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Mr. Chairman, Mr. Ranking Member, and Members of the Subcommittee, I appreciate the opportunity to appear before you today. I am Jeff Kueter, President of the George C. Marshall Institute. The George Marshall Institute (GMI) is a 501(c)(3) non-profit organization founded in 1984, focused on how science is used in making public policy. The Institute's analyses are designed to improve the comprehension of the public, the media, and policy makers of important scientific and technical issues and help them distinguish between opinion and scientific fact so that decisions on public policy issues can be based on solid, factual information, rather than opinion or unproven hypotheses. We publish reports and host roundtables and workshops. Our activities focus on the environment and national security topics, with a particular emphasis on ballistic missile defense and space security.

With respect to climate change and its public policy ramifications, the Institute's position, held for nearly 20 years, is that distinguishing human influence from natural variability is not sufficiently understood and that many uncertainties about critical climate processes require resolution before a adequate understanding is established for projecting future climate changes. Statements that greenhouse gases are accumulating in the atmosphere as a result of human activity, that they contribute to warming, that the temperature has increased in the past 50 and 100 years and that humans influence climate only tell us the obvious. [1] The plain facts are that we do not know how much human activity is influencing the climate and cannot know what temperature or climate will be 50 or 100 years from now. The Marshall Institute has long held the position that climate

[1] National Research Council, *Climate Change Science: An Analysis of Some Key Questions.* (Washington, D.C.: National Academy Press, 2001); Committee on Global Change Research, National Research Council, *Global Environmental Change: Research Pathways for the Next Decade* (National Academy Press: Washington, D.C., 1999), 127-129; J.T. Houghton et al., *Climate Change 2001: The Scientific Basis; Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, U.K.: Cambridge University Press, 2001), 698; James Schlesinger et al., *Climate Science and Policy: Making the Connection* (Washington, D.C.: George Marshall Institute, 2001); and William O'Keefe and Jeff Kueter, *Climate Models: A Primer*. (Washington, D.C.: George Marshall Institute, 2005)

policy should be related to our state of knowledge. We have documented policy actions that satisfy that standard.[2] However, many proposed actions based on the belief of an impending climate catastrophe are not consistent with our state of knowledge.

Censorship, the Pursuit of Consensus, and Misperceptions About Climate Science

It is, indeed, unfortunate that we are here today discussing calls to effectively silence debate on climate science. The censorship of voices that challenge and provoke is antithetical to liberty and contrary to the traditions and values of free societies. That such calls are now coming from venerable scientific societies, such as Britain's Royal Society,[3] and U.S. public policy institutes is disturbing and should raise concerns worldwide about the intentions of those seeking to silence honest debate and discussion of our most challenging environmental issue– climate change.

The foundation of science, as well as its contributions to the betterment of mankind, is based on skepticism and debate. Schools teach that science is the clash of ideas, sharpened by data and observation, and subject to revision and reversal. Political discourse rests on the principle that all voices have the right to be heard and that any person is free to associate with whomever they so choose. Science demands those freedoms and scientists ought to embrace them.

The effort to promote and assert a 'consensus' on climate change science subverts the basic principles of science and is reaching the point where the very freedoms on which science depends are now in jeopardy – not through action of government but by scientists themselves.

Yet, a careful and thoughtful examination of this issue plainly reveals that the debate is not about science. It is about different interpretations of studies and data when different assumptions and models are used. There is a major distinction between interpretation of data and established, verifiable facts. Much of what is put forward as fact are interpretations of data and the projections of climate models which have not been scientifically validated and which are driven more by assumptions than extensive observational data and measurements. In a free society, policy makers and the public are free to judge such interpretations and judgments and the weight of evidence that supports them.

It is suggested that the guarded language of serious scientific dialogue is being mischaracterized as vagueness and uncertainty as part of an intentional campaign to misguide the public. In fact, the drive to end discussion on climate change is a mischaracterization of what the Intergovernmental Panel on Climate Change (IPCC) said in its Third Assessment Report about uncertainties, as well as statements from the National Academy of Sciences (NAS). As the IPCC, the NAS, and the U.S. Climate Science Strategic Plan, which has been endorsed by the NAS, clearly demonstrate, there are many critical uncertainties in our understanding of the climate system. Until these uncertainties are reduced and our understanding of the climate system is greater,

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[2] James Schlesinger and Robert Sproull, *Climate Science and Policy: Making the Connection*. (Washington, D.C.: George Marshall Institute, 2002).

