

COMMITTEE HEARING

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SCIENCE AND TRANSPORTATION COMMITTEE, SCIENCE AND SPACE
SUBCOMMITTEE WASHINGTON, D.C. U.S. SENATOR KAY BAILEY HUTCHISON (R-TX)
HOLDS HEARING ON HUMAN SPACEFLIGHT

U.S. SENATE COMMITTEE ON COMMERCE, SCIENCE AND TRANSPORTATION:
SUBCOMMITTEE ON SCIENCE AND SPACE HOLDS A HEARING ON HUMAN
SPACEFLIGHT

SPEAKERS: U.S. SENATOR KAY BAILEY HUTCHISON (R-TX), CHAIR; U.S. SENATOR
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TRENT LOTT (R-MS); U.S. SENATOR JOHN ENSIGN (R-NV); U.S. SENATOR JOHN
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WITNESSES: MICHAEL GRIFFIN, ADMINISTRATOR NASA

MICHAEL MCCULLEY PRESIDENT/CEO UNITED SPACE ALLIANCE

JOAN JOHNSON-FREESE CHAIRMAN DEPARTMENT OF NATIONAL SECURITY
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ACCOUNTABILITY OFFICE

HUTCHISON: The person is ready so I'm going to start. That is our witness. I'm starting
because there is a possibility that at 11:30 we will have to break because of what we call the
two-hour rule being invoked. And therefore, I'm going to jump right in with our first witness.

And want to welcome Dr. Griffin. We very much appreciate all that you have done in the
very short time that you have been in place.

Today's focus is going to be the space shuttle and how we are going to utilize it fully and go forward with a crew return vehicle. We are very concerned on this committee, as we have made clear, and I know you are as well, about the current status of our ability to fly the space shuttle beyond return to flight, how long can we use it and what your plans are to bring up the crew return vehicle.

In addition, in the question period I want to say that I want to start talking about not only the crew return vehicle, which is, I know, in the top three priorities for NASA, but what we are doing with the capacity to take the payload up that we can't take on the crew return vehicles.

You've said to me straight out, the space shuttle is flawed. The words are indelibly impressed on my mind from the last hearing, and therefore, I want to know how we're going to get equipment and repair type tools up there, if we have a crew return vehicle in the long-term future and where that stands in the priority list.

It is essential that we learn from mistakes made in the past, as we develop a new generation of vehicles for human space flight. We don't have the luxury of time or resources or a false start as we add the new dimension of moon, Mars and beyond.

So, I hope that we can go one step beyond where you did in your hearing for confirmation about where you see us in the main priorities for NASA, which are return to flight, the crew return vehicle, and the finishing of the space station.

And of course, as you know, Dr. Griffin, my fourth priority but very high on the list and considered essential to me is the science research at the space station, going on a continuing basis rather than being delayed for the first three priorities.

So, with that, I will welcome my Ranking Member, Senator Nelson, who is our only Senator who has been in space, and let me say, glad you're here.

BILL NELSON: Thank you, Madam Chairman. And I understand that it's possible that we're going to have to conclude this by 11:30? Is that correct?

HUTCHISON: That's correct.

BILL NELSON: So then I will just say, Dr. Griffin, in the interest of time, I think you have demonstrated extraordinary leadership, and you've only been on the job a month, but of course, we knew that. That's why Senator Hutchison and I both encouraged your appointment and then your confirmation, once appointed. So we're very grateful.

And I think that what you've done in trying to lessen the hiatus between the CEV and the end of the space shuttle is not only commendable, it's absolutely necessary. As well as you taking a fresh look at whether or not we can go and service Hubble. I thank you for that. I'll reserve my comments for questions.

HUTCHISON: Thank you, Senator Nelson.

LOTT: Thank you, Senator Hutchison. I'm so pleased that you have taken over this subcommittee chairmanship. Your interest, your knowledge, your energy will be very helpful.

And I want to also recognize Dr. Griffin's good work already. I just sense a change, already, which is pretty impressive and I'm wishing you the best and we want to be partners with you in trying to get this very important agency up and running and doing the kind of job we know it can do. I know there will be lots of discussion about your plans to accelerate the crew exploration vehicle acquisition and how NASA's other programs will be affected by the increased emphasis on space exploration. I look forward to working with you to achieve the former, while making the latter more plausible.

