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White House Conference on Global Change 4/17/90 [OA 8311] [2]

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APRIL 17, 1990

MEMORANDUM

TO: MARK LANGE
FROM: CAROLYN CAWLEY
RE: WHITE HOUSE CONFERENCE CLOSING REMARKS ACKNOWLEDGEMENTS

AS OF 5:15 P.M. ON 4/17:

The three co-chairs (Bromley, Boskin, Deland) are charged with compiling a summary of the conference, the "Co-Chair Report".

The three of them will be on the stage from 2:05 to 2:29. At the end of their delivery, there will be an off-stage announce for POTUS. Therefore, no acknowledgement of introduction.

The three of them will remain on stage while POTUS delivers his closing remarks. Therefore, we must acknowledge the three co-chairs of the Conference:

Dr. D. Allen Bromley
Michael Boskin
Michael Deland

OTHERS:

No word yet on Cabinet members or members of Congress.

Secretary Watkins speaks to the Conference earlier in the day and is expected to be there during POTUS' remarks, though this is not confirmed. No other Cabinet members are confirmed to be there, nor any members of Congress.

We should probably acknowledge/give a nod to:
the US delegation
Bert Bolin of the IPCC

plan

write insert on proposal (based on something
from Ceccare)

tidy up sound bites

@ CONFERENCE:

Bob Cornell

Andrew Bean
(Brit.)

1:45

□

UNIFICATION TALKS ENTER NEW PHASE

EAST BERLIN -- Talks on German unity move into a new phase this week with the first Cabinet-level contacts between West Germany and the new democratic government of East Germany.

Officials in Bonn confirmed Monday that Wolfgang Schaeuble, the West German interior minister, will meet Wednesday in Bonn with his East German counterpart, Peter-Michael Diestel. The ministers of economics will meet the following day. The foreign ministers are also expected to meet this week.

(Tyler Marshall, Los Angeles Times, A4)

BUSH PICKS NEW U.S. AMBASSADOR TO HUNGARY

President Bush, seeking to conclude an embarrassing diplomatic episode, said Monday he intends to nominate Charles Thomas as U.S. ambassador to Hungary, replacing Mark Palmer.

Palmer resigned from the post in February after disclosure that he had made preparations to join an investment concern run by former U.S. Ambassador to Austria Ron Lauder....

Thomas, 55, of Bethesda, Md., is a career member of the U.S. foreign service. He...is a specialist in the reduction of conventional forces. (UPI)

LONDON TIMES SAYS BUSH TO END U.S. COOLNESS TO LABOR PARTY

LONDON -- President Bush is confident of good relations between the U.S. and Britain if the opposition Labor Party comes to power, The Times newspaper said Tuesday.

The Times said this was a signal from Bush that the days of deliberate White House hostility to Labor could be over.

Bush told The Times in an interview that in the event of a future Labor government, "If we do have a special relationship, it will continue, I'm sure."

Asked about President Reagan's cold, brief reception of Labor Party leader Kinnock in the past, Bush said that when "the opposition leaders come here, we will see them. That's the way it should be." (Reuter)

DELEGATES BOP BUSH ON GLOBAL WARMING

Delegates from 17 nations gathered for a White House conference on global warming amid criticism from some participants and environmentalists that the Bush Administration isn't dealing with the problem....

The Sierra Club...called the White House conference an attempt by the Administration to shift the focus of the issue away from the need for pollution controls to a debate over economic considerations.

"It's really a smokescreen for the Administration's inaction on global warming," said Daniel Becker of the Sierra Club. "We know enough now to begin acting to curb global warming today."

(AP, Washington Times, A4)

ANTI-SEMITES SAID TO BE AMONG SOVIETS ON U.S.-FUNDED TOUR

The USIA is financing a month-long tour of the U.S. by a group of Soviet editors and writers associated with extreme Russian nationalist publications, some of whom have been accused of antisemitism.

Several leaders of American Jewish groups have criticized the USIA for bringing the group to this country. "Inviting these kinds of people from the Soviet Union with known anti-Semitic views is unacceptable and harmful," said Mark Talisman, director of the Council of Jewish Federations. "Sponsorship by the federal government is ludicrous and appears to smack of approval."

USIA spokesman Frank Johnson said, "I'm not in a position to confirm...whether they have anti-semitic views or not. These people are Russian nationalists. That is why they were invited.... Is the situation such that everybody has to agree with us before they can be invited?" (Judith Havemann, Washington Post, A1)

U.S. Sponsoring Visit By Anti-Semites, AJC Says

The government is sponsoring a month-long U.S. tour by a group of Russian writers that includes known anti-Semites, a major Jewish group charged Monday night.

"This visit is not in the interests of the West generally," said David Harris, president of the American Jewish Committee.

A Russian Jewish emigre whose studies of anti-Semitic writers were used by the committee, Semyon Reznick, said some writers in the group "exuded the myth of a Jewish-Zionist conspiracy, an old Russian hatred" in their work.

Frank Johnson, a spokesman for the USIA, sponsor of the tour, said, "I don't know that they are anti-Semitic; I don't know that they are not, either.... We feel very strongly that pluralism in this country is worth talking about and observing." (AP)

RANKING OF NATO BURDEN-SHARING REVEALED

Turkey, Greece, Britain and France were given high marks by the Pentagon Monday for their contributions to NATO's defense, while Canada, Denmark and Luxembourg were cited for doing "relatively less" than others.

The findings were contained in a publication on burden-sharing of costs that Secretary Cheney sent to Congress....

The report said some allies "appear to be doing at least their fair share or substantially more, others appear to be doing substantially less than their fair share, while a third group of nations shows performance that can be best described as mixed."

...The group of "non-U.S. NATO allies doing relatively less" included Luxembourg, Denmark and Canada, and the report said their performance "looks substantially below-par based on the defense-gross domestic product share and most of the key indicators examined." (Robert Mackay, UPI)

Europeans Miffed Over White House Climate Conference

The White House conference on global climate change began on a discordant note Monday as European delegates accused the Bush Administration of trying to stifle discussion of possible international action to reduce "greenhouse" emissions....

Dutch delegates, [at a Monday afternoon news conference], expressed irritation with the Administration's "one-way traffic conference."

The Dutch charged the White House had tailored the agenda to fit the Administration's position that more scientific research is needed before the international community can agree on economically costly steps to reduce industrial carbon dioxide emissions.

"We were quite surprised with the agenda," said Pier Vellinga, director of The Netherland's national climate program. "We now see the United States is organizing this conference to stress the difficulties in economics of reducing carbon dioxide emissions and stating not enough research is done."

Vellinga said his country and others wrote letters to the White House asking to change the agenda to include public discussion of possible international action to freeze or reduce carbon dioxide emissions from the burning of oil, coal and other fossil fuels. "We have had no reply," he said. "We do now see that it's kind of a one-way traffic conference."

(George Lobsenz, UPI)

BUSH ALLOWS S. AFRICAN STEEL DESPITE SANCTIONS

The Bush Administration is allowing South African iron and steel into the U.S. despite a 1986 economic sanction designed to force an end to apartheid, the State Department said Monday.

Most of the controversial imports are ferroalloys, strategic commodities never intended by Congress to be banned under the law, said Department spokeswoman Tutwiler....

"The Administration will continue to enforce fully all provisions of the Comprehensive Anti-Apartheid Act," Tutwiler said. "This is an old issue that has been thoroughly reviewed by the Treasury Department."

Another U.S. official, requesting anonymity, said some prefabricated items, such as toasters and some ferroalloys had been imported.

(Barry Schweid, AP, Washington Post, C3)

KEEP SANCTIONS AGAINST PRETORIA, MANDELA SAYS AT POP CONCERT

LONDON -- Nelson Mandela used a star-studded London rock concert Monday to urge the world to maintain anti-apartheid economic sanctions against white-ruled South Africa....

"Reject any suggestion that the campaign to isolate the apartheid system should be wound down," Mandela told about 70,000 people at Wembley Stadium and a world television audience estimated at up to one billion people.

"There are some in the world who wish to support the South African government by giving it rewards and carrots," he said.... His words appeared aimed at Prime Minister Thatcher, whose easing of some sanctions...he has termed "absolutely disastrous."

(Peter Millership, Reuter)

HILLS SAYS SUBSIDY ISSUE FAR FROM RESOLVED AT GATT TALKS

DALLAS -- U.S. Trade Representative Hills said Monday the issue of farm subsidies will determine the outcome of latest round of GATT trade talks, scheduled to end in December.

"It is a break-or-make issue," Hills told reporters after her address to a luncheon meeting of the North Texas Commission, a regional economic development group.

Hills...warned that participating nations are still far apart on the farm subsidies issue....

"Eliminating the protectionist policies that exist worldwide in agriculture will put \$11 billion in the pockets of American farmers -- that's an extra \$3,400 for each and every one of them," Hills said in her speech. "This round of the GATT is a bold and ambitious undertaking. It may be the last, best chance this century to create the trading rules we need for the next century," she continued. (Harihar Krishnan, UPI)

YEUTTER: GET MOVING ON FARM TRADE REFORM

The U.S. proposal to phase out agricultural quotas and trade barriers over a 10-year period should help get the world moving toward freer farm trade, Secretary Yeutter said Monday.

In remarks prepared for delivery to an Indianapolis seminar, Yeutter said agricultural trade barriers and subsidies cost developed nations \$135 billion a year and deprive farmers around the world of billions of dollars in trade.... Yeutter's call for trade reform followed a round of European criticism of U.S. proposals at the Uruguay Round of world trade talks....

Yeutter said the U.S. proposal to convert trade barriers into tariffs and to reduce tariff levels over 10 years "just makes good sense." ... "We need to get off dead center in the agricultural trade arena and this is the way to start," he said. (UPI)

BANKS WARY OF LOANS TO E. EUROPE
Little Prospect Seen For Major New Aid

A leading commercial bankers organization Monday warned the former Soviet satellite countries in Europe not to expect much help from bankers as the nations attempt to move toward a free-market environment.

Horst Schulmann, managing director of the Institute for International Finance, told a press conference that because the creditworthiness of the countries is "limited," there is little prospect that commercial banks will be able to make substantial new loans to the region -- and those that are made will be "customer driven," not made to governments. The economic machinery of seven states in Eastern and Central Europe "is so run down that it is near collapse," according to a report released Monday by the institute.... The seven states are Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania and Yugoslavia.

(Hobart Rowen, Washington Post, C1)

FOR EDITS:

Global Climate Research to Be Proposed

Bush to Open, Close Meeting Next Week

Los Angeles Times

The Bush administration will propose next week an international research program on the "greenhouse effect" and the threat of global warming.

The proposal will be offered at a White House-sponsored conference Tuesday and Wednesday, where economic and scientific research on climate change will be assessed by science, environmental, and finance ministers from 17 countries and the Organization for Economic Cooperation and Development.

President Bush will open and close the day session, which will consider not only what is known about the greenhouse effect, but also "more importantly what we don't know, what the uncertainties are, and how we might reduce those uncertainties," presidential science adviser D. Allan Bromley said.

Critics of the administration's response to evidence of global warming have charged the agenda will focus on uncertainties rather than addressing response strategies, such as conservation and renewable energy sources.

"The president is using this conference as a leadership facade," Ruth Caplan, executive director of the Environmental Action Foundation, said yesterday.

are open the walking gaps

"When he should be leading the international call for action, he is using debate to buy time and delay action. I predict that you will see coming out of this conference dire predictions from the U.S. delegation about the economic dislocations of responding to global warming," Caplan said.

YES - OF UNAPPROPRIATE RESPONSE

Since the emergence of the global warming issue as an international concern, the Bush administration has been under pressure from several European countries and environmental activists to take a more aggressive stance toward abatement of greenhouse gases.

In an obvious reference to those pressures, Bromley told a luncheon at the National Press Club yesterday that, while vast uncertainties remain, "The Bush administration does not and never has believed that further research is any substitute for action."

used...

In addition to proposing an integrated scientific research program, the U.S. delegation to next week's conference is expected to present estimates on the cost of stabilizing production of greenhouse pollutants, chiefly carbon dioxide and methane.

One study has estimated the potential U.S. cost of combating global warming over the next century at \$3.6 trillion, but environmentalists contend this does not take account of the benefits accompanying the reduction of greenhouse gas emissions.

Bromley said the administration already has made significant strides. He cited U.S. pressure for a ban on chlorofluorocarbons, which damage the ozone layer in the stratosphere, and acid rain abatement provisions in the clean air bill.

He also noted the administration's initiative to plant a billion trees a year on private land.

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WHITE HOUSE STAFFING MEMORANDUM

DATE: 4/13/90 ACTION/CONCURRENCE/COMMENT DUE BY: 4/16/90 9:00 AM

SUBJECT: MATERIALS RE WHITE HOUSE CONFERENCE ON GLOBAL CHANGE: CHARTER, INT'L INSTITUTES, COMMUNICATION NETWORK, AND STATEMENT OF PRINCIPLES

	ACTION FYI			ACTION FYI	
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SUNUNU	<input checked="" type="checkbox"/>	<input type="checkbox"/>	NEWMAN	<input type="checkbox"/>	<input type="checkbox"/>
SCOWCROFT	<input checked="" type="checkbox"/>	<input type="checkbox"/>	PORTER	<input checked="" type="checkbox"/>	<input type="checkbox"/>
DARMAN	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ROGICH	<input type="checkbox"/>	<input type="checkbox"/>
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CARD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>BOSKIN</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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DEMAREST	<input type="checkbox"/>	<input type="checkbox"/>	<u>BROMLEY</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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REMARKS:

Please forward any comments directly to Doug Adair, FAX 653-2034, no later than 9:00 AM, Monday, April 16, with a copy to my office. Thank you.

RESPONSE:

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James W. Cicconi
Assistant to the President
and Deputy to the Chief of Staff
Ext. 2702

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**The White House Conference
on
Science and Economics Research Related to Global Change**

**CHARTER FOR COOPERATION
in the**

Science and Economics Research Related to Global Change*

Government officials of Science, Economics, and the Environment from eighteen nations, the European Community (EC), and the Organization for Economic Cooperation and Development (OECD) are gathering in Washington, D.C. on April 16-18, 1990, to attend a White House Conference on Science and Economics Research Related to Global Change. The Conference was designed to address important next steps for substantially enhancing and broadening international understanding of science and economic research related to Global Change. The delegates to the Conference noted that;

WHEREAS:

- o Scientific evidence demonstrates that the Earth and its environment are changing on time and spatial scales not fully known to humankind,
- o Scientific uncertainty remains as to the contributions made by natural variability in Earth system processes and those made by impacts from anthropogenic sources, hence limiting the ability of science to predict, with acceptable accuracy, the future behavior of the Earth system,
- o Gaps in scientific understanding substantially limit the abilities of nations to determine the economic and societal impacts of global changes in the environment,

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- o World leaders are considering unprecedented postures and actions to address the potential economic and social implications of these changes, and
- o These national and international developments, taken in total, have placed global environmental issues central on the agenda of international affairs.

THEREFORE:

The delegates gathered at the White House Conference on Science and Economics Research Related to Global Change acknowledge the need to:

- o Increase and coordinate their science and economics research programs related to global change,
- o Work together to develop complementary national science and economic research programs that contribute to a coherent international effort,
- o Work to enhance existing international mechanisms for planning and implementing science and economics research programs, and to foster, when necessary and appropriate, new mechanisms to foster cooperation among the world's governments and international agencies in the conduct of global change science and economics research,
- o Work toward full participation of all nations in the formulation, refining, and implementation of the science and economics research agenda and work toward developing indigenous research activities relevant to the global environment change research program in all participating nations.
- o Encourage the nations of the world to contribute resources and personnel to the research agenda in measure and kind reflecting national capabilities,
- o Collaborate with other nations in support of education, training, and human resources development that contribute to the research agenda and that supports full participation by developing countries, and
- o Work toward developing cooperative access to pertinent research facilities and research data and information by all nations.

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The White House Conference
on
Science and Economics Research Related to Global Change

INTERNATIONAL INSTITUTES
for
Research on the Science and Economics of Global Change*

BACKGROUND:

Government officials of Science, Economics, and the Environment from eighteen nations, the European Community (EC), and the Organization for Economic Cooperation and Development (OECD) gathered in Washington, D.C. on April 16-18, 1990, to attend a White House Conference on Science and Economics Research Related to Global Change. The Conference provided a forum to consider a new dimension to the international dialogue on Global Change -- the proposition that economics, both analysis and research on broad economic policy and on economic consequences of policy options, is an essential link between the science of Global Change and policy alternatives. The Conference delegates addressed the importance of substantially enhancing and broadening international understanding of the relationship between science and economic research related to Global Change and the international policy process. The delegates also discussed the need to broaden the participation of all nations in fundamental economics and scientific research. ~~The delegates discussed a proposal offered by the U.S. to enhance these ideas through the establishment of a limited number of "International Institutes for Research on the Science and Economics of Global Change."~~

THE PROPOSAL:

It is proposed that interested nations consider the establishment, as joint partnerships between both industrialized and lesser developed countries, of International Institutes for Research on the Science and Economics of Global Change. Such Institutes could serve as both a focal point of cooperative research activities that address fundamental questions in the economics of global change and as a vehicle to address those issues in the context of the international science and policy interests. The Institutes could stimulate the integration of science and broad policy research through a comprehensive economics research program. The Institutes, for example, might:

- o Sponsor and conduct research directed at basic economic (including related science and policy) issues central to international interests in global change.
- o Provide a "bridge" between economic research, scientific research, and policy studies, adding the perspectives of economic analysis to the scientific research results and adding new scientific results to economic analyses, thereby enriching the fundamental knowledge base

available to nations for public policy deliberations.

- o Serve as a conduit for policy-relevant information between the physical, chemical, geological, and biological scientists, on one hand, and economists and other social scientists on the other.
- o Provide a mechanism for communication and improved understanding of global change science and economics research among nations.

Science and economics should be interrelated and interdependent; with policy choices being derived from an understanding of both the science and economic implications of changes in the global environment. Costs and benefits of policy choices depend on both scientific evidence of risks and economic analyses of policy tools. By drawing upon each other, the two disciplines will be better able to advance global stewardship of the Earth and its natural resources.

The Institutes could sponsor and conduct, through both internal programs and external grants to international scholars, forward-looking, policy-oriented research. Although present national and international research institutions conduct research independently in science and economics, the challenge for the Institutes is to ensure that the range of scientific and economic aspects of policy choices are studied in an integrated fashion, and that all nations are involved. For example, research within the Institute framework might include:

- o Developing new perspectives on the economic implications of changes in the global environment.
- o Studies of the economic and scientific aspects of diverse policy options.
- o Advancing frontier studies of economic thought, i.e., analyzing the validity and means of discounting future environmental impacts.

The Institutes would be international, involving researchers from throughout the world, and interdisciplinary, bringing the scientists associated with international global change research efforts (e.g., WCRP, IGBP, and other related international research programs) together with economists and other social scientists in related research efforts. By focusing their efforts on research topics chosen by virtue of their relevance to ongoing policy deliberations, the Institute(s) could provide a bridge between the scientific research program and the policy process by adding the needed economic analysis to the scientific research results. One possibility is that several Institutes might be founded to address global research questions from a regional perspective, such as issues facing the countries of the Pacific Basin, the Euro-African region, or the western hemisphere. Such regional foci might also provide a vehicle for developing the multi-lateral arrangements to sponsor an Institute as a joint venture between the more highly industrialized countries and those nations with newer economic and industrial programs.

ACTION SUGGESTED

It is proposed that interested nations engage in a set of informal discussions with the goal of developing detailed proposals for the potential establishment of one or more International Institutes for Research on the Science and Economics of Global Change. ~~The U.S. is prepared to host such discussions and is, in principle, prepared to enter into detailed discussions associated with the establishment of one such Institute.~~

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The White House Conference ON Science and Economics Research Related to Global Change

GLOBAL CHANGE DATA AND COMMUNICATIONS NETWORK

BACKGROUND:

The study of Global Change requires the communication, exchange and analysis of large volumes of scientific data and information dispersed throughout the international scientific community. ~~over~~ As nations plan to undertake new and expanded global change scientific efforts, including, for example, observational programs on regional, national and global scales, effective data and information management and people to people communications become essential elements for success. International cooperation is vital to ensure efficient and effective allocation of resources to support these data exchange and communication efforts. Global change scientists and economists must have the means to share information and exchange ideas directly with one another to achieve the synergistic potential of this international research effort.

