

Transcript: “Lost in Space: The Need for a Definitive U.S. Space Policy”

Panel Discussion

Sponsored by the Space Policy Program at Rice University’s Baker Institute

George Abbey: Good evening. I would like to welcome you all to the James Baker Institute for Public Policy. We are very pleased to have you here this evening, and I think you are going to find it’s going to be a very interesting program.

As we are meeting here tonight, the International Space Station is flying in orbit with a crew of six — three Russian cosmonauts and two Americans and a Canadian. And come this July, it will be two years since an American-manned spacecraft has been up to visit that station, and this July, it will make four years that the Russians have been taking the Americans up to the International Space Station. They have been a good partner, and it looks like they will be doing that for some time to come. For an American astronaut, the road to space is really through Star City, Baikonur in Kazakhstan, and then up to the International Space Station; and as I say, it will be that way for a long time to come.

Human spaceflight really has become historically a measure of a country’s leadership in space, and with the large gap that is occurring in flying humans in space, it certainly has affected the perception of the United States as a leader in space. It looks like that — as I say — that gap is going to continue for a good while. Last month there were two reports that came out that addressed NASA and the future of NASA. One was done by the National Research Council and one was done by the Space Foundation. The National Research Council pointed out, and I think rightly so, that NASA is at a transition point due to a set of circumstances that is really beyond their control to some degree. Their budget is a level budget in constant year dollars, but their programs have been getting increasingly more expensive, and their infrastructure, the infrastructure that exists within the agency that is now in varying degrees of service, has been there since it was established during the height of the Apollo Program. As you look to the future, the programs that they have to do are out of synch with the budget, and the budget pressures are going to continue. The National Research Council also commented there was not a national consensus on what the NASA vision should be. And there wasn’t a national consensus and even

a consensus within NASA that their existing mission to send a human to an asteroid is really supported. So they had a number of recommendations. They had a number of options that they proposed to get the NASA budget back into some accord with the programs that it's going to have to do.

Then, of course, the Space Foundation took a little different twist. They addressed NASA and said that really NASA should be a pioneering organization and they ought to divest themselves of all those activities and all those functions that don't support that pioneering aspect. They didn't identify those, but one can imagine what they might be.

So it is against that backdrop that we are having this meeting this evening.

We have six panelists this evening, and I think they are eminently well qualified to speak to NASA and the future and where we might go and what kind of space policy the country needs.

We are going to start off this evening with John Logsdon. John Logsdon is a professor emeritus in politic science and international affairs in George Washington's Elliott School of International Affairs. He taught there for thirty-eight years, and he also is the founding and long- term Director of George Washington University's Space Policy Institute. He has a great biography included in your program, so I am not going all through that. So let me turn it over to John.

John Logsdon: Thank you George. One of the things that didn't happen before this evening is any sense of the order of speakers. It was only when I got here [that] I discovered I was first. My mental set was that I was going to react to what everybody else said, which is hard to do when you're in the lead-off position. My identity in the space policy field is kind of: I am old. I have been working at this stuff for a long time. Mr. Abbey said why don't you start by putting some historical context into the current debate. So that is what I will try to do.

George did a good job of summarizing the recent National Research Council report. It is a report worth your reading. It is called NASA's Strategic Direction. A group of people half familiar with the space program and half not that were asked to assess NASA's strategic direction looked at it

and said [it] doesn't have one. They didn't say, well, "lost in space," as the title of tonight's program suggested, but they certainly intimated that we didn't have a very clear image of where we're going. Today is the 24th; one week from today is the 55th anniversary of the first U.S. satellite, Explorer I. Fifty –five years into U.S. space activities and we are still saying: What are we doing? Why are we doing it? That is an interesting phenomenon, and I want to reflect a little bit on why that is the case and whether we are at a point where something can be done to give a more clear orientation toward the future. The word in the title tonight — definitive — I am not quite sure what that means, "a definitive space policy." Maybe we can come back to that in discussion. It sounds a little more precise than in a political system would ever be possible.

I think you can more or less divide the history of the U.S. space program into a set of eras, the first of which is clearly Apollo. There were three years of just getting started. President Eisenhower was in office. When Kennedy came into office in 1961, there was no clear future for NASA. There were considerations of ending human spaceflight. A lot of people didn't want the NASA job, because they didn't want to preside over a declining agency. That is hard to imagine during what happened. That was the situation in January of 1961. It was the stimulus of the Gagarin flight that led Kennedy to say to his advisors: find me a space program which promises dramatic results and which we can win. Pretty clear strategic direction: space, dramatic results, win. And the answer came back that sending people to the surface of the moon was the first accomplishment that NASA had more than a fifty-fifty chance of doing before the Soviet Union. So Kennedy said sure, let's do it and did it. He not only made the decision to go to the moon, he provided the resources to implement that decision in his remaining three years in office. There was a strategic direction. There was a clear goal of using the space program as an instrument of U.S. foreign policy to demonstrate U.S. technological and managerial power in a peaceful way to the rest of the world and to re-establish a sense of national pride in common accomplishment.

I, unfortunately, think that however positive those elements were, the overall assessment — doing Apollo so soon — was not good for the space program. It used up the obvious destination, the moon, right away. Because it was designed as a race, it was not sustainable. There was no reason to recreate it once you won the race. It created an image of what NASA was about — large-scale engineering achievement built around human spaceflight with a large infrastructure to

support the effort. I think, in a sense, we have spent the past 40 or so years — wish to say, I am not sure I do in this crowd — trying to escape the heritage of Apollo and figure a new direction that is more sustainable, more productive for the future.

As Richard Nixon came into office — and I should say I am trying to work on a new book on Richard Nixon and the U.S. space program, so I have been spending a lot of time in the Nixon archives and the Nixon Library. It is kind of interesting. Side footnote, a Nixon fan had chosen to mark the 100th anniversary of Nixon's birth, which was just a few weeks ago, with an exhibit at the National Archives in Washington on Nixon and the space program. I bet in this crowd, none of you would have identified that and Nixon as something worth celebrating. But there it is. And in fact, I think he made, arguably, the correct decision that the country was not interested in maintaining the kind of high profile, fast pace, expensive program aimed at continuing exploration that was proposed to him at the height of the success of Apollo, with the extreme version having the first mission to Mars take off in 1981.

There was a report under a group chaired by Vice President Spiro Agnew that made that set of recommendations that Mars should be the defining, shaping goal of U.S. space efforts. Nothing's changed since then — that there should be an integrated, fast pace, definitive program aimed eventually at human missions to Mars. Mr. Nixon said no, space has to be lowered to be part of the normal part of politics. And I guess I'll say now rather than conclusion, if something becomes the normal part of how we make decisions in this country, then the idea of definitive strategy and policy is a non sequitur. That is not the way we make decisions in this country on anything. So space is not exceptional, but part of the normal flow of political decisions. And the idea of a definitive policy is probably a non-starter.

The Nixon administration was then faced with the issue: if not an ambitious Apollo-like continuation, then what? And the answer came out to be the space shuttle. I found the kind of smoking gun record of a meeting. John Erlichman kept minutes of all of Nixon's meetings. I found a memo of a meeting November 24, 1971, that said the president has decided to support the space shuttle as long as it is located in California. He is very concerned about aerospace unemployment in California before the 1972 elections. That's normal politics. That's the way

decisions are made. There was no strategic framework. In fact, one of the option papers for the shuttle decision said the beauty of the shuttle is we can chose a program without choosing either a goal or a destination. And that decision defined the program because a decision to eventually go to the space station — what is the word I want — connected at the hip with the decision to go with the shuttle. That decision defined the program for the next 40 years until Chris Ferguson landed STS-135 in July 2011. There was a recognition along the way that really wasn't a strategy, and there were various attempts to change that. There was the National Commission on Space in 1986, the Space Exploration Initiative under Dr. Albrecht's gentle guidance in 1989 — I suspect Mark will talk about that — Lori Garver is one of my former students; I sometimes take credit for that — not always — sorry Lori ... changed the paradigm to something that was strategic that had a future vision, a particular way of doing things that once it was announced many disagreed with. There were so many vested interests in the way that things had been done — in the way that they were proposed to be done — that the result has been, I think, an uneasy and an unsatisfactory compromise, which is the situation we are in today. So is there a chance of changing that? That's the question that the five gentlemen to my right — four gentlemen and one gentle lady to my right — will address. And I'll come back topically and comment in the Q-and-A. I am not very optimistic, at least in the short run. The perception of the need is there, but it is not a widely shared perception. And it is hard to change things in our system of government, and it is designed to be hard to change things. I have been in Washington now 46 years, and it is worse now than I have ever seen it. The idea that out of the current criticism and controversy there can arouse a consensus on a need for change and a need for a definitive space policy — so as I said — I am not very optimistic. Gene says he is going to be positive though.