I also want to thank you for going forward with the NASA Shared Services Center decision. I think you made a good choice. Obviously I'm prejudiced in that regard, but there were a lot of, you know, things to consider. A lot of countervailing pressures, and I think you made the right decision. And that the history of this will show that it will serve NASA well.

I also understand that the U.S. trade representative is providing you with guidance on the use of NASA facilities in connection with the EADS proposed, U.S. commercial aviation research and manufacturing facility, and I urge you to work as closely as you can with the state of Mississippi and Hancock County in our state, with respect to this proposal.

So, basically I just want to get those things on record, and at this point it makes me feel good to be able to come to a NASA hearing and commend a NASA representative for their effort. Maybe it's just because you're just getting started, but I hope you can keep it up. Good luck, sir.

HUTCHISON: Thank you, Senator Lott. I'm very pleased that you are staying active on this subcommittee, because I do want to have a reauthorization of NASA this year and I do plan to invigorate our oversight efforts.

Dr. Griffin, welcome.

GRIFFIN: Thank you, Senator Hutchison, Senator Lott, Senator Nelson. I appreciate your very kind remarks. I will endeavor to continue in the pattern that we have begun in our relationship, which is to give you the best answers that I have to the questions that you ask, and if the answers are difficult, then I look forward to working with you to make them as palatable as we can, but I will tell you every time what I believe to be the case.

Senator Hutchison, while you were talking about the, mentioning that the most important person for the hearing was here so we could start, I was actually thinking in my own mind that my role was more like that of the pig in a ham and eggs breakfast.

(LAUGHTER)

You can't start without me, but I'm at the wrong end of the food chain.

(LAUGHTER)

So with that, I'll continue with my more formal remarks.

Madam Chair, members of the subcommittee, thank you for the opportunity to appear before you today to discuss the plans for the space shuttle and carrying out the first steps of the vision for space exploration, with return to flight and assembly of the international space station. Our plans to date for the shuttle retirement by 2010 and our progress in minimizing the gap between retirement of the orbiter and the first flight of the crew exploration vehicle.

In presenting the vision last year...

HUTCHISON: Could I interrupt you?

GRIFFIN: Yes, ma'am.

HUTCHISON: You weren't planning to read your whole statement, were you? Could you summarize?

GRIFFIN: I had an oral statement.

HUTCHISON: Is it different from your written statement?

GRIFFIN: It is, but let me shortcut it in the interest of time and let me just go forward and say, we're in the middle of returning to flight. As you know, we delayed by three months. We think that was the right thing to do. The recommendation was presented to me and I concurred with it. We're still working some technical issues. We'll go when we can.

We are, as I believe you now know, working vigorously at NASA to consider alternate options for space station assembly sequence, looking at how we can complete the station consistent with our obligations and yet consistent with a shuttle retirement date in 2010. I've promised the Congress the results of this internal study by mid- summer.

We are looking at phasing out shuttle operations. We have studied lessons from the Titan 4 community. We are considering how the phase-out of the shuttle orbiter will be consistent with the development of a new architecture for the CEV, its transportation system and human return to the moon.

There are a number of critical decisions that need to be made in that regard, and we will be sharing those with you as we go forward.

As I have just said, we have an explorations system architecture study ongoing at headquarters in parallel with our space station assembly study. That result, preliminary results from that study also will be made available to the Congress by mid-summer. I look forward to working with you as we shape that up.

And with that, as I have testified previously in my confirmation hearing and last week, I believe with you, that the gap in human space flight capability, access to space by the United States between the necessary retirement of the shuttle orbiter and the bringing online the new crew exploration vehicle must be absolutely minimized, and I look forward to working with your committee and with the Congress as a whole to achieve that goal.

Thank you, and I stand ready for your questions.

HUTCHISON: Well thank you. I am so sorry we're having to do this quickly, because there is so much that we have to say, and we have a great second panel as well. But let me ask you first, if I were to ask you, what are the top priorities for the use of the space station, the research that you would do at the space station right now, what would those three priorities be?

