1   the inspiration of discovery and the longing to

2   understand. Our journey into space will go on."

3   Mr. Chairman, I'm prepared to answer any

4   questions that you or the Board may have.

5   CHAIRMAN CONWAY: General, I thank you

6   very, very much for a very, very excellent

7   presentation here. And your report itself is an

8   indication of a very good hard work by a lot of very

9   experienced and very capable people.

10   I will say I'm hopeful that the Department

11 of Energy and the work that it does for the safety of

12 the nuclear weapons program will have learned from

13 this because we see right today the Department of

14 Energy has undertaken what we believe to be some major

15 changes in the way they've operated in the past, and

16 as they're proposing to upgrade in the future, that

17 have this Board somewhat concerned.

18   I think there's a lot of lessons to be

19 learned here. And we hope that the DOE will have

20 learned from these studies that you and your

21 associates have put together, and to keep them from

22 making some major mistakes.

23   VICE CHAIRMAN EGGENBERGER: I'd like to

24 discuss a little bit with you the engineering

25 organization as you believe it should be. Let me talk

1   here a little bit, and then we'll get to the bottom

2   line.

3   Within the project organization, our Board

4   here believes that there's no substitute for a strong

5   and capable engineering organization.   And this

6   organization generally is viewed as in charge of the

7   project from a technical point of view, and is capable

8   of making all analyses, or whatever is required to

9   make the project go.

10   And in fact, it is in the line

11   organization.   And what it has done is also

12   responsible for safety. Safety is the responsibility

13   of the line, and it starts at the top and goes to the

14   bottom, and goes from the bottom to the top.

15   Now, you have suggested, or recommended,

16   that NASA establish an organization off to the side

17   that whenever a waiver or a change is required or

18   asked for by the project organization that affects,

19   can I say safety, that it must be approved by this

20   organization off to the side.

21   Now, I don't quite understand that from my

22   following thoughts. Do you believe there would be a

23   tendency for the project organization to begin

24   throwing everything up to this approval board that's

25   out on the side, and then hence be shirking their

1   responsibilities of conducting the proper engineering

2   that's required for the conduct of the project, and

3   hence the safety of the project.? That I don't

4   understand.

5   And then there's always, and this bothers

6   me, and has bothered me for a long time, and

7   especially in the nuclear weapons program. Eventually

8   whatever is being asked to be done, to be waivered,

9   has to come to the top somewhere. There's always a

10   top. And that person needs to be able to say yes or

11   no. Otherwise, he is not in charge.

12   So now that I've attempted to talk about

13   this a little bit, could you maybe talk about how you

14   would envision this organization in NASA that's set

15   off to the side, how it actually should operate? Do

16   you see what I'm pushing at here?

17   MAJ. GEN. BARRY: Yes, sir, I do, and it's

18   actually the struggle that I know NASA's going through

19   right now. What we did do was tell them what to do

20   and not how to do it.

21   VICE CHAIRMAN EGGENBERGER: Yes.

22   MAJ. GEN. BARRY: And that puts, of

23   course, the implementer, because I've been on the

24   receiving end of those kinds of things in my career,

25   too. And here's some thoughts that I might share with

1   you, if I may.

2   First of all, we did some analysis of

3   theory. And one of the theories that we looked at was

4   Perrow.   And this is an author that talks about

5   tightly coupled organizations. My words. A truck or

6   a tank driving, goes off the road. Not a big deal,

7   you're not going to hurt anybody, you can probably get

8   it back on the road, a lot of options. If you fly an

9   airplane, like an airliner, it's more tightly coupled.

10   Something goes wrong, you don't have a whole lot of

11   options in a lot of cases, but you do have some. You

12   go into space, you're even more tightly coupled. So

13   the bottom line is small technical failures can result

14   in catastrophic outcomes in a very tightly coupled

15   organization.   NASA we determined to be a complex

16   organization that was very tightly coupled.

17   So with that understanding, we looked at

18   some benchmarking elements. And we turned to SUBSAFE

19   in the Navy.   And that is where we became more

20   familiar with the issue that they do not allow kind of

21   the operator or the program manager to waive technical

22   issues without a substantive analysis. The reason we

23   arrived at that sensitivity was we found in some cases

24   that NASA was, and I'll use the term PowerPoint, were

25   not doing technical analysis of specifications or

1 waivers. They were doing analysis, but it wasn't as

2 technical with a report, we thought, in a lot of

3 cases, particularly with the foam coming off on the

4 left bipod. Had they done that more detailed

5 analysis, they might have been able to conclude that

6 they had a more serious problem than they really did.

7 By separating this from the program, and

8 having a technical assessment of authority that has to

9 be -- they have to go to them to get approval to waive

10 any kind of specifications, then it builds in a

11 balance of power and a check and balance element that

12 we saw in the Navy that worked pretty well,

13 particularly with their SUBSAFE issues.

14 We also looked at aerospace, and the Air

15 Force, and how while the relationship is different

16 than SUBSAFE, it does provide an independent review as

17 they work up, get ready for launch. As opposed to

18 NASA, where they've out-sourced quite a bit to the

19 contractor, but it still was internal to them, and it

20 wasn't an out-sourced review to verify how they wanted

21 to be able to arrive at the conclusion that it was

22 safe for flight.

23 I'll also share with you some other things

24 that we thought that were important, that you'll see

25 in the report, particularly in Chapter VII, on things

1   that we thought were important for a high reliable

2   organization.

3   First of all, here are the management

4   failures that I alluded to, but I'll go into a little

5   more detail. The space shuttle is not operational.

6   It is not correct to have cost, and schedule, and

7   safety, and waiver in one organization. It is not

8   correct to have normalization of deviance. You have

9   to be sensitive to that. It is not correct to have an

10   integration office that is not truly an integration

11   office, and it is not correct to ignore specifications

12   that are on paper that are not being realized in

13   reality.

14   If you take that, what can this second

15   independent technical assessment group do? It can

16   allow for what we concluded to be the valuable

17   elements of a high reliable organization. Constant

18   learning. You're going to require those people to do

19   the technical analysis, not PowerPoint. Checks and

20   balances. You're going to have that additional

21   although bureaucratic element that is going to just

22   say, okay, here's another set of eyes. Redundancy.

23   A preoccupation with failure. Resilience. Have trend

24   analysis done much more readily than was done before.