George Abbey: Thank you, John. John is also the author of a fairly recent book, "John F. Kennedy and the Race to the Moon." I would certainly recommend that book to you. It is very interesting and gets back into all the history that he was speaking about.

John Logsdon: George, the new book is "Retreat from the Moon: Richard Nixon and the American Space Program," to be published in 2014.

George Abbey: Our next speaker is Gene Levy. Gene is in the department of physics and astronomy here at Rice University. He was the provost here at Rice for 10 years. Prior to that time, he was professor of planetary science at the University of Arizona. He became head of the planetary science department at Arizona and also served as the Director of the Lunar and Planetary Science Laboratory there for 10 years. He has served on a number of NASA advisory committees in science and is serving on the Science Committee of the NASA Advisory Council today. Let me turn it over to Gene.

Eugene Levy: Thanks George. The premise of this colloquy this afternoon is a question of title that means the United States is lost in space. What that apparently means is the United States has failed to articulate, has failed to plan, has failed to fund, and has failed to undertake an ambitious continuation of human piloted missions that began with the Apollo “man on the moon” series of expeditions and ran for three and a half years from the first Apollo landing in 1969 until the last one in 1972. We just passed last month the 40-year mark since the last time a terrestrial human being set foot on any natural extraterrestrial object. This four decade hiatus has given rise to a great deal of soul searching, navel exploration — I mean navel with an “e” not naval with an “a” — navel exploration, and criticism of public and political processes in the United States.

Notwithstanding that hiatus, there has been an articulate school — a vocal school in fact — advocating continuing expansion of the sphere of human physical presence in space, building on the achievements of Apollo and taking us to, by now, well to ... you choose the destination. A host of destinations has been put forward at various times, which to places and the purported temperatures of the trip continue to evolve and never become stable. The failure to implement continuity in the deep space human exploration program — despite that failure, we should not lose sight of the positive aspects of the discussion over the past four decades. The lack of continuity in pursuing deep space piloted missions has, in my view, enjoyed a parallelism in thought and in outcome between the two political parties that could well represent the single greatest area of political cohesion that our nation has witnessed over the past four decades.

While on the political stages, the players shoot in every which direction; in actuality, the cohesion has been truly remarkable. Even recently, the current president is blamed by many for the loss of national human access to space, but, of course, that outcome was preprogrammed by

his predecessor in the other party. I want to emphasize I am not making any political comments here, I am just — not necessarily being critical — I am just describing the reality. The current president has been criticized by many for not planning the next phase of deep space programs, goals or missions such as a moon colony. Yet, during the campaign, his opponent of the other party insisted that if anyone in his administration were to advocate putting a colony on the moon that individual would be fired immediately, apparently oblivious to the fact that Mike Griffin was at that moment a prominent member of his space policy advisory board, for what that's worth. The loss of space characterization of the NASA program is, I guess, meant to capture a sense of crisis, as if we are otherwise wanting for crisis on the U.S. political landscape.

But I would like to shed a different context. I want to speak, very briefly, and just have a conversation, like the context of my view here, by taking a different perspective. I would like to suggest the failure to articulate and announce a program of human piloted missions to deep space — rather than being a crisis, rather than being a bungle of leadership and political process — represents a triumph of rationality and a success in the political process. Of course, by no means can the spacious or paralysis that has characterized the discussion and development of our national future in piloted missions to deep space ... in no way can that itself be considered a triumph of leadership. However, it might be considered a triumph of rationality and a triumph of good judgment or a holding back of attempted leadership toward a future that would be at best of questionable and certainly of undemonstrated real value. I would like to suggest that no convincing case has been made for mounting a program of deep space piloted missions. It is not for lack of trying; it is just that a convincing case has not been made despite reams of reports and opinions that have been published over a four-decade period of time. I am mindful of the downside and hazard of seen to oppose human piloted missions in deep space, especially living in Houston — but not just in Houston, anywhere among the believers.

In fact, I am not opposed per se to deep space piloted missions. In a vacuum, I think they are fine. I can almost hear you all say of course in a vacuum, where else would you do space missions. But I didn't mean in a physical vacuum, I meant in a conceptual vacuum. Leaving all other issues aside, including money, competing programs and other priorities, etc., every kind of exploration is a good thing. Who can oppose deep space piloted exploration going everywhere?

After all, it is not hazardous to your health. It may be hazardous to the health of the astronauts, not hazardous to the health of the people who pay for it. Every kind of exploration is in principle a good thing, but we actually don't have the luxury of leaving everything else aside. It seems likely that NASA is already getting about as much of the national resource as it is likely to get on any time-horizon worth planning for. I certainly do not expect the NASA budget or any other budget of somewhat connected agencies to expand substantially in the foreseeable future. In one element of the country, unanimity in the plethora of handling reports of our nation's stalled future in manned space is the assertion — the clear asserted opinion, which I think is justifiable and defensible and almost inescapable — that the budgets are insufficient for the aspirations that have been articulated even if they have not been adopted as national goals. Continuing to plan and to continue to expand for eventualities that will not come to pass is not a recipe for a rational program; it is not a recipe for success in any endeavor.

Let me conclude with these remarks by saying I don't believe that the absence of an expanding human presence in space is the reason the NASA program or the space program at large of the United States is lost. I think it is because we continue to try to recapture the singular excitement of the 1960s during a different time when we are confronting different conditions and to again capture the excitement of doing for the first time that which you can only do for the first time once. My own view is the real loss in space is three fold. The first [loss] is our failure to capitalize fully on the burgeoning capacities of robotics of the nation — remote manipulation, artificial intelligence — to assert our presence in space in a manner that is fitting to the 21st century and at a level that is fitting to the world's leading social and technological power house. Second, there are continuing and failing attempts to plan for alternatives that are neither realistic nor would be especially rewarding were they to come to pass is a valuable and fruitful activity. In particular, I mean the continued planning for deep space human piloted missions and colonization. Our inability to accommodate our own launch capability to near-earth space, in my view, is another serious problem.

Despite my skepticism about the value and reward that awaits us from piloted missions to deep space, I think a good case can be made for the development of an expanding operational capability in near-earth space with human beings. The inability to launch our own people is a

problem; however, it is not clear to me that there is any deficit if that capability is developed by the private sector. I think, in fact, that would be a step forward. I think I'll conclude my remarks there and hope for some further discussion later.

George Abbey: Thank you, Gene. Our next speaker is Neal Lane. Neal is a senior fellow here at the Baker Institute for science and technology. He served as the science and technology advisor to the president — President Clinton — and headed up the Office for Science and Technology Policy in the White House at that time, 1998 to 2001. Prior to that time, he was head of the National Science Foundation and a member of the National Science Board. There are a lot of other accolades within his biography, but I won't go into all of those, but turn it over to you Neal.

Neal Lane: Thank you very much, George. It is certainly an honor to join this panel. In fact, I am a little overwhelmed. Everybody else at the table knows a lot about space. I thought what I would do is reflect just a little bit on what connection I have had with space policy and say a little bit maybe about policymaking in this country and what I think some of the problems were.