GRIFFIN: The space station is very useful as a test bed for hardware that we will be developing for exploration. Much of that hardware that we intend to take to the moon and later on to other destinations, would be better flight tested in lower orbit close to home. One does not require that such hardware be tested on a space station, but given that we have one, that would be the logical place to do it.

As the years evolve, there will be a number of scientific experiments that can be palletized and can be attached to the space station as opposed to necessarily being on a free-flying space craft. Again, if we didn't have a space station we might do otherwise, but having one, we will look for opportunities to use it.

There will be research that can be conducted on the station by virtue of the ability of the station to provide an extended zero gravity time. Response of human and other organisms to zero gravity can be examined under controlled conditions on the station.

The station is limited in its research potential by the fact that we are not able, on the station, to combine the appropriate radiation spectrum for deep space flight together with the zero G environment. It is those two environments together that are the truly relevant environment and we can't mimic those, but we can at least mimic the zero G portion.

HUTCHISON: There is a consortium of universities now that takes the medical research that decides what the priorities are, and then expands on those. Do you foresee, within your budget, being able to continue that consortium doing the medical side of the research that's going on at the space station?

GRIFFIN: Given the priorities that I have stated, that the administration has supported, and that I believe are shared by this committee, the short answer to your answer is, not in full scope. In order of priorities I need to return to the complete return of space shuttle to flight and fly every flight safely. We need to complete the assembly of the international space station. Deferring it will likely only cost more money.

We need, very much need, as you have said, to bring the CEV online sooner rather than later, minimizing the gap in human space flight. One of the few areas of freedom that I have as the administrator is the, I hesitate to call it a pot, but the pot of research and technology money that can be, if you will, bought by the yard. That is one of the few areas where I have any flexibility at all, and if I am to accelerate the development of the CEV, a good chunk of that money must be used to do so. HUTCHISON: Would you provide for me and the committee, a cost estimate of what the biological research, the medical research is, and even if it's scale back perhaps, but the ongoing experiments that we have heard about on breast cancer tissue.

I would imagine that even in your top priorities, the zero gravity conditions still allow you to look at the osteoporosis affects on humans and so that would be one continuing area of the medical research that would also be in your top priority list.

But could you also tell us what it would cost to do the other types of research that can be done in zero gravity uniquely and are a part of the university-based research consortium, so we have an idea of what that would, how big a budget that is?

GRIFFIN: Yes, Senator, we will and I will indicate to you what our priorities would be for the research that would continue, and what we would plan to delay or defer in order to accelerate CEV.

HUTCHISON: That would be very helpful. My last question in this round would be, obviously you are focusing on the CEV. You have said that the shuttle itself is flawed, perhaps because of the heavy payload. I don't know all of the reasons why. But my question is this.

How do you propose and what is your priority ranking for getting payload to the space station, or perhaps even beyond to the moon if that's necessary, if you don't have a shuttle that can carry payload? How do you plan to do that and where is that in your priority list when you don't have a shuttle anymore?

GRIFFIN: Senator, that's an excellent question. Thank you. Of course we have been getting cargo to the space station for the last two plus years while the shuttle has been grounded, through the good offices of our Russian partner with a series of Progress flights. The Progress system is limited in capacity, but it does feature the capability to do an automated, proximity operations flight plan, and an automated rendezvous and docking with the space station.

The United States needs to develop that capability and we will be doing so. Later this summer, perhaps early fall, we will be releasing an RFP (ph) in the crew and cargo line -- I think you'll find that in our budget -- that is intended specifically to address the provision of space station cargo resupply, up-mass if you will, by commercial means: commercial contracts to all carriers.

In addition, the exploration systems architecture study we're doing over this summer will define a path by which the government can meet government requirements for cargo to space station, should commercial providers fail to show up. So we will have two paths.

Going forward, our budget baseline will assume that commercial cargo carriers will be able to provide those services to the station.

HUTCHISON: So bottom line, you do intend for us to have some capability besides depending on any other partner, for that responsibility?

