PRESENTATION OF DR. NEAL LANE
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UNIVERSITY OF COLORADO-BOULDER

DR. STEFFEN: It is a pleasure and honor to welcome you to our Fourth Presidential Science Advisor evening on Policy, Politics and Science in the White House.

Tonight, we are honored to welcome Dr. Lane, who was Presidential Science Advisor to Bill Clinton from 1998 to 2001. Dr. Lane will be introduced by Roger Pielke, Jr., just after my brief welcome.

The kudos for organizing this exciting lecture go to Roger Pielke, Jr., the Director of the CIRES Center for Science and Technology Policy Research and his staff.

Some of you probably noted that I used the attribute "junior" when I introduced Roger Pielke. Well, there is a reason. It's not his height, it's not his age. We are actually very fortunate to add Roger Pielke, Sr., to our CIRES research and teaching faculty in the very near future. Therefore, Roger, I'm sorry. I think you got stuck with the attribute "junior."

Let me suggest an alternate way to differentiate between these two distinguished eminent scientists, the Pielkes. Maybe "PP" and "CP." "Policy Pielke" and "Climate Pielke." Well, it doesn't really sound very exciting, but I actually just heard prior to this lecture that Roger Pielke, Sr. requests that his email will be "SeniorSR," so maybe they have to change your email.

The Center for Science and Technology Policy Research was initiated in 2001 by our former director and interim provost, Susan Avery, in promoting science in service to society. It's Roger's compelling efforts and his accomplishments that just after five years make the Center a very recognized Center; not only at CU, but in the U.S. and abroad.

Science and policy problems are not bounded by any discipline. But, on the contrary, they should reach across the physical, societal, and biological science.

In CIRES, we have a long tradition in basic and applied research in the physical sciences, and more recently also in biological sciences. With the addition of the Center in 2001, we added a third lab that addresses the relationship between societal needs and science and technology policy.

Today's topic in our Presidential Science Advisor series, as it has been in the three previous ones, is "Policy, Politics, and Science in the White House."

I know very little about policy. I know even less about politics. I know a little bit about science. How will science and the White House mix? Question mark.

Dr. Lane will address some of these issues tonight, how science is used and has sometimes been misused in Presidential decision-making.

I'm looking, Dr. Lane, for your presentation and for the following discussion.

Junior, it's your turn. *(applause)*

DR. PIELKE: I know folks are going to have a lot of fun when my father joins CIRES here pretty soon, and I'm sure it will be a lot of confusion and the continuation of a life-long excitement for me.

I want to join Koni in welcoming Neal Lane here to CIRES, to the University of Colorado. An event like this, again, for those of you who come to our other events, it doesn't take place without the support of a number of institutions and people, and I'd just like to thank them.

Major support has been provided by CIRES, of which Koni is the director here at CU. We also acknowledge the support of the graduate school, the Office of the Vice-Chancellor for Research, the Provost's Office, the College of Engineering and Applied Science, the College of Arts and Science's Dean's Fund for Excellent.

And from beyond CU, we really appreciate the support of Southwest Research Institute, the Colorado School of Mines, and Boulder-based ICAT Managers. They all make this possible.

Several individuals I'd like to thank: Bobbie Klein, who is the managing director of the CIRES Policy Center, and Ami Nacu-Schmidt. Both have been instrumental in making things work as well as they have.

And I have been requested to call your attention to a little white piece of paper in your programs. We would really appreciate it if you would fill this out. This gives us some feedback on how you heard about this event and whether you'd like to hear about future events and any other notes you'd like to put in there. You can give that to me afterwards, or any of the folks who are standing around looking like they know what they're doing.

I want to also announce that on October 24th, just a few weeks away, we will have the second to last in our series, we'll have Donald Hornig here, who was the Science Advisor to President Lyndon Johnson, which should be quite interesting.

I'd like to call your attention to our website. It's a content-rich website. You can find a lot of background readings on science, science policy, you can find video -- streaming video of all of the previous science advisor visits, transcripts also. There's also a video of the recently retired Chief of Staff from the House Science Committee, Bob Palmer. He gave a talk last spring on partisanship and science policy. Edward David's video will be on there very shortly, and Dr. Lane's will be there in a few weeks.

So, now to the main event. There are three parts to tonight's festivities. First, Dr. Lane will give some remarks that he's prepared for this occasion. The second part will be an interview taking place here, where I will ask Dr. Lane some questions. And then we're going to turn it over to the audience and let you ask Dr. Lane questions that will be on your mind.

I'll say this now, and I'll say this again, since we are having this on TV. The questions are going to have to be repeated up-front, so we emphasize the importance of concise, short questions that can be easily repeated in the microphone so it can be picked up by the television. But I'll say that again.

So let me introduce Dr. Lane. Dr. Lane is a former provost at Rice University, where his tenure began in 1966 when he joined the Department of Physics as an assistant professor. He left Rice from 1984 to 1986 to serve as Chancellor of the University of Colorado at Colorado Springs, so Dr. Lane has some Colorado roots. In addition, while on leave from Rice from 1979 to 1980, he worked for the National Science Foundation as the Director of the Division of Physics.

He became Director of the National Science Foundation, the entire agency, in 1993.

Widely recognized as a scientist and educator, Dr. Lane has written or co-authored more than 90 scientific papers and publications, including a text book on quantum physics. He earned his three degrees: bachelor's, master's, and Ph.D., from the University of Oklahoma, and is a Oklahoma native.

Please join me in welcoming Dr. Lane. *(applause)*

DR. LANE: Thank you very much, Roger. Ladies and gentlemen, can you all hear me okay? No. I'm turned on. What about now? Help! On. On. Hello? Hello? Hello? All right, thank you. Thank you very much. If I had just one more hand, I'd be in terrific shape.

I'm delighted to be here. This is a very special part of the world for me. Colorado is one of my homes. As you heard, I spent a good bit of time at UCCS. I spent quite a lot of time in Boulder when I started here in 1965, a visiting fellow to JILA. And, in fact, the couple who were the welcoming committee for my wife and myself, are John and Lindy Hall. And a most exciting event yesterday for many of us, certainly me, was the announcement that John Hall won the Nobel prize this year, so making four for the University of Colorado and three for JILA. I taught him everything he knows.

Now, John Hall is a guy, when I talked to him when I was here, I don't think I ever told him anything he didn't already know, so I couldn't be more pleased. It's just tremendously exciting.

I chose a title for this group of talks, and I put a picture of science advisors just so that you know that I know I'm supposed to talk about science advice, and here are some who are speaking to your series, and I put their names down here for some of them. And I want to be sure that you recognize Allan Bromley, who sadly cannot be with you for this series because Allan died too early in life just this last year, right after giving a lecture, in fact. Allan was a terrific individual. About him I'll say more later.

This photo at the top up here is a cluster or a covey, whatever you'd like, of science advisors, and the guy in the middle is Guy Stever, who was science advisor to Gerald Ford. After Nixon, you remember, Ed David, and you heard his stories. And there's a young Ed David right over on the right hand side. I think Don Hornig is standing right next to Guy Stever.

So we won't try to go through who all of those people are, but there have been a bunch of science advisors serving both Democratic and Republican presidents, and you're hearing from a number of them.

So the title I'm going to choose tonight, it's a pretty subtle message, "Threats to the Future of U.S. Science and Technology." I've given a similar talk, but this will be a much shorter version of it, on other occasions, because I'm very concerned about the future of science and technology, and so I want to share with you what my concerns are and say a little bit about what science advisors can do about them.

So here's what I'm going to do. I'm going to give a very short personal journey, what am I doing here, and second, how the White House works. Of course, I don't know, but I'll tell you what my observations are, and then I'll close with these four -- I picked four -- four threats to science and technology and what a science advisor can do about them.

So first of all, the personal journey, it's all on one slide. So I start in Oklahoma, and that's much of my memory of Oklahoma. I love the weather, I love the storms, I was the last kid in the storm cellar. You've got be fascinated with science, and I -- well, my physics went a different direction. I get to hang out with Roger and people who really understand atmospheric and weather science. It's a lot of fun.

And then I went to Colorado, JILA, and that's where I really experienced my first, I don't know, 80 mile an hour wind. The snow came down, blew all my boxes away, and so it's a different kind of a storm.

And then I went to Rice, where we -- you know the kinds of storms we have there, because we just had the Katrina tragedy and Rita -- not quite such a great tragedy, but a terrible storm.

And then I went to Washington, the National Science Foundation. Bill Clinton asked me to do that. I didn't know Bill Clinton, but I was delighted to do it, though, after serving a long time as provost, and so I was very happy to be involved. Of course, I spent my time at UCCS along the way, and then finally the White House.

In Washington, what I found was the storms were of a very different nature. The storms were human- caused kind of storms. Occasionally snow comes down, but the things that really shake that town are caused by human beings, and I'll tell you stories about some of those things.