[3] Bob Ward, "Royal Society Letter to Nick Thomas, Esso UK Limited," September 4, 2006.

reasonable people and organizations can reach different conclusions about the extent of human influence on climate and potential future impacts. It is puzzling, therefore, that the American public should be told that there is nothing more to know about the human relationship with climate.

For example, in addressing the effect of human activities, a National Research Council (NRC) review reveals numerous qualifications and assumptions:

> "Because of the large and still uncertain level of natural variability inherent in the climate record and the uncertainties in the time histories of the various forcing agents (and particularly aerosols), a causal linkage between the buildup of greenhouse gases in the atmosphere and the observed climate changes during the 20th century cannot be unequivocally established. The fact that the magnitude of the observed warming is large in comparison to natural variability as simulated in climate models is suggestive of such a linkage, but it does not constitute proof of one because the model simulations could be deficient in natural variability on the decadal to century time scale."[4]

There is little question that human activities, activities which raise people from poverty, allow rising living standards and improve human society, have had an influence on the climate. The question is to what extent and how strongly. As the quote above shows, this is not a settled matter.

Further, the Executive Summary of Working Group I, Chapter 12 of the IPCC's Third Assessment Report contains the following lengthy statement about uncertainties:

> "A number of important uncertainties remain. These include:
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> - Discrepancies between the vertical profile of temperature change in the troposphere seen in observations and models. These have been reduced as more realistic forcing histories have been used in models, although not fully resolved. Also, differences between observed surface and lower-tropospheric trends over the last two decades cannot be fully reproduced by model simulations.
> - Large uncertainties in estimates of internal climate variability from models and observations, though as noted above, these are unlikely (bordering on very unlikely) to be large enough to nullify the claim that a detectible climate change has taken place.
> - Considerable uncertainty in the reconstruction of solar and volcanic forcing which are based on proxy or limited observational data for all but the last two decades. Detection of the influence of greenhouse gases on climate appears to be robust to possible amplification of the solar forcing by ozone/solar or solar/cloud interactions, provided these do not alter the pattern or time

[4] Committee on the Science of Climate Change, National Research Council, *Climate Change Science: An Analysis of Some Key Questions* (Washington, D.C.: National Research Council, 2001), 17.

dependence of the response to solar forcing. Amplification of the solar signal by these processes, which are not yet included in models, remains speculative.

- Large uncertainties in anthropogenic forcing are associated with the effects of aerosols. The effects of some anthropogenic factors, including organic carbon, black carbon, biomass aerosols, and changes in land use, have not been included in detection and attribution studies. Estimates of the size and geographic pattern of the effects of these forcing vary considerably, although individually their global effects are estimated to be relatively small.
- Large differences in the response of different models to the same forcing. These differences, which are often greater that the difference in response in the same model with and without aerosol effects, highlight the large uncertainties in climate change prediction and the need to quantify uncertainty and reduce it through better observational data sets and model improvement."[5]

There is nothing in our ongoing review of the new IPCC assessment to suggest major changes in these uncertainties.

The referenced uncertainties are important in considering both the detection and attribution of climate change. Detection of climate change is the ability to say, with some degree of confidence, that the climate has changed. Attribution of climate change is the ability to say, with some degree of confidence, why the climate has changed. There is little question that in many parts of the world there has been a detectible change in climate in the last century. The IPCC authors are correct in saying that this change can be identified despite the large uncertainties in estimates of internal variability. However, attribution is a more difficult problem, and the high level of uncertainty gives us reason to question the certainty of the IPCC's conclusion.