GRIFFIN: Absolutely.

HUTCHISON: Thank you.

Senator Nelson?

BILL NELSON: Thank you, Madam Chairman.

What happens if the CEV is not ready by 2010, when your plan is to scrap the shuttle?

GRIFFIN: It's my job to convince you that we will have a development plan for CEV that has it ready by 2010 or as soon thereafter as we can. We will say the date and we will try to hold to it, and I will try to convince you as we go through the next few years together, that we are holding to that plan.

In part, the definition of what the CEV is needs to be done with the constraint that it be buildable, that it be an executable program and can be fielded shortly after the shuttle's retirement.

BILL NELSON: And in that plan would be the plan for the orderly transition from one to the other?

GRIFFIN: Exactly. Yes, sir.

BILL NELSON: Of course at that point we assume that the space station will be up in full bloom and running with a complete complement of astronauts doing research. Therein is another reason why we need to follow on vehicle ready, so that there's not this hiatus.

Given the fact of our experience back in 1975, in the last Apollo, it was Apollo Soyuz, we thought we were going to fly the space shuttle about 1978 and it didn't fly until 1981. A part of that workforce was effectively utilized so that they didn't have to lay them off, and that corporate memory was all there. What are your plans, what is your thinking about, if there did occur this hiatus of how you would keep that team together?

GRIFFIN: Senator, I lived through that period as a working engineer and remember it well, and it's not one of my more pleasant memories from my, you know, 35 years in the space

business. So one of the reasons I so strongly support the concerns which have been expressed about minimizing that gap in human space flight capability is that, I, frankly, don't want to live through that experience twice.

Our primary contractor in space shuttle, space flight launch operations, launch appropriations is, of course, United Space Alliance. We work with that contractor every day, every week. We have very close ties with them. We're pleased with the work. It is our goal going forward, in developing a transition plan from shuttle to CEV, to be hand in glove with our USA contractor to affect the most orderly transition that we can. As I said briefly in my opening statement, we have studied lessons learned from the Titan 4 transition. We have gone back and studied lessons learned from the, you know, Saturn Apollo to shuttle transitions. Some of those lessons are good ones and some are things to be avoided. We are paying attention.

There are two basic issues. Any launch system -- I referred earlier to the fact, the known fact that it takes about \$4.5 billion to keep the shuttle going, whether you fly any flights or not. The new system must have lower fixed costs or the United States will not have effected any improvement. Lower fixed costs means a smaller workforce in the sense of a standing army.

So we want to shift money from what it takes merely to launch payloads into more exciting and new things that we want to do. So some workforce will be transitioned going forward and other elements of the workforce must be transitioned to new activities. Otherwise we'd do nothing new. And that program must be managed as carefully and as much of a forward-looking sense as we possibly can and that is our every intention.

BILL NELSON: And an additional computation here is that you will have a full-up robust, internationally participated in, space station that you want to utilize. And suddenly if you stop the shuttle and you don't have the follow-on vehicle to service that space station, you can't use all of that investment of multiple tens of billions of dollars up in the heavens.

For example, what would we use as a life boat? I guess we'd have to use the Soyuz. Well then, therefore, you got to drop the level of the crew, so you're not using that superstructure up there that we've invested so much in. What's your thinking there?

GRIFFIN: I cannot but agree with you. If we have a station, we need to be able to use it, and I am, I don't know how to say in enough different ways that I am convinced that your concern about minimizes such gaps in access on target, and we at NASA are working to eliminate that and to provide a credible plan for doing so.

BILL NELSON: Well, I commend you on what you've already done, which is accelerate the CEV, and see if that is doable, but then that begs my next statement, which is, if it can't be accelerated, then maybe it's in the interest of the United States to extend the shuttle.

GRIFFIN: Sir, if we do that, then we face the circular problem. I have a hole in my gas tank, but the money I have to spend buying the gasoline prevents me from paying the mechanic

to fix the tank. I've got to retire the shuttle in order to have the money to do the things that you and I both want to do.

BILL NELSON: Understandably, but if the development of the CEV does not occur, in the expeditious way that you hope and that you're giving leadership to, and we commend you for that, you got to have a plan B. Otherwise we're going to waste all that asset up there.