25   The program was not doing it.

1   They had a tracking system for NASA called

2   PRACA, Program Reliability Action Control System. It

3   was very problematic, and very non-user friendly, and

4   very hard even for the Board to go in there and find

5   information after we asked NASA for it. Integration,

6   and finally communications.

7   All of those elements I think we concluded

8   to the Board that could be applied to this separate

9   organization that would help enhance and strengthen

10   the   NASA   organization.   So,   yes,   safety   is

11   responsibility for all people. It is not just to be

12   put in this separate organization now, nor can the

13   program manager relegate all that responsibility and

14   say, well, it's up to you. If you say it's okay, it's

15   okay. Remember he's responsible for the day-to-day

16   operational launch. Not all of those are going to be

17   requiring waiver on any specifications. And it does

18   require leadership from the top. But it takes a

19   cultural adjustment.

20   And here's what we determined. We had a

21   long conversation to say, okay, what is this culture.

22   But if you're going to change the culture, it requires

23   two things in a formula. This is very simplistic, and

24   probably not exactly the answer, but it's an answer.

25   We   determined   that   we   can   help   NASA   by   making

1 organizational changes.   Separate technical

2 assessment, better safety, and better integration as

3 a case in point. But it required leadership from the

4 top in order to change culture. And that's why it

5 takes time. You will not see our recommendation

6 saying that's a return-to-flight. Because it can't be

7 done before now and then. It's going to take years to

8 work this in a cultural element.

9   But it was a general recognition that,

10 yes, we have confidence that they will be able to get

11 flying in a safe manner in the short term, but we had

12 less confidence in the long term. That's why we

13 wanted to put this bureaucratic recommendations on

14 organizational changes to help change the culture.

15 But we give them the tools. It's still going to

16 require major leadership from the top.

17   VICE CHAIRMAN EGGENBERGER: Thank you.

18 I'd like to also say that this was a very important

19 presentation to this Board. And it's a job well done.

20   MAJ. GEN. BARRY: Thank you, sir.

21   DR. MANSFIELD: Thank you, Mr. Chairman.

22 Yes, I commend you for the effort, excellent effort

23 put together by the Board. We're going to be learning

24 from this. Many organizations are going to learn from

25 this for a long time. And we hope to reinforce some

1   of these conclusions in our discussions with DOE.

2   I would like to point out one thing that's

3   in the report in NASA's favor, but not in the manned

4   space flight program. You mentioned that Aerospace

5   Corporations serving as an independent engineering

6   organization has delivered a performance for the Air

7   Force much better than in launch failures, much better

8   than commercial rate, 2.9 percent I suppose.

9   I point out that NASA's expendable launch

10   vehicle program has even better performance. It

11   achieves that performance by having an independent

12   NASA technical organization. Now, in fact, because of

13   the organizational pressures and budget pressures, it

14   has to steal it from the rest of NASA. It arm-twists.

15   The scientific organizations, principally at Goddard,

16   sat as the payload people to provide engineers to

17   oversee the launch vehicle manufacturers. They've had

18   to hide this because budget-cutters are always after

19   it. In other words, some people at NASA, by hook or

20   by crook or by stealth created their own independent

21   engineering organizations, and it's shown paid off.

22   But it shouldn't be necessary. It

23   shouldn't be necessary in any organization. That's

24   one point to make. I think that by and large your

25   list of characteristics of healthy and unhealthy

1 organizations in this regard are almost entirely

2 transferable to the Department of Energy's nuclear

3 programs, in different ways and different places.

4 But in particular, the similarities are

5 this. SUBSAFE, for instance, is a central

6 organization because it's got a fleet that operates

7 these things, and it's got fleet commanders that want

8 their ships to be in certain places at certain times.

9 Sometimes they can't do it because the engineering

10 organization tells them they have to fix something.

11 The analog here to the Fleet is the Department of

12 Energy sites, and I suppose the analog at NASA, is

13 Johnson, and the space shuttle program itself.

14 DOE does not have a central organization

15 that can blow the whistle and direct the sites. In

16 fact, they don't want one. And that's one of our

17 difficulties. We believe that DOE is making choices,

18 or has made choices that will have to be reversed. It

19 isn't that they neglected to do something that they

20 always knew was right. They decided they didn't want

21 to do some of these things. And that's why we have to

22 question those things. The study of aberrant

23 organizations is going to be a necessary part of DOE

24 healing itself. Thank you.

25 CHAIRMAN CONWAY: Bruce.

1   DR. MATTHEWS: Yes, again let me

2   compliment you on this very thorough and compelling

3   presentation.

4   I have a question relative to where the

5   Department of Energy seems to be going. They

6   basically have embarked on some organizational changes

7   that sound somewhat similar to the history that NASA

8   went through. And their goals are good. Their goals

9   are to increase productivity without compromising

10   safety. And there's nothing wrong with that.

11   Simply put, though, they seem to be sort

12   of decentralizing authority. They're putting more

13   authority and responsibility at Field Offices, and on

14   the contractors. And as you know, the Department

15   operates very complex, tightly coupled systems, maybe

16   not -- well, maybe as tightly coupled as the shuttle.

17   Certainly the consequences of a failure could be much

18   more catastrophic.

19   And one of the objectives is to reduce

20   redundancy in oversight, and give more responsibility

21   to the field, and not have redundant oversight. Okay,

22   so that's a key word. And so given that, two

23   questions.

24   One is what's your sense on effectiveness

25   of redundant oversight in finding, uncovering

1   potential failure modes? And the second question, and

2   if you don't want to answer this it's okay with me, is

3   what would you advise the Department of Energy based

4   on what you've learned in the new way of doing

5   business that they're moving toward?

6   MAJ. GEN. BARRY: Yes, sir. Those are

7   excellent questions. Let me concentrate first on this

8   issue of decentralization and centralization.

9   My philosophy, I personally am a

10   decentralist. But in understanding the complexity of

11   research and development, I make a distinction between

12   the operational world where you can be more mature,

13   and the developing world where it's a little more

14   risky, particularly when you're dealing with enabling

15   technologies. Even though the shuttle has been around

16   for a while, it's still a lot of enabling

17   technologies.

18   What we found out was it's kind of like

19   centralized control/decentralized execution if you

20   know anything about the Air Force philosophy. But the

21   centralized control by management is stability in

22   chaos. That's what it does when you centralize

23   things. And that's good. Norms, procedures,

24   standards, you need that in order to communicate

25   through any large, complex organization. The

1   decentralized element that you have to have is

2   execution by line operators. The innovation, that's

3   where you find these amazing people that can come up

4   with, like Apollo 13, as a case in point. That is

5   where the American ingenuity and innovation is at its

6   best is when we can do that. So you never want to

7   stifle that to the point.