1998 to 2001 — when I was in the White House — was really a very interesting time for space. [The] space station was being put together. I had the opportunity to meet interesting people. The Apollo 11 crew came in, and I had [the] chance to host them for their visit with the president for their 30th anniversary. John Glenn came in prior to his launch on the shuttle. I had a chance to help work with NASA to help get all the White House people, simply everybody, bailed out of Washington to go down to see the launch, so it was a lot of fun. I had lunch with John Glenn at Johnson Space Center. He treated me to an astronaut lunch and told me all about the secrets of shrimp cocktail and so forth. It was a wonderful experience. There were a lot of fun things. I suited up in the orange suits with Dan Goldin with the diaper. I missed a great photo opportunity, actually, there, but it's too late to recover that. [I] even landed the shuttle simulator almost successfully. I wasn't asked to do that again. It was an exciting time.

Physically, the space station was being put together, including the first control module all the way to the delivery of the first resident crew, which happened before I left the White House. I have to say I was in awe of the space station, and I still am. Especially building it in orbit as the

kind of international partnership that it really is. I really don't believe the American people have any idea of what an incredible technological and diplomatic achievement it really was and is. And I think that is a problem for us. All was not rosy. That was when we had problems with the Climate Orbiter and the Polar Lander; however, many of the other robotic Mars missions were and have been just quite extraordinary. The Congress — controlled by Republicans in those years — this is a political statement John and Gene — in a fit of paranoia about China, slapped the space technology with the ITAR regulations, which was a huge policy mistake in my view, which I think has cost us dearly. Finally, the Obama administration, working with Congress, has moved to correct that situation. We will see how that goes.

Since returning to Rice, I have had the great good fortune to work with George Abbey. He has been my mentor on space issues, helped me to get ready for testimony, get ready for hearings, and we have published a couple of papers together. I am very grateful to George for that collaboration.

I want to share with you a few of my impressions about Washington and the White House that I hope are relevant here. I am going to try to keep my language clean here. Anyone who works for any length of time in that town — and we have expertise at the table here — comes away with a lot of lessons learned, and sometimes they learn them the hard way. We all have scars and bruises. Most of my experience in Washington is positive, including experience about the space program.

President Clinton was excited about science, technology, the space issues. Vice President Gore even more excited, I would say. Many in Congress, on both sides of the aisle, were interested in space matters; they were fascinated by new discoveries and were proud of the achievements of the country and NASA in particular. The president liked to hear about scientific discoveries in our reports and the White House staff did as well. Chris Bundy in the appropriations staff had a different job. There was a lot of whining about the cost of everything. The cost of shuttle operations, the over-runs and the cost of the space station, a lot of grouching in Congress about the Russians' key role — that President Clinton was responsible for — and the usual complaints about the NASA culture, about lobbying by NASA centers and so forth. I also heard many

complaints from the community: Why doesn't the president take a stronger, positive position with regard to the space program? Why is this not higher priority on his agenda? Well, I think you could argue — we have experts at this table — that no president except Kennedy has really placed the space program high enough on the list of priorities to be sustainable. And Kennedy, of course, was driven by the Cold War interests in the space race with the Soviet Union and Gagarin's flight, as John has already said, not by extraordinary public pressure to put men on the moon.

Presidential priorities, as we all know, are often dictated by happenings in the rest of the world, things like national security, energy, oil, oil-gas wars, economic recessions and so forth. What you quickly learn in the White House is the president doesn't get to do most of what he wants to do. There are always pressures on the budget and usually against what the president is trying to do. The political opposition will try to derail anything the president wants to do. And I would say we are off-scale in the current situation. Crises happen; I don't know what they will be or when they will occur, but they sometimes have to be top on the president's agenda and the nation's agenda. And every policy consideration has a political, even a partisan, side to it, including space policy. So, there is a lot of give and take. I still hold out the hope that someday our space program will excite the public to the degree that presidents and members of Congress will place it higher on the list of priorities. But it hasn't happened yet. And it can't happen, in my view, very quickly. That is one reason that discussions — like this one today — are sometimes important, and I hope will go on all across the country.

Now, the Space Foundation issued a report recently called "Pioneering" — a shorthand that's been referred to in writings and conversations — that addressed four myths. I will use those four myths, because I hear them all the time, just to make comments. First myth: An ambitious space program is too expensive. Well, yes and no. At the peak of Apollo, the NASA budget was 4 percent of discretionary federal spending, and today it's under .5 percent. On the other hand, in terms of constant dollars, it is only maybe a factor of two or three, or between two and three, below what it is right now. So, if you double the NASA budget, you really could make an extraordinary investment in space science and exploration and all the other responsibilities that NASA has. Is that out of the question? Well, NIH got a budget doubling between 1999 and 2003

so there is precedent, and, of course, NIH hasn't done so well since the doubling. So when there tends to be these bumps they tend to come down again, and that is hard to manage and usually creates all kind of crises. So, [we] have to be careful what we wish for on the doubling front. Myth number two: Space activities don't have enough support from the public. Well, I would say again, yes and no. Space polls quite well with the general public — depending on what question you ask — but like a lot of things, poll numbers don't automatically translate into budget because they don't automatically translate into who gets elected and who doesn't and for other reasons. Myth three: Presidential leadership is needed to drive space activities. Well, yes and no. When it comes to budgets, Congress takes the lead from the president, even if the opposing party says that budget is dead on arrival. Past presidents have put forward bold visions for space programs, but the funding really did not arrive. Myth four: greater congressional support can drive space activities — which is another be careful what you wish for. It is true [that] without substantial bipartisan support in both House and Senate major budgeting issues are not likely to happen, but Congress is really not the right place to develop strategic plans. Planning needs to come from NASA and the space community and have the president's strong support. In the past, planning has usually not worked very well. I am thinking of a new approach to planning that includes a much wider community of stakeholders than has been the tradition — kind of one of my bottom lines this evening.

I close with two senses about the future of the space program — maybe it's one sense even, my level of expertise in this area. One of three quick points: First, the goals of the 1958 National Aeronautics and Space Act are, I believe, still valid, even though the political climate has changed. I believe that NASA should continue with a balanced program focused on science, aeronautics, space technology, human space travel — assuming we are going to have humans in space — cooperation with other agencies and international cooperation. Trying to offload any of these to some other part of government, I think, would be a big mistake for the country and for the agency. Second point: as a recent NRC report — several reports, actually — makes clear, the current plans for NASA really are inconsistent with the budgets, and that has already been spoken to. The 2012 NRC report offers several options, none of which I find particularly attractive, except the one about the growing of the budget. The report also recommends that the administration really needs to take the lead in forging a new consensus — a new national

consensus on NASA's future — that is stated in terms with clear defined strategies, strategic goals and objectives. Well, if only this were possible. In today's political climate, as John has already commented, forming a consensus on almost anything is extremely difficult. One still has to try. One thing does seem clear to me: any effort to form a consensus must include an unprecedented outreach to inform and involve the American public. The American public is not well informed, and they are not involved and certainly don't feel involved. Finally, the third of my list of three: given the space capabilities of other countries and regions, it makes little sense for the U.S. to try and go it alone in human space flight for space-based science. We went through a period where that clearly was the posture of the United States.

Our traditional partners are key to future peaceful cooperation in space, in science and exploration. We have a very good working relationship with our space station partners, but we need to expand that partnership to include such countries as China, India, Brazil and perhaps other countries. China, for example, is spending an enormous amount of money, in my view, still fairly early on its development curve. It is going to continue to make investments, substantial investments, in infrastructure and science and technology and other things the country needs, space likely to be a very big part of that. If we ignore China's growing space capabilities and somehow fail to take advantage of the opportunity provided by that, I think we make a big strategic mistake. Sadly, we have partisan politics in the way, and ITAR is still a barrier to China.