Just a concluding thought here, Madam Chairman. In a previous hearing we had brand new testimony about the promise, for example, that I did not know, of the experiments that are going on, on protein crystal drugs, experiments that were made 20 years ago and of which there was some question of whether or not it was financially feasible to do that on orbit, as opposed to on Earth.

But now that we're seeing new promise, as was the testimony, I still have not received those answers, and I would like the statement to NASA is, please get those answers back to me. But if there is that promise of medical breakthroughs on such things like protein crystal growth on orbit, then that's just all the more reason why we need to keep that international space station functioning. Thank you.

HUTCHISON: Thank you. I agree.

I would like another round, but we are told that we have to end at 11:30 and therefore I'm going to ask you to come back and see us very soon, and stay in touch with us, and we will call our second panel.

GRIFFIN: I'm at your disposal. Thank you.

HUTCHISON: Thank you very much. (OFF-MIKE)

Okay, if you would, I would like to ask you, since we are on a very tight timeframe, if you would each speak two minutes. Summarize all of your statements with your major points, and then we will have a few minutes left for questions.

I would like to first ask Mr. Michael McCulley who is the president and chief executive officer of United Space Alliance.

MCCULLEY: Last night I took 30, Senators, and got to five, and I think I can get from five to two very quickly.

Thank you again for the opportunity to be here on this very, very important subject to all of us. It's my privilege to be representing 10,000 plus men and women of the United States Alliance, and I can tell you that virtually everything we're doing these days is focused on supporting NASA in the return-to-flight efforts.

But having said that, we recognized in January of last year, when the president gave his vision speech, that we had a new world in front of us and that was this world of transition. And so, within minutes, of the speech, we started transition planning. It goes on today.

It's a transition that must be carefully and proactively managed and led. NASA and USA have taken measures to address that transition in terms of workforce, facilities, hardware, equipment, test assets, and also the supplier base. The GAO has also weighed in on this, and I won't quote, as I was going to do, but they do an excellent initial report on our efforts to start on managing this transition.

In addition, NASA and the NASA industry partnership at a space operations summit have also begun transition planning, including all of those things that I mentioned earlier. Also it included retention, recruitment, critical skills, how we dispose or preserve the assets, the physical assets. It's resulted in some changes at the shuttle program office that are proactive attempts to get through this and get a jump on this transition.

In addition, over the years, USA, owned by Boeing and Lockheed Martin, we've had excellent results in previous times when there's been either an overage or shortage on one company's part or the other. We have developed a really good procedure of transferring employees back and forth. We've used it very successfully, and I would anticipate that we'll have that in the future as well.

In addition, Dr. Griffin mentioned the Titan program. I've been paying very close attention to the Titan program, which flew its last flight in Florida last month, including the level of detail that I've gone with contracting officers to understand what the Air Force has done with Lockheed Martin in that contracting contractual changes.

I would think that the S-FOC contract has a follow-on, the Space Flight Operations Contract has a follow-on that we're working on now, and I would anticipate that NASA would require us in that contract to do more proactive planning on how we're going to work our way through this transition and make sure that the last space shuttle flight is just as safe as the next space shuttle flight.

Of course, the execution and timing of all these measures depends on a number of different things, a number of different requirements, and I can tell you I'm sitting here with a great of uncertainty right now, but I'm also pleased that Dr. Griffin has put these teams in place and he said the summertime, so I would anticipate by the summer or the fall, I have a much better target, and then I'll have a much better idea of what I need to do and specifics in planning.

You had asked about the investoral based and asked me to comment on that. It's a great question because many of the skills and certifications that are in the shuttle program are unique to that program, and as we begin to fly-down, we've got a vendor base out there that we've got to manage as well.

Some of those have options like lifetime buys on perhaps materials or products. Other times we don't have that. For example, the United Technologies Company builds the fuel cells for the space shuttle.

We're not going to order any more fuel cells, so we're a very small part of their business, but I need that skill set in place up until the last landing on the last flight, and so our contractual arrangements need to reflect that and so it changes our contracts and the way we manage contracts and we're working that also proactively.