8   The problem is switching from one to the

9   other, and where the balance is. I use the example of

10   the out-sourcing element. Great idea, core

11   competencies is an issue. In the military we have the

12   same problem, but also I think in DOE and certainly in

13   NASA. What are the core competencies that you don't

14   give up and out-source over to a contractor? And did

15   they move too far in one direction?

16   We have a great propensity, mankind does,

17   you know we swing from one pendulum to the other, and

18   then finally we kind of come to a magic middle point.

19   Maybe we went too far. If 40,000-plus government

20   mandatory inspection points [GMIP] was too many, okay.

21

22   So you do have things like you said where

23   you reduce redundancy in oversight, because I'll give

24   you a case in point. NASA was in the early `90s,

25   after a shuttle would land at Kennedy, they had like

1   five photographers filming all underneath the orbiter.

2   And say, well, what are you doing? Well, we're trying

3   to monitor the debris that comes off from landing in

4   the lake bed. And you say well wait a minute, this is

5   Kennedy. You're landing on a hard surface. Well, we

6   do it there.

7   So there's good, prudent managerial

8   decisions that you need to make. So you don't do

9   stuff that's excessive. But going from 40,000-plus

10   GMIPs to 8,500 may be too much in one direction. Hard

11   for us to analyze that as a board and say no, we think

12   you needed 12,000. You know, we couldn't do that.

13   So this balancing between centralization

14   and decentralization I think is a very key element.

15   But certainly in a tightly coupled organization,

16   centralization is needed in a very enabling, risk-

17   oriented, highly complex organization. When you move

18   more toward an airliner, maybe you can move more to

19   the issue of being even more decentralized in some

20   cases.

21   Let me talk about another term that was

22   used, and you mentioned oversight. NASA chose to use,

23   again it's very important to understand the language

24   of any organization. They use words like "oversight"

25   and "insight." I mentioned to the Board earlier when

1 we were discussing this morning we found that to be

2 very problematic because nobody could define to use

3 what "insight" and "oversight" was, and what the

4 differences were. It was meant to explain, as they

5 moved to out-source, and they moved more to the

6 contractor. The contractor took over more oversight

7 responsibilities, and NASA took over more insight

8 responsibilities, primarily meaning that they were

9 going to look at metrics and occasionally do spot

10 checks, reduce government mandatory inspection points,

11 things like that, to be able to get a sense of it, but

12 most of it was being moved over to the contractor.

13 But you ask one person one definition,

14 they would give you another opinion. So it was

15 important for us to try to understand how that was.

16 And the basic conclusion that we arrived at, while not

17 causal, the movement to out-source was ridden with

18 unintended consequences.

19 And the unintended consequence was

20 primarily that the technical expertise for the

21 government civilians went down. And when that

22 happened, their ability for situational awareness went

23 down. And situational awareness in fighter pilot

24 terms is used in my culture, but it is being able to

25 look at all things around you and being able to make

1   an assessment. When your technical expertise goes

2   down, you may not hear that hidden echo that comes in

3   at a very low level, like foam coming off, an O-ring

4   not working right, and being able to identify it as

5   really something significant that you've got to pay

6   attention to. When your situation goes down, you're

7   not going to be able to have that key ear to be able

8   to do it.

9   Final point you made about DOE on the

10   advice. The thing that we were excited about as a

11   Board was clearly when we arrived at the conclusion,

12   that the technical cause and the organizational cause

13   were equal. I mean, you couldn't separate the two.

14   It wasn't like this, and it wasn't. [The speaker held

15   both hands out to simulate a balance.] We treated

16   them as equal. I don't know of too many

17   organizational investigations that really arrived at

18   that kind of conclusion myself. Maybe there are.

19   But we found that a lot of what I've just

20   gone through in much more detail in the report can be

21   applied to the private and the public sector. So,

22   again I go back to one of my opening comments. I

23   think if you look at the organizational culture and

24   managerial aspects of this investigation, there can be

25   a lot of great insights that can be applied to DOE.

1   So I offer that as an answer to your question.

2   DR. MATTHEWS: Thank you.

3   CHAIRMAN CONWAY: I think we're seeing

4   there's also pressure for more out-sourcing. So it's

5   coming up from the White House, it's also coming from

6   others. And obviously industry would like to see more

7   of this.

8   And I think the point you make in your

9   report of the lack of technical competency within the

10   government, the adverse effects that has as we

11   proceed, and we don't want to lose that if we have not

12   already lost it. So I think there's a lesson to be

13   learned there.

14   And you mentioned also the pressures and

15   budgetary pressures of cutting back personnel. And

16   we're seeing that also in the Department of Energy.

17   Eliminating personnel, and unfortunately when you try

18   to eliminate personnel, it usually is the best ones

19   that tend to go. And then it gets, as you made a

20   point here, the same amount of work has to be done,

21   and fewer people to do it. And, therefore, they lose

22   their capability of being able to do all the work that

23   previously had been done by other individuals. And

24   then the point where you can't oversee your own work

25   if you have to take on the oversight work also within

1   your organization.

2   There's a lot of lessons here to be

3   learned. You made reference also to the fact -- I

4   think you used the term two-star or three-star general

5   and someone of lower rank trying to stop on a

6   technical basis. I think we learned the lesson from

7   Rickover. He wouldn't let his officers wear their

8   uniforms. They were all in civilian clothing because

9   he said he didn't want the decisions made by the

10   sleeves on the table, the amount of stripes you had.

11   So technical matters have to be

12   determined, and conclusions based on technical

13   competence. And it may be someone down at a second

14   lieutenant level as opposed to an expert in the

15   technical area. There's a lot of lessons to be

16   learned here, definitely, that should be and can be

17   carried over into the Department of Energy.

18   Kent, do you have any questions?

19   MR. FORTENBERRY: Yes, a few questions.

20   First, allow me to belabor the point of central versus

21   decentral control. And I think when you talk about

22   that, clearly the function has to be referred to

23   because it depends on that.

