need -- and there are a number of different technologies that are accented, if you will, that may have great application for where the Defense Department may go on that. And we are engaging in discussions with them.

But at this present time, on the orbital space plane, the objective is that we get about the process of finding a complementary asset that is crew transfer vehicle in its orientation, that the board observed in Chapter 9 is the kind of thing we need to do as expeditiously as possible. And we're now in the process of trying to figure out how do you define expeditious, how quickly can it be done, what's it going to look like. And the industry is actively playing in that, working through that particular contractual effort that's being engaged right now. So we should have an answer to that in very short order.

NELSON:

Do you expect that in a net outflow of dollars from NASA, that that will require additional money to be budgeted in NASA?

O'KEEFE:

It heavily depends on how soon we want to see delivery of the asset. And as I mentioned in response to Senator Hutchison's comment, the amount that we have included in the NASA budget now, before the Congress, in the five-year stream, certainly is a

resource allocation for an orbital space plane. It will not be sufficient to cover any delivery date we may desire. To the extent we want to accelerate that, it isn't going to require more in aggregate, it may require more up front. And that's part of what we've got to sort through now.

But again, very thoughtful questions, commentary and direction that you've given us in previous hearings and along with other of your colleagues, prompt us to go back and look at that trade study, figure out what it's going to take in order to accelerate this. What are the approaches we would use in that regard. And in no instance have we made the requirements negotiable. We've made those the fixed constant, and everything else around it the variables that we may want to consider, in terms of accelerating its delivery, or what other approach you'd use for crew transfer vs. crew rescue, and the like.

NELSON:

In what time frame so that we can be expecting it, would you expect to come to the Congress for that kind of request?

O'KEEFE:

To the extent that a request is required, it will be at the point in which the president determines that that's necessary. And that's exactly when it will be delivered.

NELSON:

And is your answer the same then with regard to the additional expenses that will be required for the return to flight?

O'KEEFE:

Again, those are more dependent -- I've got to serve up to, within our administration, a clear understanding of the options we choose for the 29 recommendations and the raise-the-bar inputs that are going to be equally important in making a determination of how

much we need in order to implement the options we've chosen. And that is going to, again, be a fulsome debate within the administration, and we're in the midst of that now.

NELSON:

All right. I will just merely close out my comments in the considerable, fine hearing that we've had and thank you all both, by saying: You've read the Gehman report. The Gehman report said that the cost-cutting in the past has been a part of the problem. That's what I said I was pleasantly surprised in seeing in the report, because I didn't anticipate that Admiral Gehman's board was going to address cost.

It is part of the problem. And they have identified it. And the long and short of it is, over four administrations -- and this is bipartisan, both parties -- that NASA has been, to use my word, starved of funds, and it has always been that Office of Management and the Budget that has said "nyet" to NASA.

I think everybody, including the members of this committee, that want, as Senator Dorgan so eloquently said, to see our space program continue to be robust and fulfill that desire of this nation to explore, needs to know that you're going to be in there fighting in the internal fights in the administration with OMB and the White House to make sure that the monies are there for NASA.

O'KEEFE:

Yes, sir.

NELSON:

That answer's good enough for me.

O'KEEFE:

Thank you, sir.

NELSON:

Admiral Gehman, again, you've done a great service to the country. An enormous service. We thank you from the bottom of our heart.

No other questions from the committee, the committee is adjourned.

GEHMAN:

Thank you, sir.

CQ Transcriptions, Sept. 3, 2003

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WITNESSES:

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