In summary, we were created for one customer, and that's NASA. I've got 10,000 plus experts, including myself and my management team focused on supporting that customer.

HUTCHISON: Thank you very much. I appreciate the very difficult job you're going to have in the, well, next five years to 2010, to maintain all of the capabilities and yet knowing what a final date is, when that final date is set. Thank you very much. Dr. Joan Johnson-Freese is the chairman of the Department of National Security Studies at the Naval War College. Dr. Freese, welcome.

FREESE: Thank you. Senator Hutchison, Senator Nelson, thank you for inviting me to speak with you today on the critical issue of the future of manned space flight, specifically the strategic environment of human space flight.

I've worked on space policy issues for more than 20 years from many perspectives, and based on that experience, I feel that human space flight is not just something the United States should remain actively engaged in. It is an area strategically it must retain leadership in.

In May 2003 there was a newspaper op-ed piece, entitled Next huge space shot: China. It began with the sentence: "Once upon a time we ruled the universe." Now we're second-raters in space. It concluded with the sentence, We have forfeited the last frontier.

Convoluting interpretations of events and leaps of reasoning, like those expressed in that piece, unfortunately, are not uncommon. Consequently, it's not really surprising that many people have concluded that with one 21-hour manned space flight, China has catapulted ahead of the United States in overall space capabilities, especially human space flight capabilities.

While it's sadly true that the U.S. has not chosen to pursue human space exploration in a timely and concerted manner as many people hoped it would, we are certainly, by no means, a second-rate space power because it has pursued a different priority and slower pace.

But there is perception. Human space activity has always had a strong symbolic significance. Because of the early and spectacular U.S. successes in the manned space arena, winning the race to the moon, the U.S. has heretofore been considered the unchallenged leader in human space activity.

That, unfortunately, again, that perception has been slipping. Now, with the Chinese willing to play the tortoise to the U.S. hare, there's a very real chance that the U.S. will be out-paced by commitment demonstrated by consistency rather than by speed or substance, creating the perception that the U.S. is forfeiting its leadership.

There are many reasons this should not be allowed to happen, and I'd be happy to go into them with you, but as the sole superpower, the U.S. must lead the way to the future. How we lead the way is critical as well, and I think offers the United States an opportunity to demonstrate inclusive leadership toward generating soft power critical to advance U.S. policies.

The U.S. cinched leadership in human space flight early on. Now, the strategic imperative is to maintain it.

HUTCHISON: Thank you very much.

Dr. Scott Horowitz, director of Space Transportation and Exploration at ATK Thiokol.

HOROWITZ: Thank you, Madam Chair, Senator Nelson. It's a great honor to be here today and I appreciate the opportunity to discuss evolving space shuttle systems that will provide a safe, reliable and a cost-effective method to ensure human access to space. Along with the heavy lift, we're going to need to do space exploration and retire the shuttle by 2010.

It's been a great privilege and an honor to have served as an astronaut on four space shuttle missions, so I've seen rendezvous in space, international space station and the Hubble telescope up close and personal. And we at ATK are very excited about the president's vision and support for NASA's new administrator, Mike Griffin, in his efforts to make this vision into reality.

And I firmly believe that we can safely and affordably transition the space shuttle program to support exploration by leveraging our flight proven and human rated elements that exist today.

NASA needs a safe, reliable, affordable method of transporting crews to and from low Earth orbit and heavy lifts. That's the bottom line, and I believe it's tremendously important to learn the lessons from the past and apply them to the future of the human space flight.

Columbia Accident Investigation Board had concluded and I quote, The design of the system should get overriding priority to crew safety, rather than trade safety against other performance criteria, such as low cost and reusability. And I totally agree with this conclusion. So there's two things we have to address, which is heavy lift and crew transport.

Albert Einstein had once said, Make everything as simple as possible, but not any simpler. So we have concepts for a simple, safe way, evolving for example, the solid rocket booster and using maybe a J-2 using the Apollo program or another engine to safely get the crew to and from orbit. In fact, a recent study had showed that that particular launch vehicle had a forecasted crew safety level more than an order of magnitude safer than today's shuttle.