THE PROPOSAL:

With this in mind, a "Global Change Data and Communications Network" is proposed. Part one of this two-part "Network", (the Data Module) would integrate existing international computer networks and provide a mechanism to facilitate various types of data transfer. Part two, a "Communications Module," would apply advanced technologies to electronically link investigators involved in global change science and economics research.

In order to provide the widest possible availability of key global change data and information for worldwide research efforts, the nations of the world must collaborate in ensuring the availability and exchange of scientific data and information. One of the key purposes of the proposed Global Change Data and Communications Network is to provide an advanced communications capability to lesser developed countries. ~~Highly industrialized nations, such as the United States, Japan and the Soviet Union, could help to provide the physical capabilities in equipment and financing to some of the lesser developed countries which would benefit from inclusion in the network.~~ Some of the infrastructure is already in place through entities such as the Global Telecommunications System of the World Meteorological Organization, which is used to routinely

exchange meteorological observations on a global basis. Other regional and point-to-point links have been established on a project-specific basis. In other cases, researchers use commercially available facilities to the extent possible. There are over fifteen existing computer communications networks already in place around the world that could become associated with and benefit from the enhanced capabilities of the Global Change Network.

New technologies, available today, provide capabilities to implement a worldwide scientific and technical network in support of global change science and economics research. ISDN, and higher bandwidth technologies, are now being implemented throughout the world and will be available for use in transmitting large amounts of data between institutions handling voice mail, interactive graphics and video conferencing, this allows for the development and use of a new multi-media communications network. The Communications Module of the proposed Network would build upon the solid foundation of communications networks already in place around the world. These existing networks could be integrated into, and be substantially enhanced by, the proposed Global Change Data and Communications Network.

~~Through the discussions in this Conference, and related exchanges in other international groups, a consensus has developed that~~ this enhanced communications capability is a key element of the international global change science and economics research. Through international cooperation and collaborative planning, this capability can be ensured, and its use made easier and more accessible to all interested nations.

It is important to continue and enhance efforts to collect, quality control, and maintain data and data systems (including directories and catalogs) in parallel with the creation of new communications systems/networks. Communications capabilities will only contribute to the goals of global change science and economics research if quality data sets are available to be accessed through it and enhancements are provided to facilitate person to person communications. ~~Resources must not be diverted from research efforts just to create a communications system.~~ Rather, the communications system must grow in support of the research requirements. Through international cooperation and integration of existing systems, the Global Change Data and Communications Network can serve to significantly enhance the research efforts of the international scientific and economic community.

ACTION SUGGESTED:

It is proposed that interested nations engage in a set of informal discussions to develop a strategy for implementing a Global Change Data and Communications Network. ~~The U.S. is prepared to host such discussions.~~ It is also proposed that the issues of data and information access and exchange and international scientific communication continue to be addressed as appropriate in formally-established international forums related to global change.

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**The White House Conference
on
Science and Economics Research Related to Global Change**

**"STATEMENT OF PRINCIPLES"
for
Developing an Strategy for Implementing
International Cooperation in Scientific Research in Global Change**

BACKGROUND:

Government officials of Science, Economics, and the Environment from eighteen nations, the European Community (EC), and the Organization for Economic Cooperation and Development (OECD) are gathering in Washington, D.C. on April 16-18, 1990, to attend a White House Conference on Science and Economics Research Related to Global Change. The Conference provides a forum to explore the possibility of developing a jointly agreed upon set of principles that could lead to an "implementation strategy" among nations for cooperative international research programs, that includes sharing of scientific and economic data, coordinating the development of international global observing systems, and improving the capabilities of models to predict controlling global and regional environmental processes (i.e. GCM's). The U.S. proposes that delegates consider endorsing a "Statement of Principles" that outlines the essential ingredients for an "implementation strategy", the focus of which would be on research efforts that can be substantially enhanced by joint efforts that build on the collective expertise, experience, and data and information of participating countries. It is suggested that a more fully coordinated international research effort could substantially increase collective knowledge of the science and economics of global change, assist the on-going policy debate, and support up-coming international

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policy forums, such as the IPCC and the Second World Climate Conference. The proposal builds upon existing discussions initiated by the International Council of Scientific Unions (ICSU), developed during the recent ICSU Annual Meeting in Lisbon, in October, 1989. The proposal is intended to fully support the implementation of the research programs such as the World Climate Research Program (WCRP), the International Geosphere-Biosphere Program (IGBP), other international efforts like the "Human Dimensions of Global Change" program, and to support new international research efforts as needed. The proposal suggests that such a "Implementation Strategy" might lead to what might be called, an "International Global Change Research Program", an informal agreement among nations to more fully coordinate their national global change research programs with other countries.

THE PROBLEM TO ADDRESS

The international scientific community has recognized the need for world-wide network of research programs to address the gaps in knowledge and the scientific uncertainties in understanding of the Earth system. National and international planning and coordination mechanisms have been established to address the fundamental scientific questions of "Global Change", i.e., the International Geosphere-Biosphere Program, the World Climate Research Program, the U.S. Global Change Research Program and other such national programs, and the G-7 Summit proposal for a multinational global observing and monitoring system, etc. The process, however, is incomplete. The structuring of planning, implementation, and resource allocation is evolving primarily within the many individual international research programs, good examples of which are the Tropical Ocean Global Atmosphere Program (TOGA), the World Ocean Circulation Experiment (WOCE), the International Satellite Cloud Climatology Project (ISCCP), and the Joint Global Ocean Flux Study (JGOFS). A critical remaining need is to foster international cooperative planning, implementation strategies, and resources allocations among and between the variety of international programs that address the science of global change. Resolving this need could lead to a coherent and more fully coordinated international scientific research effort, one that more nearly optimize the allocation of financial, human (i.e. scientists), and major facility (i.e. satellites, ships, etc.) resources. The premise is that nations can not hope to address the complex scientific research questions except through a more fully coordinated international research program. It is out of this context that the U.S. proposal is offered.

THE PROPOSAL:

The U.S. offers the following "Statement of Principles" as a vehicles for discussions at the White House Conference on Science and Economics Research Related to Global Change, and as a framework that might lead to further informal discussions among country science and/or research agencies that are responsible for global change research programs.

"STATEMENT OF PRINCIPLES"

1. THE PREMISE:

The scientific research efforts that address global change all are guided by a fundamental premise that profound uncertainties exist in our understanding of how the total earth systems functions and that carefully conceived scientific research programs are needed to describe and expand our understanding of the interactive processes that regulate the total earth system, and the roles played by both natural and human-induced changes. Such an effort requires a coordinated international implementation framework. That framework must enjoin the best scientists of the world, the best of resources and scientific facilities of many nations, and the support of national and international organizations and bodies.

2. THE CONTEXT:

There is now a need to consider the establishment and fostering of partnerships among the various international scientific organizations and their adherent national organizations (i.e. ICSU and its various national academies of science and "Unions"), intergovernmental bodies (i.e. UN specialized agencies like WMO, UNESCO and its agencies like IOC, UNEP, etc.) and individual government coordinating bodies (i.e. the U.S. CES which coordinates the US/GCRP) and agencies of those governments with global environmental science responsibilities.

3. THE RELATIONSHIP TO THE POLICY PROCESS:

There exists a need for strong and well-designed relationships between the policy processes of governments (i.e. the IPCC) and the science that underlies the need for such policy development and implementation has always been recognized but has often not been a fully integrated process. Any international effort that seriously seeks to address the science of global change must, by necessity evolve from the need to dramatically increase our understanding of earth system processes and to more adequately support the policy process within and between governments.

4. THE GOAL:

The overarching goal for an international global change research program is to substantially improve scientific knowledge and to reduce the uncertainties in global processes and their regional implications that now limit the ability of science to predict, with acceptable accuracy, the future behavior of the Earth system, and that such knowledge is designed to enable individual nations and international bodies to develop international policy(s) that reflect an understanding of the roles that both natural and human-induced changes play in global change and their attendant regional impacts.

5. THE ELEMENTS OF A JOINT INTERNATIONAL RESEARCH PROGRAM

Agencies of governments with responsibilities for the sciences that contribute to the study of global change, are the primary sources of the funding required to implement WCRP, IGBP, and the other components of any international global change research effort. As wider recognition of the need for a comprehensive effort to study global change on an international basis grows, nations are establishing their own internal organizations for the coordination and implementation of their national research priorities which, when taken together, could form the beginning of a comprehensive and more coherent international global change research program. The funding levels planned and the recognition that no nation alone can mount the global-scale studies leads inexorably to a need to coordinate among nations and to link with the national and international science community (i.e. academies, ICSU, etc.) and with intergovernmental (and regional) bodies (i.e. WMO, IOC, UNEP, etc.).

6. THE ELEMENTS OF AN IMPLEMENTATION STRATEGY:

It is suggested that interested countries, through an ad hoc Working Group, develop and produce a draft "Implementation Strategy" for an international scientific research program which brings together the collective expertise, experience, and data available in participating countries in a more integrated and coherent fashion. It is proposed that an ad hoc Working Group of representatives from interested countries, prepare a draft "Implementation Strategy" document for an international global change research program. The draft might include, inter alia:

- a. The rationale and need for a joint strategy for implementing an international program of scientific research on global change issues,
- b. The goals, objectives, and expectations for a joint research program,
- c. The conceptual framework for structuring a scientific research program,
- d. The central and priority scientific questions that must be addressed,
- e. A framework for discussing priorities, mechanisms for implementation, etc.,
- f. The international arrangements to support the program, including linkages between government science and/or research agencies, intergovernmental scientific bodies (i.e. WMO, IOC, and others), and non-governmental scientific bodies (i.e., ICSU),
- g. The linkages to the policy process, and
- h. The identification of products expected from the program, oversight review mechanisms, and the necessary timetables for results that support the policy process.

SUGGESTED ACTION:

It is suggested that the Conference delegations consider the possibility of creating an ad hoc Working Group so that a draft outline of an "Implementation Strategy" is produced within a few months after the Conference, including plans for subsequent "in-country" review by all interested countries. The "Implementation Strategy", when completed, could provide the basis for an aggressive and more fully coordinated international research program, and might be helpful additions to other up-coming meetings, e.g., various "Summit" meetings, the IPCC, the Second World Climate Conference, and the 1992 "Environment" meeting in Brazil. There have been preliminary discussions of the concepts outlined in this proposal, including several informal meetings among a few interested nations, the most recent of which was held in the U.S., January 22-23, 1990. If delegates from interested nations wish to more fully explore this proposal, an agenda item could be added to the meeting which continues the discussions started at the January 22-23, 1990. The meeting is now scheduled for early summer, hosted by the Federal Republic of Germany. Preliminary discussions with officials from the Federal Republic of Germany indicate that this item of agenda would be appropriate addition for that meeting.

FILE = I_OCRP.412

Thursday
April 12, 1990
3:53 pm

ABC's Todd

From the desk of

George Bush

a single soldier arrested the gesture was those who Tiananmen Square throughout the year against a re that the spirit revived.

*Dave
In my remarks
we may want to
point to these
views by name*

so fearful that est that they mourning. His oath and hail tration. At in formation tanding guard to make sure ement is not (ABC-2)

MANDELA

Morrison: Ne in nearly the Thatcher's ir investments in South Africa. later this summer.

first visit ime Minister or her decision to resume Today, he said, they'll sit down (NBC-6)

ENVIRONMENT

ABC's Kathleen deLaski reports that global warming is the biggest issue for many environmentalists for this year's Earth Day. But today on "This Week with David Brinkley," scientists were still debating whether it's even happening.

(Michael Oppenheimer, Environmental Defense Fund: "If we let fossil fuel burning continue as we are now by the end of the next century Earth could be 9 degrees Fahrenheit warmer than today.") As a result some scientists say many fertile areas could one day be desert and coastal areas like New York could be under water. But other scientists say those projections are wrong, and there is no reason to spend a lot of money reducing carbon dioxide emissions.

(Patrick Michaels, University of Virginia: "The very real possibility, given the way the data is running, is that we wind up with an impoverished nation waiting a warming that never comes.") The Bush Administration is not choosing sides.

(EPA Administrator Reilly: "We have to be cautious, careful, and take out something of an insurance policy.") At the global warming conference here this week President Bush is expected to tell other countries that more research is needed before any dramatic steps are taken.

Simpson reports that in an unusual twist, scientists in California are challenging the wisdom of an environmental protection law enacted by Congress saying it goes much too far in the effort to keep the Pacific Ocean clean.

ABC's Jed Duvall reports 190 million gallons of sewage every day pours out into the ocean in San Diego, CA. But those who say it is all right are distinguished scientists of extraordinary reputation. The pipe goes out two miles offshore and empties at a depth of 200 feet. The toxics and 80 percent of the solids have been removed. And fish and plant life there are abundant.

(Mia Tegner, Scripps Institution of Oceanography: "Certain amounts of sewage spread well over large areas -- in other words, so they're well-diluted, are in fact simply an addition of nutrients to the ocean.")

Handwritten initials: TREC & MCC

ADMINISTRATION TO ARGUE FOR FURTHER STUDY ON GLOBAL WARMING

President Bush will ask a 17-nation conference this week to examine the economic impact of global warming, but the Administration plans to argue it's too early to propose specific measures to deal with the problem, officials say.

The White House's cautious approach...is expected to unleash renewed criticism from some European countries that the U.S. is failing to provide leadership in dealing with the so-called "greenhouse effect." ...

Senior Bush advisers said they hoped the conference would for the first time give equal weight to economic as well as environmental issues related to global warming.

"We hope it will raise the level of debate...on the science and economics of global change," said Michael Boskin, chairman of the President's Council of Economic Advisers, who will be one of the three conference co-chairmen.

Administration officials cautioned in the briefings with reporters that the gathering is not intended to produce any blueprint for dealing with global warming. Instead, the officials said the Administration will emphasize the need for further scientific studies and incorporating the economic issues involved.

(H. Josef Hebert, AP)

TEAM OF SCIENTISTS SEES SUBSTANTIAL WARMING OF EARTH

Assembled by the U.N. in an attempt to arrive at a global consensus on the effects of growing concentrations of industrial gases on the atmosphere, an international team of scientists says it is a "virtual certainty" that the earth's surface will warm substantially in the next century.

The scientists generally agree with the theory that has been largely accepted by other national and international panels: that energy trapped in a greenhouse effect by the gases will warm the earth by 3 to 8 degrees Fahrenheit within the next 60 years....

Three U.N. teams are examining the theory and its policy implications.... Although still in draft form, the report...is likely to play a role in a White House conference on global climate.

(Philip Shabecoff, New York Times, B7)

U.S. BARS CHINESE ROLE AT TALKS ON AIR POLLUTION

To avoid violating sanctions imposed on China last year..., the Administration has excluded Beijing from an international conference on air pollution and climactic change, even though the Chinese burn more industrial coal than any other country, officials said Sunday.

The conference...will include the rest of the world's most industrialized or populous nations, and White House officials said they normally would have considered Chinese participation an important element of such a meeting....

Officials said that even if China's participation might have been useful, the Administration wanted to avoid the kind of severe criticism it drew last year after...[the two high-level] trips to China after the sanctions were imposed.

(Andrew Rosenthal, New York Times, B7)

-more-

BRAZILIAN ANTI-INFLATION PLAN HAS STRONG SUPPORT

SAO PAULO -- Seven out of 10 Brazilians support the tough anti-inflation plan of President Fernando Collor de Mello, which has frozen most of the money in the country for 18 months, according to a poll released Sunday.

The poll...said 71 percent thought the plan was good and 10 percent thought it was bad.

The poll was published by the newspaper Folha de Sao Paulo. A poll published by the newspaper March 21 found that 81 percent thought the plan was good. (Reuter)

FRAUD CHARGES RISE AS ALIENS SEEK TO ENTER THROUGH RULINGS

Thousands of aliens who do not have papers to stay in the U.S. are trying to take advantage of two openings in the legalization program that resulted from federal court rulings. The issue has led to allegations of fraud and government foot-dragging....

Duke Austin, a spokesman for the INS in Washington, said it had received a "glut" of applications, 50,000 to 100,000, and had found "a significant level of fraud" connected with them. "A lot of people are trying to get into the program just to get work authorization," he said....

The agency is not trying to subvert the extended program, Austin said, and applications that appear valid are still being accepted. Applications are rejected only when officials detect "fictional eligibility" or "clear evidence of fraud," he said.

(Marvine Howe, New York Times, A13)

REPORT URGES SINGLE U.S. COUNTERSPY AGENCY

The U.S. government needs a national counterintelligence center to analyze and act against the challenges posed by hostile spying, a growing problem for the 1990s, according to a report by a former White House intelligence director.

Kenneth deGraffenreid, the National Security Council intelligence director during the Reagan Presidency, said the government needs a coordinated national response to "the strategic threat" of spying posed by new arms control treaties and high-technology development....

The new national counterintelligence center "must have a national-level perspective transcending the views of any one department or agency, as well as the leverage to overcome bureaucratic resistance" to national counterintelligence, a major stumbling block for effective security, he said.

(Bill Gertz, Washington Times, A3)



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
WASHINGTON, D.C. 20500

Michael R. Deland
Chairman

(202) 395-5080

Saturday Pm

Mark/Chris:

From this vantage point yet another
"Fourth Week" speech very well done!
Relative to the NSC comments which
you mentioned: I do think statements
on page 5 are a bit condescending -
Suggest you could delete specific
the "developing countries" reference. Consequences
effect as well (eg. clean air, water etc.)
developed + developing - lead into
"hungry children" then becomes just a bit
more subtle

Last 4// p. 5. Should we not simply
be extending "the helping hand" The "thinking
twice line" ~~could~~ subject to gross misinterpretation.
You will not survive other minor
suggestions to your masterpiece.

Recycled Paper

Hope you can hold the line on (over)

this version!

On the ^{#1,} speed, I recall language to the effect "we will have a CIA this year." That could give the House more business for mischief... ~~Math~~

Finally, I talked to MT Jamin at DOE & as I ~~see~~ suspected the comments attributed to Ashwin were not his but those of a staffer - who is about to be chastised! - If Watkins doesn't like something he will detail why....

Again very well done!

Bromley Memo.

~~Opening~~

Flora?

- The United States is strongly committed to environmental protection: the best protection policies are those which are based on sound science and economic principles consistent with economic growth and free markets
- The stakes are too high, the consequences too significant for anything less
- We are doing serious analytic work to advance the state of our scientific understanding:
 - US Global Change Research Program: \$1 billion
 - Mission to Planet Earth: will initiate the US Earth Orbiting System to advance the state of knowledge about the planet we share
- On the economic side, we are intensively studying the economics of possible strategies and developing real data on the costs of various approaches
- Even as we continue our research, we are taking further steps to protect the environment, steps that have economic as well as environmental benefits:
 - Clean Air Act Legislation:
 - encourages emissions trading, using market driven solutions to enhance air quality
 - energy efficiency
 - clean coal technology
 - National Energy Strategy
 - comprehensive blueprint for addressing future energy needs in environmentally sound manner by increasing energy efficiency and the use of renewable resources
 - Environmentally sound technology development
 - Energy Efficiency Program
 - Alternative Energy Sources
 - Forestry: America the Beautiful program
 - Phase-out CFCs and development of safe substitutes

• This is a high priority for my Administration, and together, here we can explore the problems and concerns posed by environmental issues.

C.N.
USE

Notes from *Rielly / Brinley / Brady et al.*
Beland / Watkins Closing

A FEW:
we've done this.