So, I'll close with the obvious point: our present Cold War system of policymaking — on pretty much all science and technology matters, so I'll limit it to that, including space — is simply not working very well. It was designed a long time ago. A lot has changed in our country, a lot has changed in the world, [so] it doesn't work very well. I think it is time to start a serious adult conversation and get some new ideas on the table, not just new policy. We have lots of reports of lots of good policy recommendations. I am talking about the system that we use to set policy. Now does Neal want to reorganize government? Why, sure, that's great. I mean, reorganizing government is just a lot of fun, and we all have engaged in such discussions. But I am not going to live long enough to reorganize government. The other point about reorganizing government is that it really takes a crisis to get that done, and the outcome is often not as good as what you had to start out with, so it is a really risky venture. No, I think what we really need to do is to find a

way to form a closer, better working relationship between the federal government and the private sector — not just the space-interested private sector, but more broadly — and in the case of science, the universities around the country — to have a serious, long-term look at policy, including space policy and many others, if we are going to make any progress. I have been giving some thought to such ideas. They are a little bit crazy, and people are going to have better ideas than the ones I've got. If you have good ideas along those lines, please get in touch, because I'd love to hear them. Because I think the way we are going right now hasn't been working well for a very long time. We need a new direction, and I think we need a new approach. Thank you very much.

George Abbey: Thank you very much, Neal. Our next speaker is Joan Johnson-Freese who is a professor of national security affairs at the Naval War College in Newport, Rhode Island. She is also on the faculty of Asian Pacific Center for Security Studies of the Naval War College and was also director of the University of Central Florida's Center for Space Policy and Law. I'll turn it over to you, Joan.

Joan Johnson—Freese: Thank you. It is a pleasure to be here this evening on this esteemed panel and being asked to think about this topic. It gave me the opportunity to rewrite these two cards six or seven times to think of a way how I wouldn't be "Debbie Downer," and I was not very successful. And I probably won't use them anyway, because, being fourth, a lot of what was on here has been said, so I'll try not to repeat myself too much. I also should mention, as Mr. Abbey said, I am with the Naval War College, but I am speaking tonight — since I tend to be a little opinionated sometimes, I need to point out — speaking for myself as an academic, and certainly not for the Defense Department, the Department of the Navy or the U.S. government.

Like John, I was a little stuck on the word definitive, the need for a definitive space policy. Do we need a definitive space policy? Yes, what does that mean? I am not sure, because, of course, there are multiple space communities. There is NASA, there is the military, there is intel, there is commercial. At one point in 2009, I was on the National Academy of Science Space Studies Board Committee that looked at the comprehensive space policy. We did a report called "America's Future in Space Aligned with Civil Program with a National Need," which I think

points out [that] part of the problem of looking at NASA and looking at the civil space program alone really runs into problems of ITAR and China and issues that go beyond the civil space program. But at the heart of all this, I think the problem is politics. Politics is the art of the possible. I am a political scientist so I can say this. From my perspective — again as an instructor at the Naval War College — our students in my department study three things: strategy — specifically strategic mismatches — organizational behavior and leadership. And we use NASA as case studies on all three.

I would agree that there have been repeated strategic mismatches as characterized by goals [that] are not supported by resources or rational timetables. I think the previous administration's — the plan to go to the moon was a great vision. But only poets plan strategy without a budget, and I think that's exactly what it was. And I think the Obama administration, quite frankly, was right to pull the plug on the life support system that was not adequately funded to meet the goal. I also believe it is time for this transition, and transitions are always very difficult. And I have been a supporter of, yes, it is time to transition low Earth orbit to the private sector and let NASA concentrate on other destinations. But I don't think the Obama administration really wanted to set a destination. I think they were trying to get rid of legacy systems, get rid of the whole idea of destinations and build new technology, but [there was a] public outcry of "we need a goal, we need a goal." Suddenly an asteroid appears, and I was a supporter of that as well, but it has been three years now. And I would suggest if that is, in fact, a goal that they are serious about, there ought to be first steps taken, there ought to be some telescopes being built to identify, I don't know, which particular asteroid or asteroids, and you would see multiple destinations. And it doesn't seem to be done. If I am wrong, I hope you will all tell me. But other than pockets of people doing view graphs and PowerPoints, I am not sure there is actually much being done or as much as could have been done in three years, so there is strategic mismatch.

I would also argue, as others have, Washington is littered with policies and studies. We don't need any more studies. We have got more policies than we know what to do with. But organizational behavior being what it is, I think if you were to ask ...well with this recent National Research Council study that was done that said there is no consensus, apparently when it was briefed to the White House, they listened very politely and said yep, we're going to an

asteroid. OK, ask Congress. Well, you'll get a different answer in the House than the Senate. Everybody in their own little stovepipe has a different opinion of what the consensus is, and that is not a consensus.

Part of organizational behavior, too, is to move something forward, you need a crisis. Now what can be the crisis? China. China is the crisis. China is doing all kinds of things in space. It has an ambitious and aggressive space program. Yes, it does. What China has that we don't is political will. They don't have super technology, it is actually quite Spartan. I am over there quite a bit, and they are moving forward, and they will continue to move forward. But it is very difficult in a democracy to garner the kind of political will that is needed to push manned space flight — human space flight — forward. Polls will show there is support for space exploration. As was already said, it is the question that matters. If the follow-up question to the same group of 100 people is which would you prioritize for government spending: education, health, job training, defense or space exploration, it drops right to the bottom. It does come in ahead of foreign aid, but it doesn't come in ahead of any [of] those things that, in fact, are short term needs. And I would suggest, as well, outside of pockets like Houston and around Kennedy Space Center and parts of California, it is not a voter priority. The American people for the most part get what they want. If they really wanted an aggressive, ambitious space program, they would be clamoring on the doors of their politicians to get it together and do something. But that is not the case. And I don't think it is a matter of education. I think it is a matter of, again, rational policymaking. That what they want when you are hanging on the edge of the fiscal cliff doesn't necessarily translate into more money for space exploration. There have been attempts to gin up a crisis with, again, China.

When I am in China ... I was in China last year giving a series of lectures at their law schools — and just a little side note, we have 200 accredited law schools, and they have over 2,000. That is the good news for us, that is good news for us. I wrote an editorial on that, and that was good news — and I would try to talk to them about the need to be responsible space partners. And I had this speech, you might expect, all worked up, and when it came time to Q-and-A, the first question, inevitably, was could you please explain the American political system to us and how it is that the president can say he wants more space cooperation, potentially including China, but

yet NASA is banned from talking — even talking — to China about bilateral cooperation. Well, here we are, and we don't understand it, so imagine it is very difficult for them as well.

So, is there a crisis? We are not racing China. China and India, I would argue, are not in a race. But the important part of that, as Mr. Abbey said, is the perception of leadership. Leadership — the connotation of leadership of space — is regarding the future. But leaders go into the future. And if leaders do this feeding, that leadership to other countries, it will have larger geo-strategic implications. Which is where I think we have the biggest opportunity to really push forward with the need for a consensus. And I think that consensus is going to have to go beyond NASA, it is going to have to go outside of regular kind of chains of operation and modes of operation to include all the space community and make it a part of, again, a geo-strategic leadership effort. We are not going to sell it based on excitement alone. There will have to be a need. And frankly, I don't think it is going to happen in the near future, again, with economics and the fiscal cliff looming in the future.

One of the options for policymaking is called “muddling through,” and that's where we are, and I think that is where we are going to stay. I am usually pretty down on Congress because the partisan ... the nature of partisan politics there, where partisanship will trump rationality any day of the week. But in this case, I think the only fault is the White House. If in fact, an asteroid, in some way, shape or form, is the goal for NASA, then I think it is up to the White House to budget for it and push it forward. Congress is not the place [where] policymaking should be done, and if this [is] what the White House wants, I think it is up to them to do it. I am not terribly optimistic in that regard however, because I think, again, other priorities are looming. I'll stop right there.

George Abbey: Thank you, Joan. Joan has written, I might add, two excellent books that I would recommend your reading, “Heavenly Ambitions: America's Quest to Dominate Space” and “Space as a Strategic Asset.” And both of them are very well done.

