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US Space Policy Briefing
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MOD: Welcome everyone. This is Paul Karoff, from the American Academy of Arts and Sciences in Cambridge. Thank you all for joining us today for this media briefing on US space policy. Just a few brief housekeeping items before we begin. The American Academy's role is as a sponsor of public policy research to inform complex and emerging issues facing the nation and the world and we do that by convening leaders from various fields from among the Academy membership and beyond. Today's briefing is an example of that role. We're not, today, making any announcements. Rather, what we're doing is trying to provide a forum for background and for setting context around policy. And by three very distinguished presenters. And we're glad that we also have a group of very distinguished journalists on the line with us. All comments are on the record. I want you also to know that we've had some request for transcripts. We're going to consider doing that, and toward that end we are recording this session. And lastly to tell you that each of the individuals will speak for themselves, not necessarily for the Academy, which is an independent and non-partisan institution. Our mission is to inform public policy but not to advocate for policy. So with that we'll get started and I'm first going to turn it to Martin Malin, who is the project director for the Academy's Reconsidering the Roles of Space project.

MM: We're really fortunate to have three fellows of the Academy to brief us on space policy issues. This is, as I'm sure you know, a pivotal moment for US space policy. John Steinbruner, Neal Lane, and Richard Garwin are with us to offer their exceptionally well-informed perspectives on the decisions facing policy makers and the potential consequences of those decisions. Each has been a part of the Academy's research program on international security issues and is helping to guide the work on our project on the rules of space in particular. The project examines the implications of US policy in space from a variety of perspectives and considers the international rules and principals needed for protecting a long-term balance of commercial, military, and scientific activity

in space. The project is producing a series of papers intended to help foster and inform public discussion on the uses of space and on US plans and policies in space. One paper on the physics of space security came out last month. A second paper, entitled "US Space Policy: Challenges and Opportunities," co-authored by Neal Lane and George Abbey, the latter former longtime head of the Johnson Space Center, will be issued later this month. Others are forthcoming and we'll send them to each of you as they appear. I'll turn things over now to John Steinbruner, Neal Lane, and Dick Garwin, who will each speak briefly in that order before we turn to your questions. You've already received their bios so we won't spend time on introductions. We'll get right into it. John, do you want to begin?

JS: My presentation -- a brief one -- will have to do with the broad policy situation. We have observed, along with much of the attentive international community, a series of US military planning documents dating back to June of 2000 that present a very assertive -- some would say aggressive -- view of space development, whereby we say that we will exploit space for national military advantage and deny similar capability to everyone else, and introduce weapons into space for that purpose. Recent press reports indicate that the White House is about to, or has endorsed that conception.

Needless to say, or not surprisingly at any rate, the rest of the world has sharp objections to that idea. There have been attempts in the United Nations to introduce negotiations that would work out negotiated rules and would basically preclude this idea or put severe constraint on it. The United States has been isolated in promoting its conception and really only three other countries support us in the General Assembly. In the Committee on Disarmament in Geneva, we have vetoed a mandate for such negotiations. Using the consensual rules, we could do that by ourselves.

Meanwhile, as you observe the programs that are being pursued in support of the United States projected conception, although it's apparent that the spending is increasing and there is a projected increase, the details do not seem to match the aspiration. It seems very unlikely that the programs currently being pursued will actually enable us to do what we are saying we are going to do, both for physical and economic reasons. And so that creates a situation in which we appear to be provoking everyone on the basis of a conception that we're unlikely to be able to implement.

With that in mind, we at the Academy are suggesting that the country as a whole needs to have a broader debate about this to consider the balance of interests in space and the options, including options for indeed agreeing to rules that would be as protective to us as most everyone else, and so we're basically trying to encourage that discussion. So much for me. Neal?

NL: I'm Neal Lane, Rice University, and I'm a member of the Academy's Committee on International Security Studies at the Academy. My role in the Rules of Space project has been with my colleague George Abbey at Rice to look into a broader set of issues -- we call them barriers -- that we see to future progress in US space programs. I'm not a space expert by any means. My background includes some time in the White House where I

did have White House responsibilities for much of the space program. It's really based on that experience that I make these comments. So George Abbey and I have, working with the Academy and with the Baker Institute, organized some workshops in which we've brought in people from the space industry and other space experts to talk about a whole range of issues. On the basis of those workshops and other information, we have put together this paper, which as Marty Malin said, will soon come out.