In summarizing their review the state of science, the National Research Council used highly qualified and nuanced language which further supports our position that the question of human attribution is far from settled. The NRC stated:

> "The changes observed over the last several decades are likely mostly due to human activities, but we cannot rule out that some significant part of these changes is also a reflection of natural variability . . . Because there is considerable uncertainty in current understanding of how the climate system varies naturally and reacts to emissions of greenhouse gases and aerosols, current estimates of the magnitude of future warming should be regarded as tentative and subject to future adjustments (either upward or downward).[6]

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[5] Houghton et al, *Climate Change 2001*, http://www.grida.no/climate/ipcc_tar/wg1/442.htm.

[6] National Research Council, *Climate Change Science*, 1.

If anything, the prevailing view is that we are not able to answer many significant questions about climate change and, at this point, the evidence available is "suggestive" but does not "constitute proof."

It is important to recognize that these statements are solely the product of the scientists who participated in the process and those representatives of government assigned to produce the summary reports. Scientists have declined to participate in the process, citing its overt biases or unwillingness to commit the time and effort demanded. The failure to give adequate recognition to uncertainty and to reasonable interpretations of its impact on climate models and public policy contributes greatly to the contentiousness in the current debate. Expert analytical judgments are subjective and tentative. As the recent debate over the paleoclimate temperature history has plainly revealed, analytical studies are subject to numerous and sometimes substantial questions that alter their conclusions significantly. Expert judgment is not science and neither is the output of models that have been calibrated but not validated. The fact that a range of possible climate futures result from running a single scenario through the models relied on by the IPCC make it clear that the science is not settled and that there is room for differences of opinion and debate.

Nevertheless, as is shown, the statements themselves detail numerous significant uncertainties. That the participants in the IPCC, for example, reached one conclusion does not make that a fact. Fair minded people can reach other conclusions, as the National Research Council did when it concluded that "current estimates of the magnitude of future warming should be regarded as tentative and subject to future adjustments (either upward or downward)."

Providing a different interpretation about available data and understanding is not misleading the public nor is it providing inaccurate or misleading impressions. To charge otherwise is tantamount to saying that a prevailing view should never be challenged. The history of science is replete with examples of where the prevailing view was overtaken by new information. We once believed that Pluto was a planet and generations learned of it in that context. Yet, with the expansion of knowledge and sophistication of techniques, we learned that we were wrong and now Pluto is no longer a planet. Eugenics was once supported by the best minds in the nation before persistence discredited it. Lysenkoism severely damaged Russian agriculture and did great damage to the fields of biology and genetics before it was rejected.

Expressions of doubt—skepticism—about aspects of climate science and projections of future impacts are claimed by some to hinder sound policy. Significant uncertainty is not an obstacle to action. It is a signal for caution and flexibility.

Politics and Science: A Permanently Politicized Relationship?

Politics and science are intrinsically related. As scientific and technical matters have become more influential on matters of public policy and the financing of the scientific enterprise become dependent on the federal government, there are strong pressures exerted on science and scientists. All the participants in policy making --

politicians, bureaucracies, public policy institutes, industry, the media, and scientists -- have their own preferences, interests, and objectives. These decidedly different views and preferences color the interpretation of often tentative scientific results and the conclusions drawn about the science may be more a reflection of the preferences of the viewer than the science.

Some politicians are inclined to focus on scientific results that support their policy preferences. Similarly, some scientists tailor their research and slant interpretations as a way to curry favor, gain funding, and enhance recognition of their work.

Scientists, politicians, and public policy institutes regularly use the media to frame public policy issues in ways that are favorable to their preferred positions. While some see this as informing the public, it can be nothing more than clear manipulation. This tactic is effective because of what the late historian Daniel Boorstin saw as a growing gap between what an informed citizen can know and should know.[7] Information overload and the trend toward "sound bites" have produced circumstances where citizens have lost their capacity for skepticism. Reality often is now measured against created images instead of the reverse.

The media is also criticized for including the views of the so-called skeptics in their reporting. The media's role, of course, is to provide information to the public. Reporters should not be criticized for including diverse views in their work.