How the White House works. Well, I really don't know how the White House works, and sometimes the White House does not work very well. Please keep in mind, I was only there two and a half years. Now, it seems like longer, but two and a half years.

So, Jack Gibbons served this wonderful period as presidential science advisor to Bill Clinton for six years, which is an extraordinary tenure. He was a wonderful mentor to me, great supporter of everything I was trying to do over at the National Science Foundation, and extraordinarily strong and effective science advisor in my view. He had the respect of

the president, vice president, and he built a team of staff that I inherited in the White House, and I couldn't have asked for better support.

But the White House is a kind of strange sort of place, and I could not -- I had not any clue when I was at NSF how the White House actually functioned, because things I thought ought to be done, in fact, they were obvious that they should be done, and I would simply propose them and they didn't get done. So my view was, "there's something wrong in the White House."

Now, I supported President Clinton, I believed in what he was trying to do, so when I explained what we needed in NSF, how come I didn't get the money? Well, when I got to the White House, I understood the situation a little bit better, and I had to cope with the same sort of balances and judgments and decisions that Jack Gibbons had to cope with when he was in the White House before.

Now, so what goes on over there? Well, let me sort of explain it the following way: I will just give you some impressions; I'll just make some points about my observations.

So, the first one would be that the principal focus of everybody in the White House is the Oval Office and the President. The President's agenda, the President's priorities. If you're there for anything else, people know it right away and you might as well get out because they're not going to let you do anything and you're not actually serving the nation in that.

So that's number one. You can never forget that in that job. If you get to a point where for some reason you can't support the President, you need to move on and do something else. The President's going to ask hard questions, the President's going to ask, "How much do we want to spend on nanotechnology?" and my answer to that was, "With respect, Mr. President, we need to spend $500 million." And he didn't just say "yes," okay? He thought carefully about it and we ultimately got the nanotechnology initiative out of that.

So, second with this sort of consistent focus with the President is the day-to-day activities of the White House. I put them in three categories. The day- to-day activities are: urgent, so those are crises, they're disasters, they're wars, scandals, a bad story in the press that you've got to deal with, things that everybody focuses on in real-time.

Or perhaps the other category is strategic things, things that have to do with making sure you're advancing on the President's agenda and delivering on the President's campaign promise, you're working on whatever legislation you're trying to get off the Hill, and you're worried about foreign policy and national relations and so forth and other strategic issues.

And the third category would be routine. So these would be the President is giving speeches, the President every week is going to give a radio address, this press advisor every day is going to answer questions for the press, and you need to be a part of that. You need to be preparing the press secretary, at least in your area of science and technology, for that event.

And then there's the message of the day, that the communication staff and the regular meetings and all that. So that's the routine. That's what goes on.

The third thing about the White House is it's a team effort, and there's some difficult personalities in that team. You can't get anything done. So, sure the science advisor could go into the President and say, "Mr. President, we ought to do `X'," and Mr. President says, "Absolutely, Neal, you're absolutely right. I feel strongly about that issue," and leave. And then another Presidential aide comes in and says, "Don't pay any attention to him, he's just Neal," you know, "he just cares about science."

So you've got to make sure that if you care enough about an issue for the President to pay attention to, you've got to have a lot of support. You've also got to be there for them. They've got issues that they think are important. It may be education, it may be health, it may be crime, it may be anything. Wherever your office can be helpful, you need to do that.

That was probably the thing that most described what we tried to do in the last two years, is make sure that our office was there for every other part of the White House to help them do their job in any way possible. And I told my staff, "When we tell them we're going to give them something, they've got to get it, what we told them we'd give them, and they're got to get it when we told them we'd give it to them. If it's an hour late, it's too late." And it actually is too late. Whatever memo that is, whatever was written, whatever is going on, is gone. It's done.

So if you're able to do that, you establish an enormous amount of trust and rapport, and it doesn't mean everybody is going to support you in your work with the President, but it often means they will. And without that, then it just isn't going to work.

This was some briefing in the Red Room. I don't remember what it was about; nano or something. It's a user kind of interaction with the President. You get about five minutes for this sort of thing. He's getting ready to go make remarks on briefing, and I'm telling him something which I didn't need to, probably, because he's a very quick ready, quick study. That's a speech writer in the middle, about 16 years old. Extraordinarily gifted young man.

That's John Podesta, and I get the impression from John's face that I've exceeded my five minutes. That's my impression.

Fourth on my points, is the science advisor, of course, often speaks to the President on matters of science and technology, and that means you need to know what it is the President thinks so that you say the right things. But it also means you have to support the President in his policies; whatever those policies are, and you have to do that while preserving your integrity as a scientist and the integrity of your office.

If the President says something that's just wrong scientifically, then you've got to figure out how to explain to the American people what the President really meant to say in such a way that everybody is okay. So that's part of the job as well.

Now, the last thing you need to do in that office is work with all of the federal agencies in our government, and so you have a role in that. So let me look at that issue this way: Here's part of the Executive Branch of government. So the President is the boss. My staff

made this, so they put the science advisor right at the center of all of government. So the President has a bunch of offices and senior aides advising him, and national security, and financial issues, the budget, science and technology, environmental issues, economic and domestic policies, and so forth. They're in all of these offices.

He also is the boss of all of these Cabinet- level agencies-departments, of course, and then each one of them headed by secretary, energy, defense, interior. Inside of those are a lot of agencies. I'm sorry about the acronyms; some of you won't know them and some of you will. But we'll just pick commerce because NOAA is a big deal in town. So is the NSF, but the Nobel prize I mentioned, of course, is another Nobel prize, but as well as the University of Colorado.

So those are two agencies embedded inside the Department of Commerce. Sometimes it's good to be covered by a Cabinet-level department and sometimes it's not so good. In this particular case, my view is "not good." So here's a policy issue that we could talk about at some point.

In addition to the Cabinet-level departments that are headed by Presidential appointees, usually very political folks. They're a bunch of independent agents. Some of them are regulatory, some of them are things like the National Science Foundation. It's independent in the sense it's not part of the Cabinet agency, and while the President appoints the head of these agencies and they are confirmed by the Senate, as are the Cabinet secretaries, it's anticipated that these people are chosen because there's some kind of expertise. They have a slight clue of what the agency is actually supposed to be doing when they take the job. That's the idea.

And of course, the regulatory agencies -- you don't want the White House manipulating regulation. Regulation is supposed to be an interpretation of the law, and that should not be politically motivated.

So, okay, so that's what that looks like. Now, what you find in this system, which the Founding Fathers put together, is not exactly as we see it today, but this was their idea. Government is all spread out. It would be impossible to run this operation. Yes, the President is the boss, but you can't run the government, and therefore, democracy can function in this way because we, the people, can come into this government organization in a whole lot of different ways, and this is only part of the government.

We've got the Congress, which I won't say a lot about this evening unless I get carried away or I get a question.

So, one thing you find here is science and technology are everywhere, so science and technology are in almost all of these agencies. Many of them actually support research and development activities in the universities, national labs, and so on. Many of them also use science and technology for whatever their mission is; maybe agriculture, environmental protection, energy defense, whatever that might be.

One job of the science advisor is to coordinate those activities, and here's a list of science and technology-related activities; just the ones that came up or that we were working on in the time I was in the White House, two and a half years. And don't read all this stuff, I

just put yellow so you can see that we're across the map. I mean, there's food safety, there's space, health, information technology, environment, energy, and we in fact put together the national nanotechnology issue during the time I was there.

The science advisor is supposed to coordinate those kind of activities across all of government, all the federal agencies, get everybody to work together like a happy family somehow. And yet the science advisor has no clout. The science advisor is a staff member in the White House.

The only reason any agency pays any attention to the science advisor is if they believe the President supports the science advisor, and vice-versa and the science advisor is speaking for the President. Then when you invite people to come and meet, they usually come. That doesn't mean they always do what you'd like to do, but they do come and you have a chance to do that. So that's one of the jobs.

You have to do the same thing inside the White House. So suppose an issue comes up, food safety or something like that happened to be one where I had -- my office had the lead. So if your office has the lead, it's just so obvious science and technology should be taking the lead here to make sure the job gets done. Then you call people in from the economic council, all these offices in the White House, and you call the deputies in from all of the relevant agencies. If it's food safety, it would be agriculture and health and human services, because FDA supports -- inspects some of our food and agriculture supports other of our food; eggs. If the egg is whole, as I recall, it's FDA. If the egg is broken, it's agriculture. Think about pizza: cheese and meat. So if you think we've got a real policy problem, you're absolutely right. So we work on that.

But the way you work on trying to improve policy, you've got to bring these people together to convince them that they're going to have to give a little, because any change means fewer staff here and more staff here, and budgets change and so on. That's also a job, at least for some issues, for the President's science advisor.