So, the barriers we talk about are four. First, the U.S. satellite manufacturing industry has suffered in recent years, almost to the point of extinction, as a result of U.S. export control policy that requires State Department licenses to sell or share anything having to do with space. The impact is looking very large, and we feel that it's important to call attention to this problem. It affects many other areas of technology and it's not just impacting commerce and industry. It's also impacting research by government scientists and by universities, as well.

The second barrier we point to is one that's much talked about -- a possible shortfall in science and engineering workforce -- but it's exacerbated by the current visa restrictions. The U.S. has been very fortunate over the decades to attract here many of the best and brightest young people from around the world to come and study and work. But in a post 9/11 world, it's harder for them to come and it's much harder for them stay. And they're, at the same time, finding opportunities elsewhere. So, we're likely to pay a very large price for that policy problem.

The third barrier is what I'll simply describe as an unrealistic plan for the future of NASA. The goal that President Bush announced in 2004 is to return humans to the moon by 2020 and do it with rather little additional funding. I was asked by Senator McCain to testify before the Senate Commerce Committee shortly after the announcement, and I told the Committee I thought the plan was bold but it was incomplete. And it was incomplete in at least two ways. First, it assigned science a lower priority than human exploration. And we're beginning to see how that plays out. And it's incomplete because the President offered no commitments for the money that would be required to undertake such an ambitious mission. And the funding trade offs, we're beginning to see in the President's budget. The projections are dismal with the escalating deficits and the reduction in non-discretionary spending down the road. We see cuts as far as we can see.

And, finally, the most serious barrier is the erosion of international cooperation in space. In conversations that George Abbey and I have had with colleagues in other parts of the world, we found -- really we've been stunned by a strongly held view by space people in other nations -- that the U.S. has very little interest in international cooperation in space or most any other technical endeavor. There are at least two reasons for the perception. One, the export controls I talked about earlier, which are seriously hampering all forms of cooperation involving technology, certainly in space. But a more recent confirmation that the U.S. intends to go it alone came from the President Bush announcement of the Mars/Moon Exploration Program, and especially in NASA's comments the same day. They made it very clear this is going to be a U.S.-led endeavor focused on U.S. goals. And as far as we've been able to determine, there really was no consultation with foreign

space partners, Russia in particular. And finally, and perhaps the most serious impediment to future international cooperation in space, is uncertainty and fear about U.S. plans to increase military use of space in ways other nations find threatening. John Steinbruner talked about that and Dick Garwin will talk about it shortly. I believe for all these reasons, the U.S. civilian space program is in real danger of continuing its slide downward, with all the great achievements of the U.S. in space, sadly left behind us. Those are my comments. I look forward to your questions.

MOD: Thank you, Neal. Dick Garwin.

RG: Yes. I'm Dick Garwin. First, I should say I agree with what Neal and John have said. And I should add that other countries are number two or three in space and they are working hard and effectively, just as AirBus is now a real threat to Boeing, by selling good airplanes in the commercial world. I have worked in space for almost 50 years. And folks, if they don't know my web site, ought to look at it -- fas.org/rlg/. About 1/3 of the papers shown there in the 2000s have to do with militarization or weaponization of space. And from earlier than that, going back to 1999 and 1982.

I'm going to talk really about a paper, "Space Weapons Good For Us or Bad," that I gave in November 2004 in New York. There I discuss the weaponization of space and the purposes that might be served by that. Because it's good for everything from, you know, fallen arches to eczema. But it will not really cure any of those problems. The one thing that all in the U.S. military are agreed on is that there is a growing threat to U.S. satellites. That U.S. satellites are essential for our current military capability. And that we have to do something to counter that threat. But the jump to space weapons is a big one because, for the most part, they have nothing to do with reducing the threat to U.S. military or commercial satellites.