This has been a great deal of discussion ~~technical~~

- We have heard much about global climate change these past two days
- We ^{have some} understand what drives our atmospheric system yet we do not fully understand how ~~man's actions~~ ^{natural and human activity} may affect this system
- We have shared our scientific knowledge and debated our assumptions; and we have begun to explore the economics
- Much remains to be done. Many questions remain to be answered.
- We must continue to seek hard data, accurate models and new ways to improve the science
- We must intensify our efforts to improve our economic models
- Nothing presented here indicates that we are facing an imminent crisis: we should not proceed with unnecessary haste - the potential for severe economic and social disruption is too great
- We must match policy commitments to emerging scientific knowledge and reconcile environmental protection with the benefits of continued economic development *weak. One supports the other.*
- This is not to say we should sit idly by: we must fulfill our stewardship obligations
- But we also have a responsibility to do it right
- Believe we should proceed:
- With respect to our understanding of all aspects of climate change, look forward to reviewing the IPCC Interim Assessment.
- From our discussions here, it is clear that we must continue and expand our research and monitoring; believe existing IPCC structure provides a sound framework for this
- We believe a framework convention provides the best means to continue this important analytic work, ~~as has been the case with the IPCC~~
- Such a framework convention would commit us to cooperate in continuing our research and monitoring efforts

IPCC

(IMPLICIT) ✓

POSS IF THEN

- Actions, if needed, could be developed subsequently, but only as part of a comprehensive approach that addresses the system, sources and sinks, as a whole
- Reiterate invitation to host first session of the negotiations in the US
- In the interim, have an insurance strategy: take those actions that have benefits distinct from climate change, such as energy efficiency and conservation, phasing out the use of CFCs and forestry programs
- These actions have economic as well as environmental benefits and it is unlikely that we would ever regret having taken them

10 regrets

IPCC

THE WHITE HOUSE

WASHINGTON

April 13, 1990

INFORMATION

MEMORANDUM TO THE PRESIDENT

THROUGH: CHRISS WINSTON

FROM: MARK LANGE

SUBJECT: REMARKS AT THE WHITE HOUSE CONFERENCE
 ON GLOBAL CHANGE

I. SUMMARY

Attached are your closing remarks for the White House Conference on Global Change on Wednesday, March 18 at 2:30 p.m. The Conference will be held in the Grand Ballroom of the J.W. Marriott Hotel and there will be an audience of approximately 450. The remarks will be TelePrompted.

II. DISCUSSION

The Conference will be conducted over the course of two days, Tuesday, March 17 and Wednesday, March 18. You will deliver the attached remarks at the closing session on Wednesday.

Your remarks stress both the human dimension of environmental problems and the need for solid research, while reiterating the commitment of this country to preserve the earth.

*Corrected
stuffed*

(Lange/Cawley)
April 12, 1990
11:25 P.M.
[GLOBAL.DOC]

PRESIDENTIAL ADDRESS: WHITE HOUSE CONFERENCE ON GLOBAL CHANGE
[PLACE] JW MARRIOTT - GRAND BALLROOM
450 ATTENDEES WEDNESDAY, APRIL 18, 1990
[2:30 P.M.]

*acknowledgements + thanks to all +
a thank you for organizers & co chairs*

[Acknowledgements...]

After all of the work that has taken place here -- in what I know was an atmosphere of lively debate -- I would begin with thanks, and a moment of perspective: for your purpose here is profoundly important to the state of nature, and the fate of mankind.

Your presence offers hope for a new era of environmental cooperation around the world -- and the promise of a quieter, more thoughtful, more careful tenancy of nature's legacy to humanity.

A growing sense of **global stewardship** prompted us to host this conference. It is a sense of stewardship shared by all of you, and by the nations you represent. And it arises out of a natural sense of obligation. An understanding that we owe our existence, all that we know and are, to the *JWS* miraculous sphere that sustains us.

Such stewardship finds expression in many ways -- from public demonstration, to landmark legislation. But it is also rewarded in many ways, in moments unexpected and unforgettable. To feel the cold rush of water falling from an ancient glacier, to see the glint of light in a panther's eye, to stand in silent witness to the timeless beauty of a heron's flight: Such moments

are among the most precious mankind might know on this abundant earth.

Such moments also have a special power -- a resonance that at once elevates the mind's eye, and yet humbles us as well. Before such beauty the works of humanity seem somehow small. We may build cathedrals, temples and mosques; monuments and mausoleums to great men and high ideals. And still we know we can build no monuments to compare with nature. Our greatest creations cannot equal God's smallest.

Yet as our tools and intellects advance, we've learned of our power to alter the earth. We understand that small actions, taken together, have profound global consequences for the environment we share, and the humanity we share it with. **Global stewardship can only be understood in human terms.**

That is the reason we have held this conference.

Ours is a prosperous planet -- with greater hopes now than ever before that **more** of our people may come to know an unexpected peace, and an unprecedented prosperity.

So we are called upon to ensure that both the earth's integrity -- and mankind's prospects for prosperity, peace, and in some regions, even survival -- are not put at risk by intemperate action.

The minds at work here are among the very best we have -- and the best insurance that our actions are sound. Here, for the first time, we gathered talent from around the world -- scientists, economists, environmentalists, energy ministers,

policy-makers -- to assess the environmental and developmental future of the planet. An **unprecedented** cross-fertilization of disciplines -- and of nations. That alone is reason for hope.

If you have raised more questions than conclusions here, your work has been worthwhile. But if diversity of perspective is expected, unity of purpose is crucial. In an atmosphere of uncertainty, we must foster a climate of good will -- and a stubborn hope, that we might forge solutions without the excessive heat of politics.

Among all of the challenges in our tenancy of the planet, climate change is, of course, foremost in your minds. You are helping us work from what we know, through the uncertainty of both the science and the economics of climate change. But there is one area where we will allow for no uncertainty -- and that is **our commitment to finding solutions that work.**

There are several things that the climate change debate is not about. It is not "Jobs versus Environment" -- the two are inseparably interdependent, as the destructive experience of so many developing nations has shown. We must clearly understand both environmental cause and economic effect. For if we cannot see the forest for the trees, we risk losing both.

Nor is the climate change debate about "Economists versus Environmentalists." Only in the most primitive minds has it been reduced to a rhetorical holy-war between bean-counters and tree-huggers.

But above all, the climate change debate is not about "Research versus Action" -- for we have **never** considered research any substitute for action. We already know enough to act -- and we are.

Over the last two days you've heard from key members of this administration about action the United States is already taking -- our leading investment in climate change research and response strategies, our Clean Air legislation, our comprehensive national energy strategy, our search for alternative and more efficient sources, our re-forestation initiatives, and technical assistance programs to developing nations.

*Drug
Air*

energy

What bears emphasis is that we are **committed** to -- **moving** on -- and out **front** with -- domestic and international policies that are environmentally aggressive, effective, and cost-effective.

And we are deeply committed to an international partnership, through the I.P.C.C. process. We look forward to its Interim Assessment -- and would encourage a framework convention as part of a **comprehensive approach** addressing the system, sources, and sinks as a whole. We hope to host the first negotiating sessions here in the U.S. -- and we've just offered four new proposals at this conference:

*Bromley
Memo*

[Specific U.S. proposals, T.B.D. noon Wednesday 4/18 per Dr.s Bromley/Maynard. Roughly: To endorse a "Charter for Cooperation in Science and Economics Research Related to Global Change" ; To create "International Institutes for Research on the Science and Economics of Global Change" ; To encourage data

and information transfer through a "Global Change Communications Network" ; and to endorse a "Statement of Principle to develop an internal strategy for cooperation in Scientific and Economic Research in Global Change."]

*Draft of
Cobarr
Report*

All of you here today understand climate change as one of many challenges in the call to global stewardship. Ozone depletion, food security, water supply, ocean pollution, wetlands, deforestation, biodiversity, population change, hunger, energy demand -- in short, **all** of the interrelated issues of sustainable development: Each demands our attention. And each has a human dimension we must never forget.

Understand the choices we are making. They affect us all, but in profoundly different ways.

The consequences of reducing carbon dioxide emissions in a wealthy nation like the United States would likely be measured in relatively manageable terms: additional costs incurred, to be sure; job losses, probably temporary; and some effect on G.N.P.

But in too many developing countries, the consequences of such policy will surely be painfully reflected in the hollow eyes of hungry children. In life-threatening competition for already-scarce resources. In political instability -- and man-made limits to prosperity. Security. Survival.

If developed nations ignore the needs of developing nations, it imperils all. We know that a change in G.N.P. of even a few tenths of a percent often means the difference between adequate shelter, food, and health care -- and human catastrophe.

To bear this in mind is no barrier to action. It merely suggests that those who have ascended the economic hill must think twice before building walls that would prevent others from making the climb.

Debs
hinder *is the climb?*

It is a reminder that economic limits have serious human costs. And it suggests that the best policies are those of well-managed growth: The only kind of growth that true global stewardship allows -- but only possible if the nations of the world are linked in partnerships of every kind: scientific, economic, technical, agricultural, environmental.

Developing nations will contribute a growing share of the world's emissions in the coming decades. They face the greatest threats from environmental degradation of every kind -- and can least afford the consequences.

But pollution is not, as we once believed, the inevitable by-product of progress. The developed nations of the world will better serve their own interests, and those of the world community, **not** by seeking limits to growth -- which would never survive human nature -- but by catalyzing environmental protection through more **intelligent**, more **informed**, more **efficient** growth.

Here, I must confess to some confusion. Those who value environmental quality most highly, should be the most ardent supporters of strategies that tap the power of free wills and free markets, that turn human nature to environmental advantage. Efficient strategies are the **only** realistic hope that developing

nations might avoid making the mistakes that developed nations have made.

And we have made mistakes. When America made its transition from an agrarian to an industrial economy, we paid a price. What we learned, we learned the hard way. And in some ways, we're **still** fighting our way back. But over the past century we've made tremendous progress -- especially in the last twenty years.

Two decades ago, this nation -- holding to its birth-right of free expression and the value of the dissenting voice -- was home to one protest movement in an era of protests, called Earth Day. It motivated President Nixon to sign into law "a national policy [to] encourage productive and enjoyable harmony between man and his environment." And it set in motion a new sense of conscience, that a few idealists hoped would change the world.

It did. What began as an isolated American movement twenty years ago is now shared by 135 countries on seven continents. And while many thought our experiment in environmental protection would prove impossible -- that you couldn't maintain both a productive economy and protective ecology -- we've learned that economic prosperity and environmental protection go hand in hand.

And we understand no nation can act effectively alone. Unilateral action is futile. But united action? Essential -- and more than merely possible, as the Montreal Protocol proved.

Around the world, America and other nations now extend an offered hand to emerging democracies ~~denied that knowledge~~ emerging in Eastern Europe and in this hemisphere. And only now

2012



do we see the extent of the challenge we share.

In this hemisphere and in Africa, the raging fires of forests burned for compelling but mistaken economic reasons have been visible to astronauts in space. Other nations, in the struggle to support life, have been virtually stripped of the resources that sustain life. *Hausman*

And whether through the tyranny of ignorance, or the ignorance of tyrants, pollution has been unveiled as one of Eastern Europe's cruelest dictators. An oppressor. Not man -- but man-made. In the majestic city of Krakow, statues that survived invasions by Swedish Kings and Austrian emperors, by Hitler and by Stalin -- monuments to great men -- have been defaced by pollution, as their medieval majesty is reduced to shapeless lumps of stone.

If mankind's greatest **creations** cannot equal God's smallest, some may grieve that our greatest **destruction** is turned at times upon ourselves. And we may not see much hope in the faces of the starving, or the faces of ancient monuments. But we can find cause for optimism among the men and women in this room.

Let us act on what we know, and in good faith. The earth cannot, must not be sacrificed to blind material ambition -- nor can the health, the very survival of millions be sacrificed by intemperate policies. Let us work to meet the needs of this generation, while preserving the earth for the next, and all that follow.

#

Thank you. —

FORWARD STEPS: CONF. PROPOSALS / OUTCOMES

REPORT.410

THE WHITE HOUSE
WASHINGTON, D.C.

The White House Conference
on
Science and Economics Research Related to Global Change

DRAFT OF CO-CHAIRMEN'S CONFERENCE REPORT

GOALS AND OBJECTIVES OF THE CONFERENCE:

A White House Conference, initiated by President George Bush, on Science and Economics Research Related to Global Change was held in Washington, D.C., April 16-18, 1990. Conference Co-Chairmen were, the Chairman of the President's Council of Economic Advisers, Dr. Michael J. Boskin, the Assistant to the President for Science and Technology, Dr. D. Allan Bromley, and the Chairman of the White House Council on Environmental Quality, Mr. Michael R. Deland. Seventeen nations and the leadership of the E.C. and the OECD sent ministerial-level delegations to the Conference (See Appendix I for a List of Delegates). The Conference sought to add a integrating focus for international thought on Global Change, by introducing the concept of "Global Stewardship", and by adding a new dimension to the international dialogue on Global Change -- **the proposition that economics, both analysis and research on broad economic policy and on economic consequences of policy options, is an essential link between the science of Global Change and policy alternatives.**

The "strong force" binding

GLOBAL STEWARDSHIP

(INSERT GLOBAL STEWARDSHIP TEXT HERE)

THE CONFERENCE AGENDA

To address the substantive Conference goals, the agenda focussed the presentations and discussions on:

- o **Science and economics research** issues relevant to policy on global change,
- o Important next steps that substantially **enhance and broaden international understanding** of science and economic research issues that relate to global change,
- o **The special role that economics plays** in integrating the science of Global Change with the policy process,
- o **Demonstrating linkages between science and economics** research results and both domestic and international policy processes, and
- o **Framing the initial steps towards strategies for implementing joint international science and economics research efforts.**

The Conference focussed on "Global Change," a scope of research interests that evolved out of the sciences that are concerned with understanding the fundamental processes that govern the way the global Earth system functions. Global Change encompasses such diverse and interrelated issues as ozone depletion, greenhouse gases, climate change, food security, water supply, sea level changes, wetlands, deforestation, biodiversity, population changes, and energy demands.

The Conference was conceived as an integral part of the on-going international process to understand the science of and policy options relating to global environment issues. The need to substantially improve understanding of both the science and economics of global change has been noted by virtually all world leaders. The Conference, therefore, focused on scientific and economic research issues as a complement to the on-going Intergovernmental Panel on Climate Change (IPCC) and other international forums that seek to address the research agenda for Global Change.

The Conference provided a forum of international leaders to address a variety of complex science and economics research issues central to the policy process, for example:

- * How well can we predict temperature trends in the decades ahead?
- * How "good" are our global-scale models, such as models to predict temperature changes?
- * How well can we predict the interconnections between global environmental change and the resulting social and economic impacts?
- * What are the economic costs of adapting to or mitigating global change?
- * How "good" are the economic models used to compute these costs?

By having ministerial-level discussions of such questions, it was hoped that nations might join together to enhance cooperative international research programs that focus on rapid improvement of both scientific and economic knowledge.

To address these complex and interrelated issues, ministerial-level delegations were invited to the Conference from a representative group of nations. The Conference was conceived with the idea that a small representative group of countries would participate. Their selection was based on the simple criteria that the meeting should be modest in size and include countries or organizations of countries that have substantial populations, large land masses, industrialized economies or heavy future energy needs, major research infrastructures, or have provided international leadership on issues related to climate and global change. A representative group of countries was selected, including:

1. Australia
2. Brazil
3. Canada
4. Federal Republic of Germany
5. France
6. India
7. Indonesia
8. Italy
9. Japan
10. Mexico
11. Netherlands

12. Nigeria
13. Norway
14. Poland
15. Soviet Union
16. United Kingdom
17. Zaire
18. European Community
19. OECD

CONFERENCE PLENARY AND WORKING GROUP SESSIONS

The Conference Plenary and Working Group Sessions provided an opportunity for delegates to address the critical science and economics research issues related to Global Change. The agenda was designed to provide a forum to:

- o Substantially increase collective understanding of the critical scientific, economic, and environmental research agenda central to the needs of future global change policy development.
- o Identify the uncertainties in both scientific and economics knowledge critical understanding changes in the global environment of the planet,
- o Increase mutual understanding of and sensitivity to scientific and economic research efforts between both of those research communities.
- o Increase sensitivity by the two research communities to the policy needs in the environmental and energy arena, and visa versa.
- o Foster the concept of the importance of a solid and well implemented scientific and economics research effort, as a pre-requisite for and parallel complement to, the evolving efforts by nations to address the international policy questions of global environmental changes.
- o Enhance communications and establish a broader "network" of among national leaders, concerned with and responsible for, the research and policy agenda related to global change. The Conference sought to provide a forum to forge partnerships between the scientific and technical research communities and the policy-makers.

To provide a vehicle to focus on these vital issues, the Conference Program was designed around a balance between several Plenary Sessions and concurrent Working Groups that addressed three major themes:

- o **Theme I: The Science and Economics Research Challenge**
- o **Theme II: Integrating Science and Economics Research in the Policy Process**
- o **Theme III: Building Partnerships for Science and Economics Research**

PLENARY SESSIONS

The program for the Conference was divided into three broad components: (i) One half day of **Opening Plenary Sessions**, (ii) two half days of **Working Groups Sessions**, and (iii) a half day of integrating and **Summary Plenary Sessions**.

OPENING PLENARY SESSIONS

Opening: The Conference was opened with a presentation by Secretary of the Treasury, Nicholas F. Brady. The welcome addressed focussed onInclude Summary of Brady's Remarks.

Address by President George Bush: The President of the United States, George Bush spoke to the Conference and his central messages wasInclude a Summary of President Bush's Speech. Full Text of the President's Speech is appended in Appendix A.

Remarks by _____, Delegate from _____. The Honorable _____, from _____, provided the Conference with a visiting delegation perspective on the Conference, during whichInclude a Summary of his remarks. Include full text if available in the Appendices.

Central Themes of the Conference: The Three Conference Co-Chairmen gave major addresses on the three Conference Themes, the purpose of which was to outline the central issues of the Conference and to provide a focus on each Theme for the Working Group Sessions. The full text of these three speeches is appended in Appendix B.

Theme I: The Science and Economics Research Challenge. Dr. D. Allan Bromley
..... Include a Summary of Bromley's Speech....

Theme II: Integrating Science and Economics Research in the Policy Process.
Dr. Michael J. Boskin Include a Summary of Boskin's Speech....

Theme III: Building Partnerships for Science and Economics Research.
Mr. Michael R. Deland Include a Summary of Deland Speech...

Visiting Delegations Perspectives on the Themes. Three delegates formed a Panel to discuss the Themes and to give several visiting delegations views on the Themes of the Conference.

o Foreign Delegate - Include Short Summary Here

o Foreign Delegate - Include Short Summary Here

o Foreign Delegate - Include Short Summary Here

(Include full text if available in Appendices)

MAJOR ADDRESSES

There were two major addresses given during the Conference Luncheons.

o Admin. William Reilly - Include a Summary of that Address

o Sec. James D. Watkins - Include a Summary of that Address

The full text of both of these address is included in Appendix C.

WORKING GROUP SESSIONS

The Conference agenda was organized so that delegates were divided into three Working Groups (Working Groups A, B, and C), each of which consisted of a mix of ministerial-level delegates from science, economics, and the environment agencies of government, and in some cases from energy agencies. All countries were represented in each Working Group. The list of Working Groups is contained in Appendix D. Four Working Group Sessions met sequentially, two on Tuesday afternoon of April 17 and two on Wednesday morning of April 18. The first sessions were devoted to the three Conference Themes and the fourth was designed as a session to integrate the discussions and to prepare a written summary of the Working Group deliberations as a contribution to the Co-Chairmen's Conference Report. Those reports are summarized herein.

Working Group A: Summary Report of Working Group "A"

Working Group B: Summary Report of Working Group "B"

Working Group C: Summary Report of Working Group "C"

SUMMARY PLENARY SESSIONS

SUMMARIES OF CONCLUDING ADDRESSES AND PRESENTATIONS

- 1.) **Foreign Delegations Summary of Conference:** Three visiting delegates reviewed the results of the Conference from their perspective, a summary of those remarks follow. ...Include the comments here. (Include full text if available in Appendices)
- 2.) **Working Group Leader Summaries of the Conference:** The three Working Groups gave summaries of their deliberations, a summary of which follows.Include it here. (Include full text if available in Appendices)
- 3.) **Conference Co-Chairmen Summaries of the Conference:** The three Conference Co-Chairmen outlined their summary views on the Conference, a summary of those comments follow.Include those here. (Include full text if available in Appendices)
- 4.) **Closing Remarks by President George Bush:** The President of the United States, George Bush presented his closing remarks to the Conference.Include a Summary of President Bush's Speech..... Full Text of the President's Remarks is appended in Appendix A with the Opening Address.