In today's highly charged environment of climate change policy, it is claimed that the political interference with climate scientists is unique. It is alleged that federal scientists are not free to speak their minds and are subject to oversight by political appointees. The situation is neither unique nor exclusive to one political party. Our book, *Politicizing Science: The Alchemy of Policy Making*, documents numerous past examples of where science and politics intersected with damaging impacts on science and negative public policy outcomes.[8] Further, those who believe the current situation is unique should make themselves familiar with the story of Dr. Will Happer. As told by Happer in *Politicizing Science* and widely reported at the time of its occurrence, in the early months of the Clinton-Gore Administration, Dr. Happer, then head of the Department of Energy's Office of Science, questioned the Vice President's views on climate change and ozone depletion. Despite his scientific credentials, he was summarily dismissed at Gore's direction.[9]

Further, efforts are often made to impugn the credibility of those engaged in the debate through assertions that their views are a product of financial relationships rather than sincerely held beliefs or objective research. All too frequently evidence of a financial tie is sufficient to condemn, without proof that the tie altered the views, opinions, or conclusions in any way. The public discourse suffers as arguments are not explored in sufficient detail.

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[7] Daniel Boorstin, *The Image: A Guide to Pseudo-Events in America* (New York: Harper & Row, 1964).
[8] Michael Gough, ed., *Politicizing Science: The Alchemy of Policy Making* (Palo Alto, CA: Hoover Institute Press, 2003).
[9] William Happer, "Harmful Politicization of Science" in Gough, *Politicizing Science*, 45-56; Holman Jenkins, "Al Gore Leads a Purge," *Wall Street Journal*, May 25, 1993.

Often overlooked or ignored in such discussions is the fact that the American scientific enterprise is critically dependent on funding from the federal government. Without public funds, the burgeoning enterprise of universities and researchers would contract dramatically. While few would dispute the value of the contributions made by the government-supported scientific enterprise, some facets of government financing of science are troublesome.[10] Public funding can generate unwelcome pressures on scientists to conform to prevailing beliefs. Public funding is also said to breed alarmism and facilitate distortion in public discourse.[11] Studies of organizations and bureaucracies demonstrate that, over time, institutions devise strategies to perpetuate their continued existence and encourage their expansion. Organizations have agendas and preferences and these guide the actions they take and, in the case of a grant making organization, the relationships they enter into. Bureaucratic organizations charged with distributing public resources exert power and influence over their environment as they have considerable autonomy within the policy making process, are supported by strong clientele groups, and are very internally cohesive.[12] As bureaucratic institutions mature, they develop structures, processes, and procedures designed to preserve the integrity of the organization, socialize its workforce to support the mores of the institution, and build alliances and relationships with external interests and political overseers to assist its growth and expansion.[13]

The U.S. government is the main source of funding for academic research and development at colleges and universities. With the growing number of federal research supporting departments and agencies and the emergence of new federal missions such as the environmental sciences, the academic research enterprise has grown substantially. While the growth in federal support for R&D brings new opportunities, it also has resulted in near complete dependence of individual researchers and university programs on publicly-financed R&D.[14]

Yet, the focus remains on the alleged distorting influence of corporate funding on scientific results. One of the most prominent and frequently voiced fears is that private interests can undermine objectivity, inject bias and error, lead to the suppression of results, and perhaps even precipitate outright fraud. That claim rests on the assumption that private interests demand results that are solely consistent with their views and interests. It also rests on the assumption that integrity and objectivity are always for sale. Unfortunately, the claim is frequently repeated without the benefit of rigorous evaluation or evidence to support it.

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[10] For example, see Linda Cohen and Roger Noll, *The Technology Pork Barrel* (Washington, D.C.: Brookings Institute, 1991); Daniel Greenberg, *Science, Money, and Politics* (Chicago: University of Chicago Press, 2001); and James Savage, *Funding Science in America* (Cambridge, U.K.: Cambridge University Press, 1999).

[11] Gough, *Politicizing Science*, 2-5; Steven Milloy and Michael Gough, *Silencing Science* (Washington, D.C.: CATO Institute Press, 1998); Marc Morano, "Meteorologist Likens Fear of Global Warming to 'Religious Belief.'" CNSNews.com, December 2, 2004.