There's another paper on my website, the second one listed, "Space Weapons: Crossing the U.S. Rubicon" with three co-authors. That was the outcome of a two-year project with the Council on Foreign Relations that I staffed. The three purposes usually given for space weapons by their proponents are defensive counter-space, that is, active protection of space assets, offensive counter-space to deny the adversaries use of space, and global and rapid power protection for a strike in maybe less than 90 minutes. But what everybody is agreed, what is applied there, is that General Jumper said, the U.S. relies on space operations for its security and this reliance may make us vulnerable in some areas. We must protect our space assets. Absolutely. We go into detail in the paper that that's why space is a very bad place to base offensive capability. And whatever you can do from space can more cheaply, more rapidly, and more effectively be done by specialized payloads, like nuclear payloads on ballistic missiles, whether ICBMs or shorter-range ballistic missiles. And we then explain why that is. That leaves defensive counter-space, that is, preventing other people's attack on our satellites. And a constellation of space weapons really has nothing to do with that, unless it were so dense that it would suffice to prevent anything being launched, even to the vicinity of low earth orbit. Not necessarily into orbit. And even SCUD Ds can launch a ton or half a ton of payload in the form of dust to low earth orbit that would destroy U.S. or other satellites. Not a

persistent destruction, but launched in time for the satellite to encounter it and to destroy itself.

As for keeping other folks from using space effectively in pursuit of their military goals, it takes a global power to do that. To use satellites such as communication satellites and the U.S. GPS system, they don't have to put up their own satellites in order to do that. And if we want to keep them from doing such things, then we will need to have local jammers in the theater of operations.

To protect our satellites, we have to make attack on our satellites less rewarding to others. That is: to have satellite replacements, not in orbit, but in the theater of operations where other folks will be concerned about it. If one considers operations in the Taiwan Straights, then we would need to have and worry about the Chinese disabling GPS or imaging satellites in order to keep us from knowing what was happening in the Taiwan Straights. Well, it's quite simple to provide local information from airplanes or rockets or other things that will give us a good replacement for those satellites, and thereby make it unlikely that anybody would attack them. But mostly, what the US needs to do is to explain that attack on our satellites would be followed by our attack on their military, not on their satellites. They might not even have any. And that should really give pause to countries that are considering attacking our satellites.

We've proposed that the United States have the stated policy not to be the first to deploy weapons of any kind in space or to use or test further destructive anti-satellite capabilities. And they should try hard -- it's not a do-nothing proposal -- try hard to have an international agreement and to universalize that proposal. When we need to take action against somebody attacking U.S. satellites, we will have the support of the rest of the world, and they having agreed not to be the first to deploy, and thereby to support the United States, which would be then trying to reverse somebody else's deployment of weapons to space. I'll stop there. And I think we are all three open to questions.

MOD: Thank you. Thank you to all three of you.

LD: Leonard David at space.com. I'm thinking of a thread question that goes between all this. In some ways, not to discount your views and concerns, it seems we're a little behind the power curve, literally. Either on civilian space policy or this issue of weaponization of space. It sounds like somebody's asleep at the switch. If people have this much concern about all these different kinds of issues, where do you point the finger? The policy makers in Congress? Who's at fault, in your view, that has led us into this either strategic switch of gears for the Air Force or the lack of a civilian space agenda?

RG: Let me take the first crack. Seems to me that people in the military have been quite happy with this policy of studied ambiguity. The latest space policy was from 1997, I think, in the Clinton administration. And it was that we would possibly have weapons. We don't have any plans to have them now. And that, of course, was supported in 2001 by, Rumsfeld's Space Commission report that says we have to have, not only weapons, but we have to fire these weapons in space in order to find out that these work. And

that's a bad show. Because it says the United States can do these things and other people can't. So, nobody has wanted to have an explicit policy saying that, but they've tried to move in that direction. However, much of the military sees this as a sinkhole for money and a big competitor for funds that could be better spent elsewhere. Yet, they haven't been able to oppose it because there is no policy to oppose. Nothing's happening so the budget competition hasn't been very big.

MOD: John or Neal?

NL: Yes, this is Neal. Let me just make my comment focused on the export control issue that I mentioned. My comment's clearly not a partisan criticism. We've had this problem, these problems developing over a long period of time on export control. The way we've gotten ourselves in the situation, I think, is to have incidents occur in which American companies can be accused -- whether they're guilty or not, but they end up in a bad way in terms of the public relations -- can be accused of inadvertently, of letting technologies dribble over to countries like China, through consultations over one or another cooperative activities that went badly. And then, that gets politicized, and there are always people on the Hill and in the agencies who believe that what we really ought to do in this country is put the walls up high and keep people from getting their hands on our crown jewels, not realizing that it's a two-way street and that when we put the walls up, we lose as much. Sometimes we lose more than we gain. But the export control issue has been around for some time. The most recent placing of strict restrictions on export controls of weaponry. It really has come from the Congress and it happened during the Clinton administration.