24   If I look at the specific recommendation

25   for this organization, and we refer to it as sort of

1   an organization on the side, that's not at all what I

2   see.   I see functions developing the technical

3   standards, conducting trend and risk analysis for both

4   subsystem, system, and enterprise levels, owning the

5   failure modes and effect analysis, conducting the

6   integrated hazards analysis, deciding what is and is

7   not an anomalous event.

8   Those functions, if I refer to those --

9   was there some insight as to whether those should be

10   or could be centralized, or for example, is there a

11   thought, and I think when we look at the Department's

12   approach, we see a tendency for those functions to be

13   very decentralized.   What's your response to that?

14   MAJ. GEN. BARRY: Again, we got to the

15   point where we didn't tell NASA how to do it, we told

16   them what we wanted to do.

17   MR. FORTENBERRY: Sure.

18   MAJ. GEN. BARRY: But let me just comment

19   on, I think, a recent paper that I reviewed. And it

20   had to do with the way they're trying to organize to

21   work their way through this.

22   One of the ideas, and this isn't fully

23   approved yet, as far as I understand, is that they

24   will have decentralized representatives of this

25   independent technical assessment assigned to each

1   center. So there will be a decentralized element

2   there that will work their day-to-day routine kind of

3   concerns, trend analysis, problem review, certainly

4   looking at any incidents that could be, again,

5   listening for those low signals. And all the elements

6   that you just cited. And then to be supervised by a

7   central safety authority up at NASA, and to try to

8   look at these and see if we've gotten anything.

9   It's interesting.

10   DR. MANSFIELD: Excuse me, can I

11   interrupt. There will be a tenant at the site.

12   MAJ. GEN. BARRY: Right. Exactly.

13   DR. MANSFIELD: Because that's important.

14   Any way that the site director or his manager --

15   MAJ. GEN. BARRY: Well, I think there will

16   be a dotted line.

17   DR. MANSFIELD: Well, they'll tell them

18   what's going on.

19   MAJ. GEN. BARRY: Sure.   Keep the

20   information flow.

21   DR. MANSFIELD: But he would answer only

22   to and report to headquarters.

23   MAJ. GEN. BARRY: Yes. Again, it's hard

24   for me to be put in a position where, you know, this

25   is what they're going to do, because they're still

1   working it out, and that certainly was not our

2   responsibility.

3   DR. MANSFIELD: Well, I'm trying to

4   understand what the necessary characteristics of this

5   are.

6   MAJ. GEN. BARRY: Yes, I think that's

7   definitely true.   And this balancing between

8   centralized and decentralization has got to be worked.

9   You've got to be able to work both sides of the fence.

10   You have to know when to go from one to the other.

11   But I think overall, you know, you set the

12   basic procedures, and establish the standards and what

13   it wants. You can decentralize down to a lower level,

14   my view, my personal view, not the Board's.

15   And I agree with you. You've got to work

16   the functions and make sure that's done.

17   MR. FORTENBERRY: For example, actually

18   establishing the standards -- I would think that would

19   be very difficult to decentralize that.

20   MAJ. GEN. BARRY: Yes.

21   MR. FORTENBERRY: That would have to be …

22   MAJ. GEN. BARRY: That would have to be

23   from the central area. And that's good because people

24   can now know how to communicate with each other using

25   the same terms.   They establish procedures and all.

1   But then, you know, how you work specific elements.

2   I mean, I'm using a fighter pilot term, but I will,

3   you know. The central operational command will tell

4   you where you need to go to attack a target. It won't

5   tell you how to attack the target, what weapon to use,

6   what axis to come in on, what airspeed to fly, and how

7   many airplanes you necessarily need in some cases.

8   But they're telling you, "We need to take that target

9   out at such and such a time."

10   So when you establish centralized control

11   you say, okay, here are the procedures, here's how

12   we're going to communicate, here's the standards that

13   I will not accept to be violated. Okay, now you go

14   make the day-to-day work within that framework.

15   MR. FORTENBERRY: And the trick is

16   deciding what are operational decisions that you could

17   make at that level, and what are not.

18   Another point. You certainly talked about

19   it in terms of the pressure, and the checks and

20   balances. But there was a little discussion, and

21   actually it came from a previous assessment, in the

22   report. And I'll just read this.

23   "The workforce has received a conflicting

24   message due to the emphasis on achieving costs and

25   staff reductions and the pressures placed on the

1   flight schedules." And you had a picture of the clock

2   that was ticking down. And that was also discussed in

3   the report. How do you eliminate the inappropriate

4   pressure and still have a motivated schedule-driven

5   operation? Is that even possible, or is the Board

6   just simply making an observation that that's a

7   reality that has to be dealt with?

8   MAJ. GEN. BARRY: That's an excellent

9   question. And schedules are good management tools.

10   And this pressure that we showed with the clock, that

11   was to get to this node 2 for the space station. By

12   February, '04, they wanted a node 2, so they were kind

13   of driving to that.

14   That in itself is not bad. What we found

15   to be bad, if I can use that word, was that the

16   understanding of the pressure at the headquarters

17   level was different than the understanding of pressure

18   down at the floor level. When we did our interviews

19   of the people on the floor, they were highly convinced

20   that there was pressure. I mean they're looking at

21   clocks that people are talking about. They said they

22   felt like they were being pressured. The headquarters

23   level, they were seeing that as just a management tool

24   to say this is where we want to guide them, which is

25   prudent.

1   The problem was the communication between

2   the two levels. That's when you have a disharmony.

3   That's when you have a disconnect. That's when you

4   have a problematic element with pressure and schedule.

5   So if both were communicating, both

6   understood, maybe headquarters, maybe they would have

7   been more aware of these incestuous elements that they

8   could have been putting out messages they didn't

9   really intend. And then the lower level could have

10   been communicating back up and saying, well, here's

11   what we're really having to deal with.

12   So I'd say scheduling and pressure are

13   good prudent managerial concepts. The problem is when

14   the senior level management and the shop level are not

15   communicating, and they see it differently.

16   MR. FORTENBERRY: And one other point. A

17   lot of what I read in the report, and what you talked

18   about today, has to do with what I'll call decision-

19   making under uncertainty. And some cases, it's a vast

20   amount of uncertainty.

21   And depending on how that's done, and I

22   think that's one of your points about the technical

23   authority, some people can make those decisions quite

24   easily. And I think the phrase, "Fools rush in where

25   angels fear to tread," is maybe appropriate.