[12] See, for example, Kenneth Meier, *Politics and Bureaucracy: Policymaking in the Fourth Branch of Government* (Wadsworth: Belmont, CA: Wadsworth, 1987), 101-110.

[13] Meier, *Politics*, 57-77.

[14] *Ibid.*, 102-103.

When the research process is transparent and results are open for review, it is difficult for bias, fraud, and suppression to long prevail. And, there can be serious legal and financial consequences from such behavior. Those potential consequences provide strong incentives to avoid it.

The George C. Marshall Institute takes its mission seriously and, consistent with its principles, works diligently to publish reports that highlight honest assessments of the science. We support a scientific community that can do its work, generate data, test hypotheses, and educate free of politicization. This campaign to shut off funding of organizations that do not accept the global warming orthodoxy demonstrates that others do not.

We also want to be perfectly clear -- no grant to the Institute is contingent on support for a specific point of view or conclusion. Our views on climate change long pre-date any support from any corporate entity. Grants to support the Institute's programs are made without conditions. Like many public policy institutes, the Marshall Institute receives support from foundations, individuals, and corporations.

Nevertheless, the Marshall Institute is cited as an example of an institution propagating misinformation and confusion at the behest of corporate support. For example, the Union of Concerned Scientists (UCS) report, *Smoke, Mirrors, and Hot Air*, released in January 2007, and its accompanying press release singles out the Marshall Institute for close scrutiny.[15] Specific to its references to the Marshall Institute, the UCS makes basic factual errors and fails to deny the substance of our work:

- Sallie Baliunas is not a Marshall Institute board member or the Institute's Senior Scientist, as is stated on page 15. She stepped down from both those positions more than a year ago. Nor is she Chair of the Science Advisory Board as is claimed in Table 2 on page 34. The Science Advisory Board has not existed since 2001. The report references a six-year old archived website to obtain basic information about the Institute's organizational structure (see footnote 204).
- Willie Soon is not a Marshall Institute Senior Scientist as is claimed in Table 2 on page 35. Again by relying on a version of the Institute's website archived by a third party, the UCS reports out-dated and inaccurate information (see footnote 261). Dr. Soon stepped down from his position as Senior Scientist several years ago.
- The Marshall Institute did not provide a grant to the Tech Central Science Foundation in 2004 as is asserted on page 32. We received a grant for $12,602 from them and that grant supported a project focused on risk assessment for chemicals, not climate change.
- Neither of the pieces by Baliunas cited in footnote 78 merit the weak criticism delivered by the UCS. Most significantly, both pieces were written before the Institute received any corporate support. The Marshall

[15] Union of Concerned Scientists, *Smoke, Mirrors, and Hot Air: How ExxonMobil Uses Big Tobacco's Tactics to Manufacture Uncertainty on Climate Science*, (January 3, 2007), http://www.ucsusa.org/news/press_release/ExxonMobil-GlobalWarming-tobacco.html.

Institute did not begin accepting corporate contributions until 1999, while both pieces were published in 1995 & 1996.[16] Second, both pieces are intended to review aspects of the scientific debates of the time for the general public. They examine a series of claims about climate, including solar influences, the Arctic, severe weather, and much more.

- A National Academy of Sciences panel endorsed the core premise of the Baliunas-Soon analysis in its examination of the past temperature record (critiqued on page 15). The NAS panel concluded that Earth's temperatures were relatively warmer during the Medieval Warm Period (approx. 1000 A.D.), then cooler during the Little Ice Age (approx. 1700 A.D.), and have increased since then. Sparse data coverage for the period before 1600 A.D. prevented the NAS from reaching definitive conclusions about temperature trends before that date; however some reconstructions before 1000 A.D. show surface temperatures comparable in warmth to the early 20th century.