JS: This is John Steinburner. Let me just say, I don't think we're behind the power curve, whatever that means here, in the sense that not much has actually happened yet. So far, this is talk and programming with ominous implications that there's no irreversible event that is, had occurred. So, there's plenty of time to talk about it. If there's any fault, it is of the political system, as a whole, being sluggish in generating a discussion of broad national interest. We have that problem in many areas, but we really have in this one.

RG: Dick Garwin, again. Neal is right, in my opinion. It's largely the Congress which is responsible or irresponsible for these export control requirements, to the extent that foreign manufacturers now offer satellites that are so-called ITAR, (International Traffic and Arms Regulation) ITAR-free. They have no U.S. technology. And so, people don't have to confer with the U.S. for months or years in order to be able to sell or buy such satellites. So, we are losing our edge and people don't have to be politically antagonistic to the United States. They just have to explain that you can get your satellite delivered on time if you buy an ITAR-free satellite.

DZ: This is Debra Zaborenko at Reuters. I have a big picture question for you about civilian space in the United States. Ever since the cold war ended, it seems to me and it seems to people who know a lot more than I know, that NASA's been floundering around looking for a mission that will catch fire with the American public, who, in fact, write the check and pay the bills. At this point, ever since Columbia, there seems to be a real stall over at

NASA. What's your prescription, any and all of you, for getting NASA or any other kind of space back on track?

MOD: Neal, do you want to take that?

NG: This is Neal. Can I lead off on this real quickly? I agree with that perception that NASA has for some time, had a difficult time finding an exciting vision that really would capture the public's attention in the way that Apollo did. And, meanwhile, they've been given the responsibility to build a space station, which some people are excited about, but other people aren't. And that was a big job and has been very difficult to do. So, I don't blame NASA in the least for working with the current administration to try to find an exciting opportunity to help stimulate the creativity of the organization and to get it going again. I just don't think this is the plan.

DZ: The Moon/Mars thing, you mean?

NL: Yes, the Moon/Mars thing. Now, having said that, the President, I think, has made an outstanding appointment in Mike Griffin, as the new administrator. He's smart. He knows NASA. He's an engineer. He knows space, the technology. And he's saying a lot of the right things. And I think, given enough flexibility by the White House to make good decisions that are not run from either the Congress or from the White House, he has a chance to turn NASA around and give it a bright future.

DZ: But what's your specific prescription, if you have any? I mean, I know that when you ask NASA what their mission is, they point to Bush's vision for Moon/Mars. But even Mike Griffin, smart guy that he is, recognizes that it's a huge challenge and also recognizes that at this point, it doesn't seem to really have peaked extraordinary interest in the public.

NL: Well, I think what we'll see, and I absolutely, don't know, I could be totally wrong here, but what I think we'll see in Mike Griffin's statements, speeches, policy evolution over the next year or so is a change, that can always be shown to be consistent with the President's exploration vision, there's no choice about that, but will operate on a different time scale with, perhaps, more balance in priorities than Administrator O'Keefe talked about when he followed up the President's speech. So, I expect that to evolve in such a way that it balances human exploration with science and, given enough time, we might need to go back to the moon. I'm not arguing against that. I'm just saying, you need a realistic plan that doesn't kill all the good things you're doing, while you're unable to actually deliver on the President's directives. So, we need reason and balance here. And that's going to take some patience, which Administrations and Congress have not shown to NASA and some leadership, which perhaps we have. That may be the answer.

DZ: OK.

RG: Dick Garwin here. Yes. But you have to save money in doing what you propose to do. Going to the moon really has nothing to do with going to Mars. In my opinion, that ought to be cut out. Any agency just loves to have the White House make a decision that

it does not have itself to justify by showing where the means are, showing the technology is there, and how it will do it. That was the case with the space shuttle, which got us into a lot of this mess. Being a very high-cost way of getting into space, and it retarded the program enormously.