We also have tremendous capabilities that we can utilize to support our exploration vision. The propulsion system, for example, as has been said before, already today propels 240,000 to low Earth orbit. That's over 100 metric tons, so we have a tremendous capability today.

And one of the things that I do as I travel around the country, as I share the adventure of flying of space, I point out that it isn't the thrust of the solid rocket motors in the space shuttle main engines that propel us to space, but it's the dedication, hard work, hopes and dreams of the many skilled and talented people that develop, manufacture and prepare these systems that carry us to orbit.

Transitioning this work force to support exploration is going to be key to our success. In summary, we do have a safe and a simple solution that we can have soon. We owe it to our children and future generations to do so.

Thank you very much for this opportunity and I'd be pleased to answer any questions you may have.

HUTCHISON: Yes, thank you very much.

And Mr. Allen Li is director of Acquisition and Sourcing Management of U.S. Government Accountability Office, GAO.

LI: Madam Chairman, Senator Nelson, members of the subcommittee, as requested I will focus my brief remarks on whether NASA is positioning itself to have people with the proper skills to maintain and operate the shuttle safely until the very last flight. And building on Senator Hutchison's remarks on lessons learned, I will also offer some observations on NASA's plans to develop a new manned space craft.

Over the last two years, NASA and its contractors have worked diligently to return the shuttle to flight. Understandably, focus has been on SCS114. However, as we approach the day when Discovery does return to space, as we all hope it will, NASA will need to pay more attention to activities aimed at ensuring that a shuttle workforce has the critical skills needed, until the shuttle is retired.

It is this workforce that is enabling NASA to soon achieve return to flight. It is also the workforce that will allow NASA to finish the space station. In summary, we found in our March 2005 report, that NASA had made limited progress in planning efforts for sustaining the shuttle workforce through the program's retirement.

The shuttle program has taken preliminary steps, including identifying lessons learned from the retirement of comparable programs, such as the Air Force's Titan 4 program. And NASA's prime contractor for shuttle operations, United States Alliance, has also taken some initial steps to prepare for the impact of the shuttle's retirement on its own workforce.

However, USA's progress depends on NASA's decisions that affect contractor requirements through the remainder of the program, so in essence, it is waiting on NASA. In our report, we identified several factors that have hampered the shuttle program's planning efforts

For example, because of the program's near-term focus on returning the shuttle to flight, other efforts that will ultimately aid in determining workforce requirements have been delayed. In addition, program officials indicated they face uncertainties regarding the implementation of future aspects of the president's vision for space exploration.

I weigh my remarks with two observations on current plans to develop the Crew Exploration Vehicle, otherwise known as the CEV. When the shuttle was initially designed, ease in maintainability was not a major factor, but it should have been. A few years ago, I appeared before this subcommittee when it reviewed the reason behind wiring failures in the orbiter. As it turns out, some wires, which are bundled, cracked from maintenance personnel repeatedly stepping on them to access other parts of the orbiter.

So it seems appropriate for NASA to remember this lesson and that future reusable space craft be designed with maintenance in mind. Furthermore, even if the space craft is not totally reusable, producibility will be a factor to consider. This is important if the CEV is to be the building block for the future and is produced in different forms over 20 years.

It would appear that NASA would have much to gain by insisting on designs that can be efficiently produced and thus reduce long-term costs. This ends my prepared statement (ph).

HUTCHISON: Thank you very much.

Dr. Freese, I would like for you to go back and expand a little bit on the concerns that you have from a national security standpoint about the United States having the independent ability to launch and support humans in space.

FREESE: Space has always had a very strong symbolic value. Today, we term that technonationalism. Science and technology is an indicator of national power and with space representing the future, any slippage in U.S. leadership in human space flight capability translates into a negative indicator of national power.

Countries are acutely aware of that, and specifically China is reaping great rewards in technonationalism right now from its very incremental and very Spartan but very ambitious human space flight program.

That creates a perception of competition where the Chinese only have to be consistent and we have to, we are put in a position where we are racing against ourselves to outdo our past, our glorious space past. And I think this puts us in a very precarious position.