SUMMARIES OF PROPOSALS FOR ACTION OFFERED DURING THE CONFERENCE

The delegates of the Conference concluded that several specific actions, developed during the Conference should be addressed in the period immediately after the Conference. These include:

- 1.) The Working Groups considered a proposal by the U.S. to endorse the principles contained in a "Charter for Cooperation in Science and Economics Research Related to Global Change", the draft of which is contained in Appendix E. The general consensus of the Conference wasInclude the specific results of discussions on this topic here,

Tuesday
April 10, 1990
9:08 am

including any recommended action steps.

- 2.) The U.S. proposed an initiative designed to initiate international and jointly sponsored research "centers" that focus research on the science and economics of global change. The purpose of these centers, which might be called **International Institutes for Research on the Science and Economics of Global Change**, is to develop internationally recognized "Center of Excellence" where both resident and visiting scholars address key research topics that contribute research results to the international policy process. A draft of the U.S. proposal is contained in Appendix F. The Working Groups discussed this proposal and concluded Include the results of those discussions here.....
- 3.) The U.S. proposed an initiative to increase communications among nations engaged in research on global change. The U.S. proposal suggested that nations join together in what might be called a "**Global Change Communications Network**". The proposal suggested that a joint effort be undertaken that builds on the available technology for data and information transfer, electronic mail, and other telecommunications technologies. A draft of the concept is enclosed in Appendix G. The Working Groups discussed this matter and concluded that.....Include the results of those discussions here.
- 4.) The U.S. proposed that the Conference consider endorsing a "**Statement of Principle**" for **developing an international Strategy for Cooperation in Scientific and Economic Research in Global Change**. The draft "Statement" is attached in Appendix H. The "Statement of Principles" outlines the basis for developing a strategy among nations for a cooperative international effort to implement joint scientific and economics research programs, including sharing of scientific and economic data, coordinating the development of international global observing systems, and facilitating joint research efforts to substantially improve the capabilities of models to predict controlling global and regional environmental process (i.e. GCM's). The "Statement" outlines the essential ingredients for an overall strategy to implement cooperative research internationally. The focus would be on research efforts that can be substantially enhanced by joint efforts that build on the expertise, experience, and data available of each participating country. The U.S. suggested that if the "Statement of Principles" is endorsed by the Conference, then a Task Team of interested nations would prepare a **Draft Strategy**, within a few months, for consideration by government agencies responsible for implementing Global Change research programs and projects. The proposal suggested that such a Strategy then could lead to what might be called, an "International Global Change Research Program". The proposal suggested that such a more fully coordinated international research effort could substantially assist the on-going policy debate and could support other up-coming international meetings, such as the IPCC and the Second World Climate Conference. The proposal builds upon existing discussions initiated by the International Council of Scientific Unions (ICSU) during its recent Annual Meeting in Lisbon, in October, 1989. The proposal is intended to fully facilitate the implementation of the research programs of the World Climate Research Program (WCRP), the International Geosphere-Biosphere Program (IGBP), and others. The Working Groups considered the proposal and concludedInclude the results of the Working Group discussions here.
- 5.) Other proposals - include here.

File = REPORT.410

**PRESIDENT'S TWO SPEECHES
(To be Added at Conference)**

THREE CO-CHAIRS THEME SPEECHES
(To be Added at Conference)

LUNCHEON SPEECHES
(By Wm. Reilly and James Watkins)
(To be Added at Conference)

WORKING GROUPS MEMBERSHIP LISTS
(To be Added at Conference)

**CHARTER FOR COOPERATION
in the
Science and Economics Research Related to Global Change"**

Government officials of Science, Economics, and the Environment from eighteen nations, the European Community (EC), and the Organization for Economic Cooperation and Development (OECD) gathered in Washington, D.C. on April 16-18, 1990, to attend a White House Conference on Science and Economics Research Related to Global Change. The Conference was designed to address important next steps for substantially enhancing and broadening international understanding of science and economic research related to Global Change. The delegates to the Conference noted that;

WHEREAS:

- o Scientific evidence demonstrates that the **Earth and its environment are changing** on time and spacial scales unknown to humankind,
- o **Scientific uncertainty remains** as to the contributions made by natural variability in Earth system processes and those made by impacts from anthropogenic sources, hence limiting the ability of science to predict, with acceptable accuracy, the future behavior of the Earth system,
- o Gaps in scientific understanding substantially **limit the abilities of nations to determine the economic and societal impacts** of global changes in the environment,
- o World leaders are considering unprecedented postures and actions to **address the potential economic and social implications** of these changes, and
- o These national and international developments, taken in total, have placed **global environmental issues central on the agenda of international affairs.**

THEREFORE:

The nations gathered at the White House Conference on Science and Economics Research Related to Global Change will seek to:

- o Increase and coordinate their science and economics research programs with internationally planned research efforts,
- o Work together to develop national science and economic research programs that complement and contribute to a coherent international effort,
- o Work to enhance existing international mechanisms for planning and implementing science and economics research programs, and to foster, when necessary and appropriate new mechanisms to foster cooperation among the world's governments and international agencies,
- o Work toward full participation of all nations in the formulation, refining, and implementation of the science and economics research agenda,
- o Encourage the nations of the world to contribute resources and personnel to the research agenda in measure and kind reflecting national capabilities,

- o Collaborate with other nations in support of education, training, and human resources development that is focussed on the research agenda and that supports full participation by developing countries, and
- o Work toward developing cooperative access to pertinent research facilities and research data and information by all nations and toward developing indigenous research activities relevant to the global environment change research program in all participating nations.

FILE = CHARTER.410

INTERNATIONAL INSTITUTE CONCEPT PAPER

GLOBAL CHANGE COMMUNICATIONS NETWORK CONCEPT PAPER

STATEMENT OF PRINCIPLES
FOR
IMPLEMENTATION STRATEGIES FOR COOPERATIVE RESEARCH PROGRAMS

**LIST OF DELEGATIONS
(To be Added at Conference)**

SUMMARY:

End of life of the people.

It is the reason why we are one of many challenges

Lower
water quality
Air quality:
50% ↓ 20%
CO ↓ 15%

air quality in 90%
of our countries
in 1990.

People spend
hundreds
of
people to stay in
country

Millions
of people
are
leaving
country
to
find
work

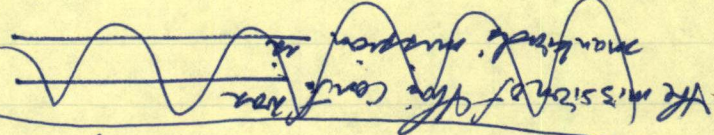
Real
wages
are
falling
in
many
countries

Real
wages
are
falling
in
many
countries

In 1950, we
looked
at it, and
said, "oh
my god, look
at these
costs, look
at these
prices, look
at the
life of
the people
in the
country."

Followers
of the
movement
will
spend
thousands
of dollars
to
make
the
country
work
again.

Stop
the
movement
from
making
the
country
work
again.



under the
movement.

important, but
many
concern
and
issues.

Been
out
front
- air
clean,
a
signal,
and
state

consistent
commitment
- and
state

Take
credit
for
what
has
been
done
(quick,
hard)
for
the
21.5
years
over
20
years.

J. Edgar
Hoover

Price
in
Washington

1. Make
a
list

2. What
are
the
issues

3. How
to
solve
the
problems

Station
in
the
country
(long
face)

All
the
time
the
country
is
in
the
air

~~WELCOME TO THE U.S. KENNETH SCOTT~~

The dollar buys a known dir.
 infant mortality life expectancy
 food for the hungry health
 human capital creation
 marginal use in GDP in
 support in life expectancy

The Conference focuses on "Global Change," an area of research concerned with understanding the
 fundamental processes that govern the Earth system functions. Global Change encompasses such
 diverse and interrelated issues as ozone depletion, greenhouse gases, climate change, food security,
 water supply, sea level changes, wetlands, deforestation, biodiversity, population change, and energy
 demand.

(Key Short) --
 All of the issues that affect
 sustainable development
 - health
 - drugs
 - environment

Buckle up
 3rd world

The
 world
 is
 changing
 fast
 and
 we
 need
 to
 act
 now

** (Tangly and on about
 his experience, his committee,
 his freedom.)

(at Conference still)
 economic, political and
 you, and on
 and public health care, sports

"Do this (or) Summit conference, or my conference?"
 ↳ we met in front in great bank, + looking guidance.
 packed speaker's meetings (set up for and for bank)
 "This is a scientific audience..."
 on PPTs, not empty
 pseudo-conference
 that respects

Deb
Amend

THE MAKING OF A GREENHOUSE POLICY

M
su page
10
D

D. ALLAN BROMLEY

**Assistant to the President for Science and Technology
and Director, Office of Science and Technology Policy
Executive Office of the President**

**National Press Club
Washington, D.C.
April 11, 1990**

When the media describe a scientific advance, they often focus on a particular individual or event, as if the advance derived entirely from that source. Scientists working in the field typically know the situation to be much different. Many steps are needed before a particular advance can occur, and much needs to be done for an insight to be integrated into an existing body of knowledge.

Similarly, in describing the formation of policy, it is often easy to overemphasize a particular incident: a clash of personalities, a pivotal document, the meeting at which everything becomes clear. I wish it were so simple. In fact, I have often found policymaking to be somewhat similar to scientific research, both in its rewards and its frustrations. Thomas Jefferson described science this way: "A patient pursuit of the facts, and cautious combination and comparison of them, is the drudgery to which man is subjected by his Maker if he wishes to attain sure knowledge." He might as well have been describing how you put together the fifth draft of a policy statement.

In a somewhat less solemn fashion, the making of policy has also been likened to the mating of elephants -- it takes place at a high level, it involves substantial trumpeting and thrashing about, and it takes a long time to produce any tangible results.

What I would like to do today is describe the process by which the Bush Administration has been forming a national policy -- and contributing to an international policy -- on global environmental change. You will be hearing much about that policy over the next few weeks, largely because of an international White House Conference on Scientific and Economic Research Related to Global Change that I will have the pleasure of cochairing next Tuesday and Wednesday. But that ~~conference~~ is just one step in the much larger process of trying to understand and respond to the possible adverse effects of global change. I have spent much of my time since coming to Washington last summer on this subject. And I believe that the actions the Bush Administration has taken -- and will be taking -- in this area amply demonstrate the President's commitment to dealing responsibly with this issue.

A POLITICAL AWAKENING

The term "global change" encompasses such diverse but interrelated issues as ozone depletion, greenhouse gas emissions, climate change, sea level changes, deforestation, levels of biodiversity, and energy demands. But much of the public's attention has focused on global warming. And I don't think that anyone can look at the possibility of global warming without being struck by an immediate paradox.

The enhancement of the greenhouse effect is one of the most long-term and global problems that we face. As such, it will require a long-term and global response -- not what might be described as slam dunk solutions.

Yet the political atmosphere surrounding global warming resembles nothing so much as a crisis. A remarkable number of pieces of legislation have been introduced on Capitol Hill, and the latest research results -- some emphasizing and some minimizing the potential impacts of global warming -- make the front pages of newspapers.

There are several quite understandable reasons for this widespread concern, including the fact that four of the warmest years on record have occurred in the 1980s. But I believe that much of the current ferment still derives from the summer of 1988. In that single season, a severe drought struck the Midwest, much of the nation sweltered under unusually high temperatures, forest fires scorched large areas of the West, and a particularly strong hurricane devastated the Caribbean. The greenhouse effect made the covers of Time and Newsweek -- even though scientists cannot yet, in any convincing fashion, connect these events of that summer to the greenhouse effect.

This political awakening has driven the greenhouse effect toward the top of the national and international political agendas. It should be remembered, however, that ~~—~~scientists have been speculating about enhancements of the greenhouse effect for decades and more. The Swedish chemist Svante Arrhenius predicted, in 1896, that the temperature of the Earth would go up 4 to 6 degrees Celsius if levels of atmospheric carbon dioxide doubled -- a remarkably prescient prediction given that, until the role of clouds were incorporated more accurately into global circulation

models, they estimated temperature increases of only slightly less. As early as 1957, Roger Revelle and Hans Suess wrote about the "large-scale geophysical experiment" that we are conducting by releasing carbon dioxide into the atmosphere.

Scientists know much more about the Earth and its components now than they did when these early predictions were made. General circulation models mimic global climate reasonably well. And we can observe the Earth from space, which has made a deep impression not only on our understanding of the Earth but on our sense of the planet as a unified, somewhat fragile home.

But what we do know about the Earth is still dwarfed by what we do not know. I know that journalists are expected to answer the four W's in the first paragraphs of their stories: who, what, where, and when. Suffice it to say that it would be very difficult to write a first paragraph describing the greenhouse effect.

There is a general consensus among scientists that continued loading of the atmosphere with greenhouse gases could lead to warming. However, the uncertainty and controversy center around the magnitude, rate, and timing of a warming.

In addition, there is a general consensus that the planet has warmed up by about 0.5 C during the past century. But very few scientists would claim that they are yet able to determine whether any of that warming can be attributed to a greenhouse effect or whether it represents a natural fluctuation. And although some climate models predict a warming of between 1 and 2 C from a doubling of atmospheric carbon dioxide -- although there is still large uncertainty as to whether this doubling will occur in 2050 or in 2200 -- it is also true that the historical record shows that the natural background temperature could, over this same period, go up or down by a similar amount, leaving us with no change or with twice the model predictions. We simply do not yet know.

We are also only beginning to understand what the impacts of a potential ~~warming~~ might be on agricultural productivity, sea level changes, biological productivity in the oceans, shifting vegetation patterns, storm patterns and severity, droughts, and the like. We are even further from any quantitative understanding of the corresponding economic impacts, as I shall discuss in a moment.

Two of the most severe difficulties involve the treatment of clouds and of oceans in general circulation models. Until recently, geoscientists did not even know if clouds warm or cool the Earth. We still do not know for certain whether the increased cloudiness associated with a warmer Earth will augment or counteract a greenhouse effect. It will depend on the nature and altitude of the clouds.

Regarding the oceans, we know that only about half of the carbon dioxide released through fossil fuel combustion and deforestation remains in the atmosphere. For years, researchers assumed that the rest was being sequestered in the oceans, but recent studies indicate that no more than a quarter probably ends up there. Where does the rest go? We still are not sure, although some suggest it is in temperate latitude biomass.

Uncertainties regarding the behavior of clouds and oceans also contribute to one of the most vexing difficulties of current atmospheric models: their inability to make accurate regional predictions. Models still disagree about such fundamental questions as whether the centers of continents will get wetter or drier if the Earth warms. Yet these regional predictions are essential to assess the possible impacts of global change.

Because of the limitations of models, we must remain aware of the potential for surprises. The development of the ozone hole over Antarctica was such a surprise. The hole develops through a mechanism that was not included in earlier models of ozone destruction, and as a result was found almost by accident. We need a careful program of observing and monitoring the Earth to detect any such surprises caused by our emission of greenhouse gases.

What the ozone hole has demonstrated beyond question, however, is that, contrary to long-held assumptions, our atmosphere is not so large, nor its inertia so great, that human activities cannot affect it on human time scales. Human release of ~~chlorofluorocarbons~~ combined with unique meteorological conditions has indeed created the ozone hole -- through well understood chemical mechanisms -- in only a few decades at most.

Lewis Thomas, among others, has compared the Earth to a living organism, and in particular to a single cell. The comparison is certainly apt in this regard: as

much as we still have to learn about the nature of life, about how it developed and where it is going, we have as much to learn about the nature of the Earth.

THE NATIONAL RESEARCH AGENDA

Bertrand Russell once wrote: "The most savage controversies are those about matters as to which there is no good evidence either way." Global warming comes dangerously close to falling into this category. As research reveals more about how human activities can influence climate, we will have a much less controversial basis on which to take actions.

The U.S. government is now engaged in a large-scale, integrated program to develop the understanding that will guide future policy decisions. That program is known as the U.S. Global Change Research Program, and it was established by the interagency Committee on Earth Sciences chaired by Dallas Peck of the U.S. Geological Survey. The Committee consists of directors of independent agencies and of assistant secretaries of cabinet departments doing research on the global environment. Working groups organized under the committee consist of the senior program managers working in a particular area. For example, the U.S. Global Change Research Program was organized by the committee's Working Group on Global Change, chaired by Robert Corell of the National Science Foundation and incorporate the programs of seven different agencies.

The FY 1991 budget that President Bush sent to the Hill at the end of January -- reflecting the compelling case made by the CES for its integrated, national program -- called for a 57 percent increase in funding for this program, to a total of over \$1 billion. The proposed funding would significantly expand research, data gathering, ~~and modeling~~ activities through a carefully balanced mix of ground-based and space-based research.

I might say, by the way, that the success of the Committee on Earth Sciences has acted as a model for similar efforts by the Office of Science and Technology Policy. We have recently reorganized and revitalized the Federal Coordinating

Council for Science, Engineering, and Technology -- the parent body of the Committee on Earth Sciences -- and have established a number of new interagency committees in such areas as education, the life sciences, and technology and industry. In this way, we hope to bring a much greater integration and coordination to a number of important areas of science and technology.

THE WORKING GROUP ON GLOBAL CHANGE

The Committee on Earth Sciences focuses on the research aspects of global change. The policy analog to the CES is the Working Group on Global Change, which President Bush established last fall under the Domestic Policy Council, one of two senior, Cabinet-level policy councils within the White House. The Working Group, which I chair, provides Cabinet-level coordination on global change issues and is an important source of information and advice for the President.

Shortly after it was established, the Working Group called for three specific studies of global change. The first looked at the economic costs of both global change and responses to possible change; it also considered the potential costs of inaction. The second considered private sector concerns and activities. The third reviewed the legal precedents for international agreements and conventions on the environment. The Working Group has also been briefed by top experts on the scientific and economic aspects of global change.

The Working Group on Global Change will continue to be the focal point within the White House in considering Administration policies toward the global environment. But at this point I would like to break my promise about sticking to process and discuss some of the policies themselves. The Bush Administration does not believe that further research is any substitute for action. It is clear that we are accelerating our research in the face of uncertainty; but what bears emphasis as being even more important is decision making in the face of uncertainty.

As such, this Administration has already instituted a number of policies that will reduce greenhouse emissions while being fully justified for other reasons. The

President refers to these as "no regrets" or "all weather" policies, because even if our concerns about the greenhouse effect turn out to be unfounded, these policies will have other benefits. I look on them as an insurance policy against possible adverse effects of global warming.

- o The United States is committed to phasing out the manufacturing and use of CFC's by the year 2000 to protect the stratospheric ozone layer -- ahead of the requirements of the Montreal Protocol -- provided safe substitutes are available. If not controlled, CFC's would account for as much as 25 percent of the greenhouse effect's increase in the next century.

- o The Clean Air Act now being debated in Congress will provide for substantial reductions in the emission of other greenhouse gases by fostering more efficient use of energy. The Environmental Defense Fund has estimated that the acid rain provisions of this act alone, if implemented, would have the same effect on our greenhouse gas emissions as would removing fully one fifth of our current automotive fleet (22 million cars!) from our highways for a period of 10 years.

- o The Department of Energy is developing a National Energy Strategy that will focus, in particular, on an aggressive commitment to energy conservation and to the development of non-fossil-fuel sources of energy.

These initiatives address the source component of the greenhouse gas question; turning to the sink component, the Administration is again taking concrete steps.

- o The Department of Agriculture is proposing to plant a billion trees on private land across America, trees that will eventually absorb 13 million tons of carbon annually.

- o Diplomatic discussions are being conducted aimed at protecting the remaining tropical forests through such mechanisms as debt-for-nature swaps.

An underlying theme in all of the Administration's global change policies is that they be based on the best possible science and that they be technically and

economically sound. These are criteria that we will continue to apply as we consider policies in the future.

THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

Thus far I have been discussing our national research and policymaking with respect to global change. But the greenhouse effect is no respecter of national or political boundaries, and its understanding demands information and analyses that span the globe. International cooperation will therefore be essential to continued progress.

The primary international forum through which these issues are being addressed is the Intergovernmental Panel on Climate Change (IPCC), which has been organized under the auspices of the United Nations Environment Program and World Meteorological Organization. The IPCC involves hundreds of scientists and government officials from a number of countries who are seeking to establish an international consensus on the likely causes and consequences of climate change.