  The NAS also expressed "less confidence" in the original conclusions of the Mann et al "hockey stick" used by the IPCC because "the uncertainties inherent in temperature reconstructions for individual years and decades are larger than those for longer time periods, and because not all of the available proxies record temperature information on such short timescales."[17]

  An independent review of the statistical methods used in constructing the "hockey stick" revealed additional shortcomings. The review led by Professor Edward Wegman of George Mason University concluded that the "assessment that the decade of the 1990s was likely the hottest decade of the millennium and that 1998 was likely the hottest year of the millennium cannot be supported by their analysis."[18]

- John Christy and Steven McIntyre are not "affiliated" with the Marshall Institute as is suggested on pages 23-24. They have participated in our public events as invited guests and Dr. Christy wrote a chapter for book, *Shattered Consensus*, but neither is formally affiliated with the Institute.

- The Institute's book, *Shattered Consensus*, is cited as an example of "information laundering" (pg. 12) yet the UCS provides no refutation of the contents of the 10 chapters in this well-reviewed book. Should the rights of these authors to publish a book be left to the UCS to decide? The

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[16] See a statement by a past Institute Executive Director discussing the topic at http://www.marshall.org/article.php?id=17, which is a reprint of an op-ed appearing in the *Wall Street Journal* on July 2, 1997.

[17] Committee on Surface Temperature Reconstructions for the Last 2,000 Years, National Research Council, *Surface Temperature Reconstructions for the Last 2,000 Years* (Washington, D.C.: National Research Council, 2006), 3 http://www.nap.edu/catalog/11676.html.

[18] Edward Wegman et al., *Ad Hoc Committee Report on the 'Hockey Stick' Global Climate Reconstruction* (Washington, D.C. 2006), 4-5 http://republicans.energycommerce.house.gov/108/home/07142006_Wegman_Report.pdf

authors of *Shattered Consensus* are experienced scholars with recognition and credits meriting attention to their views. They each have significant qualifications in their fields. For example, the book's editor, Patrick Michaels, was a co-author of the climate science paper of the year for 2004 recognized by the Association of American Geographers.

- There is no evidence to suggest that the work undertaken by Dr. Seitz, one of America's most noted scientists and the Institute's emeritus chair, adhered to anything but the highest standards (see page 16); a fact which even the UCS acknowledges. Dr. Frederick Seitz, the Institute's chairman emeritus, is a distinguished and acclaimed scientist. He is president emeritus of Rockefeller University, a premier biomedical research institution. He is a recipient of the National Medal of Science, the nation's highest award in science, for his contributions "to the foundation of the modern quantum theory of the solid state of matter." He is also a recipient of the fourth Vannevar Bush Award presented by the National Science Board. His work, The Modern Theory of Solids, was the base from which generations of students learned about solid state physics and served to define the field. Elected to the National Academy of Sciences, he also served as its President. His contributions to science and this country are beyond question.

  Dr. Seitz is free to express his views and opinions on climate change as he sees fit. The UCS singles out his involvement with a research program funded by RJ Reynolds in an attempt to prove that he was a pawn in tobacco's scientific disinformation campaign. Yet, the research overseen by Dr. Seitz is not criticized in any way. In fact, the research was of the highest quality, with one of the scientists supported later earning a Nobel Prize.

Nevertheless, if we accept that the source of funding invariably affects findings and opinions, then what should we make of the significantly greater amount of money spent by environmental advocacy groups that promote the notion of an impending climate catastrophe? Governments, private foundations, and non-profit institutions worldwide spend orders of magnitude more to support the view that apocalyptic climate change is near. According to data for the period 2000-2002, private foundations conservatively spend $35-50 million each year on climate-related projects. This support was significant for many of the receiving institutions, which are principally public policy institutes and advocacy organizations. Climate change-related projects accounted for over 25% of the 3-year total reported grants and contributions received by 10 of the top-20 institutions.[19] At the same, the federal government provides $2-4 billion per year for climate change research and related environmental sciences. Those funds are significant to the researchers and the research institutions that receive it. In 28 of the top-30 performing universities, federal financing accounted for more than 50% of the institution's expenditures on atmospheric R&D.[20] Nearly one-half of the top-30 institutions depended

[19] Jeff Kueter, *Funding Flows for Climate Change Research and Related Activities* (Washington, D.C.: George Marshall Institute, 2005), 4.
[20] *Ibid*., 10.

on federal support for more than 80% of their resources in this 5-year period (1998-2002). By comparison, the federal government provided 59% of total R&D funding at academic institutions in 2001.[21]

We would never call for organizations to stop their funding, even though they make statements that clearly are exaggerations and have no scientific basis. Public policy institutes and think tanks play an important role in American policy making. They are free to disagree with us just as we are free to make our views known.