One of the last things that NASA and Congressional leaders seemed to want was to recognize that the American public was really enthusiastic about the unmanned exploration of Mars when we had two little robots running around and sending home pictures. Because that seems to compete with the manned space program. And those of you may be too young to remember the adage that no bucks without Buck Rogers. That doesn't seem to be the case anymore. People really like the reinforcement of getting things back. And great discoveries will certainly help to make the Mars exploration, human exploration, more reasonable in time. But we need output. What we've done is to abandon the space station. We're just going to complete it and then quit. And we're abandoning the shuttle, which is right, but without a good replacement. In the meantime, we rely on the Russians. So, Mike Griffin, even if he had total freedom to set out a program and the little bit of increase in money, would have a really difficult time in laying out a program that would match the stated goals. But under the present political situation with the imperial presidency where nothing a President ever says can be regarded as wrong or misguided, I see more disaster in space, itself.

MOD: Another question.

MC: Mark Carreau from the Houston Chronicle. I guess I want to see if I can understand the sort of interplay between the civilian space objectives that have been announced by the President and carried out by NASA and how that helps or conflicts with the military policies that you're speaking of. I guess they're not policies yet, but the concerns you have. Is there a synergy between all of this? Is there kind of a conspiracy to use NASA for military space in some way that you're concerned about?

MOD: John, do you want to take that?

JS: Well, certainly NASA's activities in space inherently require a degree of international collaboration that could not be sustained if we actually did what these military planning documents are talking about doing. So, if there is that form of tension between them, then you cannot be collaborating while you're threatening people to the extent that we're doing or said that we are doing. But if there is a deeper problem, it would be the suspicion that underneath the Moon/Mars Mission notion, NASA might start directing a lot of its activities to things such as reducing launch cost, that have more interest to the military than to the civilian space program. And I'm not saying that they are doing that, but there is some concern that that might happen that you'll basically redirect NASA's assets, really, to the military space program, claiming you're doing otherwise. That's a suspicion.

MC: Are you talking about EELD?

JS: I'm just saying that there are these underlying concerns. The NASA plan, as Neal pointed out, really does not make sense if you go look at it. The numbers don't add up. The budget allocation does not match the statement. There is, of course, an inclination to say, "OK, what's really going on? What are they really doing here?" And that encourages suspicion that NASA, wittingly or otherwise, might be made an appendage of the military space program.

RG: Dick Garwin here. I don't see any possibility of conspiracy. That what NASA is doing could help the military. Reducing launch cost, of course, would help our normal civilian program, assuming we had further launches, as well as any military, and they might, in fact, have a joint advanced launcher that would serve both NASA and the military. But NASA really doesn't know much about the military program at all and they have maintained themselves pretty pure in that way. That's one thing I don't worry about.

MOD: Another question?

MC: May I ask a follow-up on that question? I just wanted to touch the issue of NASA building reactors for its exploration plans, and also a heavy lift launcher in order to carry out these plans, and all of these have been sort of linked to military objectives in space in the past. I just want to make sure that that notion is dealt with in your responses?

NL: This is Neal. I don't know the answer to your question, but I note that Mike Griffin recently announced he was going to change some of those priorities and, for example, either slow down or maybe cancel the Prometheus budget and look at non-nuclear means for new propulsion. Am I right, Dick? That's what I read in Mike Griffin's recent statements. So, that's only a little piece of it. But I haven't heard of more onerous connections. You could stand back and say well maybe there are some in the military planning who believe somewhere down the road, wars will be fought in space with actual people out there, and of course, the military has no means now to put people in space. NASA does. And so, there might be an interest in ensuring that the U.S. continues to have that capability. But I have not really heard any serious arguments for that thing.

RG: There is a problem, again in Congress, that the Outer Space Treaty bars any national possession of any portion of a space object. A planet or moon or whatever. But you hear calls these days: "Well, if we're going to explore Mars or have a base on the moon, we've got to own it. Then we can mine it and send the valuable stuff back." Well, abandoning the Outer Space Treaty for that is not a good idea. If we're going to own it, then there'll be opposition to our ownership. It's a lot easier to poke holes in the space station or in the habitation on Mars or the moon than it is to build such a thing. That's a battle we don't need and don't want.

JS: You could say that the issue really is in important ways about the legal rules and principles that are going to govern all space activity. And the rule, which Dick just articulated, under the Outer Space Treaty, is that it's the common property of all mankind and you cannot appropriate objects in space and use them for personal or national advantage. They have to be used for common advantage. And, clearly the logic of the

announced U.S. military program runs against that particular rule and is raising the question about what kind of legal principles are we going to maintain and how are we going to elaborate these specific rules in defense of those principles. That really is where the issue is.