1   And you were referring to the impact

2   effects. And you talked about the testing that your

3   Board conducted. Did you get a sense for what sort of

4   test data had been collected, and I guess, ordered or

5   desired prior to the event in terms of looking at

6   impact? I know there's certainly a lot of focus on

7   impact. And you talked about photographers collecting

8   data. Was that a decision that was made really with

9   the absence of the R&D needed to show the effect of

10   the impact that basically your Board finally did after

11   the unfortunate incident.   Is that what we were

12   dealing with there?

13   MAJ. GEN. BARRY: Well, of course

14   hindsight is perfect in retrospect. So we tried to

15   always stay away from that, and tried to put ourselves

16   in the position of what they knew at the time when

17   they were making decisions.

18   Let me just, you're leading me to a

19   comment that I think I'd like to make, and that is if

20   safety were paramount, we'd never fly an airplane,

21   we'd never fly a shuttle. You have to manage risk,

22   similar to what you have to do with the nuclear

23   industry.

24   What's problematic if safety is not

25   paramount in this sense, and that's a hard thing to

1   say, you have to manage risk. What's problematic is

2   when you're seeing trends -- I'm going to use the word

3   "rhythm" -- that is going bad, and not hearing it, and

4   not seeing it. It's one thing to say, if you have a

5   problem with developing a new fighter, or working with

6   the shuttle, and something completely new starts, and

7   you've never seen it before, and God forbid it results

8   in some major catastrophe, that's one thing. When

9   you're getting signals a number of times, and our

10 failure not to see those signals, that's problematic.

11 That's where I think we would make a distinction

12 between decision under uncertainty.

13   There was information available, and the

14 system was not able to pull its tools together to be

15 able to rise to the occasion.

16   MR. FORTENBERRY: Well, let me augment --

17   MAJ. GEN. BARRY: Let me just make a

18 comment. It's like when you have a flight schedule.

19 When you're flying, and using my culture. But I look

20 at a schedule for flying. There's going to be young

21 people flying with old, experienced people. What you

22 don't want is two inexperienced people flying

23 together. What is the most risk-averse? What is that

24 one dot that stands out over the rest that you have to

25 train yourself to be able to see? And it's gauging

1   rhythm.

2   When you change leadership, your rhythm

3   changes because everybody's trying to figure out what

4   the boss is doing.   When you do something entirely

5   different the rhythm changes.   You move to a new

6   location, rhythm changes.   And that's all part of

7   normal risk management.

8   The problem is your ability to recognize

9   when things are in a risk state.   And that's where

10   you've got to do trend analysis, you've got to listen

11   to those little things, and you've got to have a

12   really tuned-in ear.   I'm sorry, I didn't --

13   MR. FORTENBERRY: Well, I was going to

14   augment my question by saying that my interest is I

15   didn't see recommendations that addressed deficient

16   R&D emphasis.   And I think what you're saying is that

17   that wasn't the conclusion you made.

18   But I'm interested in that, and whether or

19   not there was a driver or a motivation to pick up on

20   areas where known uncertainty existed, and areas where

21   the decisions were perhaps not fully supported, and

22   identify those for current or future R&D activities.

23

24   So just kind of explore that area a little

25   bit, because I didn't see that in the recommendations.

1   MAJ. GEN. BARRY: The recommendations had

2   to be agreed to by all 13 members, and of course, that

3   has challenges in its own as you well know. But one

4   of the things I would draw your attention to is the

5   discussion in Chapter VII. And this is: we really

6   took some hard hits against NASA on the issue of

7   technical analysis, and not just do PowerPoint

8   briefings.

9   We found a lot of times, you know, you

10   would ask people, and this is symptomatic of our

11   culture, by the way, and I mean the whole United

12   States in a lot of areas. There are two phenomena

13   going on that are pretty unique, and we don't quite

14   fully understand, and that is e-mail and the impact of

15   PowerPoint briefings. I gave you a PowerPoint

16   briefing today, but I also brought a technical report

17   with me. You know, it's backed up to support all

18   that.

19   A lot of times we find, and the Air Force

20   is as guilty about this as anybody, we conceptualize

21   with PowerPoint, and we don't do it with technical

22   analysis, and review, and writing anymore.

23   Particularly in the R&D world when you're developing

24   either basic research, developmental research, or

25   applied research, you have to have technical documents

1   to back it up. And we found that to be true in a lot

2   of places like SUBSAFE, and the EOB [earth

3   observatory], even in NASA with the EOBs. But not in

4   the shuttle. In a lot of cases they were doing it.

5   E-mail is a phenomenon I'm trying to

6   understand when you say, "Is it directive, is it water

7   cooler conversation, is it both, is it a mix?" So and

8   it flattens an organization out tremendously, but at

9   the same time does it ever rise to the level of

10   getting people's attention. Because there's so much

11   to absorb.

12   So those two phenomena we didn't have a

13   real good answer for, but I would offer them to you

14   for further study, and even in the aspects of DOE.

15   Look at how they're doing technical reports versus

16   PowerPoint presentations, and then look at how this e-

17   mail conversation is going on in any organization, and

18   try to figure out how it's impacting how it operates.

19   CHAIRMAN CONWAY: If I may, on that e-

20   mail, we saw a specific example of that as the Vice

21   Chairman just called to my attention. We had an

22   incident where we had counterfeit parts picked up in

23   the DoD [Department of Defense], in the military. And

24   the information was made available to DOE. And it

25   went out on e-mail, went out to practically all of the

1   top officials at headquarters. Not one of them picked

2   it up. Not one of them did anything on it. The Board

3   picked it up, and started to ask questions. And

4   nobody within -- my recollection is about 20 top

5   officials with responsibility for safety matters at

6   DOE headquarters -- none of them felt or took any

7   action on that.

8   And so finally we brought it to the

9   attention of one of the key oversight groups within

10   DOE, and then some action took place. But that's a

11   perfect example of an e-mail being used to get out

12   some very important information, and it was lost.

13   MR. FORTENBERRY: Can I ask you for a

14   reference on the two brothers story?

15   (Laughter.)

16   MAJ. GEN. BARRY: I don't have it off the

17   top of my head.

18   MR. FORTENBERRY: And I would like to

19   thank you for an extremely thorough briefing.