But you're doing all of this with all of this yellow stuff. It's all democracy. It's a good thing. But how we find our way in this maze, we do it through consumer advocacy groups, we do it on our own by just walking into these offices. If you're in the National Science Foundation, a chemist, a physicist, the astronomers, and God knows who else, come in and explain how they're not getting enough money.

You're government, and you really must hear from all of these people. But sometimes the din of all of this makes it very difficult to actually make progress, but it is our democracy, it's a good thing, and so I certainly support this way of doing business. But, on a given day, you never really quite know what's going to happen in the White House.

Okay, so what I want to do now is go to this issue of four threats of science and technology and what a science advisor can do.

Here are my four threats. Let me say by way of preface that some of these -- well, all of these, in my view, are current in that they're important right now. I'm not just suggesting that this administration is somehow a problem in all of these areas and we were doing just fine before. That's not the case. Many of these threats have evolved over quite a long

period of time in Republican and Democratic administrations, and then some of them are more current now and I'll talk about which ones are.

Before I do that, let me say two things I think about science and technology. These are just assertions. First of all, I simply assert science and technology are vital to the national interests. When you think of all of the ways it can actually encompass everything important to people. It impacts, in a positive way, the lives of everybody, and people know that. If you take surveys of the American people, it's different in other countries, but in this country, the American people are very supportive of science. They don't know anything about it. I mean, people are very open about the fact that they don't fully understand science very well, and they'd like to know more, but they believe that funding research, even if you don't know where the research is going, is a good thing for the federal government to do, and they believe that by a very large margin.

The second assertion would be that science and politics are intertwined. I mean, like it or not, they really are intertwined. Maybe more so now than in the past, but it does happen.

The current debate over embryonic stem cells, for example, therapeutic cloning, global climate change, intelligent design, reproductive medicine, and there are other examples, are examples where science and politics are mixed up, and sometimes in very unhelpful ways and Neal may have even been a part of some of these unhelpful ways. We'll get a chance to talk about that.

So each of these assertions is debatable, but just take it for a minute that I'm going to use that as a basis for what I'm suggesting as problems.

First of all, money. We need the money to support the research. Most theoretical research, experimental research, is very expensive. And some areas of theoretical research are now very expensive because of computational demands in order to go to the next step. So it's going to cost money.

In my view, the federal government for a long time has failed to adequately support research and the balance is wrong. But the combination, in my view, of the total investment and how the funding is put forward, and so I'll illustrate that with this little picture. Okay?

Here's what the U.S. spends in a year, right? The slide is a little old. It's based on the President's request for 2004 budget. The President requested $2.2 trillion dollars and change in 2004. I compare that to what the President requested this year, two years later, 2006, he requested $2.6 trillion dollars. I mean, that's a lot of money, and it's going up fast.

Okay, so how do we spend that money? Most of it is kind of off the table. It's these things with "X"s in it; it's called "non-discretionary," and non- discretionary are such things like Social Security, Medicare, Medicaid, and other mandatory and different retirement funds. We've got to pay the interest on the national debt. The national debt is their own -- national debt, as I speak, is $7.9 trillion dollars. Interest on that is $400 -- $300 or $400 million a year and we have to pay it. A lot of that debt is being bought by Japan and China, some of it by ourselves, some of it by other parts of the federal government. So we've got to do all that.

Now, you could change the Social Security law, you could change Medicaid, but you don't just do that through the annual appropriation process. I mean, you've got to work harder if you're going to do that. I don't see those things getting small. If they're going to do anything, I see them getting larger, at least in the near term.

So, what have we got to work with? Whatever the Congress fights over in the appropriation issues every year, it's just one-third of the budget and it's called discretionary, and half of that is defense. Half of that for defense. The wedges are research and development, a sizeable amount of money. The defense department will spend roughly $75 billion dollars on research and development activities, but does not allow science in that. That's mainly development; large weapons, development, ships, airplanes, missile defense and stuff like that. And there is research in there, but it's mostly big development.

The wedge down here in what's called "domestic discretion," there's all the rest of science and technology, and that's much smaller now, $57 billion dollars. During the time I was in the White House, these were about the same, defense and non- defense.

So what has grown is defense R&D and it's mainly D. So most of the research is down here. So my point is, given the tax cut situation, the state of the economy, some things that are off budget, like much of the Iraq War, expanding defense budgets, and other such matters, discretionary spending is going to get squeezed and science is going to be squeezed with that.

Now, to show that I speak truly, here's a graph that shows on the black curve discretionary -- non-defense discretionary spending since 1962 in constant dollars. And so here we are up here where the red curve stops; that's about 2006. That's where it peaks out.

So the President of the United States must tell Congress every year what he's going to do in the next five years. "Here's what I plan to request from you for the next five years." Every President does that every year.

So that black curve is what the President says he's going to do. He's going to cut the dickens out of discretionary spending for reasons I think we all understand.

The red curve -- and the scale for the black curve is on the left in billions of dollars. The red curve is non-defense R&D, and because it's non-defense, it's mainly research; basic and applied research. What Jack Marburger often emphasizes correctly, is that the red curve tracks the black curve very well. When the nation is spending a lot of money in discretionary money, science does quite well. When it isn't, science is not doing well.

And the only really strong exception is the Apollo project. That was mainly not research; that was mainly development, but it was non-defense depending on how you view the Apollo project.

So, but after that, that went away, and then after that you just track discretionary spending. So I think if discretionary spending is going to go down, which I believe it is, well at least the President says it is, science is going to go down.

My worry is that it could go down more, that it need not necessarily track. I think it will track, but I have grave concerns that connect with some of these other threats.

And so now I'll speed up. People to do science; that's my second threat. Well, this is one we all know a lot about. There's school teachers here probably, some of us are working in the K-12 classroom, some of us are trying to hire people for our companies, we know there's a problem in finding talented scientists and engineers. And in this country, for a very long time, we've not grown our own. We have not been able to adequately reach young people, young girls and boys, in the schools and young men and women as they're growing up and coax them into careers in science and engineering in sufficiently large numbers to meet the need.

Fortunately, we were attractive to people from all over the world. So young men and women came from all over the world to study here, and some of them to stay and work here and to fill jobs that were desperately needed. I think had that not happened, science and technology in this country would be a very, very different situation.

Well, this chart is only to remind you that a very large percentage, 40% to 50% of our enrollment in 2001, not too many years ago, students born in other parts of the world in natural science and engineering. Those numbers are going down. We are less attractive to the rest of the world than we once were.

The visa problem is part of it, export controls, which we can talk about later if you want to, that's part of it, and just sort of the overall image of America that may be part of it. We don't see a way to replace those young people with our own young people, because so far we've been totally unsuccessful in doing that. So I'm worried about that.

In the meantime, the rest of the world is doing quite well, thank you. So this is the Ph.D. chart, and it only goes to 2001 because the National Science Board data only went out that far. But the Asian curve of Ph.Ds in natural science and engineering is going up steeply, and that's mainly China and Japan, and China is the most rapidly growing one.

So people are doing quite well at home. There are opportunities at home, there are opportunities in other parts of the world, and young people will go there. I'm worried about what that means about the future of science in this country.

My third threat is public understanding. I suggest the public doesn't know much about science. Well, let's see, what do they know? Plants produce oxygen, 70% is pretty good. Continents have been moving for millions of years, light travels faster than sound; I did this for John Hall. Earth goes around the sun, well that's good. If you ask how long it takes, you lose 20% of the American people. So only 50% know that it takes a year to go around the sun. That's the same number of people that think that dinosaurs and the humans lived together.

Now, it sounds like I'm making fun. I'm not going to make fun of the American people. I mean, this problem is our problem, and we really need to do something about it. It has a lot to do with education. But the American people, in spite of not knowing science terribly

well, they do believe things that sometimes don't have some scientific foundation. So what do people believe?

Well, psychic or spiritual healing, over half of the American people. ESP, some haunted houses, I won't take a vote, but 40% of the people believe in haunted houses, ghosts. I mean, I don't like stormy nights and dark houses with lights off when I don't know who's there, so I can kind of understand emotionally how people might respond to these surveys. Astrology.

But it's the last one, seriously, that scares me the most right now, and it happens to be a very hot topic. Over 60% of the people, when this survey was taken, and it hasn't changed much through the years, but this survey is about four years old now, I would guess, because it's in the 2002 indicators. Over 60% of the people believe you should teach creationism in the schools, either with or without evolution. And actually, you know, 16% believe you shouldn't teach evolution at all. It's a very important issue. We, as a science community, have not the slightest clue how to cope with this issue, and we're doing a very bad job.

Respecting the integrity of science, this is one that Roger touched on just a little bit. I think some of you know that several of us, a couple of years ago, signed a statement criticizing the administration for misrepresentation of science, so-called "a pattern of abuse of science." This is kind of a new thing, because presidents over the years, including President G. W. Bush, have made statements about the integrity of science, how important it is that policy be established based on sound science. And I put a quote up here from President Bush's father, President Bush 41. Clinton had said similar sorts of things.