CC: This is Colin Clark of Space News. I'm wondering if any one of you three think that a new treaty or memorandum of understanding is necessary?

RG: Well, I think it's highly desirable for the United States to think seriously about a statement not to be the first to put weapons in space or to further test destructive ASATs and to get a treaty to that effect. In fact, in 1982, I presented such a draft treaty to the Senate Foreign Relations Committee.

JS: I agree with that, and you can argue about necessary. It certainly is desirable. And it is certainly difficult to understand why we're refusing even to discuss it because, in fact, it looks like a very attractive way of providing protection for our own activities up there. Not only military activities, but civilian and commercial, as well. So, a part of what we're saying is that it just does not make sense for the United States simply to refuse to discuss an elaboration of the rules, because ultimately, we ourselves are going to need it. And, how necessary any particular treaty provision is, of course, is always debatable. But the rules are pretty robust at the moment.

RG: Dick Garwin here. Specifically, the U.S. diplomatic posture is such that we refuse to discuss the regulation or banning of space weapons because there aren't any space weapons yet. And there's no sense talking about something that is hypothetical.

CC: Right.

JW: This is Jim Wolf from Reuters. I'd like to go back to the point that Dr. Steinbruner raised at the beginning, the idea that the U.S. may be provoking the world on the basis of a conception that it's unlikely to be able to implement, and ask you specifically what are the space weapons that the U.S. is closest to any possible deployment of and what sort of problems in their operations do you see? Why is it if they were unlikely to be able to implemented?

JS: Unlikely to be implemented to net advantage, I guess, would be the more correct statement.

JW: Implement what? I'm sorry?

JS: To our own net advantage. Because what we can do, other people can do as well. We have very valuable assets up there that are highly vulnerable to a direct attack. At the moment there is apparently, as far as public record is concerned, no other country that is actually currently pursuing space weapons. We're the only one. We are beginning to put up satellites that are said to simply be conducting infrared observation experiments from close range. But if you read the fine print, there's indication that they will also have

intercept objects on them -- things they can shoot to intercept the object they are observing. And anti-satellite weapons. And so we are able to, it's fairly straightforward, actually, to create an anti-satellite weapon and we're on the verge of doing that.

RG: Dick Garwin. None of these force projection weapons in space makes any sense. You can have directed energy, laser weapons for attacking things on the ground, but it's rather easy to counter those with a water roof or something like that. You can have kinetic energy ASATs that would come from someplace in space and in an hour or a few hours attack another satellite. But that's more readily done from the ground. The one space weapon that is very effective is the so-called space mine that would trail or lead a satellite in orbit by 100 meters or so and be ready to kill it at any time. But it's the United States which would suffer from the acceptance of space mines because space mines are not a difficult technology. Half a dozen countries could implement that and it's the U.S. satellites which would then be shadowed by these things. There's no rule against it at the moment. And that's why we ought to have such a rule: to keep space mines from becoming acceptable. We should not take measures to put up space mines first around the pitifully few satellites that other countries have that might be a problem for us.

JW: I see. That's helpful. When you mention the kinetic energy weapon, I don't know if you had in mind a possible space-based interceptor of the types that the missile defense agency may be eying for the future?

RG: Yes. Dick Garwin, again. Space is just one place to put interceptors that would otherwise have to be launched on rockets from the earth's surface.

JW: I'm sorry. OK, then. Not to interrupt. But my question goes to whether that, in itself, imposes some great technical hurdle in your view or whether that's something the U.S. may be able to achieve if it chose to go in that direction relatively early on.

RG: It's much more costly than to keep them on the ground. The American Physical Society study from 2003 goes into that, and it's also in my papers. But the main problem with them is that they are vulnerable. They are vulnerable to being shot down before they are used and back in 1985, I published papers showing how easy it is to shoot them down, compared with having them function in the intercept role.

JW: But it is true that you could put those objects up there and that they would work in that sense. Again, the question is, whether they could work to net advantage economically.

RG: There are two points. For mid-course, they have the same problems with counter measures, which is the big difficulty of our current national missile defense effort: balloon counter measures, too many for the interceptors to attack. And for boost-phase intercept, they have to reach down from orbit and out to catch the missiles in the couple hundred seconds that the booster is burning. So, for North Korea, it's really far better to have these things on the ground near North Korea, or on the sea near North Korea than in space.