20   MAJ. GEN. BARRY: Thank you.

21   CHAIRMAN CONWAY: Jack.

22   DR. MANSFIELD: Just one or two more. The

23   notion of a central engineering organization that

24   serves as the design authority and technical

25   authority. You mentioned either in the brief or in

1 the report, I can't remember where, that such an

2 organization should own the FMEA [failure mode and

3 effects analysis] and hazard analysis and that sort of

4 thing. This is one that we need to think over

5 carefully at DOE because we've insisted from the

6 beginning that it's the responsibility of the

7 contractor doing the job to define the work, identify

8 the hazards, identify and put in place controls for

9 the hazards, perform the work under the controls, and

10 analyze the results. We hesitate to make that

11 anybody's duty but the line management.

12   Do you have any comments on that?

13   MAJ. GEN. BARRY: Well, yes. Metric

14 review, trend analysis, whatever tools you want to

15 use. In fact, Diane Vaughan's got a good term, if I

16 can remember where I put it. But it's technologies of

17 control. You have to make an analysis of what

18 technologies of control you have to be able to tell

19 you what you need to know to run your company, your

20 business, your organization, your agency. And if

21 those tools are not doing what you need to get out of

22 them, then you obviously have to fix it. NASA needs

23 to fix this, trend analysis, PRACA [problem reporting

24 and corrective action], FMEA, because they are not

25 giving them exactly what they need. And they're in

1   the process of going through those reviews as I

2   understand it to use their tools.

3   But I would encourage any organization to

4   examine what those tools are and figure out if in fact

5   they're giving you the control that you need. That

6   would be one thing.

7   The other thing is if you train your

8   people to be able to read the bloody thing. You know,

9   it's one thing to have the tools available, but if it

10   comes across in a format that nobody understands the

11   hieroglyphics, it's not going to do you any good. And

12   you need to be able to develop something that spikes,

13   and say, okay, there's something I need to pay

14   attention to and go for it.

15   Let me give you an example. NASA was

16   absolutely stupendous on their ability to work flow-

17   liner cracks and BSTRA [Ball Strut Tie Rod Assembly]

18   balls. Now what that means is the flow-liner is the

19   flow of the liquid fuel from the external tank into

20   the orbiter. They found a flow-liner crack, they

21   fixed it, they jumped on it. I mean, it was a

22   marvelous example of team effort and success. And

23   then they had a BSTRA ball, which is again in the flow

24   line. It's kind of a valve and moves in all

25   directions, and they found a crack in one of them in

1   one of their reviews. And they did a marvelous job.

2

3   But those are big things. You've got to

4   find the little things. And if your technologies of

5   control can't get down to that lower level if there's

6   a little whisper that might be indicative. And

7   certainly if it's repeated. You ought to be able to

8   get it to flag, and say okay, is that something we

9   need to concentrate.

10   You need to review your assumptions. It's

11   like if you come to work every day and your

12   assumption's on the wall on what you need to work

13   about, and then your trend analysis or your tools of

14   control tell you something different, then you need to

15   revise those assumptions. And it may not be number 10

16   anymore, it may be number 1.

17   And those are the things that need to be

18   going on in any high complex organization. And I

19   offer that as just …

20   DR. MANSFIELD: One or two more to follow

21   up. Tell me if I'm correct here. It seems to me that

22   the central organization, the lack of which at NASA

23   you took note of in your report, would need to have

24   the power to dictate research, that that research be

25   done, to resolve issues. What I mean is that somebody

1   at headquarters should have said solve the foam

2   problem, give me a plan to solve it, years ago.

3   Am I reading that correctly? Should that

4   be a function of the central engineering authority, to

5   dictate research to resolve issues?

6   MAJ. GEN. BARRY: Well, they certainly

7   have to have resources to be able to do that.

8   DR. MANSFIELD: Yes.

9   MAJ. GEN. BARRY: And safety, too, you

10   know, has to have independent monies to be able to

11   say, okay, we need to concentrate on examining this.

12   Hire somebody to do some research, or do it within

13   your own, internal.

14   So I do say they have to have the

15   resources to be able to apply to a specific problem.

16   DR. MANSFIELD: Yes, I'm assuming the

17   resources would be there. But the authority to say

18   this research has to be done before you go on, I'm

19   assuming that should be in the central engineering

20   authority.

21   The third one is the people have to [be

22   there.] You say NASA cut back, and so has DOE. If one

23   were to establish such an organization in DOE, and

24   NASA were to establish one, they would probably take

25   people from existing NASA billets, and hire people

1   from the outside, and try to constitute such an

2   organization.   My concern is in both organizations

3   people tend to own their jobs.   And it's hard to get

4   someone to say to somebody, okay, you've been doing

5   this as part of the NASA oversight at Johnson.   Now I

6   want you to come to Washington.   Not just want you to

7   come to Washington, I tell you to come to Washington.

8   Well, moving civil servants is not like PCS [permanent

9   change of station] in the Air Force, as you know.   Do

10   you think that there would have to be special

11   agreements made with employees so that they could be

12   flexibly moved to different parts of the complex?

13   MAJ. GEN. BARRY: Well, two comments. One

14   is you're right.   I use the term tribal mentality.

15   They say, well, we do this, it's our responsibility,

16   we're not going to change, and we need to just stay

17   where we are.   So there is some of that in any

18   organization that has to be fought.

19   The second thing is moving civil servants.

20   The only example that I could offer to you is that the

21   Senior Executive Service and the Defense Department,

22   those people are clearly under agreement that they

23   will be moved.

24   CHAIRMAN CONWAY: And in the DOE, but it's

25   not being enforced.

1   DR. MANSFIELD: But I've heard it's a

2   personal belief, and I can't back it up with analysis,

3   but I don't think such a central engineering

4   organization would ultimately be healthy if people

5   didn't move around.

6   Thank you, Mr. Chairman.

7   CHAIRMAN CONWAY: Thank you.

8   VICE CHAIRMAN EGGENBERGER: I have some

9   very strong views on this independent technical

10   engineering authority, and I want to go a little bit

11   more with this. You have listed a list of things that

12   you believe this authority should do as a minimum.

13   It's also my view that the project should do those

14   things. The project should develop and maintain the

15   standards, should they not? They should do the

16   trending analysis. They should do the integrative

17   hazard analysis. And so on. That's part of the job.

18   Now, to leave that to not imply that the

19   project is supposed to do that, I believe, is a

20   problem. And as I said before, I would hate to depend

21   on or require that this independent organization

22   receive everything thrown back at it such that we do

23   not have the project being responsible for everything.

24   Of course things should be overseen, and at the top

25   where everything comes together, the Director should

1   depend on various sources of information to make the

2   final decision.