Our next speaker is Leroy Chiao. Leroy is known to many of you. He is an astronaut that has flown on the space shuttle three times. He has flown on the Soyuz spacecraft — both launched

and landed on the Soyuz — and on that flight, he went up to the International Space Station and stayed there over six months and served as commander of the space station. He's left NASA and is very much involved in the space program even though he's not with NASA today. In 2009, he served on the White House appointed committee to review human space flight plans — the committee that was chaired by Norm Augustine. Let me turn it over to you, Leroy.

Leroy Chiao: Thank you, George. It is a pleasure for me to be here and also an honor to be included in this panel. Well, how did we get here? As George just mentioned, in 2009 I was a member of the Review of U.S. Human Space Flight Plans Committee that became known as the Augustine Committee after Norm Augustine, our chairman. And we were charged with the then-new administration to come up with options, paths to form the basis of a new space policy. When we issued our report — if you took a look at our report — the very first sentences very clearly say something along the lines [of] the U.S. human space flight program is on an unsustainable trajectory, and that is because the programs have been inadequately funded and we are biting off more than we can chew and getting farther and farther behind. So, when we went to brief the White House on this and the new administration, it was made very clear, if you read our report, it says new administration you need to add \$3 billion a year to the NASA budget if you want to do beyond low Earth orbit exploration. If you don't, that's fine. Keep the budget flat and simply robustly — continue to robustly — support the space station and continue to fly the space shuttle. And the message felt was that the administration ... Please don't do in-betweens, where you want to do everything, but you only fund part of it. And, unfortunately, that was what happened. One and a half billion dollars was added to the NASA budget, and they wanted to do everything. So, there we are.

Actually, I am worried about leadership; that is my biggest concern. How does the United States maintain the leadership position in human space flight? Since we retired the shuttle about a year and a half ago, we can certainly make a case that we have at least symbolically conceded the leadership position in human space flight, because we can't launch our own astronauts into low Earth orbit. It's true we are continuing to build the Orion spacecraft. Given, you can say what you want about that, but the fact is that the first planned crewed mission of Orion is not until 2021, and that's dependent upon development, flight, test and certification of the space launch

booster. So, historically, I am not sure I would be betting on 2021. Now, one of the most exciting and controversial parts of the new space policy is the stimulation of some commercial companies to get them going to see if they might be able take over the taxi service between the surface of the Earth into low Earth orbit. And, of course, we have seen some very great strides in that, some impressive strides, in fact, from three companies now that are receiving new NASA assistance in developing those capabilities. I am getting more confident that one or more of these efforts will be successful. However, the initial operational capability of any of those folks is at least several years away. So, that still continues to leave a gap.

Today, only two entities are able to launch astronauts into space: Russia, of course, and the United States. [The] International Space Station is one bright spot in our space program. It continues to be operated robustly. But you can only get there flying with the Russians, as I did back several years ago. One of the findings — one of the key findings that our committee came up with on International Space Station — is that one of the big successes was this international framework; that we were actually able to cooperate with all these different nations and create this absolute engineering marvel, something that was so audacious that even those of us in the Astronaut Office and the business were surprised how smoothly the construction sequence went. We were sure there would be one or two pretty major glitches that we would have to do some major work around. Certainly, there were glitches, but nothing on the magnitude that we'd feared back in the early days.

International cooperation, I think, is the key to maintaining U.S. leadership in the future. We are the lead nation in the International Space Station, even though we can't send our own astronauts up there right now. But this international framework should be expanded, I agree, that it should be expanded to include countries like China. We can have a debate on the merits of that, but the bottom line is [that] they will be a very different partner than Russia. Russia has been a superb partner. They supported us after the *Columbia* accident and enabled us to continue flying to ISS, such as my crew. We supported Russia in the days when they were about to lose station Mir. Without the shuttle they would have lost it many years earlier, and the capabilities of the shuttle allowed them to keep it. China will be a very different partner because it does have technology. Now, I am going to differ a little bit with you Joan. I have been over there several times. I think

their technology is pretty good. What they lack is operational experience. They've only flown, you know, a handful of missions and some very basic things that they haven't figured out yet. But they would be a fine partner because they can help pay for everything, you know, unlike some of our other partners.

But that's my main point here tonight, is that for the United States to maintain a leadership position in human space flight — which, I agree with Joan, is critical for not only the space program, but for the country as a whole — I think that's where we need to focus our efforts and get over the xenophobia and allow it to happen and take the lead position in making it happen. Thank you.

George Abbey: Well, thank you. Our next speaker is another individual who has also worked in the White House, who was executive secretary of the [National] Space Council under President George H.W. Bush. And I think he has been actively involved in the space business since that time. Let me turn it over to you, Mark.

Mark Albrecht: Thanks, George. And it is a real pleasure to be here with this distinguished group of people and talk about something that most of the people in the audience certainly care a great deal about. First off, I am going to resist the temptation to respond to some of the things that have been said, even though I am dearly and sorely tempted. Second — and since I am the last speaker before you can get at your questions and we can start hashing over what's said — I'll try to be brief. I will confess right up front that I am a combat veteran of definitive space policy, and I am also a combat veteran of partisan politics. And despite the bad name it has, I kind of like partisan politics, and I think it has a very positive role to play in where we need to go. I think of George's charge for a definitive space policy as comprehensive. So, my remarks will be really looking at the United States space policy, not as a NASA policy or a civil space policy or a human space flight policy, but a United States space policy.

And the first thing I would like to do, with that in mind, is to do a quick review of what I think the current situation is. First, I think we have a weak national policy in that regard. And what I mean "weak" is not muscularly; there are certainly some very muscular parts of current U.S.

space policy, but it has no strong center, it really has no overarching theme, it has no central plan, it is really largely a guidance document rather than a definitive plan with implementation direction and processes. Each department and agency is told what the government would like them to do and expects them to do and lays it out by way of a strategic guidance but doesn't have a central theme or core. The independent national security and civil space programs are left really pretty much to implement that policy on their own. [The Office of Management and Budget] is the integrator, if at all. There have been some efforts over time to change that, but today, current situation, OMB is the integrator of this national space policy, if at all. They do pretty much annual reviews, at best. They do detailed reviews and adjudicate requests as they come in. But most of the resource cycle currently is dominated by congressional committees, which are very, very interested in the activities of the department and agencies through hearings, through specific direction to member interests. They are much more tightly coupled with the department and agencies, as it relates to space, than is the executive branch in the White House. That is just the way it is today.

We have little or no international policy. There is still the authoritative language in policy about [how] international cooperation is good and should be supported, and we should use our allies and partners to the maximum extent possible. But there is no centralized theme to it, there is no notion of national objectives of international cooperation in human space. And it is the current vestige of the program we have.

We have an uncoordinated, unfocused — yet, growing — commercial space infrastructure. To me, this is probably the most disappointing. You have department and agencies that are feeling their way, attempting to feel their way, on how to integrate a growing commercial interest and commercial sector in space. And it is epithetic, one department handles it one way, another department handles it another way, some with programs, some with permissive or nonpermissive implementing rules and regulations. So, it is again something that is happening. It is big; it is potentially amenable to central policy management or organization, structure and guidance. But it is not currently done.

So, what are the results of the current national space policy in my opinion? Let's talk about [the Department of Defense]. We spend about \$20 billion a year. And, quite frankly, we are back to what most of us in this room would recognize is the Milstar era of very, very large, expensive satellite programs in DOD that are launched on very large and expensive launch vehicles rather infrequently. It is a vicious circle and a very viscous cycle that we've been through before in the '90s, where you have ever-bigger platforms, because it is more and more expensive to launch them. And therefore the risk[s] associated with any individual launch are so high, you try to make sure that the platform has everything on it. That, of course, justifies making launch costs more and more expensive because the payloads are bigger and more costly and of themselves, and the risk of loss is higher and higher.