But something has changed, because certainly in the time I was in Washington and the time I can remember when Allan Bromley was in Washington, when Ed David was in Washington, I don't remember anything like the kind of incidents that we complained about, and they tended to be in climate change, they tended to be in reproductive medicine, they tended to be in areas where the science was saying things that certain special interest groups that were very important to this administration, and so you found the government actually misrepresenting what the science was about. We thought that's actually dangerous in some areas, such as reproductive health, for example.

So we spoke out on it. It probably was not at all smart politically to do. Jack Marburger even commented when he had to defend the administration on this, which he certainly did have to do, and he and I remained quite cordial through the process. Not that he would have preferred that we not do that, but I think we decided the situation was a sufficiently serious issue, we had to speak out. We can't just simply worry about the fact that people are going to be mad at you. The people were really quite mad at us over this sort of thing.

So that's what I'm very worried about, because if science should become something that can be used for political purposes, if science, science knowledge, doesn't continue to have some special credibility to it, it doesn't answer all questions, but there is something special about scientific knowledge, at least we believe that. If you lose that, then I think this American support of science that I've talked about could go away very fast. So I'm very concerned about that.

Any of these is a problem; many of these issues have been around a long time. The reason I'm so concerned now is we've got all four of them, I think. They're all coming down for no progress. That's what those arrows mean. And we're in a post-9/11 world, people are nervous. There's a great deal of uncertainty and a lot of economic problems. There's a lot of problems all around the world, and when people are scared in times of chaos, it's very difficult to get attention to these kind of long-range issues of education and science and so forth. I'm worried about that, and so that's why I'm raising them.

Since this is the year of physics -- did you all know this is the year of physics? It's a year of physics because of the 100th anniversary of Einstein's famous papers in 1905 where he laid out not all, but many of his most extraordinary discoveries and published speeches the same year. It was a busy year, and he had a full-time job in the patent office and a wife at home. So he's a very impressive guy.

But because it's the year of physics, I used two quotes from Einstein, just to make two points. Einstein had some advice for scientists, and he had a lot of advice, but this one, "Concern for man and his fate must always form the chief interest of all technical endeavors in order that the creation of our minds should be a blessing and not a curse to mankind." Never forget this. He said that in 1931, obviously a time of great turmoil in Europe and many parts of the world.

The second quote is one I also think is very important and it's a message for all of us. Where he says "Everything that's really great and aspiring is created by individual labor and freedom." He said that in a commencement address in 1938, and that was published, of course, later in the book. This is a picture from becoming a citizen, which I call a real patriotic act.

These messages, both of them, I think, especially in a time that we're living in right now where the truth and the value of science is being questioned in ways that to me are quite disturbing, suggest to me that scientists and technical professions of all kinds really need to get much more involved with the public and with the political process. I've believed that for a long time, but I couldn't believe it anymore than I do now.

We need to help the public understand why science is special and what the risks are, as well as the benefits, and we need to do that in a candid and open way. And maybe even more important than that, we need the public to know that we care what's on their minds. We need to know what the public is thinking about. That's going to help us enormously in communicating with the public in the future.

This is kind of a concept I've called "the civic scientists," where a scientist uses his or her skills, knowledge, fame, education, and science and engineering technology to reach out to the general public. Maybe in a classroom, maybe in a church, the community groups, or maybe go to Washington and maybe actually get elected to office. I hope some of you will do that; I will vote for you. Well, I think. We'll talk.

There are many civic scientists in this country. I'll use three here who are no longer living, because we lost Allan Bromley, and it spans U.S. history.

So we'll start with Benjamin Franklin, a great scientist. He wrote beautifully also about electricity. He became famous really as a scientist, and that helped him get the money we needed from the French. Thank you very much for that money, Eldon. And in that way we were able to throw off the British; I'm sorry to my British colleagues, King George and so forth.

So here's a civic scientist who gave up his scientific career to form a new nation, and first of all to try to repair relationships between the colonies and England, and that didn't work. So then when he saw that failed, to try to get the resources necessary to have a successful revolution.

Albert Einstein, that's a different case. Albert Einstein, he probably would have made a terrible policy person, even though he was offered the presidency of Israel. Fortunately he declined it. But he used his fame to reach -- to open doors. To reach into the White House and be sure that Roosevelt understood there was atomic energy which is Einstein's legacy, the equal MC squared formula -- make sure Roosevelt understood that you could make a bomb, a highly destructive bomb, and Hitler might be doing it.

Well, that led to the Manhattan Project. We built the bombs, we dropped them on Hiroshima, Nagasaki, we killed over 200,000 people. Einstein certainly regretted that outcome, especially when he did not have a bomb, and I think that is certainly the case.

Allan Bromley. I used that as an example of contemporary. Allan was a great scientist, who was a great science advisor and gave a lot of his time to public policy and did it quite generously.

So those are my examples of civic scientists. There are many civic scientists in this room. So my message to young scientists at the end is, of course science is very challenging. It's very hard. It takes enormous commitment, focus, time, energy. It's a wonderful calling, and I hope everybody who wants to be a scientist gets to be a scientist.

All I would ask is that at some time in your career, some time when you're inclined, some time especially if you feel you have the skills, you take a little time out to do some of these other things and deal with some of these broader issues that touch on public opinion, on educating kids in the classroom, on the health, safety and welfare of all the people in the country and the world.

Thank you very much. I appreciate it. *(applause)*

DR. PIELKE: All right, so let's start the interview part, and I think we're going to have to trade back and forth this microphone.

Can you just tell us briefly how you went from NSF to being Science Advisor? Did Bill Clinton call you up, or what was the process? How did that occur?

DR. LANE: Well, I think -- I don't actually remember precisely, but I think it was probably Jack Gibbons that called me and said would I meet with the vice president. I mean, the answer to that question was "yes." He said, "Would you meet with the vice president because he'd like to talk to you about being science advisor for President Clinton?"

So I went over and met with the vice president, did a quick read of his book in case he asked me questions. I hadn't read it, unfortunately, before. And we had an interview, and at the end of the interview, I said, "Well, Mr. Vice President, how did I do?" And he said, "Nobody has ever asked me that question before." And I said, "Well, will you autograph this book for my mother? In case I don't get this job, it's my last chance." So I got the job.

DR. PIELKE: Can we discuss a little bit your relationship with President Clinton and your relationship as science advisor and how that compared with other of the top staff in the White House Executive Office of the President?

DR. LANE: Well, I think I had a very good relationship with President Clinton. Presidents are busy people, so that's why, just to give you a sense of the pace of the White House. Has anybody watched West Wing? Well, that's how it is. Did anybody see the science advisor on West Wing? That segment is coming up. I often complained about it. I mean, I saw Josh at some dinner in Washington and forgot who the actor's name is that plays Josh, and I said, "Well, there's no science on the show. It's a great show, my wife loves what you're doing. I don't have time to watch it, but she says it's a great show, but you need some more science." And so it wasn't very long before they launched some poor guy in a space station. I felt, "well that's not what I had in mind."

That show is extremely realistic, and so that's my point. The pace of the White House is pretty much as it is on the show. The sets are not right; the offices are not that nice, you don't have the glass panes, you can't see through to everybody that's doing the White House mess, it's smaller and all that. But the Oval Office always looks the same in all the movies. But the point about that is that it is a pretty realistic situation.

So the President is very busy, so you catch the President on the fly. I mean, we don't go in -- I don't go into the President and have 15 minutes every week to tell him what's on my mind, and so who would do that? To answer the other part of your question. He certainly would see his chief of staff every day, several times a day. He would see his national security advisor probably every day, once a day, talk to him several times a day. He would see his political advisors frequently. They're really the inner-circle. They came off the campaign. They're old buddies, they play hearts together, you know, and that's their focus. Their focus is this president will succeed. This president will succeed. You know, if something is going on, we will figure out how to fix it.

They are totally focused on the president's political agenda and his legacy, so those people see him frequently.

And so then it's back to my point about what's important in the White House? It's things that are urgent, it's things that are strategic politically, and it's things that are routine. And so usually, science is going to be routine.

So what would be routine? I'd see the president sometimes once a week and sometimes I wouldn't see him for three weeks. It just depends on what's going on. If he had an interview coming up, if he's got a speech coming up that has something to do with science and technology, if there's something in his State of the Union Address on science and technology, any of those kind of things, he will call me in and I'll go in and I'll brief him on

it. Sometimes that briefing is on Air Force One, sometimes it's in the Oval Office, sometimes it's in the Red Room, like this one was. And there were a lot of those. And even though they're short and they're brief, he's very smart, he reads everything. That same man, you have to send weekly reports, he read them all, he would write in the margins and send questions back. He would send long memos. There's a lot of that communication, and so you get to know a president over that time.