3   Do you want to comment any more on what I

4   just said? Tell me something?

5   MAJ. GEN. BARRY: You know, as a commander

6   in the field, I can empathize with what your points

7   are. And again, we tried to tell NASA what to do and

8   not how to do it. And we're as anxious to see what

9   they're going to come up with as anybody.

10   VICE CHAIRMAN EGGENBERGER: All right.

11   MAJ. GEN. BARRY: Let me just make a

12   point. I agree with you that the standards in trend

13   analysis and integrated hazard analysis. But it's

14   interesting to watch the benchmarking that is done by

15   aerospace. The Air Force does that. And aerospace

16   does that. And they get confirmation on it.

17   Now, if that's the way that NASA chooses

18   to go, you know, fine. I don't think it was the

19   Board' intent to relegate full responsibility in all

20   those areas over to this independent technical

21   assessment. That's my opinion of what the Board

22   meant. And everybody's responsible for safety. You

23   have to be focused on that.

24   But it is using independent tools and

25   people who are not owing their existence to schedule

1   and cost, to be able to sit there and say I'm not

2   influenced by any of that, and here's my opinion. And

3   that way I think you get that balance of power and

4   checks and balances.

5   So I'm not sure I quite agree with your

6   premise that we intended for all that responsibility

7   to put in there.

8   VICE CHAIRMAN EGGENBERGER: I'd hope not.

9   MAJ. GEN. BARRY: Certainly in there. It

10   needed to be done. But as a secondary check, and a

11   redundant effort.

12   VICE CHAIRMAN EGGENBERGER: And as I think

13   about this, I look at this Defense Board. Now at the

14   Defense Board, we do all of those things except we do

15   not grant the waivers, and we are not responsible for

16   the project. That's the project's problem.

17   And so we do provide oversight to various

18   people, and we do have various tools to require that

19   things like this get done. But we do not have the

20   authority to stop something.

21   I'll stop at that.

22   DR. MATTHEWS: Yes, I have another

23   question. As you were giving your talk, there were

24   three things that stood out in my mind as significant.

25   One is the lessons learned from Challenger somehow

1   atrophied over the years. Two is that they ignored

2   the sort of indicators of previous flights where the

3   foam came off. They ignored what seemed like a pretty

4   important analysis of the effect of that on the

5   underside of the wing, as you described. And they

6   didn't do any comprehensive testing like the panel

7   did, which was very dramatic to show that. And then

8   the third piece was they waived the criteria on

9   impact.

10   And so you talked a little bit about

11   normal accident theory, and high reliability

12   organizational theory. And I'm trying to weave them

13   together. I think the normal accident guys would say

14   I told you so, this was going to happen, it just

15   happens. And the high reliability guys would say well

16   if you'd only done this to your organization you would

17   have avoided that.

18   So my question is in your recommendations,

19   and I think I know the answer to this, but I want to

20   hear it and a little bit of discussion from you, is

21   what sort of addresses this long-term look so it's not

22   going to happen eight years from now when the

23   adrenaline, as you said, is taken out of the system?

24   MAJ. GEN. BARRY: Well, again, our answer

25   to that last point was that we stated that NASA's

1 culture needed to change. Now it's hard to define

2 culture, but the two things I mentioned earlier was if

3 you change an organization with some of the

4 recommendations that we gave. We said NASA we can

5 help you on that. We can help you with some

6 organizational recommendations. But you've got to

7 have leadership from the top to be able to do that.

8 You've got to talk about it and work it.

9 And everything we've seen so far has

10 indications that's going to happen. But it's got to

11 pass the test of time. Because this is not something

12 -- we call it "iron majors" in the Air Force, you

13 know, or military. It's that middle group you've got

14 to convince too, and it takes time to do that. You've

15 got to grow them, and educate them, and train them.

16 And then when they finally do get to senior

17 leadership, then they're supporting the solution and

18 not part of the problem.

19 So there were echoes. There were

20 indications that problems weren't done with the

21 analysis. There were not enough comprehensive testing

22 as indicated. And they did make too many waivers in

23 a lot of areas.

24 So as I said earlier, we have pretty good

25 confidence that the short term's going to be good. The

1   long term, the culture has got to change. And if that

2   doesn't happen, then they're going to gravitate back

3   to what happened after Challenger, and hopefully not

4   after Columbia.

5   One other point, Mr. Chairman, if I may.

6   I know you're running out of time. But it goes back

7   to a point that you made a little bit earlier that I

8   just want to respond to. And it had to do with the

9   issue of the future.

10   One of the things that we make a mistake

11   at, and I think this would apply to DOE also, is that

12   we are too -- I'm going to use the word platform-

13   centric -- too system-centric. If something is old,

14   then you're going to replace it in the same kind of

15   system. Fighter gets old, we replace it with a

16   fighter. Ship gets old, you're going to replace it

17   with a ship. Shuttle gets old, you're going to

18   replace it with a shuttle.

19   That's the wrong manner of approaching the

20   next step. What we recommended in the report was not

21   to do it ass-backwards; to do it the other way. And

22   the other way is to go from a vision and a strategic

23   plan, establish a concept of operations, what you want

24   to do.   Establish   the   requirements   and   the

25   capabilities, and then and only then do you define

1   what this thing's going to look like.

2   Now the Board took a very serious issue.

3   There's two pictures in the end of Chapter XI. You

4   complimented on Chapter XI, which we're very proud of.

5   One picture has a picture of a winged vehicle as a

6   replacement orbiter. The other one has a capsule.

7   Okay, now we didn't recommend one or the other. It's

8   not in our purview or our expertise to be able to do

9   that. But if you arrive from the position of a vision

10   of strategic plan, a concept of operation

11   requirements, a capability discussion, then you can

12   get to a more educated discussion on what that

13   solution ought to be. Don't immediately go to the

14   fact, well, it's got to be a winged vehicle, it's got

15   to be a capsule, it's got to be, you know, who knows.

16   So I offer that as maybe something for DOE

17   to look at. You know, you need to go to that vision

18   of strategic plan. What is the concept of operations

19   for how you're going to operate nuclear power in the

20   future. What requirements do you need, and then

21   figure out what it is you need to build to be able to

22   get there. And not just say, "Okay, we have a system

23   that's getting old. Let's replace it."