HUTCHISON: Is there anything quantifiable about what we would lose if we could not put humans into space within a five year period, other than perception of power loss?

FREESE: Well, again, perception is soft power, and while that's very hard to quantify, it's very real. There are some fields, certainly there is medical research and there are certain fields, life support research, that have to do with human space flight which has technology benefits that we would lose in, but my work primarily focuses on soft power issues, which I think are considerable.

HUTCHISON: Mr. Li, let me just ask you, what do you think are the highest risk workforce retention issues that you see, as we get toward 2010, and then with the crew return vehicle, also trying to get it online. LI: That's a fair question. I think at issue here is, if we don't have a plan that is fully understood by the workforce, they will migrate toward what is best for them, and that unknown may be not knowing what program, future program will be. And they might, in essence, leave that shuttle workforce which would be very bad for, obviously in terms of safety.

HUTCHISON: Senator Nelson?

BILL NELSON: Mr. McCulley, you're experiencing that right now, aren't you, with some of your young engineers.

MCCULLEY: Yes, sir, I am. And one quick anecdotal story. I've got a young man from Pennsylvania who came out of college to Florida specifically to work on space programs and human space flight program.

Last week in the cafeteria at the Kennedy Space Center he said, Mike, what about my future? I've got two children now and a wife and there's jobs in Pennsylvania that I'm aware of that I'm debating. And he's in a very serious internal debate with his family.

Now, we'll tell you that at this point we've had no problem at all in recruiting, which has been very, very pleasing. Given the accident, we're having no problems at all getting good people. I don't think we'll have any problem for the next year or two, but my folks are starting to think about, what do I do post-shuttle, until we get more definition.

And I applaud Dr. Griffin's efforts to get us that definition sooner rather than later.

BILL NELSON: Dr. Freese, in our world of politics, perception is not only soft power, it's hard power. But thank you for telling us about what perception to the world, with regard to the United States space program.

Taking that a step further, what happens to our perception if our partner, our international partners up there on the space station, either there because it's been completed or not there because it hadn't been completed, and it comes 2010 and there's no space shuttle to service and build the space station

FREESE: That's a scenario that I don't think would be in our best interest. I strongly believe we need to be co-opting others to work with us inclusively, so that we can avoid a situation

where the United States is the odd man out potentially on the space station. That could occur.

BILL NELSON: Dr. Horowitz, what are the advantages to using space-shuttle-derived systems for helping implement this CEV.

HOROWITZ: Thank you, Senator. Well, as everyone's concerned, we've very worried about the gap. And the best way to avoid the gap is to take the equipment that we already have at our disposal. I mean we already have the first stage of the vehicle I described. It's already built and flying today. So we can minimize the amount of development time, the amount of cost, and then we can meet the ambitious schedule of having a crew exploration vehicle ready to fly in 2010, because we have most of the propulsion components already. They're already rates, and it will be safer and more effective than anything else we could do.

BILL NELSON: And of course, that will be something that NASA will be looking at.

HOROWITZ: Yes, sir.

BILL NELSON: Trying to make that decision, what's best, safety- wise as well as from a cost and timing schedule.

Thank you, Madam Chairman. This has been an excellent, excellent hearing, and you have compressed it into 35 minutes. It is a record, Madam Chairman.

HUTCHISON: Well, thank you. It took the cooperation of everyone involved, and let me just make one last, quick statement. And that is that I do believe that NASA is looking at and working, will be working with you, Mr. McCulley, to use many of the people who are also doing the space shuttle for crew return vehicle evolution and so I don't think the picture is totally bleak here.

I think there will be a lot of overlap that will keep our best people. And I know that between you and Dr. Griffin and all of the people in your two organizations, that you will have a lot of ability to coordinate that.

I want to remind everyone that all the statements and additional materials from the witnesses will be made a part of the hearing record, and also any answers that you might have to questions that might not have been asked but will be submitted to you in writing by members will also be made a part of the record.

Thank you for the cooperation on this very short timeframe. We appreciate it. We have learned a lot in a short time and we appreciate your cooperation. Thank you.

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