So I think his -- I think he liked the job I was doing. I certainly loved working with him. And remember the timing. The way you would know, I arrived in December of `98 just before impeachment. I went to my first State of the Union Address after impeachment and when the Senate was taking him to trial. Remember, many people on the Hill didn't even think he should give a State of the Union Address.

So Neal was going around the halls talking science while the they were deciding whether to throw the President out of office or not, and this is kind of a tough sell. So it had to be very clear that to the extent Neal was selling science, Neal was selling the science and technology issues that are important to the President, nothing to do with impeachment, but just his agenda. So I would see him a lot, and all during that period, he was totally focused on the -- when I saw him -- he was totally focused on the job he was doing.

He came into the staff meeting one morning, and he said, "I'm sorry my personal problems are making your job a lot more difficult. But the American people sent me here to do a job, and I'm going to do that every minute of every day, and I'm asking you all to do your job, as well." Which, of course, we all did.

So business was actually uninterrupted all during that extremely horrible and excruciating period.

I like the President. We would somehow how time to have small talk about black holes and things like that, because he's intellectually very curious. But usually the focus was on the kinds of things that were particularly important to his agenda.

DR. PIELKE: Well, on that note, can you give us an example of a time when the President came to you with a substantive issue or a substantive question that asked your office to weigh in on?

DR. LANE: Yeah, I think once of the larger issues, I think, was missile defense. But that was more of a formal process. It was anticipated that I would give the president advice on missile defense.

The President had promised the Congress he'd make a decision on whether to deploy a system or not. And when he was in the process of making that decision, I, with the advice of my staff and briefings, prepared a memo for his -- to provide him my own advice on just the technical capability of the system. I'm not there to advise him on other aspects of whether national security interests or political consideration or anything else. My job is to tell him whether the system is technically correct. It's a classified memo and I can't tell you what it says, but I can tell you that he was very happy when he decided to go ahead and deploy a system.

The second one is a little bit different. It's sort of more an anecdote. We were on Air Force One flying to California where he was going to give a speech on science and technology and roll out his nanotechnology initiative and the rest of his budget for science and technology, which was wonderful in fiscal year 2001. He was proposing almost double the largest dollar increase the National Science Foundation had ever gotten, and that was not all nanotechnology. So he was going to give a speech. Well, you saw the speech right? Wonderful guy, but it's always an excruciating event working with these speech writers. They know what they want the President to say and you know what you want the President to say.

I'd been trying to get something in that speech for weeks and couldn't get it in. It would always get taken out by the speech writer who always has the last word.

However, on Air Force One, the President comes in and says, "What do you think of this speech?" "Oh, it's a great speech, Mr. President, I really like it." He said, "They're going to love it," which they did. The President said, "Anything in this speech that you don't think ought to be here or anything that you think ought to be here that isn't?" And I said, "Well, now that you ask, Mr. President, there is something I think you would want to say," and I told him what it was, and he said, "Absolutely." He said, "Any idea where to put it in this speech?" And I said, "Yeah, page four, paragraph six." He opens it up and scribbles it in.

And the point was, he's talking to a CalTech audience of primarily scientists, and at some point in the speech he said sort of something like I said that we've been very fortunate in this country over the years. We've been able to attract to America some of the brightest and the best young men and women born in countries all over the world, and they have contributed enormously to the progress of this nation in science and technology and many other ways. And that got him the only applause, except for the end, in his speech.

But he deeply believed in those kinds of issues and it should have been in the speech from the very beginning.

DR. PIELKE: The converse question is were there cases, policy issues, that the administration dealt with that you really thought your office should have been consulted on, or consulted more thoroughly on, that it wasn't?

DR. LANE: There were a lot of them when I was in NSF that I should have been consulted on, that I think the White House should have done differently, and that generally had to do with money and how the money was passed to them.

For some years now, our budget increases for climate change. That's ridiculous. I'm for climate change. We need to do more global change research. So, for things like that, but that was not -- and that wasn't, I think Jack Gibbons' doing either. The science advisor can only do so much.

There were a couple of things that Jack, maybe -- I don't know what Jack talked about on that particular issue, if he had the same question. But I do remember that prior to my going to the White House, there was a stem cell decision that I think the science advisor was consulted on and the President made a decision that was different than the one I

would have advised him to make had I been there, but I don't know what Jack's advice was.

And there was also an issue of needle exchange, and the science is pretty clear on needle exchange if you want to cut down on HIV, but the President didn't go for federal funding for needle exchange, so I know that was an issue that was often talked about. And so there are these issues where the President makes policy decisions, but I don't know of a single case where -- certainly where I, as science advisor, was not consulted where I thought I was.

There was a budget meeting that I was not invited to that I thought I should be invited to, but that wasn't the President's decision. That was a member -- another of the Presidential Aides who sets the agenda for the budget meeting. If Neal comes, it's going to cost money, so I didn't get invited. I heard about the meeting and I went anyway and I even got there early. There was a young staffer putting out the name cards, and I said, "I just don't see my name tag." "Well, who are you?" "Well, I'm Neal Lane." "How do you spell it?" I sat down and then everybody started coming in. But once people start coming in, the President starts coming in, nobody's going to throw you out of the room.

That was a very important meeting. That was a meeting where the President asked a lot of questions about nanotechnology initiative. So you need -- in that White House, yeah, you need to be a part of the team. You need collegiality and trust, but you need assertiveness.

If you don't, from time to time, make a decision to push over the edge, even if you get a slap back, then you're not doing your job. I did that a couple of times; I have a few scars and bruises, but fortunately, none from the President.

DR. PIELKE: In our discussions and in our research preparing for this series, we got sort of an image of a golden age of -- during the Eisenhower and Kennedy administrations where scientists were very close to the President, very close to the seat of power. That all, obviously, came crashing down when President Nixon decided to kick the scientists out of the White House. But what's your sense, taking the long view of the evolution of the role of science advisor, its ups and downs, and where it is, I guess, today and since your tenure?

DR. LANE: Well, this is a hard, much debated question, and I don't have any special wisdom on this or anything else my wife would tell me. But my best guess on this is just a straight, simple, answer.

After the war -- first of all, the science role proved itself in the war. I mean, that's what grew the science budget as pointed out to President Truman, because President Roosevelt had died, that the science that won the war could win the peace and the federal government should make an investment, and a lot of it should be in the universities and not launched to the NSF, and much of the rest of the rather elaborate science technology system that you see.

The early days of the Cold War, it was still very nuclear kind of issues, and so physicists were the science advisors by and large. And they were close because you were designing new weapons, you were designing new missiles, you were pushing those things. So, yes, in

some sense, there was a "golden age" of science advisors, but it was all about war and it was all about Cold War.

In the latter stage of the Cold War, things thawed out a bit, but for some reason we didn't blow each other up. I don't know why we didn't. I'm glad we didn't. Things eased off, and the focus got more diffuse. Science technology then, it was clear it was impacting all kinds of things: health, economic development, environmental protection, energy and so forth. So there wasn't such a clean single focus. They still tended to bring physicists in for some reason.

But the issues weren't quite so urgent as they were during the war time. Now, in the post-9/11 era, and Jack Marburger, for reasons we all understand and probably agree with, has had to focus his attention, his office's attention, on the agenda right now, which has a lot to do with terrorism, has a lot to do today now with Katrina and natural disasters. And you have to be agile; you have to do that.

Will something replace the Cold War as a reason, as a way to focus again science and technology and bump the budget up so this dismal curve that I showed is no longer there, I don't know the answer to that. I don't see what it is right now. People have been searching for a long time. The latest "buzz" word is "innovation." It's CEOs of major corporations, not all of them, but many of them in this country, realizing that to have innovation, they've got to have that infusion of technology and bright people that they're not seeing in such large numbers anymore. They're worried, and they're starting to speak out.

I would say even in this budget cycle that we're getting some traction on that issue, until Katrina. And that pretty well took the wind out of all of us. So we still need to work together to focus on that.

But because of the diffuseness now, the science and technology, I would say the science advisor is less immediately connected, and sometimes less valued by the President and the people around the President.

I even found, when I went to the White House, and Jack told me, Jack Gibbons told me this was going to be the case, you're really going to have to prove quickly your value in the White House and there are a lot of different ways to do that, but you've somehow got to make it clear that the President's agenda is your agenda and that your office -- it's got 60 people in it -- has got something to offer to the President's agenda, and we worked very hard on that.

DR. PIELKE: Before we talk about the current administration in a little bit more depth, I'd like to get your views on the different perspectives you get being director of NSF and the science advisor to the President. Those are probably two of the most influential science policy positions in the country, and you were in both. What's the view look like from the different positions?