The IPCC is conducting its activities through three working groups. The first, which is chaired by the United Kingdom, is seeking to develop a better scientific understanding of climate change. The second, chaired by the Soviet Union, is assessing the possible environmental and socioeconomic effects of climate change. And the third, chaired by the United States, is seeking to identify potential responses to global change.

These three working groups will produce reports by the end of the summer. Policymakers around the globe will then be able to draw upon these reports in formulating national and international policies. In addition, our conference being ~~held next~~ week on scientific and economic research relating to global change is designed to complement and support these IPCC activities.

The three working groups of the IPCC met here in Washington in February, and President Bush addressed their opening plenary session. He told them, "The United States is strongly committed to the IPCC process of international cooperation

on global climate change. We consider it vital that the community of nations be drawn together in an orderly, disciplined, rational way to review the history of our global environment, to assess the potential for future climate change, and to develop effective programs."

President Bush has also expressed his support for the next logical international step: a Framework Convention on Global Change to be negotiated among the countries of the world. At the Malta Summit, President Bush proposed that the United States host the first negotiating session of the Framework Convention, and he reiterated that offer to the IPCC.

In thinking about the goals of a Framework Convention, the Vienna Convention offers a useful analogy. In 1985, the United States and 20 other countries signed the Vienna Convention for the Protection of the Ozone Layer, which established a framework for international scientific and technical cooperation. However, the Vienna Convention did not set limits on emissions. Rather, it included provisions to establish protocols as further research developed.

A Framework Convention on Global Change could serve the same function. It would build cooperation among nations and establish the mechanisms by which future steps are taken. But the United States believes that a comprehensive approach should be taken to encompass all greenhouse gas emissions on the basis of a scientifically determined greenhouse equivalent index and that possible actions should employ market-oriented approaches.

THE WHITE HOUSE CONFERENCE ON SCIENTIFIC AND ECONOMIC RESEARCH RELATED TO GLOBAL CHANGE

— The reports of the IPCC working groups will be an important input to the Framework Convention, but an important complement to the IPCC will be the White House Conference being held here in Washington next week. President Bush is hosting the conference and will open and close the proceedings. I am one of the

cochairmen of the conference, along with Michael Deland of the Council on Environmental Quality and Michael Boskin of the Council of Economic Advisors.

The conference will bring together the three senior officials in science, economics, and the environment from 17 countries, the Organization for Economic Cooperation and Development, and the European Community. The conference is designed to explore what we do know about the scientific and economic questions surrounding global change, what we do not know, and when remaining uncertainties might be reduced. In addition, the conference will examine ways to more fully integrate the results of scientific and economic research into the policymaking process.

I have already mentioned some of the scientific challenges, so let me focus here on the economic ones, since in many cases they are even greater than the scientific ones. For example, one recent analysis was able to conclude only that emissions of carbon dioxide in the year 2050 are likely to be between 1.5 and 12 times what they are today.

We need much better measures of the potential costs and benefits of limiting or adapting to global change. Preliminary studies show that the costs could be very high, but data and assumptions with which to make such estimates are riddled with uncertainties.

In general, the social sciences will be as important as the natural sciences in improving our understanding of global change. Even when the physical and biological aspects of a problem are understood, all too often agreement is lacking on the underlying social, behavioral, and economic causes and consequences of an action. The conference next week will be focused at least as much on these aspects of the problem as on the purely scientific aspects. We hope in this way to add a new dimension to the international dialogue on global change.

The Conference is expected to produce a Cochairmen's report, which will set forth common actions designed to expand research and cooperation among nations. The United States will also be making a number of concrete proposals during the conference, such as a proposal for an international global change research program comparable on the international scene to the U.S. national program described above. You will be hearing about those next week.

CONCLUSION

Let me conclude with a bit of history, which I hope to relate at the conference next week because I believe that it summarizes our current situation very well.

The year after next we will be celebrating the 500th anniversary of Columbus's discovery of the new world, an event of unsurpassed importance in the course of world history. As might be expected, Columbus was an astute observer of the natural world. While he was anchored off the coast of Jamaica, Columbus noted in his journal that it rained for about an hour every afternoon. Columbus also pointed out that the same thing used to occur in the Canary and Azores Islands, but that the rain had stopped since the trees on those islands were cut down. In other words, Columbus was one of the first people to observe the effects of human beings on climate.

I think it very appropriate that Columbus should have done so, because he was engaged on a great voyage of discovery, and today we find ourselves engaged on a similar voyage. We are changing the world in ways that it has never been changed before. And yet human beings, by their very nature, cannot help but change the world.

We have no reason to fear such changes. But we must keep our eyes open, and try to understand where we are going, and change course when we have good reasons to do so. We need not sail blindly into our future. But if must keep moving forward if we are to achieve the complementary goals of an economically healthy and environmentally sound world.

THE EXPECTED RESULTS OF THE CONFERENCE

The Conference will provide an opportunity to address the science and economics research issues related to Global Change in the context of the policy process. To accomplish these goals, the Conference will focus on and seek to promote:

- A substantially *enhanced understanding* of science, economics, and environmental research agenda central to the needs of future Global Change policy development.
- A *substantive understanding of the uncertainties* in both science and economics knowledge of changes in the global environment of the planet.
- *Increased mutual understanding* of and sensitivity to the substance of science and economics research between both of those research communities.
- *Increased sensitivity* by the two research communities to the policy needs evolving in such areas as environmental and energy policy, and vice versa.
- A *solid* and well implemented science and economics *research effort* as a prerequisite for a complement to evolving efforts by nations to address the international policy questions of global environmental changes.
- A communication *network among national leaders* concerned with, and responsible for, the research and policy agenda related to Global Change. More particularly, this Conference provides a "first-ever" opportunity to forge a partnership between the science and economics research communities and the policy-makers.

To provide a vehicle to focus on these vital issues, the Conference will include two Plenary Sessions and several concurrent Working Groups, which will address the three major themes of the Conference:

- The Science and Economics Research Challenge
- Integrating Science and Economics Research in the Policy Process
- Building a Partnership for Science and Economics Research

The Conference is expected to produce a Co-Chairmen's Report, which will outline the deliberations of the Conference and set forth common actions designed to expand research and cooperation among nations.

As President Bush stated in his invitation letter, "It is my hope that the expertise, experience, and data available in our respective countries can be brought together in a more integrated and coherent fashion. By working together, our nations can enhance international cooperation in these vital areas and contribute to the success of the ongoing IPCC process."

No Global Warming Signs Spotted

WASHINGTON, March 29 (AP) — Data from weather satellites show no evidence of global warming in the 1980's, scientists say, but it will take at least another decade of measurements to draw a firm conclusion.

The data, collected from 1979 through 1988 by the Tiros-N series of weather satellites, proved that the earth's temperature can be measured accurately by instruments probing the atmosphere from space, two scientists say in a paper to be published on Friday in the journal *Science*.

"We found that the earth's atmosphere goes through fairly large year-to-year changes in temperature and over that 10-year period we saw no long-term warming or cooling trend," said Roy W. Spencer of the Marshall Space Flight Center in Huntsville, Ala.

Dr. Spencer's co-investigator, John R. Christy of the University of Alabama at Huntsville, said that there were temperature swings "that can be quite dramatic" during the decade, but that on a global basis, the thermal changes tended to even out.

A Net Effect of Zero

"The northern hemisphere goes up slightly during those 10 years and the southern hemisphere goes down slightly," said Dr. Christy. "The net effect for the globe is basically zero."

Detecting a climate trend, the scientists said, will take at least another decade of satellite measurements.

"There is no guarantee that if you take a 10-year segment out of a long time that you'll get the overall trend," said Dr. Christy. "The data cannot be used to say we've got an enhanced greenhouse effect." He said that the findings "are enough to tantalize us, but this is just a start" and that satellite measurements are continuing.

The new data is the first on global temperatures from satellites to enter the scientific debate about the greenhouse effect, Dr. Spencer said. Most other studies of temperature trends, some extending over more than a century, have come from the records of ground-based thermometers. These readings, he said, do not fully reflect the global temperature because there are very few temperature measurements for vast areas of the earth's oceans.

Debate Focuses on Measurement

Some experts say the earth is beginning to warm as a result of carbon dioxide and other gases dumped into the atmosphere over the last 150 years of industrial civilization. This warming, the enhanced greenhouse effect, is a matter of controversy in the scientific community because of the difficulty in measuring small climate trends over a long period of time.

Eric J. Barron, director of the Earth System Science Center at Pennsylvania State University, said the analysis of the Tiros data by Dr. Spencer and

able" in the global warming debate, and he agreed that 10 years is too short a period to determine a climate trend.

What is important from the study, said Dr. Barron, is that it proves studies by satellites eventually may settle the controversy.

Dr. Christy and Dr. Spencer spent two years analyzing old weather satellite records to come up with the decade of temperature measurements.

The scientists used data from Tiros instruments that measure microwave radiation caused by heating of the first six miles of atmosphere above the earth's surface. Accuracy of the data was verified by instrument calibrations and by comparing it with known

temperature deviations detected by ground-based thermometers.

Temperature Rises Detected

Dr. Spencer said the data detected a sharp rise in Pacific Ocean temperature in 1983 and 1987, years when the weather phenomenon El Niño was in play. These events had been detected and analyzed by other instruments. The Tiros data also detected a cooling in the tropics from 1984 to 1986, and a "warm event" in the northern hemisphere during 1987 and 1988.

On a global basis, the study found, the warmest years, in descending order, were 1987, 1988, 1983 and 1980. The coolest years were 1984, 1985 and 1986.

Scientist in 'Cold Fusion' Project Reasserts Claim and Is Disputed

By WILLIAM J. BROAD

Special to The New York Times

SALT LAKE CITY, March 29 — In his first appearance at an open scientific meeting in many months, a scientist who claimed to have achieved "cold fusion" presented no new data today that would be likely to persuade skeptics that the disputed findings were real.

The researcher, Dr. B. Stanley Pons, chairman of the University of Utah chemistry department, said at the meeting here that he had observed excess heat from a simple table-top apparatus and suggested that commercial applications of the process were possible.

But his heat-measuring methods came under attack during a discussion session, and Dr. Pons avoided a detailed reply.

Two hundred or so believers in cold fusion, curious onlookers and skeptics gathered for a three-day conference marking the first anniversary of the announcement by Dr. Pons and Dr. Martin Fleischmann, of the University of Southampton in England, that they had achieved fusion in a simple table-top apparatus at room temperature.

Nuclear fusion is the force that powers the sun, the stars and hydrogen bombs, fusing atoms together rather than breaking them apart, as nuclear reactors do. The process frees vast amounts of energy, but usually requires temperatures of millions of degrees to get started. The controlled release of "hot" fusion in huge machines of vast complexity has eluded scientists for decades.

Although the cold fusion field has been ridiculed and scorned by many scientists, and its ranks have thinned considerably, enthusiasts here contend that prejudice is blinding many researchers to the work's merit.

"The possible technological implications were, and are, enormous," said Dr. Fritz G. Will, head of the National

Cold Fusion Institute, a nonprofit corporation founded by the University of Utah that is sponsoring the conference.

But in opening the program, Dr. Will also alluded to dashed hopes that the table-top apparatus unveiled a year ago could rapidly evolve into a font of nearly limitless energy and profit.

"What was originally believed to be simple experiments that could be readily reproduced in other laboratories," he said, "turned out to be complex phenomena that defied confirmation in many laboratories and which cannot be explained on the basis of classical nuclear physics."

Dr. Will estimated that 40 to 50 researchers in the United States were still actively working on cold fusion research, 20 of them at the institute.

Heat Attributed to Fusion

In their announcement a year ago, Dr. Pons and Dr. Fleischmann said they had used a test tube fitted with palladium electrodes and filled with heavy water. An electric current was then passed through the electrochemical cell, causing excess heat that was attributed to nuclear fusion.

Such a process could revolutionize the world's production of energy, if it could generate great heat. But hundreds of scientists failed to duplicate the Pons-Fleischmann process. In a report today in the journal *Nature*, for example, Dr. Michael H. Salamon of the University of Utah and colleagues reported that they had measured no nuclear byproducts from Dr. Pons's and Dr. Fleischmann's own equipment.

Today Dr. Pons outlined in some detail his team's work at measuring heat produced by the electrochemical cells, asserting that excess heat was generated by "a large number" of palladium electrodes.

STATEMENT

BY

**D. ALLAN BROMLEY,
ASSISTANT TO THE PRESIDENT FOR SCIENCE AND TECHNOLOGY, AND
DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY**

BEFORE THE

**COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE**

ON

S. 324

NATIONAL ENERGY POLICY ACT OF 1990

**WASHINGTON, D. C.
APRIL 5, 1990**

STATEMENT

by
D. Allan Bromley,
Assistant to the President for Science and Technology, and
Director, Office of Science and Technology Policy

before the
Committee on Energy and Natural Resources
United States Senate

on

S. 324
National Energy Policy Act of 1990

April 5, 1990

Thank you for the opportunity to present the views of the White House Office of Science and Technology Policy (OSTP) on S. 324, the National Energy Policy Act of 1990. OSTP and the entire Administration share the committee's conviction that our national energy policy must be based on sound environmental, economic, and technical considerations. However, we believe that mechanisms now in place offer a significantly better chance of developing and implementing such policy than do the measures in the Act. The Administration, therefore, opposes enactment of S.324.

SCIENTIFIC UNCERTAINTIES REGARDING GLOBAL CLIMATE CHANGE

There is no question that human beings have significantly altered the composition of the atmosphere by burning fossil fuels, cutting down forests to greatly expand agriculture, and producing industrial chemicals such as chlorofluorocarbons. Over the past two centuries, the amount of carbon dioxide in the atmosphere has risen 25 percent. The level of atmospheric methane, a potent greenhouse gas generated by agricultural and industrial practices, has more than doubled.

Although scientists have predicted since the end of the nineteenth century that increases in atmospheric carbon dioxide would increase the temperature of the planet, our understanding of the relationship between greenhouse gases and global climate change remains imprecise and inadequate. The scientific challenge is great, and our inability to separate human impact from natural variability and the uncertainties surrounding temperature records compounds the problem. Nevertheless, few scientists would argue with the contention that if we continue to load the atmosphere with greenhouse gases, we will eventually experience some degree of warming.

Our general understanding of radiative forcing mechanisms in the atmosphere leaves unanswered the critical questions regarding how much warming will occur, the timing of any warming, impacts on sea level, rainfall and soil moisture, and the regional effects created by all of these factors. Those who are following the literature know that new, and sometimes conflicting results on the predictions for future global changes appear almost on a daily basis.

It is also important to recognize that developing an improved understanding of geophysical climate processes is only the first step in developing appropriate policies. Estimates of the human and social consequences stemming from actions that might be taken to curtail greenhouse emission, as well as those stemming from predictions on future warming and ancillary changes associated with it, must then be developed and used as the basis for policy formulation. Science and economics research aimed at developing necessary estimates and insights is a top priority for the Administration.

Our scientific research is making significant progress. Nonetheless, the state of the science remains highly uncertain. In fact, several recent studies suggest a move to more moderate predictions of the extent of global climate change and its potential impacts. For example:

- o In January of this year, a National Academy of Sciences panel concluded that current climate change models predict a global warming closer to 2 degrees Celsius over the next fifty years, not the previous range of 1.5 degrees to 4.5 degrees Celsius.**
- o In December 1989, the American Geophysical Union revised earlier estimates of rise in sea level of between 20 and 120**

inches by the year 2100 to a new estimate of between 0 and 30 inches.

- o Recently U.K. scientists have introduced a better representation of cloud processes in their global climate change model. The new estimate of warming for a doubling of CO2 dropped to 1.9 degrees Celsius, down from the previous estimate of 5.2 degree Celsius.
- o In January of this year, NOAA reported new results from its global climate model, using more realistic ocean simulations. This model now predicts that even with a doubling of the current CO2 levels there would not be warming in the Southern Hemisphere. Indeed, projections indicate some areas of the globe will be cooler.

Given this level of uncertainty in predictions about global climate change, it is clear we need to continue the aggressive research program being supported by various Federal agencies to understand more fully the ramifications of increased greenhouse gas emissions in the atmosphere and potential impacts that could be caused by global climate change. In the meantime, we should embark on measures to reduce greenhouse gas emission only if those measures also serve other policy objectives. That is precisely what the Administration has done.

ADMINISTRATION ACTIONS FOR ENERGY AND THE ENVIRONMENT

I would like to now summarize several initiatives undertaken by the Administration that address some of the objectives of S.324. Then I will describe our recent progress toward establishing a comprehensive research program in the areas of energy and global climate change, as well as mechanisms -- both national and international -- that we have developed for formulating informed policy decisions and for implementing these decisions. These actions, in my view, constitute an effective response to the goals that we all share.

The Administration considers it imperative that we continue to develop, in cooperation with the Congress, a well-designed program for research into the effects of greenhouse gas emissions on climate. We must also evaluate the economic and policy aspects of potential responses. Such a program will provide the foundation essential for the development of a

rational national energy policy that is economically and environmentally responsible.

I would also wish to emphasize the Administration's position that, pending the resolution of the significant scientific uncertainties surrounding climate change processes and their human and social impacts and concerns regarding economic and social dislocations stemming from efforts to limit fossil fuel use, our immediate focus should be on those actions that will reduce greenhouse gas emissions, but which can be fully justified for other reasons. For example, we have a commitment to phase out manufacturing and use of CFC's by the year 2000, ahead of the requirements of the current Montreal Protocol, provided safe substitutes exist -- these constitute 25 percent of our current greenhouse gas emissions. The Clean Air legislation currently under debate in the Congress will also provide substantial reduction in the emission of some of the greenhouse gases. A strong commitment to energy conservation is to be a major component of the Department of Energy's National Energy Strategy; and as an initial step in putting this strategy forward, the Department of Energy has already announced a series of conservation and renewable energy initiatives that are included in the President's FY 1991 budget request.

Turning from sources of these emissions to sinks, the Department of Agriculture's tree planting initiative (the planting of a billion trees on private land across America -- trees that could eventually absorb 13 million tons of carbon, annually) presented in the President's FY 1991 Budget, and our continued diplomatic discussions with countries such as Brazil aimed at protecting the remaining tropical forests, are key parts of our immediate response to this potential problem.

The Administration has already taken a number of additional steps that will enhance our understanding of, and response to, the potential effects of global climate change.

The President proposed in his FY 1991 Budget that funding for the U. S. Global Change Research Program be increased 57 percent over FY 1990, to \$1.03 billion in FY 1991. The proposed funding would significantly expand research, data gathering, and modeling activities through a carefully balanced mix of ground-based and space-based research.

An underlying theme in all of the Administration's activities relative to potential climate change is that the strategy must be scientifically-based and technically and economically sound. It must also be dynamic -- responsive to new knowledge and ideas, and to global, environmental and international changes. A report on the wide ranging public hearings that represent a step in the process of formulating the National Energy Strategy, for example, has just been released.

FEDERAL RESEARCH POLICY AND COORDINATION

The Office of Science and Technology Policy is charged with reviewing and coordinating Federal R&D that cuts across the missions of more than one Federal agency, and with providing advice to the President on issues of science and technology policy that affect national and international policy. As Assistant to the President for Science and Technology and Director of OSTP, I chair two complementary councils -- one federal, FCCSET and one private sector, PCAST -- that provide information and advice. In addition, I chair working groups of the Economic Policy Council and the Domestic Policy Council related to science and technology issues. These groups, whose functioning I shall now describe, will accomplish the objectives -- and many more besides -- of the coordinating council proposed in S.324. Thus, the organizational changes proposed in S.324, I believe, are unnecessary. The establishment of a coordinating council proposed in S.324 would be duplicative and would not add significantly to the existing mechanisms.

S.324 also sets out specific R&D criteria that the proposed coordinating council is required to use as the basis for preparing "management plans" for the conduct of R&D in certain identified technologies. We do not believe the overly prescriptive nature of such an approach will be successful. The proposed approach does not adequately include the participation of the private sector technology developers and technology users. Most observers of R&D policy have found that successful government R&D occurs most frequently when the users or ultimate manufacturers of the technology are involved in the planning, conduct and testing of the applied technologies. S.324 does not provide adequate mechanisms for this critical private sector involvement.