Currently, DOD is scrambling, as everybody has talked about the budget austerity, which is certainly going to happen. And I think it is going to be even stronger than people recognize. And DOD is scrambling with contract cycles like a disaggregation to adjust to the funding reality, i.e., let's make smaller platforms, let's not put all our eggs in one or two large baskets — expensive baskets — and we will achieve survivability, some military objectives through disaggregation. The problem is you are halfway through a cycle of large buys for large satellites, and multi-year procurement is the kind the current administration plans to try to maintain costs with, [with] very little room, therefore, to start creating new disaggregated smaller programs.

I won't spend a lot of time on NASA spending about \$18 billion. We all know what is going, and everybody has talked here about it. I will just simply say that the infrastructure of NASA is beginning to crumble, in my opinion. I think you see that at Kennedy and Johnson, as flagships, and I think to a lesser extent, the smaller centers. I am sure you see it on a local level, but those are the most obvious. The centrifugal organizational forces that drive duplication and cannibalism and diffusion of effort are really at an accelerating pace. Again, it comes back to the fact [that] the administration is not as focused on it, and the congressional committees are very focused on it.

[The National Oceanic and Atmospheric Administration]: \$2 billion a year. I would say the weather program's in deep problems. NPOESS, [the] National Polar Operational Environmental

Satellite System, is just sort of a tipping function, but there are innumerable problems with the weather program. And the commercial business for space in the United States, I would say, is a little less than \$2 billion a year. We currently have less than 50 percent of the market share and less than 40 percent in launch. And with the MDA purchase of Space Systems/Loral, that total market share, depending on whether you count Space Systems/Loral as an American company or as a Canadian company, could tip even further down.

So, what's the argument for creating a comprehensive national space policy — one that integrates all the parts of the United States space program? Well, the first one, the obvious one, is efficiency. Simply managing like activities as a whole or at least in league with one another can save money, unlock resources for other activities, cause collateral efficiencies by being forced to operate in close proximity — in some cases jointly — obviously low hanging fruit-like launch. The United States' current launch policy is, in my opinion, an embarrassment. We have at least three different launch programs, and all of them are becoming more expensive and becoming much more limited.

Another reason is synergy. If you actually have the departments and agencies working collaboratively on national objectives, whatever that objective may be, you will get, in fact, new ideas, new technology and new perspectives to problems that are not part of the parochial core. Today, things are done in stovepipes; NASA has its programs, [the Defense Advanced Research Projects Agency] has its programs, Air Force has its programs, [the National Reconnaissance Office] has its programs, and there is precious little synergy between those programs in terms of technology. Yes, there are a lot of conferences; yes, there are a lot of meetings where ideas are exchanged, but it is not really collaborative research that I think could result in a much more aggressive program on all fronts.

But, really, the largest reason and the most significant reason and one that we have seen in the past is that it's part of a larger national strategy — but what one? The United States, as we have heard here, has had a policy, largely out of the Cold War, that said preeminence in space, leadership in space, is good for the United States in our efforts to win a war with the Soviet Union and alternative economic constructs. I am a veteran of trying to figure out how you can

morph that strategy after the Cold War to create a positive role for United States leadership; leadership being first — preeminent, dominating, dominating space militarily — being preeminent space explorers.

But right now, we don't have a national strategy, I'll argue. Just as recently as last Sunday, in the Washington Post Ann Marie Slaughter, who was part of the current administration's State Department, Princeton, head of the Woodrow Wilson School, suggested that the Obama administration consider three alternative new global strategies. I think it is remarkable that a person that senior in this administration's State Department would write an alternate op-ed saying that we don't have a broad U.S. national strategy. And she suggested three that had been done by various think tanks. But I will just read the titles to you to give you a flavor and ask yourself how does the way we think about space — we being the space people — in terms of dominance, preeminent leadership, fit into the context of U.S. national goals and strategies that would run under the banner of things like “Strategy for a Post-exceptionalist Era” — these are literally the titles of them — and “Strategy for a Post-Western World,” and, finally, “A Strategy for a Sustainable Planet.” Again, she argued that these three studies — and they are comprehensive, they are coherent and comprehensive alternative U.S. national strategies that she would argue, even a week ago in the Washington Post — are viable alternatives. I am not going to talk about the merits of them. But we as space people have to think about how would an aggressive, comprehensive, definitive national space policy for the United States fit under the banner of those kinds of U.S. national strategies. I think it is something to think about, because, to my mind, none of them fit in very well.

Again, I agree with all the other participants, I think we have the space program today that is the result of all the forces on it. It is like physics; it is a result of the forces that have been applied on it. The only way, in my opinion, that you could change that is to have an overriding national policy for the United States for which a different kind of space policy would fit in, as had in the past with the Cold War strategy. So, I have a variety of suggestions of what we want to do if we ever came to that point. But I would be very interested in hearing others' comments about that, because I think the United States space policy for the last 50 years has really been driven as components of a larger U.S. national strategy, and I think one of the reasons of why we are

where we are today, with a program as profuse as it is, is because it no longer fits with a broad U.S. national strategy. So, with that, I'll turn it back to you, George.

George Abbey: Thank you, Mark.

If you have questions, please pass them over to the people collecting them.

I am going to give each of the panelists an opportunity, starting with John, to comment on the other comments that were made by the other panelists, John.

John Logsdon: Several of my colleagues have talked about return consensus. And I wonder whether you're speaking of a consensus on [if] what we should do in space is really, first of all, achievable, and second of all, necessary. Again, I think some history is good. The second NASA administrator, James Webb, didn't want to take on the Apollo assignment unless there was a consensus that it was the right thing to do. What did he mean by consensus? He meant agreement among the political leadership, and particularly congressional leadership, that the program would be sustained, would be supported. He didn't care about the public opinion or broad elite opinion — maybe elite opinion, but certainly not the public opinion. And he resisted putting forth any post-Apollo program because of a lack of that political consensus. And I think that's the operational definition of consensus that is relevant to today's discussion. Not some broad sweep of public opinion, I guess, [but] the idea of if they only understood the value of space — they being the unwashed public — they would support the program, is a non-starter in my thinking. And this comes from all the years I have spent inside the beltway. There is a consensus among the politically relevant people in this country that space should be part of our strategic portfolio that, I think, is missing, and I think those of us in the community have to do some introspection on why it is missing.

Gene Levy: I am kind of at a loss for words. And I don't mean that in any kind of critical way. It has been unclear to me for many years that we have the capacity to render space an element of national, international policy. And I speak in that as someone who participated in many activities a long time ago, early in my career, in a sense, attempting to help render the new NASA program.

There is an element of national, domestic and foreign policy in the way it was during the 1960s, as articulated by President Kennedy. I think that has eluded us. In a sense, I think that the drive to crystallize a single or coherent national policy toward space — that I think has been reflected in some of the comments this evening — that is, is that achievable and [it] may not even be productive. We live in a society, part of a country and a world, that has diverse needs, diverse imperatives, diverse motivation, and I would, frankly, be satisfied — again, having spent too many mental cycles many, many years ago, I think — thinking about a coherent national space policy. I would be happy with coherent parts of a space policy I think we could achieve. Frankly, if we could get one coherent part, that would be a big step forward in my view.

Neal Lane: You weren't at a loss for words, it turns out. I appreciated what you had to say. I think I'll talk a little bit about the public issue, an unformed public and an unengaged public. I am still a little idealistic about a democracy. Somehow, when we can, we owe to as many people as possible to let them know what actually is going on and give them a chance to say something about it. But the realities are that there are key communities and segments that are going to help change our space policy in a more positive direction, as John has said. I guess I would argue that that community be larger than maybe it has traditionally been and initiate a conversation about what I mean, larger in which dimension and which direction. But politics, in the end, is going to decide this, and pressures are going to have to come from people whose interests are served by a change in policy. But another thing I would say — and maybe I'd ask Mark — or suggest [is] that depending on what our objectives are in space maybe the way dominance would apply in some areas and maybe cooperation or collaboration would apply better in others. And sorting that out, I understand, is not easy. But we have been doing that with other countries and other domains for a very long time. And companies do that; they cooperate when it's in their best interests, and they compete like crazy when it isn't. So, it seems to me that is sorted out. Maybe in the public understanding of this, it could be quite confusing as to whether the U.S. is going to go it alone or is the U.S. going to be dominant or preeminent in everything it does in space. Then people start to wonder why you are actually cooperating on the space station and other places. So, somehow sorting that out in our discussions with the public, I think, would be an important thing to do.