DR. LANE: Well, I mean, I loved the NSF job. I didn't want to leave NSF. I committed to serve a term when I came. NSF director is s six year term, and most directors do not serve the full term. And the vice president asked me, when I first came and I had my first interview with him before NSF, if I would serve the term and I said I would.

And I kind of wanted to serve the term, but I understood Jack Gibbons wanted to move on and certainly deserved to be able to step down. And when asked by the President to be science advisor, unless you've got a really good reason, I had to say yes. And I was flattered and certainly privileged to do the job, so don't get me wrong about that.

But the NSF job, you're CEO of a very well regarded agency. And the agency has a lot of money. In those days, it had, I don't know, three and a half billion dollars. You've got five and a half now. You don't go in with the thought you're going to change a lot and you're going to move a lot of that money around, but the agency, as a whole, does a lot every year and can do a lot. So you really feel good about that. And you're the CEO. In the White House, you're a staff member, so -- you're staff member for the President.

So the two jobs are totally different. When you're the CEO of NSF, you have quite a lot of power, and if you use it properly, and that means respecting the people who work for you and the people in the community who you work for in a sense, you can actually get a lot of things done in a short period of time if you can get along with Congress.

And in the White House, your power is the President's power. You speak for the President, but your job is really to cajole, to persuade people to work together, bend a little, give a little, to get something done. So it's a very different kind of job.

And then you also have to figure out how to be a part of the team, and a lot of those people came off the campaign. If you weren't in the campaign, you're starting way back in terms of credibility in the organization. But if you've done a campaign, which I never have, you know what it's like. I mean, you become brothers and sisters. I mean, blood relations to the core. You know everything about one another and you learn how to get along. If not, you're no longer together. That gets translated into the White House at the beginning of the term, the first term. Sometimes not translated terribly well for the country, because that's not a campaign any longer. That's a very responsible job in charge of the executive branch of government.

So that job is quite different. I liked both jobs, I learned a lot from both jobs. I've got scars and bruises in both jobs of a different kind, and feel enormously privileged in a very patriotic way, actually, about serving the country in that way. I wouldn't have traded that for anything short of the Nobel prize.

DR. PIELKE: All right, so I'd open it to questions to amplify some of your remarks and your prepared comments. What is your view of the current state of science advice in the Bush Administration?

DR. LANE: Well, I'm not a fan of G. W. Bush. I don't think he does a good job. I am a fan of Jack Marburger, and I complimented -- I mean, President Bush didn't ask my opinion, but when the press did, I complimented President Bush on his appointment of Jack Marburger. I thought it was a kind of standing appointment. Jack had all of the background knowledge, skills, ability, personal skills, to do the job. Everything he has done he has done well in his career as far as I know, including his last job as director of the Brookhaven Lab, when the lab was in major trouble.

But, and I think Jack is trying to do the very best job he can. As far as I know, he is doing the very best job he can, and I'm not aware of anybody else that could do a better job. It's a very difficult time in the administration to be trying to do that job now.

As you know, right after 9/11, the White House moved his whole office out of the White House complex down the street. Not far; a half a block, down a little closer. But they're outside the White House complex. If you're outside that fence, you are outside. You might as well be on the other side of the country, because that's a security thing. So if you're inside, either in the Dwight D. Eisenhower Executive Office Building and you're in that great hall that sits next to the White House, if you're in that building or literally in the West Wing of the White House, you're only a few minutes away from one another, any one another. Your staff moves all around. In a day, they see dozens of other staffers in all of these offices; you do also. You can get to the President if he needs you in four minutes, faster actually, if he says so.

And so that's access that you can't trade for anything. And it's not Jack's fault. I would have been moved out, too, after 9/11. 17th Street is very close to the edge of that building and cars and trucks go up and down 17th Street. They moved everybody out of that wing of the Executive Office building, but Jack was unable to move back in. It's not his fault, but it's his problem.

So his office does not have that kind of access. Also, his title -- he wasn't given the title assistant to the President. It was kind of a slap in the face, and it's a signal to all of the other senior aides that the science advisor's role is important. Whether it's true or not, and I'm not saying it's true, but it signals that, and so it's another problem with access.

And the other thing is that this administration has really shown no sign of having science as a terribly high priority, or engineering or technology for that matter. So all of these things together make it just a very difficult time and situation in which to be a science advisor.

But I've always supported Jack Marburger, I'm glad he's doing the job he's doing. I'm not sure what would happen if he were to leave.

DR. PIELKE: You mentioned that you signed the statement, I guess it was last year, criticizing the Bush Administration's role in scientific integrity. But then after -- soon after the election, you were one of I think it's fair to say very few people who adopted a more conciliatory tone, saying now's the time for the scientific community to reach out to the administration. And you were quoted in Nature as saying that -- I think it was last February. So now that we're a few months on from that, do you still feel that the scientific community should be reaching out, and what does that exactly mean for scientists and leaders of the scientific community?

DR. LANE: Well, I think I did say that, and I did sign the statement. I signed it because I thought the situation was sufficiently outrageous, to pick another word, that somebody had to call attention to it. Obviously it didn't have to be me. I mean, most of the people who signed that were well known figures, Nobel laureates. So the list is Nobel laureates and Neal.

The reason we signed the statement is because the administration, for whatever reason, had false information on the website of the National Cancer Institute about the alleged relationship between breast cancer and abortion because they were pushed by conservative groups to do that, so they did it. They put false information out -- or took correct information, valuable health information, off of one of the health websites on the effectiveness of condoms and preventing disease, and replaced it with abstinence only information that was highly misleading. They doctored it, I would say, in a way that went well beyond any kind of editing we would have suggested in government reports.

The State Department reported first, and then the Environmental Protection Agency reported climate change, essentially changing those words so that it was totally misleading what the science was all about. They muzzled a scientist in the Department of Agriculture and wouldn't let him publish his work because they found a connection between pesticides, I guess, and the potential for antibiotic resistance to human beings living in the area or something like that. So the health effects of agricultural practices that some agricultural company didn't like. So it was just becoming very clear that there were some lobbies whose voices were being heard and things were being done that we considered abuse of science.

It's not that policy decisions were made that we disagreed with, where many considerations applied. Stem cells. We didn't complain about stem cell decisions because nobody was misrepresenting the science. The President made a decision, some of us liked it, maybe some of us didn't like it, but that's not the same as the government misrepresenting or falsifying what the scientific record really is. That's what we were complaining about.

So why did I say reach out after all that? Well, you can't give up. I didn't expect that we'd all be welcomed into the offices of the people who were just slammed, and we never said - and never believed - I certainly don't, that the President directed all of these things to happen, or there was some conspiracy in which these high level officials all got together and said, "Hey let's falsify science to please us." It just happened.

As Jack Marburger himself said, when he was defending the administration, "Sometimes people do dumb things." Well, these were some of them, so we felt it was a very bad situation.

I felt, and I feel still, that with turnovers in agencies, new people come to town, and new political appointees, let's have a conversation about this issue. Let's see, okay, do you think we really misrepresented what your agency did under a previous director? Or give us some advice on what's a better way for us to call these things to your attention. Would it have worked better if we had gone to the secretary of Health and Human Services and said, "Why did you do this, Mr. Secretary?" Because in some cases, it was Mr. Secretary or the second level political appointees.

So it's just time to talk about those kind of issues, because you can't win this. I mean, this can't be a continuing battle somehow between science and the administration. It's a larger set of issues. It's not about what president even. It's not about one set of political appointees. Some of these things reflect changes that have been occurring over the whole country. They reflect, I don't know, values, beliefs of a large fraction of the American

people. Maybe not the majority, but a lot of people and what they think is important and what they're willing to tolerate.

So I'm worried about it at a much larger level than the Administration, and I think whoever the next Administration is, the science community needs to show that whatever some of us might have saw that irritated people as a community, we really recognize the reason we're funding science is for the benefit of humanity.

The things we do in our laboratories, the things we do in our classrooms, the things that use federal money, are supposed to be for the American people. In order for that to happen, our voice on policy has to be heard and we have to be supportive of the political process. So I think, again, we need a dialogue here. I believe that then, I believe it now, and there have been some meetings. The more effective ones probably are the more private ones, because it's such a hot topic politically, and I think it's not good to publicize the meetings themselves.

DR. PIELKE: Well, before we turn it over to the audience, there's two topics that are of particular interest to the Boulder community I thought I'd give you a chance to reflect on.

One is, what's your thoughts on the current approach to space policy, human space flight and its effects on space science in particular?

DR. LANE: Well, I co-authored a paper on that not very long ago with George Abbey, who is a wonderful former director of the Johnson Space Center, and he actually knows a lot about space. So it was fun to write this paper with him. We wrote it for the American Academy of Arts and Sciences, and it's on the civilian -- the U.S. civilian space program.

We made, I think, four points. Our first point was the export controls, especially as you must get licensed through the State Department, it really essentially killed the U.S. satellite industry. France has run away with it. The U.S. satellite industry has been deeply hurt by these export controls.