Federal Coordinating Council for Science and Technology

The Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) was originally established in 1976 by Public Law

94-282, the National Science and Technology Policy Organization and Priorities Act, which also established the Office of Science and Technology Policy.

FCCSET is charged with providing more effective planning, coordination and administration of federal scientific and technological programs. This includes identifying research and development needs, and developing and reviewing in close cooperation with the Office of Management and Budget federal budget plans in cross-cutting areas of science and technology.

Research on global change is supported by a number of federal agencies and constitutes an exemplary case of common effort on a science policy issue. OSTP's coordinating function in global change research has been carried out largely through the Committee on Earth Sciences (CES), which is one of the committees under FCCSET.

The CES in turn has two subcommittees that deal with global change, the Working Group on Global Change, chaired by Robert Corell of the National Science Foundation, and a new Working Group on Adaptation and Mitigation Technologies, headed by John Knauss of the National Oceanic and Atmospheric Administration.

I would like to submit for the record a copy of the document "Our Changing Planet: The FY 1991 U.S. Global Change Research Program," which was developed by the CES Working Group on Global Change and which formed the basis for the President's FY 1991 budget request in this area.

The CES has integrated the efforts of the federal agencies conducting research on global change into the U.S. Global Change Research Program (USGCRP). The goal of the program is to reduce key scientific uncertainties and to develop more reliable scientific predictions upon which sound policy strategies and responses can be based. The CES expects to update the research plan annually and to change priorities as research results are obtained and as nonfederal groups provide input into the research process.

Among the many interesting and important science questions that need to be investigated, I would mention, in particular, the reliability of general circulation models, the earth's climatic history, the role of

clouds, oceanic influences on the atmosphere and climate, the hydrologic cycle, and changes in ecosystems.

This existing interagency coordinating mechanism is far preferable to the establishment of the committee directed in S.324, composed of directors of national laboratories who, after all, are contractors to the Department of Energy. In fact, the Committee on Earth Sciences, has done an excellent job in coordinating global change R&D. Having established an interagency process that works, it would be a mistake to replace it with a new mechanism which places contractors on an equal footing with cabinet agencies.

The President's Council of Advisors on Science and Technology

The President's Council of Advisors on Science and Technology (PCAST) was established by Executive Order of the President on January 19, 1990. The Council, which I chair, reports directly to the President and consists of 12 distinguished scientists and engineers from academia, industry, and other nonfederal institutions. This council provides an important ingredient that is missing from the FCCSET process -- views from outside the federal sector.

PCAST has already met twice with the President and his senior advisors. One of the topics discussed was global climate change, and I shall request PCAST to form a panel on environmental science and global change. This panel, with its private sector perspective, will complement the advice we receive from the CES subcommittee of FCCSET. The fact that I chair both FCCSET and PCAST insures good communications between the two groups.

The Domestic Policy Council Working Group on Global Change

President Bush also has asked me to chair a Cabinet-level Working Group on Global Change under the White House Domestic Policy Council. The Working Group provides Cabinet-level coordination on global change issues and is an important source of advice for the President.

The Working Group, when established last October, called immediately for three specific studies: (1) an analysis of economic costs of global change and responses to it, (2) an analysis of private sector concerns, activities, and issues on global change, and (3) legal precedents for international agreements and conventions on the environment.

Preliminary drafts of these reports have been presented to the Working Group for use in their deliberations. In addition, the Working Group has set up a number of briefings by top experts on the scientific, economic, environmental, and industrial aspects of global change.

Economic Policy Council Working Group on Science and Technology

Late last month an Economic Policy Council Working Group on Science and Technology was established to assist in formulation, coordination and implementation of Administration policies involving science and technology. The Working Group will also develop science and technology issues related to domestic and social policy for consideration by the Domestic Policy Council.

I will chair this Working Group, and members will include White House officials and senior representatives from all federal agencies and departments with substantial involvement in scientific and technological issues. This Working Group will analyze the scientific and technological components of economic and domestic policy issues.

INTERNATIONAL RESEARCH AND POLICY-MAKING MECHANISMS

Global climate change affects all nations and thus requires international study and cooperation. Within the international scientific community are a variety of informal mechanisms for planning science programs. Often these informal mechanisms are used to plan the detailed scientific elements of a more formal program, several elements of which are outlined below.

Conference on Science and Economics Research Related to Global Change

The President has asked me, together with the Chairman of the Council of Economic Advisers and the Chairman of the Council on Environmental Quality, to organize a White House meeting of the three senior officials in science, economics, and the environment from a number of countries. This White House Conference on Science and Economics Research Related to Global Change will take place in Washington, D.C. on April 17-18, 1990.

The conference will be devoted to science and economics research issues relevant to policy on global change, including climate. The Conference is designed to address important next steps that substantially enhance and broaden international understanding of science and economics research issues, and to frame initial steps toward a strategy for implementing joint international science and economics research efforts. It seeks for the first time to join research issues central to both the science and the economics related to global change.

Intergovernmental Panel on Climate Change

The U.S. government was instrumental in establishing and continues to support the work of the Intergovernmental Panel on Climate Change (IPCC), which is sponsored by the United Nations and the World Meteorological Organization. The three working groups of the IPCC, which are studying the scientific aspects of global change, impacts, and response and mitigation strategies, respectively, met here in Washington recently to prepare their reports. The final papers of the working groups will be presented to the full IPCC in August, shortly before the Second World Climate Conference in October.

In an address to the IPCC Plenary Session here in Washington, President Bush commended their activities and reaffirmed the United States' strong commitment to the IPCC process. He said, "We consider it vital that the community of nations be drawn together in an orderly, disciplined, rational way to review the history of our global environment, to assess the potential for future climate change, and to develop effective programs."

The IPCC process is designed to provide input to an International Framework Convention on global warming. At the Malta summit last December, President Bush proposed that the United States offer a venue for the first negotiating session for this Framework Convention, and he reiterated that offer at the IPCC meeting.

CONCLUSION

A National Energy Strategy is currently being developed by the Administration that will respect the environment, meet our nation's needs for energy, and not damage our economy or international competitive position. The Administration has already taken specific actions to begin dealing with the potential problem of global change by

taking the initiative on CFCs and Clean Air legislation that will have the effect of limiting greenhouse gas emissions. A vigorous structure of coordinating and advisory councils on global change is already in place and is functioning well.

Title I of the Act would unnecessarily duplicate, and thus complicate and hinder, aspects of both the National Energy Strategy planning process and the Executive branch committee structure we have just revitalized. I would have to oppose, in particular, formation of the proposed Federal Energy-Environmental Coordinating Council. More generally, I have a concern with requirements that would set goals or targets before we have reached agreement on how to evaluate total fuel cycle costs. Certainly, we should not do so unilaterally. These requirements could constrain our technical options, weaken our economy and threaten our competitive position with little environmental gain. The White House Conference later this month will begin to provide a basis for more considered actions.

Title II addresses energy efficiency. Increased efficiency and conservation are being closely considered in the formulation of the National Energy Strategy. The removal of market barriers to increased efficiency is relatively noncontroversial. Other steps to raise efficiency must be evaluated in light of their other impacts and benefits. The contribution of increased efficiency to lowering greenhouse gas emissions is clearly relevant. Our greenhouse gas emissions goals must ultimately be set with reference to the social and economic consequences of the actions required to attain them and those that would arise in a scenario where no such goals were adopted.

If significant greenhouse emission limitation over a relatively short time frame is ultimately judged to be desirable, increased efficiency alone will not suffice. In my considered opinion, massive fuel switching in our generation of electrical energy, greatly increased reliance on nuclear energy as well as other actions will be required. Consequently, to prepare for this possible policy direction, any long-term national energy plan should include research on advanced inherently-safe reactor concepts. These critical elements are missing from the Act. These very issues, however, are being addressed in a comprehensive fashion in the development of the National Energy Strategy and in the Intergovernmental Panel on Climate Change process.

Title III, in addressing energy research initiatives, would impose in several instances, detailed micromanagement that could be harmful to our development of an effective National Energy Strategy. I will defer to the Department of Energy for specific comments on individual technologies, many of which can play vitally important niche roles, but would again note my concern – expressed above – that research continue, with high priority, on advanced reactor concepts.

In summary, the Administration shares the Committee's commitment to address global climate change issues in a comprehensive manner based on sound environmental, economic and technical considerations. We believe, however, that the mechanisms currently in place are more than adequate to achieve this objective and we oppose the bill because many of its provisions are unnecessary, duplicative and overly prescriptive.

That concludes my prepared testimony. I would be happy to answer questions from the committee.

STATEMENT

by
D. Allan Bromley,
Director, Office of Science and Technology Policy

before the
Subcommittee on VA/HUD and Independent Agencies
of the Senate Committee on Appropriations

February 8, 1990

Thank you for inviting me to speak before you today on the subject of global warming. As this committee well knows, human beings have embarked on an enormous, unplanned planetary experiment that poses unprecedented challenges to our scientific understanding and our societal foresight. The greenhouse effect is nothing new. Without carbon dioxide and water vapor in the atmosphere, which warm the earth by keeping infrared energy from escaping into space, the oceans would have frozen early in the earth's history and our planet would have remained lifeless. But since the beginning of the Industrial Revolution, human beings have significantly altered the composition of the atmosphere by burning fossil fuels, cutting down forests, greatly expanding agriculture, and producing industrial chemicals such as chlorofluorocarbons (CFC's). The release of manmade emissions into the atmosphere constitutes the single largest impact--by a substantial margin--that human beings have had on this planet.

Let me put this impact into perspective. On average, every human being on the planet accounts for the release of over a ton of carbon in the form of carbon dioxide into the atmosphere each year. Because of the United States' extensive use of fossil fuels, each American, on average, is responsible for the release of five tons of atmospheric carbon annually. Over the past two centuries, the amount of carbon dioxide in the atmosphere has risen 25 percent. The level of atmospheric methane, a potent greenhouse gas generated by agricultural and industrial practices, has more than doubled.

Scientists have predicted since the end of the nineteenth century that increases in atmospheric carbon dioxide would increase the temperature of the planet. However, a sequence of unusually hot years during the 1980s, including six of the ten hottest years on record, have helped to propel this issue toward the top of national and international agendas. In fact, warming seems to have begun slowly around 1880

and was thought indisputable by the late 1930s. However, between 1940 and the mid-1970s, global mean temperatures tended to decline, with another warming trend taking hold during the 1980s.

Scientists continue to struggle with understanding this nonlinear behavior. Our inability to separate human impact from natural variability and the uncertainties surrounding temperature records compound the problem. Nevertheless, few scientists would argue with the contention that if we continue to load the atmosphere with greenhouse gases, we will eventually experience significant warming.

Issues of global change are very important to me and to the President. Many people have the impression that the Bush Administration is doing less than other countries about global warming and other major environmental problems. That impression is entirely mistaken. If we measure progress in terms of concrete actions, we find that the United States is doing more than any other country to understand and address these problems.

A crucial factor in the actions we take has to be our understanding of the earth as a system and the human role in that system. It is imperative that the Bush Administration, in cooperation with the Congress, develop a well-designed program for research into both the earth system and the economic and policy aspects of potential responses. Using the results of this program, it will be possible to develop a rational global change policy based on the best available scientific and economic understanding. I look forward to working with you and your colleagues in Congress to accomplish these tasks.

RESEARCH ON GLOBAL CHANGE AND THE COMMITTEE ON EARTH SCIENCES

The Office of Science and Technology Policy is charged with reviewing and coordinating federal R&D that cuts across the missions of more than one federal agency and with providing advice to the President on issues of science and technology policy that affect national and international policy. In light of these responsibilities, global change is an archetypal science policy issue. Research on global change is being supported by a number of federal agencies, and global warming itself has assumed a prominent political visibility, as demonstrated by the President's addressing the Intergovernmental Panel on Climate Change earlier this week. OSTP will continue to devote substantial effort to global change and other important environmental issues.

OSTP's coordinating function in global change research has been carried out largely through the Committee on Earth Sciences (CES), which is one of the committees under the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET), of which I am chairman. The CES has two subcommittees that deal with global change, the Working Group on Global Change, chaired by Robert Corell of the National Science Foundation, and a new Working Group on Adaptation and Mitigation Technologies, headed by John Knauss of the National

Oceanic and Atmospheric Administration.

I would like to submit for the record a copy of the document "Our Changing Planet: The FY 1991 U.S. Global Change Research Program," which was produced by the CES Working Group on Global Change to support the President's FY 1991 budget request. This document follows two previous CES working group publications: "Our Changing Planet: The FY 1990 Research Plan," which was released last summer, and "Our Changing Planet: A U.S. Strategy for Global Change Research," which accompanied the FY 1990 budget submission.

The CES has organized the efforts of the federal agencies conducting research on global change into the U.S. Global Change Research Program (USGCRP). The goal of the program is to reduce key scientific uncertainties and to develop more reliable scientific predictions upon which sound policy strategies and responses can be based.

Because of the program's importance, the President proposed in his FY 1991 budget that funding for the program be increased to \$1.03 billion, a 57 percent increase over FY 1990. The proposed funding would significantly expand research, data gathering, and modeling activities through a carefully balanced mix of ground-based and space-based research. The emphasis given to the program in the budget testifies to the President's concern about this important environmental problem.

As part of the USGCRP, the CES has developed a set of priorities in the broad field of global change. Though the development of these priorities was a difficult task, they are an effective way to communicate a complicated and interdisciplinary program to participants and observers. The priorities are organized into seven categories: (1) climate and hydrologic systems, (2) biogeochemical dynamics, (3) ecological systems and dynamics, (4) earth system history, (5) human interactions, (6) solid earth processes, and (7) solar influences. The CES expects to update the research plan annually and to change priorities as research results are obtained and as nonfederal groups provide input into the research process.

There are, of course, many questions that need to be answered before we understand the earth system and are better able to predict future changes. Some of the most interesting and important science questions concern the reliability of general circulation models, the earth's climatic history, the role of clouds, oceanic influences on the atmosphere and climate, the hydrologic cycle, and changes in ecosystems.

Climate Modeling

The most common way to predict future climate is with general circulation models (GCM's). These models, which typically run on supercomputers to cope with the enormous computational requirements of characterizing the earth's climate, treat the atmosphere as a grid of points that interact with each other according to basic thermodynamic and kinetic laws. Unfortunately, these models provide only a relatively broad-brush representation of the earth as an integrated system. For instance, the horizontal distance between grid points is typically greater than 100 miles. Important

influences on climate, such as the detailed effects of clouds, mountains, vegetation or unique factors like the Gulf Stream, may be emitted or significantly muted in current GCM's because of computational limits or a lack of understanding of the fundamental processes involved.

The consensus of state-of-the-art GCM's over the past few years has been that a doubling of carbon dioxide from preindustrial levels, which is expected to occur sometime during the next century, will raise mean global temperatures by 2 to 5 degrees centigrade. Recent results, taking into account more accurate representations of clouds and other climatic influences, have tended to lower the more extreme estimates.

One major problem with current GCM's is their inability to predict climatic change on a regional scale. For example, GCM's do not now agree on the effects of increasing carbon dioxide on soil moisture in agriculturally important areas of the world. Improving such predictions will require both improved models and more powerful computers.

Past Climate History

An important source of information in addition to GCM's is the earth itself. The earth's climate has varied considerably in the past. At the height of the last Ice Age 18,000 years ago, a sheet of ice over a mile thick covered much of the northern United States, and sea level was about 100 meters lower. At other times, the global mean temperature was substantially higher than it is today.

The geological record contains important information on past climates and their influence on ecosystems, hydrologic conditions, and landscapes. Tree rings, ice cores, fossils, geomorphic features, and sediment characteristics can provide valuable insights into the conditions we might expect if temperatures rise. These climatic histories can also be used to test and validate the predictions of GCM's.

Clouds

The effects of clouds and water vapor on global temperatures are just as important as the effects of carbon dioxide and other greenhouse gases emitted through human activities. Moreover, recent investigations confirm that the treatment of clouds in current GCM's can significantly alter the magnitude of a projected warming. For example, when British modelers recently changed their model's treatment of clouds, the model's projections of global warming due to a doubling of carbon dioxide dropped from 5.2 degrees centigrade to 2.7 degrees centigrade. While these modelers do not claim that the new approach is a better representation of reality, their results show that changing a single parameter, like clouds, can dramatically alter the outcome of current model projections.

A change of a few percent in cloud cover could either greatly exacerbate or

substantially counteract the potential warming due to the emission of anthropogenic greenhouse gases. We are beginning to understand the net radiative properties of some kinds of clouds, but we need to know more about both the current global distribution of the different kinds of clouds as well as future changes in the mix of clouds.

Oceans

Oceans play a major role both in transporting and absorbing heat and in providing a sink for many greenhouse gases. Because the heat content of the upper 3 meters of the ocean is equal to that of the entire atmosphere, it is clear that the oceans will be involved in climate change in an important way. For example, research on the El Nino phenomenon indicates that this irregular, aperiodic oscillation in global climate is centrally tied to the exchange of heat between the ocean and the atmosphere in the tropical Pacific. Similarly, evidence from the geochemical record suggests that a brief return to Ice Age conditions some 10,000 years ago was linked to a major change in the circulation of the North Atlantic. Thus, we can expect the evolution of climate change in the atmosphere to be strongly influenced by the capacity of the ocean to absorb, store, transport, and release heat.

The oceans also play a major role in influencing levels of carbon dioxide in the atmosphere. Only about half of the carbon dioxide that has been released by human activities now remains in the atmosphere. Much of the rest is believed to have been dissolved in the oceans, which contain about 50 times as much carbon as does the atmosphere. Scientists are still unsure how this exchange of carbon between the oceans and atmosphere takes place and whether current absorption patterns will continue.

Hydrology and Glaciation

The water cycle is important for at least two reasons. First, changes in the phase of water, for instance from liquid to gas, are a major mechanism of heat exchange and transport. Second, temperature changes are not the only area of concern regarding future environmental changes. Soil moisture, water availability, precipitation patterns, glaciation, sea level changes, and storm intensity are also important.

GCM's generally predict increases in global precipitation, but they are not able to specify much about changes in precipitation events, such as more storms, storms of longer duration, or greater rainfall intensity. A second family of models now receiving increased use are mesoscale models, which operate over smaller areas with a higher resolution than GCM's. The challenge is to find the appropriate means to translate from the smaller scale to the scale of a GCM.

A potentially very serious impact of global warming is an increase in sea level,

which would inundate coastal areas and contaminate freshwater supplies. However, recent studies indicate that global warming will not necessarily lead to a rise in sea level, even though water expands as it warms and the leading edges of glaciers are likely to retreat. There is likely to be more precipitation as the world warms, some of which will fall in the form of snow on ice and glaciers. Studies of such mechanisms have led to a recent revision of a projected sea level rise under doubled levels of carbon dioxide, from about three feet to a foot with a margin of error of 12 to 18 inches on either side.

Ecology

The natural ecosystem is remarkably robust and adaptable. Nature fills seemingly every available niche with organisms that compete with each other and that mutually support each other. Given a changed environment due to human influences, nature would continue to populate those areas that experienced changed climates. What scientist do not know is how much and what kind of change in the ecology of an area will accompany a given climate change. Most changes will occur at the edges of ecosystems, where thermal and water stress and species competition have the greatest effect. How fast can ecological systems respond? What negative side effects can we anticipate?

An additional problem is the lack of understanding about how ecological systems contribute to global change. Exactly what effect does deforestation of a particular forest type have on global fluxes of greenhouse gases, for example, or on the earth's reflectivity? Will global change result in an increased frequency of fires, with concomitant releases of carbon dioxide, methane, and nitrous oxide?

Space-Based Global Change Research

To complement ground-based research, the Global Change Research Program includes research focused on space-based monitoring. The space-based research is particularly important because it is in many cases the only way to derive a global balance for important earth processes.