- JW:** OK. One last housekeeping matter. There was a mention made of only three countries supporting the United States in the General Assembly, if I understand correctly, on the matter of U.S. Space Policy. Which countries are they?
- RG:** Israel, the Marshall Islands, and Micronesia.
- JW:** OK. Thanks.
- KY:** This is Kelly Young at New Scientist. I was wondering if, in your opinion, is there any strategic advantage to being the first nation to deploy space weapons?
- RG:** Absolutely not. If you could suddenly deploy 10,000 effective space weapons that would keep anything from being launched without approval, yes. But that's not a possibility.
- CC:** This is Colin Clark. One of the things that we hear every couple of weeks, whenever you guys are quoted, there was a reference to the Rumsfeld Report and the chance of a space Pearl Harbor. That's a wonderful phrase. A) What does it mean in real life? And B) is it is (inaudible) and why?
- JS:** The one thing to say is it's talking about a theoretical possibility, which is certainly the case. If somebody wanted to attack U.S. satellites they could succeed in doing so and it would have a devastating effect on our military capability. That's generally true. However, there's no evidence that anybody is actually preparing to do that.
- RG:** Dick Garwin again. You have to ask, you know, which satellites would we miss? We would miss the reconnaissance satellites. But if this happens not in the context of a war, they can't destroy a large fraction of the GPS satellites all at once. There are relatively few imaging satellites. Those could be destroyed. But what would be the purpose in doing that? Because there will certainly be retribution, with my full support, against all elements of the military of the country that did this. Now, it's not so easy to get to space, but North Korea could attack satellites in low earth orbit, for instance, with the so-called direct ascent weapons. And then, North Korea would certainly have a war on its hands. So, who's going to have this Pearl Harbor? Is it an unattributable Pearl Harbor?
- JS:** I think the point, Dick, is to have a Pearl Harbor, you have to do more than just attack a single satellite.
- RG:** That's right.
- JS:** You'd have to attack a whole capability. You would probably have to go up all the way to geo-synchronous orbit and at any rate, hit the GPS system, etc. That is a very substantial capability. And, the facts are, nobody is displaying such a capability at the moment.
- RG:** Yeah. Semi-synchronous. Right.
- LD:** Leonard David from space.com again. Maybe for Neal, the tension between science and

exploration. I think I caught that from your talk. People will argue that exploration is science. And then you have the scientists afraid that the exploration of the space, putting humans everywhere, just killed science because of the cost. And once humans are involved, the science goes to hell in a hand basket or something. How do you define the tension between those two?

NL: This is Neal Lane. We, in the science community, haven't really been very smart, I would say, in having this dialogue over the last decades. Some scientists have sharply attacked the Shuttle. This is not right. The Shuttle has been used to launch some important satellites, and a lot of important science has come out of it. The discussion is more serious, and flip comments get in the way of the discussion. There's nothing that says human exploration of space is inherently a bad thing for an advanced nation to pursue, I believe. If the people in the country, if the American people in our case, are excited about that, want it to happen, are willing to pay the price, then as far as I'm concerned, exploration of space is a fine thing to pursue, but it's very expensive and there's no sign the American people are interested in paying the bill for that. Science is not so expensive and, as Dick Garwin pointed out earlier, very exciting, with the robotic missions to Mars, and broadly, if you look over the last couple of decades, the history of the planetary exploration programs has been just extraordinary. I mean, not just beautiful images, but a whole new understanding of the solar system, where it came from, how it's made and where it's going to go. Science does stimulate the public's interest, and I think it is shortsighted to set policy that trades off science against exploration where you really don't have the public support for the latter, and you don't have a commitment for the funding.

RG: Dick Garwin. In fact, a mixture could be good. You have to ask what it is that you want as a result of exploration, what will repay the American public for what they provide. And there will be a few people up there and they will be sending back information and samples. The problem with Mars is that it's a long way away. And if it's not pure robotics, it's too far to command anything from moment to moment. But we could put people into low Mars orbit, and they could then have instant communication with semi-autonomous things on Mars's surface. Then you wouldn't have to land these extremely heavy things with people in them onto Mars. But there's another aspect, and that's human settlement away from earth. And that's a serious question, as well. But if we're going to do that, then we should have a lot more effort, to look at the effects of zero-G, countering zero-G, and at human organization in small groups, how we will run these settlements and what not. And plan toward that as well. But we're very far from understanding how we would do it.