See, if you want to sell anything -- any kind of a space technology or instrument, something to do with space, to some other country or you want to share collaboratively with a fellow scientist in another country and it's got to do with space technology, you've got to get a license or you're in violation of the law. And that means you have to apply to the State Department, because space issues define space technology -- are defined as munitions, the same category as guns and rockets and stuff. Well, rockets, space, you sort of get it? Okay. So, the trouble is it's a very cumbersome process. It takes forever, and there's no assurance when you'll get a license, there's no assurance you will get a license. Well, people who want to buy things from us don't need that. You can buy equally if not better technology in other parts of the world, so we lost the market.

Not only that, I don't think we would have been able to do the show program of the space station, whether you think it's a good idea or now, under the current export regulations.

So we were simply drawing attention to a serious policy issue that's well known in policy circles, that has not gotten much attention in the larger circles.

The second issue we point to was I think what we called a -- I don't remember the term we used, but it had to do with an incomplete vision for space science and human space flight in the future. And there we were commenting on President Bush's Moon launch plan.

And what I had already said in testimony was what we said in the paper, that I believe President Bush's vision was a bold vision that I felt was incomplete. It was bold in that if you say you're going to go back to the Moon and onto Mars, that's bold. That would sort of have to be a Presidential statement. You'd never do anything like that if it's not a Presidential initiative.

But it was incomplete in my view, because science was not included as one of the high priorities of NASA, and many of the gems of NASA, you know, really the science, all those planetary missions, even the ongoing Mars robotic missions and so on, the Earth observations, satellite missions and so on, I mean, all that stuff was relegated to a lower priority by just simply not raising it. I felt that was very scary, very dangerous.

And the other thing about the President's vision being incomplete is it wasn't funded. So we're still without. The future budget was totally inadequate in my view to do anything like what they said they were going to do.

There's a lot of things about phasing out the shuttle that they said they were going to do, and some of it just didn't compute. It's just not carefully thought out enough going into the plan. The President just gave his speech, being handed something from NASA, and it wasn't a real plan there.

To be fair, in parenthesis, the new administrator, Barry, a very accomplished and very knowledgeable person, is trying very hard to make sure they view the President's vision, but at the same time they don't kill all the science and so on. I'm hopeful these same people do it without a lot more money, so we shall see.

Meanwhile, science is getting killed every day, every year. Missions are being delayed, canceled. You may remember the big battle over the Hubble. It looks like we will make a mission back to repair the Hubble, but that was after a huge amount of noise from the astronomy community and Senator Mikulski. A huge amount of noise on the political front, so that was happening.

The other thing we point to is a problem, in my view, we have all over the science technology in the country, and that's a manpower issue. I already talked about that. We just called attention to it in the case of space. I hear that from NASA, I hear it from the contractors, I hear it from the aerospace industry. They just cannot find the quality of people that they need. So that's a scary situation.

The last one is really the most serious, in my view, and it relates to the others, is the sort of deterioration of international cooperation in space. It's something to do with something of the negative image that our country has gotten for various reasons over the last several years.

But when the President's Moon-Mars plan is rolled out, essentially saying we're going to back away from the space station, a very important international cooperative activity that

many nations have invested in, we didn't consult them. We didn't even let them know we were going to make a speech, as far as I know. If you know different, then please tell me. But my checking is with my colleagues in other parts of the world is it was a total surprise.

And when Sean O'Keefe did his talk about what was going to happen, same day as the President made his speech, Sean made it very clear that this is going to be a U.S. mission, it's going to be a U.S. plan, a U.S. program, and sort of if other nations want to be a part of it, we'll be glad to talk to them.

It's not a really good way to start a partnership, and we can't do any of this without other nations. We can't do most of the large astronomy missions without other nations. We can't do a lot of the Earth observations without other nations. We just can't afford it, and in some cases, we don't have the technology. We need these other countries.

So I think it's not prudent to offend them all when you're rolling out your new space mission. So, I have other criticisms, but those are just a few.

DR. PIELKE: All right, my last question for tonight is the same one, but what are your thoughts on climate science and climate policy and where we're at and how things have evolved since your term as science advisor?

DR. LANE: Well, something's going on. I never saw weather like we've had recently. It's a really complicated issue. I mean, climate science is wonderful, it's really interesting. It's system science and it's very challenging, kind of on every front, and so that's why I really enjoy it. I don't know climate science, but I really enjoy learning about it.

But my point is, it's really complicated. It is not the answer to all the questions, as you well know, so there are uncertainties and we have lots more work to do.

But because it's so important, and has such important policy implications, the likely increase in the average temperature of the Earth by, I don't know, pick your number, but let's say four, five, six degrees Fahrenheit, and even in as short a time as 50 years, but certainly in 100 years, the increase in the -- the likely increase in sea level is a range, but 20 inches would not be too surprising in a century.

Those are big, big policy issues and we need to get ready for them. But there's a lot of political sensitivity here. ExxonMobil is in my home town. They haven't been really friendly toward climate science, so the climate science community has to be extraordinarily careful in saying what it knows and what it doesn't know and then I think, to be fair, the people on the policy side need to actually be receptive to those ideas and not falsify the information for the American public.

And then we desperately need the people in between who really understand policy and who really understand climate science and help us get through these gaps. So I think global warming is clearly real. Climate change is real in some measurable ways. The predictions can only be done using very elaborate computer models, which are limited by the physics and chemistry models, although they're very sophisticated ocean and atmospheric coupled models. And they're also limited by computing power. And finally, they're limited by not knowing what the world is going to do in the next 100 years. So the

best you can do is to make assumptions about population growth, which is pretty clear why these people are born. So we're going to go from six to 9.8 billion people by 2050 and then we're going to go to a little less, or 11 maybe by 2100. It could be different numbers.

Economic growth, you've got to assume something, so assume two and a half percent a year for that period. Reduction in energy intensity, we just take the historical assumption. Energy intends to be, you know, energy per economic growth is going to be going down a little bit. We've gotten a little more efficiency as a world for the last 20 years or so. Use those same numbers.

Assume carbon intensity reduction as a function of energy is going to keep going down, as it has been doing, I don't know, 2/10ths of a percent a year. I'm not sure I got that number right. Put it into the model and decide how much carbon you think we're going to pump into the atmosphere between now and 2050 and 2100. So that, you have to have that also, before your models can predict what the temperature is going to be and what the sea level rise is going to be.

So I'll stop at that. I've already told you a lot more about climate science than I know, except that it's complicated, it has enormous policy implications. And on this, I'd rather agree with Roger, although we haven't had a chance to discuss it on this trip. There are a lot of things we could be doing right now that we should be doing right now because we already have a problem. Katrina exhibited that in a horrible way for New Orleans. It was coming. We knew it was coming. We just didn't know when. We're built up all along the Gulf Coast, million dollar homes. I don't own three of them or one for that matter, along the Gulf Coast. The next category four comes through Padre Island or anywhere along those barrier islands, it's all going to go. The government is going to pay a lot of money, your tax money, my tax money, people building along the rivers, heat index, heat controls in cities, building planning in cities, parking lots, buildings, why don't you put green roofs on them. I mean, all that whole set of kind of friendly environmental issues which many of my colleagues call "tree healthy." I mean, these all make sense.

We know what all of those technologies are, and science really is pretty good in a lot of that. There's terrible water problems coming up, droughts in this part of the country and other areas we're going to have a lot of flooding. Climate change is probably going to make droughts worse, it's probably going to make flooding worse, and in my view it's probably going to make more high intensity storms like category four or five hurricanes. I may be wrong. It's a much less certain issue, but why not -- we have the storms already. Why not as a country decide we're going to deal with some of these issues that are killing people right now as we speak, and then as we learn more about the science, we'll be much further along and protecting ourselves from whatever climate change is going to deliver.

DR. PIELKE: All right, thank you, Neal. So, the ground rules are quick questions and quick responses. We'll get as many in as we can tonight. So let me just see a show of hands. I need to repeat your question for the TV, so I'll go around the room. So why don't we start on this corner? *(male asks question)*

DR. PIELKE: So the question is to relate a few interactions testifying with Congress.

DR. LANE: Clean ones you mean? Congress is kind of funny. I may say some things that I probably wouldn't share with you. I did testify a lot before Congress. One positive one, one negative one. I testified before Senator McCain actually after leaving government when McCain -- no, I was still in government. McCain had come back up the campaign trail. He had been asked by a lot of people their opinion on climate change. Senator McCain, and this is a serious problem, climate change, said "I don't know what it is." And so he promised young people that he would find out when he got back to Washington, because by that point he knew he would be president. So when he got back to Washington, he asked his staff, "What is this all about?" Staff told him, he got concerned, and he set up a series of hearings. I was the first witness as the first hearing. I was a government witness, and it was a wonderful hearing. It was a balanced hearing. He had climate skeptics as well as people who believed strongly in the harmful effect of climate change. I was simply testifying on behalf of the government's position on global change research program and our policies, Kyoto and all of the rest of those things.