24   CHAIRMAN CONWAY: Good point. Jim?

25   MR. McCONNELL: Yes, thank you. I have

1   two areas where it seems to me there are competing

2   objectives that I'd like to describe and ask you,

3   General, to comment on.

4   The first. In the conclusion section of

5   your report that talks about the independent technical

6   authority, you talk about the need or the value of

7   redundant technical authorities pulling from the high

8   reliability theory. And that seems to be somewhat at

9   odds with the obvious benefits of clarity and

10   accountability that come from a very linear chain of

11   command, where decision-making is vested in one

12   central element.

13   What I'd like to ask you to comment on is

14   that it seems to me I read in your discussions here

15   that this entity would be vested with a veto

16   authority, not with a directive authority. Where this

17   independent element wouldn't direct a solution to a

18   problem, but would hold a judgment on whether to grant

19   a veto in any particular case to a standard, or to an

20   expectation. Could you comment on that?

21   MAJ. GEN. BARRY: Redundancy I think is

22   important. It is problematic in a bureaucracy because

23   if you have too much redundancy, its stop-gaps can

24   prevent you from accomplishing your mission. So that

25   has to be balanced with a linear chain of command, I

1   agree.

2   But at the same time, when you're dealing

3   with non-operational research and development testing

4   in a high-risk environment, I think it's prudent to

5   have redundance. We see that in fighter aircraft with

6   quad redundancy. We see that in the nuclear industry

7   with multiple redundancies in systems under nuclear

8   power.

9   This separate independent technical

10   assessment authority is not necessarily meant to be a

11   veto authority, although it probably could exercise

12   that. Again, if you leave NASA to figure out how to

13   do it, not what to do. But certainly it is the

14   authority to approve waiver changes. Now you could

15   view that as a stop-gap or a veto. If somebody says

16   I can't do this, I can't launch this shuttle unless

17   you waiver this thing, or else we're just going to

18   have to cancel. Well, maybe that's a veto I suppose.

19   But at the same time, I would be much --

20   I think the Board concluded that they would be much

21   more satisfied with, instead of allowing that problem

22   that I told you the night before the launch the solid

23   rocket booster connecting points, besides just having

24   the operator more or less, the program manager has

25   authority to say, well we'll just waive that. Launch

1   anyway because we're pretty convinced it's safe. You

2   go to somebody and say, "Okay, now we have to stop, we

3   have to take some time out here." We have to do some

4   detailed analysis, and do we really have a problem.

5   And then if we do have a problem, we fix it.

6   So don't go from the attitude of if this

7   organization can help move NASA from the cultural

8   attitude of prove to me there is no problem versus

9   prove to me there is a problem, then I think we've

10   accomplished something. But it's a bureaucratic stop-

11   gap that is cumbersome.

12   But our government's not pretty either.

13   You know, we have Congress that can trump the

14   President, the President can trump Congress, and the

15   Supreme Court. It's cumbersome, but it does in the

16   long run, I think, work. Can we apply some of those

17   lessons learned in balance of power and checks and

18   balances to the R&D world? I think we can.

19   MR. McCONNELL: The second competing

20   objectives I wanted to talk to was innovation versus

21   standardization. You talk about an undesirable

22   characteristic of an organization is when the

23   organization normalizes deviations. And again,

24   getting back to this event, technical authority would

25   be good to have, an authority that could evaluate the

1   desirability of granting a waiver.

2   But I note that a deviation is a relative

3   term. You have to have an expectation before you can

4   deviate from it. And if you don't have a requirement,

5   then you don't need a waiver.

6   So my question is you also talked about

7   49,000 inspection points going down to 8,500. Did

8   your investigation identify any changes in the overall

9   level of expectations, or the specificity, or the way

10   that the federal government defined its expectations

11   for its contractors during this out-sourcing that

12   contributed to some of this problem that would have

13   shown up as a deviation, or would have shown up as a

14   waiver, but was masked by the fact that the

15   expectation no longer existed?

16   MAJ. GEN. BARRY: Well, I think the short

17   answer is yes. The bottom line on contractors: they

18   are motivated by profit. Although they're great

19   American citizens. I'll tell you, we didn't walk the

20   line that we didn't find a contractor that wasn't

21   either former NASA or former military or someone who'd

22   been in the civil service for years and years. These

23   are dedicated Americans that want to do the right

24   thing.

25   The problem is when you're making

1   decisions at the high managerial level that when you

2   got competition. Like you said, competition between

3   standards and innovation that maybe we'll make a

4   decision because this is an operational vehicle,

5   tried, true, and tested. And we can accept this risk.

6   It's really a way of approaching risk. If

7   you approach the basic focus that your organization,

8   your system of systems is mature, and tried and true,

9   then you're going to be able to make some very

10   conscious risk decisions that are prudent in some

11   cases. If you're of the consciousness that you're

12   still in an enabling technology with high risk, with

13   R&D and testing, then I think your focus is going to

14   be different. I think NASA was over here, which

15   caused them to jump from 40,000-plus to 8,500 GMIPs.

16   Because we can do that. We've got a tried and true

17   system here.

18   Our overall expectation of the contractor

19   is they can handle it. Let them handle it. We don't

20   need to monitor everything. I don't know where the

21   balance is. And I don't know if it's 12,000 GMIPs or

22   20,000. But I think it's pretty clear that we went

23   too far in reducing the technical expertise for the

24   situation awareness. If you don't have the situation

25   awareness, listening to little things and being able

1   to identify them to be problematic, then you're

2   overall expectations, I think, are going to go down.

3   And I think that's what happened when they moved too

4   much to the contractors.

5   CHAIRMAN CONWAY: General, we've taken

6   more than two hours of your valuable time. We thank

7   you for giving us the opportunity to meet with you,

8   and to ask you questions.

9   The record here is going to be kept open

10   until November 23 if you decide you want to add

11   anything else to it. You were very, very thorough in

12   your comments.

13   MAJ. GEN. BARRY: Well, we only have,

14   let's see, there's 2,200 pages in Volumes II through

15   VI, so you're welcome to have that.

16   (Laughter.)

17   CHAIRMAN CONWAY: Well, you sure condensed

18   it. You sure condensed it down in a very, very

19   excellent manner. And I thank you very, very much for

20   the time you've given.

21   MAJ. GEN. BARRY: It was an honor to be

22   here.

23   CHAIRMAN CONWAY: Is there anybody in the

24   audience that wishes to speak today?   If so, come

25   forth.   Again, the record will be kept open till