MR: This is Mike Rafferty from the Columbus Dispatch. It's interesting that we're talking about all this exploration and all, but we seem to have a space agency that is afraid to launch a space shuttle at this point. Is that an unkind observation? Could you respond to that?

NG: Well, this is Neal again. I can sort of understand the reluctance to fly again without being absolutely sure that you've covered all possible bases that you can think of. And

certainly, do what the Columbia Commission recommended. And that's my understanding of what NASA is doing. This last delay in launch time, as I understand from Griffin's comment, was to do further testing and then on the basis of those results to make some further changes to the shuttle. It does seem a long time to get it off the ground, but one more accident like that, and I'm afraid the agency's done.

MC: This is Mark Carreau from the Chronicle. Can I ask what then is the purpose of Bush's civilian space policy? If the country can't afford it eventually, what are we doing it? I mean, how does it even serve the political objectives that the administration set in its second term?

NL: Well, since I brought the subject up -- this is Neal again -- let me just say, I don't think we really are doing it. I see no indication that it was a really serious proposal by the White House. If serious is not a fair word, a carefully thought through proposal with cost estimates and real strategic thinking. If I'm right about that, what do I think it was? Well, I think it was an effort perhaps on the part of the NASA administrator to find a way to move his agency forward and it was his judgment, let me assume, at the time, that such a mission would invigorate NASA again and get it back on its feet moving forward. I have no basis to believe that was what was going on. But the plan did not appear to be the result of careful planning over a significant period of time with serious debate about the pros and cons and the trade offs. So, I can assume it was, then not considered terribly carefully, and was presented to the President. He liked the idea and he rolled it out.

MOD: We have time for perhaps one more question. Is there anyone who hasn't had a chance who would like to ask? Or who has.

LD: Leonard David here, space.com. Maybe for Dick Garwin or for the others, too. Why wouldn't I think or would the public think that one of the reasons behind, perhaps a shift in Air Force Base strategy is that there have been a number of classified programs that give commanders or even the White House some inkling that space superiority or weaponization of space is technically doable? That there are a number of classified programs already waiting in the wings that could be put into some kind of operational capability?

RG: Well -- Dick Garwin here. The problem with classified programs, in many cases, is that they don't have the criticism that they deserve. I've been involved in such things for a very long time. And some of them work very well, but others of them are simply pets of individuals in Congress who really don't understand what is going on. So, you might imagine the space laser, for instance, which was terminated as a program. It might be going on hidden some place. But that's not going to give us a real capability. You might have such a thing. It would be a big shock once it's announced that such a thing is operating, but it's not going to provide a useful capability. So, the question is, what could be done, and I don't believe that that is the case.

JS: You could go on to say that the basic physics of operating in space and the associated economics are not obscure. You cannot classify that kind of information. And there's

very little scope for any secret program that's going to have a shocking, decisive capability that we could spring upon the world. It's not too hard to figure out what's possible in general.

LD: OK. Thanks.

CC: Just for fun, if I can throw one last one in. Colin Clark. Do any of you have any evidence or a strong working hypothesis that DART was, in fact, a targeting effort and that it did not simply goof?

RG: This was the test satellite?

CC: Yeah.

RG: Who knows? But in principle it's really quite simple to have one satellite or space probe inspect or collide with another one. So what's the big deal? Whether it was intended to do that and failed or whether it was doing something else? Who knows? But it doesn't make any difference. We assume that that can be done, just the way that one assumes, and I've written with others, 200-page counter-measures report in the year 2000. You assume that the missile defense agency will be able to get it, kinetic kill vehicles to collide within tens of centimeters with a clear warhead. Now the game is to design a warhead so it never has that opportunity. And if the missile defense agency can't get the kill vehicles to collide, they're not doing their job. But if they can't counter the counter measures, then we don't have a missile defense. And that is the case. So, the same thing has to do with space weapons of the kinetic energy type, that is, the collision type.

MOD: OK. I think with that. We promised you all, we'd take only an hour of your time. I want to thank all of you for dialing in, and in particular Marty and I would like to thank John Steinburner and Neal Lane and Dick Garwin for your participation. This has been very illuminating and provocative and helpful, I think, and hope. And please, if any of the reporters on the call want to do any follow-up, you have my contact information and don't hesitate to call me. Thanks, all of you, very much.

End of Space Briefing