And McCain made a wonderful strong and informed statement opening the hearing about climate change. And I looked around in there a little bit, and there was Senator Brownback from Kansas, and I thought, "Oh my God." You probably know him. He's from Kansas and he's a very, very conservative senator. I thought, "Why did he come?" Well, if Neal had been smarter, he would have seen that Senator Brownback is interested in emissions trading and the fact that if you grow things you might bring to save money, because when you're growing things, it helps in the carbon scheme. You had to take credit for the things it grows, or it will when all else is negotiated and we get back into negotiation again. So, you know, in the Kyoto Agreement, there was lots of things undecided that in principle they were decided, that you would get credit for growing trees and green things, and you would be harmed when you cut them down or they burned down. You would be harmed when you emitted carbon from fossil fuel burning. You could buy credit by paying money to countries to produce less emissions. So all of that is built into the Kyoto protocol.

Senator Brownback was very nice. He asked very thoughtful questions. He didn't make strong policy statements about climate change, but he at least didn't rake me over the coals.

A not so politic one was early in my time when I was at NSF and I came into a Senate appropriation hearing and Senator Ted Stevens came. The Republicans were in the minority that year, and Stevens, who is kind of a curmudgeon from Alaska, and never liked the United States spending -- National Science Foundation spending all of that money in the Antarctic. NSF is responsible for all of the science in the Antarctic. We don't fund all the science, but we have responsibility for all of the infrastructure, the airplanes that go in and out and everything that goes on down there for the U.S.

And Senator Stevens, you know, didn't seem on policy at all, and so why would you do research at the South Pole that you could do at the North Pole, and you could do the logistics out of Alaska? So he raked me over the coals, so there he came in and he really ran me through the wringer. He's got fishermen drowning off the coast of Alaska, and Neal Lane and NSF are doing search and rescue in the Antarctic where people don't even live. I mean, how do I explain that? I don't remember. I hope I had a good answer.

DR. PIELKE: All right.

DR. PIELKE: So the question is whether in Dr. Lane's 10-years, did he ever receive any communication from the scientific establishment, anything similar to what the Bush Administration has received?

DR. LANE: No, I did not. But I think the administration I was working for was -- even though we were not very good with science budgets for the whole first term, because you remember President Clinton's campaign promise was "Cut the Deficit and Balance the Budget Eventually." And so he was cutting the ribbons out of a lot of federal spending, and he cut staff as well, so that was part of the frustration I'm talking about arriving at the NSF.

But I think it was clear to everybody, I think, that the administration, and it may be symbolic because Gore was there. I think people just knew that the White House cared about science and engineering and that probably Jack Gibbons, Neal at NSF, Harold at NIH -- or course, Harold was rolling in money, but what we were trying to do, we were trying to support the research as best we could. And certainly the White House is very environmentally friendly, so there was no situation in which -- that I'm aware of -- where we were accused of misrepresenting our science or using science somehow for political purposes. So I never did get a letter like that.

When I was at NSF, I got a lot of irate phone calls about Nobel laureates who had lost their grant funding, and some from Congress who discovered we were giving a grant and there's no time for me to explain it, but it's an interesting story. And then another phone call from another Congressman, and then finally a whole lot of Congressmen calling me wondering why in the world the National Science Foundation is funding research on dirty tricks in campaigns that unseat Members of Congress. So, things like that went on while I was at NSF.

Probably the most difficult call I got in the White House was after we had inadvertently crashed the biotech market in the NASDAQ in October. I wrote a statement, which really means my staff had helped me put it together, and negotiated with Britain, with Great Britain, explaining that we believe -- our position was that the human gene, the raw sequencing information of human gene, should not be patented. That should be made freely available to everybody. But it got muddled in a press release, and the people who don't know a gene from a hole in the ground ran out and called the papers and reported that the White House was decided genes will no longer be patentable. Everybody sold off. We lost billions of dollars that day, and the market never recovered, certainly during the time I was there. It first hit the biotech market and then it hit the whole NASDAQ and then it finally hit the whole tech market. That was the beginning of the slide. Neal did it.

I walked into a staff meeting, and I had briefed the President immediately after his press conference the first time that it happened. And I wasn't there when the press really got muddled. They hadn't called me down. I wish they had. I hope I wouldn't have misled them, but something got confused, and so the message with that, the reason I took the time to tell you that, is a little mistake in the White House can make a huge difference, and so you really must realize when you're there, you have enormous responsibility and that's why the

stress level is so high because even though you don't have a whole bunch of people in an agency responsible for, you do have a responsibility because a slight mistake can make a huge difference. You have to absolutely be sure as you possibly can that you're correct, what you're guiding the President to do is correct, and the President in this case signed to Tony Blair such a statement.

So later I had to tell the President, after I briefed him on something else, "By the way, Mr. President, there's this one other thing that seems to have crashed the NASDAQ." And wanted to reflect. He was very good about it. The next day he gave a speech and said, "Well, yesterday we crashed the NASDAQ. We didn't mean to, but we did it anyway."

When I went into the staff meeting the day after the crash, Gene Sperling, who is the head of the economic council, said, "Before we start this meeting, I want to tell everybody that Neal managed to do in one press release what Alan Greenspan confirms every six months."

DR. PIELKE: Why don't we take one more question, and then I think we're due over here on the right hand side. *(male asks question)*

DR. PIELKE: So the question has to do with asking Neal to address the role of science education as a possible solution to the four threats that he discussed in this talk.

DR. LANE: Well, yes and no, I guess. Absolutely yes would be more correct. This is fundamentally an issue of science education, but it's not just our young people. I'm not knocking young people understanding more about physics and biology and chemistry. There's that other more complicated level about what science has to do with all of these other issues. It is more complicated and generally not done very well. In fact, if it's taught at all, it's taught in an inverted way, as somebody pointed out to me recently. You sort of teach that part early, and the kids have forgotten it by the time they get to physics and chemistry and the way in which science progresses. But it doesn't work to deal with this kind of issue.

So, yes, definitely science and science education and educational broadening in the way I just described. It will take long-term. We've been working at it, wonderful people working on it for a very long time. I know Nobel laureates who are working very hard on education. So it's not we're not paying attention. We do a lousy job in many universities. I don't know about this one; I love this university and I don't want to say anything at all that might be negative about it, but maybe you're not doing a great job either in integrating somehow the scientific part and scholarly part of the establishment for teacher education. At least we didn't do a great job when I was working in the system, and there were a lot of reasons for that. But I think until that gets fixed, we're not going to make any progress on education. My view is the Department's, you guys, the chemists, physics, astronomers, economics, matters of social science, you're going to have to take ownership of those problems somehow. Not just here, of course, but all over the country. And that's hard. "Well, Neal, what do you mean? How would you do that?" I don't know. It's a very, very difficult issue. First of all, we all come sometimes to the table because we're threatened or we don't know anything about the classroom or we tend to come in with the wrong kind of approach. I'm not sure, but we need to work at it. We need to figure it out. If we're smart, we ought to be able to figure that out.

Universities need to find ways to encourage that, and for God's sake, the National Science Foundation needs to figure out how to encourage that rather than put in patterns that actually work in the other direction.

So I think we really need to do that. But the null part of my answer was yes. Essentially it was just your second point. You've got to do some things in real time so if Congress wants to get re-elected, they've got to do something now. They've got to do something this week, something in this speech, this campaign, and so on. And so we also have to be smart on that side and figure out what other things we can ask our policymakers or members of Congress, people in the White House, to do that's eventually going to help, but will also help them.

So we've got to put ourselves in their shoes. And I think the only way to do that is to get to know the political system. Some of us work in it. Talk to the people who have worked in it. Red Byerly over here is the world's expert. He's got bruises and scars. He knows how Congress works, and so do others in the room. Because to -- you have to understand that culture and what their needs are so that when you go into their office and say, "I'm a scientist, Congressman, I'm here to help you," you really need to help him as opposed to just taking their time. That's the short-term part. And that has to do with education and everything else connected with science and technology and policy.

But I want to thank everybody who has -- who does contribute to the education with kids and adults and everybody else in whatever way you do, and a lot of you do. Darn near everybody in this room is connected somehow with trying to improve the situation of education. Because at the core, that really is a problem, and that's how we resolve a lot of our problems, not just science technology policy, but many of the others.

DR. PIELKE: Dr. Lane has been exceedingly generous with his time, with our students, with our faculty over the last two days, and with us tonight. So why don't you join me in thanking him for coming here tonight. *(applause)*

The David proceedings were transcribed from a digital recording and reduced to typewritten form by Christopher Boone, Digital Reporter.