Instead of addressing the substance of the debate over the science and its meaning for public policy, public discussion has regressed to inferring motives and attacking sources of support in an effort to silence voices of dissent. Unfounded allegations and unjustified attacks are a poor substitute for open and candid debate.

It is more than ironic, that most of the so called skeptics focus their criticisms on the substance of research and analyses while many who claim that climate science is settled and that we face a climate catastrophe are resorting to character assassination. Our nation rejected McCarthyism 50 years ago and we should not allow its rebirth in another form.

More important than the source of funding is the substance of what an organization produces. What counts is whether the findings stand up to critical examination. Are they reproducible? Can they be verified or falsified?

Ted Koppel best summarized the situation in 1994 when he criticized a similar effort by then Vice President Gore. His admonition applies as well today as it did then:

> "There is some irony in the fact that Vice President Gore, one of the most scientifically literate men to sit in the White House in this century, that he is resorting to political means to achieve what should ultimately be resolved on a purely scientific basis … The issues of global warming and ozone depletion are undeniably important. The future of mankind may depend on how this generation deals with them. But the issues have to be debated and settled on scientific grounds, not politics. There is nothing new about major institutions seeking to influence science to their own ends. The church did it, ruling families have done it, the communists did it, and so have others, in the name of anti-communism. But it has always been a corrupting influence, and it always will be. The measure of good science is neither the politics of the scientist nor the people with whom the scientist associates. It is the immersion of hypotheses into the acid of truth. That's the hard way to do it, but it's the only way that works."[22]

[21] National Science Board, *Science and Engineering Indicators-2004* (Washington, D.C.: National Science Foundation, 2004), Chap.5, p. 5.
[22] Ted Koppel, "Is Environmental Science for Sale?" *ABC News Nightline Transcript,* February 24, 1994.

Improving the Value of Science

Preserving the integrity of science in the public policy process is an important goal. But it would be unrealistic to think that politicization is avoidable. The science on public policy issues is rarely, if ever, definitive. There will always be uncertainties that need to be addressed and matters that require judgment in translating science into policy options and analyzing them and their implications. Given the inherent uncertainties in policy planning and the value judgments that are inherent in the policy process, there is no way to avoid "politicizing" science. Policy making by its nature is political and always will be. What can be done are improvements in policy planning and analysis that improve the quality and value of science used by policy makers?

- **Promote transparency.** Models, data and assumptions used in formulating policies should be available for interested parties to review and critique. This would improve the understanding of the validity of the models and how various assumptions affect outcomes.
- **Peer review is an important step if done properly.** A third party should choose reviewers and their comments should be published but not necessarily their names. Beyond standard peer review, someone or some organization should be able to replicate the analysis, especially analyses that can have significant economic and regulatory impacts.
- **Discontinue consensus documents.** The push for consensus on important science policy issues can mask important differences among scientists. Policy makers are better served knowing where there is widespread agreement and where there are important disagreements. The ability to publish dissenting views in policy documents and NAS reports should be encouraged.
- **Establish a "devil's advocate" process.** For major issues like climate change and reports like the IPCC Summary for Policy Makers, some small group should be charged with challenging conventional wisdom that when repeated often enough is treated as fact. If this were being done routinely on climate change matters, it would not be possible to assert that the science is settled, that humans are primarily responsible for the warming in recent decades or that models are reliable for projecting or predicting climate 100 years from now.
- **Distinguish between science and analysis.** Much of the recent criticism is about the inferences drawn from science and analysis of options drawn from science. Policy and risk assessments are not science and it is inappropriate to use disagreement about policy to claim that the integrity of science is being violated.

Thank you for the opportunity to appear here today and to present these views for your consideration.