Gene Levy: I would just like to make a little comment. There is a lesson, I think, to be learned from evolution, evolution of biological organisms. And that is you cooperate to be dominant. There is a tool for dominance.

Neal Lane: A lot of people don't believe in evolution.

John Logsdon: We are in Texas.

Gene Levy: Fortunately, none of them are here.

Neal Lane: Sorry.

Joan Johnson-Freese: I guess I am going to start by picking up on Mark's reference to Ann Marie Slaughter's op-ed, as well. Ann Marie Slaughter is a well-known liberal internationalist. And as I am a political scientist, I teach political theory, and I teach the difference between liberal and nationalists and realists to undergraduates. I say how many of you watch Deanna Sloan and everybody. That's realist politics, I win, you lose. They understand if you're now the enemy, I'll stab anyone in the back.

Space politics, Cold War politics, unfortunately, has been very realist. It's been modeled on words like dominance. One of the books I wrote talked about America's quest to dominate space. And I think there has now been recognition that it is technically impossible to dominate space. That it just doesn't work. And, therefore, Ann Marie Slaughter, I would argue, as a liberal internationalist, and the image I use for that is the federation of planets, everybody gets along, but sometimes you cooperate and sometimes you compete. There is even a word, which I really don't like, but it does serve a purpose, "coopetition," where you sometimes work together and sometimes you compete. So, I think what she is arguing is that there needs to be a recognition that continuing, for example, to just ignore China is not going to be in our best interests. Just to pretend — that if we just ignore what they are doing, it doesn't matter to us — that will not serve the United States well.

And I didn't mean to imply that the Chinese were not advanced. They are coming very quickly up the learning curve. What I was trying to point out was contrary to those who are screaming this is our crisis, China is our crisis, they have not invented unobtainium and left us behind and are going to be doing warp drive off somewhere. There is an opportunity to work with them. It is an opportunity which I think we need to take advantage of. Now, I will also tell you, I get hate mail when I say that. It is unpatriotic. And my argument, too, that if you think China is a competitor, then keep them close so you know what they are doing; if you don't think they are a competitor, then keep them close and let them pay the bills. You know, either way, I don't see the downside of this.

And I guess the last point I would make is one of the words that I think needs to come out for discussion is when we are talking about "comprehensive" — which I do agree we need to be talking comprehensive, I was trying to point that out when I talked about the multiple space communities. There needs to be accountability. Somebody needs to be in charge. Somebody needs to ... You need to be able to turn around and say why isn't this happening. Because right now, there are 100 people who can point their fingers at 100 other people and say it is not my fault, it's their fault. So, I think that needs to come under discussion as well.

Thank you.

Leroy Chiao: I have heard a lot of folks here tonight talk about ... several folks talk about space policy and the need for space policy because it is one of the broader policies of the United States. I agree with that. However, you know I smile, because when I was a pretty new astronaut here — I was pretty young back then and fairly naïve — and to me space was pure. You know, we were in a pure endeavor. It was goodness. We were doing it because it was just good. And how dare the president or the Congress use the space program as a foreign policy tool. And I remember in the early '90s when we started getting involved with the Russians — and I grew up in a Cold War, and I was pretty well brainwashed at that time — and I was thinking why we are doing this. And it became clear, well because we need to find a mechanism to give them money to pay their scientists so they don't go to work for countries like Iran and things like that. And I thought that

was just a pollution of this pure space idea. But of course I was wrong. And it does need to fit in to the broader policies of the United States.

I agree, space to the general public ... I know the general public supports space. But they are arguably not as excited about space as they were during the Apollo days and for many reasons. One of which is because space kind of became routine. You know we were kind of launching several times a year and going to a space station, going into orbit for a few weeks and coming back down. And people kind of got used to that. But I agree that we need to use the policy implications in a broader picture to draw support to the space program, especially within the government. If they see that space policy can help them in foreign policy and other policies, then that becomes a driver of why they should support a robust space policy. As an example I use if you are talking a lot about China — something I feel I have pretty strong opinions on — the 2007 anti-satellite weapon test the Chinese conducted to world wide condemnation — deserved, by the way, they should have been condemned for that. But stop and think for a moment, if we had engaged them as partners in a civil space program as part of our civil space policy, and they [had] been perhaps a member of the International Space Station, would they have really gone ahead and conducted that test? Now, that's an interesting thing to think about. They certainly would have thought twice or three times about it. But, you know, once you are kind of in the same house as everyone else and you start caring more what those people think about you instead of always hearing that all these people are your enemies, so who cares, let's go ahead and show them we are powerful, too. So, I became a big believer in international cooperation for the reason I think it is very good of the planet, of the United States and of the U.S. space policy, the overall policies.

Thank you.

Mark Albrecht: Well, thanks. I would like to pick up on the thread of cooperation, which I think everybody is interested in. I have a slightly different take on it. First off, I don't mean to suggest that the United States always should go alone or, in fact, that has been the policy. It is useful to cooperate for a variety of reasons. But I think if you think about the future — and in particular the idea of China, which I think is an important one and one we ought to talk about —

you have to put it in context of the main cooperation the United States has had in space over time, which has been with the Soviet Union and then Russia. We had a very specific policy objective in doing that. We didn't need their help when we started with Apollo-Soyuz and all that. We did it because we were engaged with a conflict with the Soviet Union. And the conflict was not only material and military, but also was for the hearts and minds or opinions of other countries around the world. The Soviet Union as we now know was very much feeling that they had a prestige problem. And they solved their prestige problem doing what they did best, which was build ballistic missiles, lots of them, and lots of nuclear weapons. Because that was a prestige item that they believed that they could use to influence third countries around the world. The United States had a strategic objective that we would like them to stop building as many rockets, ICBMs and nuclear weapons. And our space cooperation was an implicit offer to them to give them prestige internationally without doing the thing that we found most destabilizing, which is building more missiles and more weapons. It was a strategic objective on the part of the United States; we didn't need their technical cooperation. We did it because we felt that we could offer them something that was in our national interest. The problem with China is, I think, the reason why we are stumbling so hard on whether we should involve the Chinese in international space endeavors, is because we don't know what the strategic objective of the United States is to do so. I don't know what that is. Are they a competitor, are they an adversary, are they a partner? Well, they are all of those things. And the question is, until we sort out, in my personal opinion, until we sort out, what is our strategic objective with regard to China? And I think we are just beginning to sort those out. Then, and only then, can we say how does space cooperation fit into that context of what our larger strategic objectives are with China. And until we get to that point, I think, we are going to have the problem of people who see that relationship in different ways and see the potential of cooperation — or, in fact, of cooperation — as either threatening or supportive to that view about the relationship.

George Abbey: Thank you. We do have some questions.

There is one that perhaps Leroy you might be able to address that raises the issues that would cause a problem relative to human exploration of space: galactic cosmic rays, radiation, radiation

shielding, bone loss and the effect of long duration spaceflight.

Leroy Chaio: Sure, I'd be happy to. Thanks, George.

A lot of people think about what would it take to get to Mars, what it would take to get astronauts to a long duration base over on the moon or something like that. They think about technology, they think about propulsion and navigation and all that. But really, by far the biggest long pole — and most people don't think about this — the biggest long pole technically is how do you keep astronauts healthy in space for long durations, especially away from the Van Allen belt where the radiation environment is much more harsh. That's why it's critical that we have a space station. People think why the space station is kind of boring — all it does is just go around the earth. It is not going anywhere. But guess what? It is on the space station that we are going to do the research to develop countermeasures to enable us to keep people healthy while we send them farther and longer into space. So, of all the issues, the biomedical issues, that is the one key area that we have to solve before we can talk about going to Mars or even an asteroid.