NASA's Mission to Planet Earth is a major part of the Global Change Research Program. This effort involves several ongoing satellite and research programs and three new initiatives: the Earth Observing System (EOS), Earthprobes, and attached payloads on Space Station Freedom. EOS is a series of space-based instruments and platforms, developed by the United States, several European countries, and Japan, that will help us improve our understanding of Earth processes and global change. It will be our first opportunity to collect data simultaneously on a multitude of different features of the planet's environment. The FY 1991 budget proposes the development of two series of EOS platforms; the first platform is planned for launch in 1998. The amounts of data that these instruments will capture

and transmit is staggering. A comprehensive data management system will be developed as part of the Global Change Research Program.

Education

Meeting the challenges of the Global Change Research Program will require more scientists with expertise in the earth science disciplines. In particular, scientists will need the background to conduct multidisciplinary global change research. The National Science Foundation and the Department of Energy have proposed new education programs as part of the Global Change Research Program. The NSF program will include training opportunities at the individual project level, at major research centers or technology centers, and for students at the institution of their choice. The DOE program will encourage basic training at universities offering interdisciplinary programs. Most agencies also include fellowships as part of their research programs. The combined programs will annually support several hundred postdoctoral appointments, graduate students, and undergraduate students as research participants. Several summer institutes on interdisciplinary global change research problems will also be supported.

The Working Group on Adaptation and Mitigation Technologies

A week ago, John Knauss chaired the first meeting of the CES Working Group on Adaptation and Mitigation Technologies. This group is focusing on scientific and technological research aimed at:

- o Reducing future growth in emissions of greenhouse gases and increasing sinks for these gases,
- o Modifying current technology and practices to adapt to changing climate, and
- o Providing the basis for economic quantification of the impacts of proposed response strategies.

Among the topics the group will assess and consider are:

- o The knowledge of current and likely future emissions of greenhouse gases,
- o Research now in progress, including the cost and feasibility of various response options, and

- o The transfer of technology to developing countries.

THE POLICY-MAKING APPARATUS

Before describing the entities within the Executive Branch that are helping to develop and implement the Administration's policies on global change, I would like to touch upon the steps that the Administration has already taken that have the effect of reducing the emission of greenhouse gases into the atmosphere.

First, the United States is committed to phasing out by the year 2000 the production of all ozone-destroying chlorofluorocarbons as long as substitutes are available, a commitment that exceeds the provisions of the Montreal Accord. CFC's presently account for a significant portion of our total greenhouse gas emissions, so reducing CFC releases to protect the ozone layer will also reduce potential impacts on global climate.

The United States is also taking a number of steps to improve energy conservation, which is the most immediate means of reducing the emissions of greenhouse gases because the majority of U.S. greenhouse emissions come from the combustion of fossil fuels. The Clean Air Act is being reauthorized and new appliance efficiency standards have recently been released by the Department of Energy. The Department of Energy is also conducting a thorough review and revision of our National Energy Policy, which will emphasize energy conservation and the development of alternate energy sources that do not emit greenhouse gases.

We are also working, through diplomatic channels with our colleagues in other countries, to develop programs that will save tropical forests. Besides being a major sink for carbon dioxide, these forests contain more than 80 percent of the remaining uncharacterized gene pool on the planet--an absolutely irreplaceable human treasure.

The Domestic Policy Council Working Group on Global Change

To develop a strong, coherent policy on global change for the United States, President Bush has asked me to chair a Cabinet-level Working Group on Global Change under the White House Domestic Policy Council. The Working Group provides an important Cabinet-level coordination mechanism on global change and is an important source of advice for the President. The membership consists of Cabinet-level representation by all relevant agencies plus the White House.

The President feels strongly that our domestic policy on global change should be based on the soundest scientific and economic information available. Accordingly, to acquire such information as quickly as possible, the Working Group called immediately for three specific studies: (1) an analysis of economic costs of global change and responses to it, (2) an analysis of private sector concerns, activities, and issues on global change, and (3) legal precedents for international agreements and conventions on the environment. Preliminary drafts of these reports have been

presented to the Working Group for use in their deliberations. In addition, the Working Group has set up a number of briefings by top experts on the scientific, economic, environmental, and industrial aspects of global change.

Conference on the Scientific and Economic Aspects of Environmental Change

In addition to the activities of the Working Group on Climate Change, the President has asked me, together with the Chairman of the Council of Economic Advisers and the Chairman of the Council on Environmental Quality, to organize a White House meeting of the three senior officials in science, economics, and the environment from a number of countries in the Spring of this year. The general purpose of the meeting will be to advance the quality and understanding of the scientific, economic, and environmental analytical tools and data necessary to confront international environmental problems, including global change.

The conference will have the specific goal of sharing among nations analytical techniques, data, and research in an effort to develop a common, integrated approach to respond to global change, taking into account the best information available on the scientific, economic, and environmental aspects of the issue. The conference will address a wide range of environmental issues, including global warming, ocean pollution, biodiversity, clean air, pure water, and conservation of natural resources, although the major emphasis will be on global climate change and, in particular, global warming.

The President's Council of Advisors on Science and Technology

The first meeting of the President's Council of Advisors on Science and Technology (PCAST) took place last week at Camp David with the President. One of the topics under discussion was global environmental issues. I have asked PCAST to form a subgroup on global change that will correspond to the CES. Along with several activities that the CES is initiating to better coordinate with the private sector, this connection between FCCSET and PCAST should prove useful so that the Global Change Research Program can take advantage of the experience of the private sector and vice versa.

INTERNATIONAL RESEARCH AND POLICY-MAKING MECHANISMS

One of the major characteristics of global change is its necessarily international nature. Global change affects all nations and will require international study and cooperation.

Research on global change involves many international science programs, some that started before the most recent upsurge of interest in global change and some that

are newer. Within the international scientific community are a variety of informal mechanisms for planning science programs. Often these informal mechanisms are used to plan the detailed scientific elements of a program. The subsequent activities are more formal programs--for instance, the World Ocean Circulation Experiment (WOCE), the Joint Global Ocean Flux Study (JGOFS), and the International Satellite Land Surface Climatology Program (ISLSCP).

The International Council of Scientific Unions (ICSU) is an international analog to the U.S. National Academy of Sciences (NAS). In 1986 ICSU established the International Geosphere-Biosphere Programme (IGBP), which is establishing a scientific agenda for global change from an international perspective. The U.S. participation in the IGBP is through the Committee on Global Change (CGC), a committee of the NAS sponsored by the CES. The CGC developed high-priority recommendations for new scientific research programs through its report "Toward an Understanding of Global Change: Initial Priorities for U.S. Contributions to the International Geosphere-Biosphere Program."

The Intergovernmental Panel on Climate Change

The U.S. government continues to support the work of the Intergovernmental Panel on Climate Change (IPCC), which is sponsored by the United Nations and the World Meteorological Organization. The three working groups of the IPCC, which are looking at the scientific aspects of global change, impacts, and response and mitigation strategies, met here in Washington this week at the Third Plenary Meeting to prepare their reports. The final papers of the working groups will be presented in August, shortly before the Second World Climate Conference in November.

In an address to the plenary session earlier this week, President Bush commended their activities and reaffirmed the United States' strong commitment to the IPCC process. He said, "We consider it vital that the community of nations be drawn together in an orderly, disciplined, rational way to review the history of our global environment, to assess the potential for future climate change, and to develop effective programs."

Framework Convention

The IPCC process is designed to provide input to an International Framework on global warming to take place next year. At the Malta summit last December, President Bush proposed that the United States offer a venue for the first negotiating session for a Framework Convention, and he reiterated that offer earlier this week. Using the results of ongoing research, the Framework Convention will be able to consider quantitative proposals for stabilizing emissions of greenhouse gases.

CONCLUSION

In this speech to the IPCC plenary session, President Bush said, "By being here today, I hope to underscore my concern--my country's and my own personal concern--about your work and about environmental stewardship, and to reaffirm our commitment to finding responsible solutions." The President also challenged the IPCC delegates to "deliver recommendations which strike a difficult and yet critical international bargain: a convergence between global environmental policy and global economic policy, a bargain where both perspectives benefit and neither is compromised."

I would like to echo the President's remarks in closing and underscore that only strong economies will allow nations to fulfill the obligation of environmental stewardship. I believe that the President's investments in improving our scientific knowledge and leadership in analyzing environmental issues will ensure our nation's ability to maintain this stewardship.

We in the Administration look forward to working with the Congress to develop a U.S. governmental response to this important issue. That concludes my prepared testimony. I would be happy to answer questions from the committee.

ORAL STATEMENT

by
D. Allan Bromley,
Assistant to the President for Science and Technology, and
Director, Office of Science and Technology Policy

before the
Committee on Energy and Natural Resources
United States Senate

on

S. 324
National Energy Policy Act of 1990

April 5, 1990

Senators, Ladies, and Gentlemen:

I am pleased to be here today to discuss with you the issue of enhanced greenhouse gases and potential global environmental change. I also want to discuss with you today the activities in which the Administration is engaged and the mechanisms we have put in place that we believe will lead to a scientifically and economically sound national energy strategy for dealing with this issue.

Mr. Chairman, I have provided a written statement, for the record.

This Administration takes very seriously the threat of potential global climate change of any magnitude. We are devoting significant amounts of time and resources to understanding the state of the science and responding appropriately to that threat.

I believe it is important for me to state as clearly as I can the policies we have put in place after numerous, detailed discussions with some of the best scientific and economics minds in the country. I speak today for all of my colleagues in the Executive Office of the President as well as for the concerned Cabinet Secretaries and Agency heads, including -- of course -- Secretary Watkins and Administrator Reilly.

Notwithstanding our own national strategy, however, I also want to emphasize that any change in global climate obviously affects all nations and, thus, requires international concern, study, and cooperation if practical, viable solutions to this potential problem are to be found. It is this Administration's position that both our own national energy policy and the evolving international energy policy must be based on sound scientific economic, and technical considerations. All nations, developed and developing, must take an appropriate share of the burdens that such solutions necessarily will entail.

In the short term this will mean that all countries will take immediate action on problems where a scientific consensus exists, and will work cooperatively to understand phenomena in key areas where a scientific consensus does not exist and in that case, will, nevertheless, move forward with measures that would reduce emission of greenhouse gases when it makes sense to do so for other policy reasons. Examples of the latter would include increasing energy efficiency and conservation measures, phasing out the use of chlorofluorocarbons (CFC), and working with developing countries to reduce net deforestation and to achieve internationally mandated environmental objectives without compromising their own legitimate economic objectives for growth.

Before I describe what the Administration is currently doing, I would like to share with you a few of the scientific facts that underpin the Administration's position and activities.

Virtually all scientists would agree that currently we have few certain, unequivocal facts or data that can be analyzed to provide a clear picture globally, or regionally, as to what would happen if humanity continues to generate more and more greenhouse gas emissions which concentrate in our upper atmosphere. However, to

get some idea of what might happen, we assert that all conditions currently observed will remain the same with the exception that we will, say, double the amount of excess greenhouse gases in the atmosphere. Then, using what is believed to be the rate of temperature increase per increase in gas concentration, we calculate an estimated rise in temperature. This calculation does not take into account the dynamic 'feedback' loops built into nature. That is, there are effects of rises and falls in temperature such as changes in ocean circulation patterns, changes in cloud cover, and changes in equilibrium points for gas absorption and saturation in natural processes. These effects are not yet taken into account, simply because we do not yet understand enough about the processes involved to be able to calculate the changes. Two obvious examples of such processes are cloud behavior and absorption of CO₂ in the oceans.

Clouds have both positive and negative effects on warming. As was illustrated in a recent scientific study, when the behavior of clouds and their water vapor content was more accurately incorporated into currently accepted global climate models, the predicted global average temperature warming dropped from 5.2 degrees Celsius to 1.9 degrees – a reduction of more than a factor of 2. Still, we have not yet developed a fundamental dynamic model of cloud behavior so that even the 1.9 degree Celsius figure has a large uncertainty connected with it.

The behavior of oceans is another area where the science is still in its infancy. Until very recently, scientists have believed that 50 percent of excess CO₂ was evolved into the atmosphere and 50 percent was absorbed by the oceans. The results of a recent study -- not yet published -- indicate that the amount absorbed by the ocean is far less than 50 percent; perhaps even only 25 percent. That would indicate that our models do not correctly account for where these gases go and what that means for our projected climate description.

All of the increases in fundamental knowledge dramatically change the predictions of current global climate models. Given this level of uncertainty in predictions about global climate change, it is clear we need to continue the aggressive research program being supported by various Federal agencies to understand more fully the ramifications of increased greenhouse gases in the atmosphere and global climate change. In the meantime, this Administration is actively working on measures to reduce greenhouse gas emissions when those measures also serve other policy objectives. I would now like to describe to you these and other activities we have initiated.

Let me begin by summarizing several initiatives already undertaken by the Administration that would accomplish objectives similar to those in S.324, the National Energy Policy Act of 1990. Then I will describe our recent progress toward establishing a comprehensive research program in the areas of energy and global climate change, as well as mechanisms – both national and international – that we have developed for formulating informed policy decisions and for implementing these decisions. These actions, in my view, constitute an effective response to the goals that we all share and that motivate the Act.

Among the actions the Administration is taking that will reduce greenhouse gas, but which we have other compelling rationales, for example, is our commitment to phase out manufacturing and use of CFC's by the year 2000, ahead of the requirements of the current Montreal Protocol – these constitute 25 percent of our current greenhouse gas emissions. The Clean Air legislation currently under debate in the Congress would provide substantial reductions in the emission of some of the other greenhouse gases. Also important are the aggressive energy conservation programs to reduce CO2 emissions – which constitute some 57 percent of our greenhouse gas emissions – that will be the cornerstone of the Department of Energy's National Energy Strategy scheduled for completion later this year.

The Department of Agriculture's tree planting initiative (the planting of a billion trees on private land across America -- trees that could eventually absorb 13 million tons of carbon, annually) presented in the President's FY 1991 Budget, and our diplomatic discussions with countries such as Brazil aimed at protecting their remaining tropical forests, are all key parts of our overall 'insurance' program.

We have just released a report on the wide ranging public hearings that represents a step in the process of formulating the National Energy Strategy.

And, finally, the President proposed in his FY 1991 Budget that funding for the U. S. Global Change Research Program be increased to \$1.03 billion, a 57 percent increase over FY 1990.

(FEDERAL RESEARCH POLICY AND COORDINATION)

As Assistant to the President for Science and Technology and Director of OSTP, I chair two complementary councils -- one federal, FCCSET and one private sector, PCAST -- that provide information and advice to the Executive Offices. In addition, I chair working groups of the Economic Policy Council and the Domestic Policy Council related to science and technology issues. These groups, whose functioning I shall now describe, accomplish the objectives -- and many more besides -- of the coordinating council proposed in the S.324 legislation.

First, the Federal Coordinating Council for Science, Engineering, and Technology – FCCSET. Research on global change is supported by a number of federal agencies and constitutes an exemplary case of common effort to insure adequate coverage on a critical science policy issue. OSTP's coordinating function in global change research has been carried out largely through the Committee on Earth Sciences (CES), which is one of the committees under FCCSET.

The CES in turn has two subcommittees that deal with global change, the Working Group on Global Change, chaired by Robert Corell of the National Science Foundation, and a new Working Group on Adaptation and Mitigation Technologies, headed by John Knauss of the National Oceanic and Atmospheric Administration.

The CES has integrated the efforts of the federal agencies conducting research on global change into the U.S. Global Change Research Program (USGCRP). The goal of the program is to reduce key scientific uncertainties and to develop more reliable scientific predictions upon which sound policy strategies and responses can be based. The CES expects to update the national research plan annually and to change priorities as research results are obtained and as nonfederal groups provide input into the research process.

The private sector Council PCAST, the President's Council of Advisors on Science and Technology, was established by Executive Order of the President on January 19, 1990. PCAST has already met twice with the President and his senior advisors. One of the topics discussed was global climate change. I intend to request that PCAST form a panel on environmental science and global change. This panel, with its private sector perspective, will complement the advice we receive from the CES subcommittee of FCCSET. The fact that I chair both FCCSET and PCAST insures good communications between the two groups.

Within the Executive Offices President Bush has also asked me to chair a Cabinet-level Working Group on Global Change under the White House Domestic Policy Council. This Working Group provides Cabinet-level coordination on global change issues and is an important source of advice for the President.

This Working Group, when established last October, called immediately for three specific studies: (1) an analysis of economic costs of global change and responses to it, (2) an analysis of private sector concerns, activities, and issues on global change, and (3) legal precedents for international agreements and conventions on the environment. In addition, the Working Group has set up a number of briefings by top experts on the scientific, economic, environmental, and industrial aspects of global change.

I also chair a Working Group on Science and Technology of the Economic Policy Council. This Working Group will also develop science and technology issues related to domestic and social policy for consideration by the Domestic Policy Council. Its members will include White House officials and senior representatives from all Federal agencies and departments with substantial involvement in scientific and technological issues.

The President has asked me, together with the Chairman of the Council of Economic Advisers and the Chairman of the Council on Environmental Quality, to organize a White House meeting of the three senior officials in science, economics, and the environment from a number of countries. This White House Conference on Science and Economics Research Related to Global Change will take place in Washington, D.C. on April 17-18, 1990.

The conference will be devoted to science and economics research issues relevant to policy on global change, including climate. The Conference is designed to address important next steps that substantially enhance and broaden international understanding of science and economics research issues, and to frame initial steps toward a strategy for implementing joint international science and economics research efforts. It seeks for the first time to join research issues central to both the science and the economics related to global change.

The U.S. government was instrumental in establishing and continues to support the work of the Intergovernmental Panel on Climate Change (IPCC), which is sponsored by the United Nations and the World Meteorological Organization. The three working groups of the IPCC that are studying the scientific aspects of global change, impacts, and response and mitigation strategies, respectively, met here in Washington recently to prepare their reports. The final papers of the working groups will be presented to the full IPCC in August, shortly before the Second World Climate Conference in October.

CONCLUSION

A National Energy Strategy is currently being developed by the Administration that will respect the environment, meet our nation's needs for energy, and not damage our economy or international competitive position. The Administration has already taken specific actions to begin dealing with the potential problem of global change by taking the initiative on CFCs and Clean Air legislation that will have the effect of limiting greenhouse gas emissions. A vigorous structure of coordinating and advisory councils on global change is already in place and is functioning well. This Administration is, I believe, on top of this issue.

The only comment I would like to make on S.324 concerns Title II which addresses energy efficiency. I believe that increased efficiency and conservation offer our best short-term prospects for stabilizing greenhouse gas will require, among other things, massive fuel switching in our generation of electrical energy and, in my considered opinion, greatly increased reliance on nuclear energy. Consequently, an effective long-term national energy plan must include research on advanced inherently-safe reactor concepts – concepts such as the Advanced Light Water Reactor and the High Temperature Gas-Cooled Reactor. These critical elements are clearly missing from S.324.

**I defer to the Department of Energy for specific
Administration comments on S.324.**

**That concludes my prepared testimony. I would be
happy to answer questions from the committee.**

DRAFT--DO NOT QUOTE OR CITE (04/10/90)

THE MAKING OF A GREENHOUSE POLICY

D. ALLAN BROMLEY

(Steve Olson)

**Assistant to the President for Science and Technology
and Director, Office of Science and Technology Policy**

Executive Office of the President

National Press Club

Washington, D.C.

April 11, 1990

When the media describe a scientific advance, they often focus on a particular individual or event, as if the advance derived entirely from that source. Scientists working in the field typically know the situation to be much different. Many steps are needed before a particular advance can occur, and much needs to be done for an insight to be integrated into an existing body of knowledge.

Similarly, in describing the formation of policy, it is often easy to overemphasize a particular incident: a clash of personalities, a pivotal document, the meeting at everything becomes clear. I wish it were so simple. In fact, I have often found policymaking to be somewhat similar to scientific research, both in its rewards and its frustrations. Thomas Jefferson described science this way: "A patient pursuit of the facts, and cautious combination and comparison of them, is the drudgery to which man is subjected by his Maker if he wishes to attain sure knowledge." He might as well have been describing how you put together the fifth draft of a policy statement.

In a somewhat less solemn fashion, the making of policy has also been likened to the mating of elephants -- it takes place at a high level, it involves substantial trumpeting and thrashing about, and it takes a long time to produce any tangible results.