George Abbey: Thank you. Another question, Gene, that talks about sooner or later we will have a habitable planet out there, and why shouldn't we look at developing the technology to get there.

Gene Levy: I think it is fair to say there is no technology on the horizon that is going to get us those distances in any kind of reasonable time scale or with any robust reliability. It is one of those things that I try to convey to my students — when I teach courses appropriate to the subject or pertinent to the subject — is just what the distance scales are. I think that it would be nice to be able to send a device even to the nearest star, which is four and a half light years away. But the planets that are being discovered are at very, very great distances. And I am a technological optimist, but I am not optimistic about that.

George Abbey: Thank you. Here is a question Joan that maybe you can address. With the rising nationalism between China and Japan, could a potential conflict increase America's spending on space and a new cold war?

Joan Johnson-Freese: I can try. There is nothing if successful. Again, using China as the threat, we must do this, the perceptions. I don't think so. It's not the crisis. But I would go to Mark's point about until we figure out if China is a quasi-partner or a competitor. Again, I don't think it is going to come down to one or the other. And I think the danger of not working with China is that everybody else is. We can't be the leader if everybody else is in a group that we're not in. And I am afraid we are going to be standing there with our football, and everybody else is going to be playing a different game. So, I don't think that waiting for a decision of, we are friends, we are not friends, I don't think that is going to happen.

If I could make one other point, about public support. I have to add I was pretty down on public support. I agree with John, we need to convince the political elite. But I will say ever since I taught a course called "space and security," and this is to political scientists, who of course are into political science because they can't do math. So this is to political scientists [that] I teach space and security. What I talk about is ... I talk about things like what is the difference between a rocket and a missile, what happens if you didn't have GPS, what happens when the wrong signal is sent and the cell phones go down, and, oh my gosh, I can't use my ATM card. And inevitably at the end of the course, on course evaluations it says everyone should be made to take this course. This is so important. People don't know this. This must be known. And the other question I ask them, because you can add on questions, are we spending the right amount of money on space or should we be spending more or less. They think it is very important, but no, the budget is fine the way it is.

Gene Levy: I can't stand resisting to comment on that. Years ago, during when whatever budget battles were going on at that time, I used to make a practice of — flying on airplanes, both when I was upgraded and when I was in the aft cabin — of asking the people sitting next to me which they thought was the larger budget, the Defense Department and NASA. And the most common response that I got was that I think they are about the same. It was remarkable, and I actually think it was a just sense that the space program, the NASA program, occupied such a conceptual place in the society and had enough cross section in the attention of people that they just assumed it was really a big budget item. And the reason I make this remark about having been

upgraded: upgraded I would be sitting next to senior executives and corporation and [the] like, and the reactions were the same all the time.

Joan Johnson–Freese: My point is that in class when you tell them this is the budget, this is what is being done, and do you want to do more, [the response is] yes, I really do. Do you want to spend more, [the response is] no.

John Logsdon: Let me try to piggyback a little bit on this and ask others here what they think. Let's say that President Obama had accepted the implicit recommendation of the Augustine Committee — and I know you weren't supposed to make recommendations, but they suggested [that] to have a good program an extra \$3 billion a year would be nice. I would hypothesize that President Obama could have increased the NASA budget by \$3 billion a year without any political opposition, should he have chosen to do so. Does everybody up here agree?

Mark Albrecht: No; been there, done that, got the T-shirt.

John Logsdon: But Mark, the last Bush year — Bush “41” year — you put forward a 10 percent increase in the NASA budget and got through Congress.

Mark Albrecht: You know, John, it is so politicized. There are so many functions that would have to be imbedded in how was it done, what was it about. Then just to say, well, the program is three billion light, I have decided to ante up another three billion, let's just steady as she goes. There would have to be another song to go with that in my mind to get the Congress to say eh, OK, you're three billion light, sure we're in for another three billion. I don't think so. There has to be something else. That's my opinion, so I disagree with that.

Neal Lane: It also has to be in the context of: part of the problem with the budget is a stability issue, so getting one chance and then getting it taken away in a couple years is a disaster waiting to happen.

John Logsdon: But we did manage, during your time, Neal, to double the [National Institutes of Health] budget.

Neal Lane: There was one member of Congress taking it as his highest priority, and had he had NASA in his budget, I think he would have done the same thing. It was John Porter. I talked to him about it — a Republican, a member of Congress — and he just thought it was worth a lot more money because of the importance to the nation; and he felt the same way about science and technology, and so he pushed it. But then, after the doubling, of course, it has been quieted down ever since, and biomedical research is in crisis in the country. It is a lot of money, but they are in a crisis.

Gene Levy: I would also argue that given the aspirations — on the ambitious side of the aspirations that have been articulated — \$3 billion would be a drop in the bucket compared to what the real costs would be. And we would be in the same situation and having the same arguments about the future of NASA today and \$3 billion out.

George Abbey: Mark, here is a question for you. How does Mars One's claim that they can colonize Mars starting in the next decade affect NASA's manned space exploration policy?

Mark Albrecht: Mars One? I don't know what Mars One is. How does Mars One's claim that they can colonize Mars starting in the next decade affect NASA's, well...

John Logsdon: Better. Mars One is a group of zealots.

Mark Albrecht: I've dealt with that as well. Let me tell you, what goes around comes around. I mean ... I tell you what, I must admit I saw with great amusement the Bigelow announcement to send up an inflatable portion adjunct to the space station, and I remember very well the déjà vu days when there were people talking about a cheaper way to do space exploration — dramatically cheaper — exploiting inflatable technologies. And at the time, that was considered aggressive, and it is remarkable. I mean good ideas do hang around, so maybe there are some very, very good ideas in there, [but] I'm not aware of them.

George Abbey: What can those of us here in the public do to promote the need of a definitive use space policy?

Neal Lane: I mean, a lot is the answer. A lot of people in the room are very involved in K12 education one way or another — volunteering, maybe we have teachers in the room — and I think it's pretty clear from what everybody has said that some of these challenges really are long range challenges and nobody is really expecting over the next year or two that we are going to reverse our priorities in terms of space versus other kinds of things. So, I think [that] just one of the things would be [for] those in the room who have ... [For] probably everybody who's enthusiastic about space issues and studies space issues and knows the kind of things that, for example, that Joan talked about, getting enthusiasm in the classrooms [is important because] it goes home to the parents. And the community groups that many people in the room are parts of are often very excited about hearing that they don't always have to have an astronaut. Although, if they can get one, that's clearly the top dollar, but they like to hear about everybody else in their views, about things like science and technology and all areas, but also space. So I think the edge is taking advantage of your relationships with young people [...] to make sure they understand what the situation is — things like how big the budget is and what's come out of the space program, and what opportunities really lie ahead that we have not been able to take advantage of. That would be at least one important thing everyone can do.

John Logsdon: Remember that people in this room work on a day-by-day basis in the space program. I realize that not all of you do, but a goodly number do. And you know that today is the day of remembrance of the crews that were lost in the Apollo I fire and the two shuttle accidents and the others that have suffered fatalities when they went to space. Make sure to the best of your potential and abilities [so] that doesn't happen again. This is a demanding business, a challenging business, but all three of those accidents were management failures, not hardware failures. To the degree that I think is important, success has its rewards. Continued success, I think, is a goal [that] all of you with hands on the program should strive every day for.

George Abbey: That's very true, John, very real.

Mark Albrecht is also the author of another book “Falling Back to Earth: A Personal Account of the Great Space Race and the End of the Cold War.” I would recommend that book to you as well. We have a number of authors up here on the stage.

I appreciate you all coming this evening, and I hope you’ve enjoyed the program and maybe will have an opportunity to talk to the panelists here for a moment after we break up. Thank you all.