What I would like to do today is describe the process by which the Bush Administration has been forming a national policy -- and contributing to an international policy -- on global environmental change. You will be hearing much

about that policy over the next few weeks, largely because of an international White House Conference on Scientific and Economic Research Related to Global Change that I will have the pleasure of cochairing next Tuesday and Wednesday. But that conference is just one step in the much larger process of trying to understand and respond to the possible adverse effects of global change. I have spent much of my time since coming to Washington last summer on this subject. And I believe that the actions the Bush Administration has taken -- and will be taking -- in this area amply demonstrate the President's commitment to dealing responsibly with this issue.

A POLITICAL AWAKENING

The term "global change" encompasses such diverse but interrelated issues as ozone depletion, greenhouse gas emissions, climate change, sea level changes, deforestation, levels of biodiversity, and energy demands. But much of the public's attention has focused on global warming. And I don't think that anyone can look at the possibility of global warming without being struck by an immediate paradox.

The enhancement of the greenhouse effect is one of the most long-term and global problems that we face. As such, it will require a long-term and global response -- not what might be described as slam dunk solutions.

Yet the political atmosphere surrounding global warming resembles nothing so much as a crisis. A remarkable number of pieces of legislation have been introduced on Capitol Hill, and the latest research results -- some emphasizing and some

minimizing the potential impacts of global warming -- make the front pages of newspapers.

There are several quite understandable reasons for this widespread concern, including the fact that six of the warmest years on record have occurred in the 1980s. But I believe that much of the current ferment still derives from the summer of 1988. In that single season, a severe drought struck the Midwest, much of the nation sweltered under unusually high temperatures, forest fires scorched large areas of the West, and a particularly strong hurricane devastated the Caribbean. The greenhouse effect made the covers of Time and Newsweek -- even though scientists cannot yet, in any convincing fashion, connect these events of that summer to global warming.

This political awakening has driven the greenhouse effect toward the top of the national and international political agendas. It should be remembered, however, that scientists have been speculating about enhancements of the greenhouse effect for decades and more. The Swedish chemist Svante Arrhenius predicted, in 1896, that the temperature of the Earth would go up 4 to 6 degrees Celsius if levels of atmospheric carbon dioxide doubled -- a remarkably prescient prediction given that global circulation models now predict temperature increases of only slightly less. As early as 1957, Roger Revelle and Hans Suess wrote about the "large-scale geophysical experiment" that we are conducting by releasing carbon dioxide into the atmosphere.

Scientists know much more about the Earth and its components now than they did when these early predictions were made. General circulation models mimic climate with a fair degree of accuracy. And we can observe the Earth from space,

which has made a deep impression not only on our understanding of the Earth but on our sense of the planet as a unified, somewhat fragile home.

But what we do know about the Earth is still dwarfed by what we do not know. I know that journalists are expected to answer the four W's in the first paragraphs of their stories: who, what, where, and when. Suffice it to say that it would be very difficult to write a first paragraph describing the greenhouse effect.

Although general circulation models predict a warming of a few degrees Celsius if carbon dioxide levels double, we still do not know when this warming will occur, how rapidly it will develop, what its effects will be on a regional scale, or the exact likelihood of its occurrence. There is now, however, a consensus as to the sign of the effect -- a consensus that was far from evident even a few years ago. Scientists now agree that continued loading of the atmosphere with greenhouse gases will produce warming.

There is also a general consensus that the planet has warmed up by about 0.5 C during the past century. But very few scientists would claim that they are yet able to determine whether any of that warming can be attributed to a greenhouse effect or whether it represents a natural fluctuation. And although our current best models predict a warming of between 1 and 2 C from a doubling of atmospheric carbon dioxide -- but with large uncertainty as to whether this doubling will occur in 2050 or in 2300 -- it is also true that the historical record shows that the natural background temperature could, over this same period, go up or down by a similar amount, leaving us with no change or with twice the model predictions. We simply do not yet know.

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We are also only beginning to understand what the impacts of a potential warming might be on agricultural productivity, sea level changes, biological productivity in the oceans, shifting vegetation patterns, storm patterns and severity, droughts, and the like. We are even further from any quantitative understanding of the corresponding economic impacts, as I shall discuss in a moment.

Two of the most severe difficulties involve the treatment of clouds and of oceans in general circulation models. Until recently, geoscientists did not even know if clouds warm or cool the Earth. We still do not know for certain whether the increased cloudiness expected with a warmer Earth will augment or counteract a greenhouse effect. It will depend on the nature and altitude of the clouds.

Regarding the oceans, we know that only about half of the carbon dioxide released through fossil fuel combustion and deforestation remains in the atmosphere. For years, researchers assumed that the rest was being sequestered in the oceans, but recent studies indicate that no more than a quarter probably ends up there. Where does the rest go? We still are not sure, although some suggest it is in temperate latitude biomass.

Uncertainties regarding the behavior of clouds and oceans also contribute to one of the most vexing difficulties of current atmospheric models: their inability to make accurate regional predictions. Models still disagree about such fundamental questions as whether the centers of continents will get wetter or drier if the Earth warms. Yet these regional predictions are essential to assess the possible impacts of global change.

Because of the limitations of models, we must remain aware of the potential for surprises. The development of the ozone hole over Antarctica was such a surprise. The hole develops through a mechanism that was not included in earlier models of ozone destruction, and as a result was found almost by accident. We need a careful program of observing and monitoring the Earth to detect any such surprises caused by our emission of greenhouse gases.

What the ozone hole has demonstrated beyond question, however, is that, contrary to long-held assumptions, our atmosphere is not so large, nor its inertia so great, that human activities cannot affect it on human time scales. Human release of chlorofluorocarbons has indeed created the ozone hole -- through well understood chemical mechanisms -- in only a few decades at most.

Lewis Thomas, among others, has compared the Earth to a living organism, and in particular to a single cell. The comparison is certainly apt in this regard: as much as we still have to learn about the nature of life, about how it developed and where it is going, we have as much to learn about the nature of the Earth.

THE NATIONAL RESEARCH AGENDA

Bertrand Russell once wrote: "The most savage controversies are those about matters as to which there is no good evidence either way." The greenhouse effect can come dangerously close to falling into this category. As research reveals more about

how human activities are influencing climate, we will have a much less controversial basis on which to take actions.

The U.S. government is now engaged in a large-scale, integrated program to develop the understanding that will guide future policy decisions. That program is known as the U.S. Global Change Research Program, and it was established by the interagency Committee on Earth Sciences chaired by Dallas Peck of the U.S. Geological Survey. The Committee consists of directors of independent agencies and of assistant secretaries of cabinet departments doing research on the global environment. Working groups organized under the committee consist of the senior program managers working in a particular area. For example, the U.S. Global Change Research Program was organized by the committee's Working Group on Global Change, chaired by Robert Corell of the National Science Foundation.

The FY 1991 budget that President Bush sent to the Hill at the end of January -- reflecting the compelling case made by the CES for its integrated, national program -- called for a 57 percent increase in funding for this program, to a total of over \$1 billion. The proposed funding would significantly expand research, data gathering, and modeling activities through a carefully balanced mix of ground-based and space-based research.

I might say, by the way, that the success of the Committee on Earth Sciences has acted as a model for similar efforts by the Office of Science and Technology Policy. We have recently reorganized and revitalized the Federal Coordinating Council for Science, Engineering, and Technology -- the parent body of the Committee on Earth Sciences -- and have established a number of new interagency committees in

such areas as education, the life sciences, and technology and industry. In this way, we hope to bring a much greater coherence and visibility within the federal government -- integration and coordination of the various agency programs into coherent national programs -- to a number of important areas of science and technology.

THE WORKING GROUP ON GLOBAL CHANGE

The Committee on Earth Sciences focuses on the research aspects of global change. The policy analog to the CES is the Working Group on Global Change, which President Bush established last fall under the Domestic Policy Council, one of two senior, Cabinet-level policy councils within the White House. The Working Group, which I chair, provides Cabinet-level coordination on global change issues and is an important source of information and advice for the President.

Shortly after it was established, the Working Group called for three specific studies of global change. The first looked at the economic costs of both global change and responses to possible change; it also considered the potential costs of inaction. The second considered private sector concerns and activities. The third reviewed the legal precedents for international agreements and conventions on the environment. The Working Group has also been briefed by top experts on the scientific and economic aspects of global change. At this point, we have consulted with some of the best scientific and economic minds in the country.

The Working Group on Global Change will continue to be the focal point within the White House in considering Administration policies toward the global environment. But at this point I would like to break my promise about sticking to process and discuss some of the policies themselves. The Bush Administration does not believe that further research is any substitute for action. On the contrary, this Administration has already instituted a number of policies that will reduce greenhouse emissions while being fully justified for other reasons. The President refers to these as "no regrets" or "all weather" policies, because even if our concerns about the greenhouse effect turn out to be unfounded, these policies will have other benefits. I look on them as an insurance policy against possible adverse effects of global warming.

- o The United States is committed to phasing out the manufacturing and use of CFC's by the year 2000 to protect the ozone layer -- ahead of the requirements of the Montreal Protocol -- provided safe substitutes are available. If not controlled, CFC's would account for as much as 25 percent of the greenhouse effect's increase in the next century.

- o The Clean Air Act now being debated in Congress will provide for substantial reductions in the emission of other greenhouse gases.

- o The Department of Energy is developing a National Energy Strategy that will focus, in particular, on an aggressive commitment to energy conservation and to the development of non-fossil-fuel sources of energy.

These initiatives address the source component of the greenhouse gas question; turning to the sink component, the Administration is again taking concrete steps.

- o The Department of Agriculture is proposing to plant a billion trees on private land across America, trees that will eventually absorb 13 million tons of carbon annually.

- o Diplomatic discussions are being conducted aimed at protecting the remaining tropical forests through such mechanisms as debt-for-nature swaps.

An underlying theme in all of the Administration's global change policies is that they be based on the best possible science and that they be technically and economically sound. These are criteria that we will continue to apply as we consider policies in the future.

THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

Thus far I have been discussing our national research and policymaking with respect to global change. But the greenhouse effect is no respecter of national or political boundaries, and its understanding demands information and analyses that span the globe. International cooperation will therefore be essential to continued progress.

The primary international forum through which these issues are being addressed is the Intergovernmental Panel on Climate Change, which has been organized under the auspices of the United Nations Environment Program and World Meteorological Organization. The IPCC involves hundreds of scientists and government officials from a number of countries who are seeking to establish an international consensus on the likely causes and consequences of climate change.

The IPCC is conducting its activities through three working groups. The first, which is chaired by the United Kingdom, is seeking to develop a better scientific understanding of climate change. The second, chaired by the Soviet Union, is assessing the possible environmental and socioeconomic effects of climate change. And the third, chaired by the United States, is seeking to identify potential responses to global change.

These three working groups will produce reports by the end of the summer. Policymakers around the globe will then be able to draw upon these reports in formulating national and international policies. In addition, our conference being held next week on scientific and economic research relating to global change is designed to complement and support these IPCC activities.

The three working groups of the IPCC met here in Washington in February, and President Bush addressed their opening plenary session. He told them, "The United States is strongly committed to the IPCC process of international cooperation on global climate change. We consider it vital that the community of nations be drawn together in an orderly, disciplined, rational way to review the history of our

global environment, to assess the potential for future climate change, and to develop effective programs."

President Bush has also expressed his support for the next logical international step: a Framework Convention on Global Change to be negotiated among the countries of the world. At the Malta Summit, President Bush proposed that the United States host the first negotiating session of the Framework Convention, and he reiterated that offer to the IPCC.

In thinking about the goals of a Framework Convention, the Vienna Convention offers a useful analogy. In 1985, the United States and 20 other countries signed the Vienna Convention for the Protection of the Ozone Layer, which established a framework for international scientific and technical cooperation. However, the Vienna Convention did not set limits on emissions. Rather, it included provisions to establish protocols as further research developed.

A Framework Convention on Global Change could serve the same function. It would build cooperation among nations and establish the mechanisms by which future steps are taken. What the United States would desire is that a comprehensive approach be taken that encompasses all greenhouse gas emissions on the basis of a scientifically determined greenhouse equivalent index and that possible actions employ market-oriented approaches.

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**THE WHITE HOUSE CONFERENCE ON SCIENTIFIC AND ECONOMIC
RESEARCH RELATED TO GLOBAL CHANGE**

The reports of the IPCC working groups will be an important input to the Framework Convention, but an important complement to the IPCC will be the White House Conference being held here in Washington next week. President Bush is hosting the conference and will open and close the proceedings. I am one of the cochairmen of the conference, along with Michael Deland of the Council on Environmental Quality and Michael Boskin of the Council of Economic Advisors.

The conference will bring together the three senior officials in science, economics, and the environment, together with up to seven senior associates, from 18 countries, the Organization for Economic Cooperation and Development, and the European Community. The theme of the conference is global stewardship, our shared responsibility to manage the Earth's finite natural resources in a sustainable manner.

The conference is designed to explore what we do know about the scientific and economic questions surrounding global change, what we do not know, and when remaining uncertainties might be reduced. In addition, the conference will examine ways to more fully integrate the results of scientific and economic research into the policymaking process.

I have already mentioned some of the scientific challenges, so let me focus here on the economic ones, since in many cases they are even greater than the scientific ones. For example, one recent analysis was able to conclude only that emissions of

carbon dioxide in the year 2050 are likely to be between 1.5 times what they are today and 12 times what they are today.

We need much better measures of the potential costs and benefits of limiting or adapting to global change. Preliminary studies show that the costs could be very high, but information with which to make such estimates is scarce.

In general, the social sciences will be as important as the natural sciences in improving our understanding of global change. Even when the physical and biological aspects of a problem are understood, all too often agreement is lacking on the underlying social, behavioral, and economic causes and consequences of an action. The conference next week will be focused at least as much on these aspects of the problem as on the purely scientific aspects. We hope in this way to add a new dimension to the international dialogue on global change.

The Conference is expected to produce a Cochairmen's report, which will set forth common actions designed to expand research and cooperation among nations. The United States will also be making a number of concrete proposals during the conference, such as a call for a statement of principle leading to an international global change research program comparable to the U.S. program. You will be hearing about those next week.

CONCLUSION

Let me conclude with a bit of history, which I hope to relate at the conference next week because I believe that it summarizes our current situation very well.

The year after next we will be celebrating the 500th anniversary of Columbus's discovery of the new world, an event of unsurpassed importance in the course of world history. As might be expected, Columbus was an astute observer of the natural world. While he was anchored off the coast of Jamaica, Columbus noted in his journal that it rained for about an hour every afternoon. Columbus also pointed out that the same thing used to occur in the Canary and Azores Islands, but that the rain had stopped since the trees on those islands were cut down. In other words, Columbus was one of the first people to observe the effects of human beings on climate.

I think it very appropriate that Columbus should have done so, because he was engaged on a great voyage of discovery, and today we find ourselves engaged on a similar voyage. We are changing the world in ways that it has never been changed before. And yet human beings, by their very nature, cannot help but change the world.

We have no reason to fear such changes. But we must keep our eyes open, and try to understand where we are going, and change course when we have good reasons to do so. We need not sail blindly into our future. But if must keep moving forward if we are to achieve the complementary goals of an economically healthy and environmentally sound world.

McGroarty/Dooley
April 9, 1990
3:00 pm
[change]

PRESIDENTIAL REMARKS: WHITE HOUSE CONFERENCE ON GLOBAL CHANGE
J.W. MARRIOTT
APRIL 17, 1990
X:XX A.M.

Thank you. [Introductory acknowledgements.] I'm pleased to welcome this international field of high-level officials -- experts on the environment, economy, science and energy to the White House Conference on Global Change.

This gathering is the first to focus on a new dimension in the global change dialogue: the link between economic analysis and scientific research in the study of global change. And of course, this conference is itself another sign of the growing importance of the environment on the international agenda. //

Here in the United States, we've moved one step closer to a great victory for the environment, the passage of a significantly stronger Clean Air Act. Two weeks ago, our clean air package cleared the U.S. Senate -- with overwhelming support. Last week, the House Committee on Energy and the Environment voted out its own version of a clean air bill, 42-1 -- and a full, floor vote may come in early May. //

The hard work isn't over. Both Houses -- and the White House -- still have plenty to say on the shape of the final Clean Air bill. But what is remarkable is not the differences that remain -- but the differences we've overcome: the solid ground

of consensus we've reached on so many contentious issues. The result: for the first time in 13 long years, we can say with certainty that the United States will have a new Clean Air Act on the books before the year is out. //

Let me be clear: We're moving ahead on Clean Air because it is in America's interest. But, like so many of the environmental issues that concern us -- we aren't the only beneficiary of a better environment. // When it comes to the environment, we are learning that local actions can have global consequences.

Understanding the effects of our actions on the environment is the first step to a sound ecology -- and the subject that led me to invite all of you here. I want to speak this morning about what we can do -- what all of you can do -- over the course of the next two days to advance our understanding on the critical question of global change.

This conference will help in three ways.

First, it provides an opportunity to sort out the science on this issue. // Let's start with what we know. There is an increase in carbon dioxide discharged into the atmosphere, with [damaging affect] on the Earths' protective ozone layer. // That much is certain. Our challenge beyond this point is to separate what we know about the Earth's climate -- and the factors, natural as well as man-made, that cause it to change -- from the many **uncertainties** that abound. **And to focus our collective effort in the search for answers.**

Perhaps it's not surprising when the subject is climate change that the debate so often generates more heat than light.

// Certainly, the apocalyptic pronouncements we've all heard don't help us make policy. If they're meant to wake us up -- warn us about the urgency of this issue -- well, we already know enough to know we can't afford to bury our heads in the sand.

What we need is fact: the stuff science is made of. A better understanding of the basic processes at work in our environment -- and how they relate to one another. Better earth system models -- that enable us to calculate the complex interaction between man and our environment.

That's why I've asked Congress to fund a 60% increase in our budget for the Global Change Research Program -- an aggressive research program that will consume more than \$1 billion dollars in 1991. More than any other nation on Earth -- to move us closer to the scientific understanding we need. // And that's one of the reasons we're hosting this conference today.

The second way this gathering can advance our understanding is to address the economic factor in environmental questions.

We know that cleaning up our environment costs money. We know it means changes in the way we work and live. We're already making those changes -- leading the world -- whether it's moving forward on clean air, phasing-out the use of CFCs, or exploring alternative sources of fuel and energy.

But we must make certain we develop a means of dealing with the possibilities of global change in a way that preserves our

environmental well-being and our economic welfare. This is in the interest of every nation here today -- in the interests of the **developed** world, and the **developing** world alike.

Let me focus for a moment on the developing world. In a climate of poverty, or persistent economic decline, protecting the environment becomes a far more difficult challenge. Cold statistics don't begin to capture the harsh realities at stake. Development doesn't mean just another point of GNP -- it's measured in human lives. An end to hunger. Longer life expectancy. Lower infant mortality. // Environmental policies that ignore the economic factor are destined to fail.

But there is another reason to consider the economic factor when the issue is the environment. There is no better ally in service of our environment than strong economies. Economies that make possible the increased efficiencies that enable us to make environmental gains. Economies that generate the new technologies that help us arrest and reverse the damage we have done to our environment. //

That brings me to the third way this conference contributes to a net gain in knowledge. No subject is so vast as the study of global change -- the ecology of the Earth. This conference is a logical next step in this study, because it brings together environmentalists and economists, experts from the fields of energy and science -- to search for common ground.

Nothing's more critical when it comes to global change. // No one nation -- acting alone -- can safeguard the environment.

And no nation can afford to stand on the sidelines, relying on others to do its part. Success requires a sense of global stewardship -- a sense that it is the Earth that endures, and all of us -- tenants, in temporary possession of a sacred trust.

For the next two days, you'll be grappling with questions of global consequence. I thank all of you for joining us here -- for seeking better understanding of an issue with such profound affect on every nation and every individual for generations to come. God bless you all.

#

The intersection of science & economics (from Global Δ Cont. delegate book)

- The Conference is designed to be a forum to bring a number of ministerial-level leaders together to enhance international cooperation and to build the basis for joint efforts in these vital areas. It is hoped that the delegates, working together, will agree upon those areas of opportunity for cooperative action in the areas of scientific and economics research. The goal would be to address three major themes:
 - Uncertain Change: The Scientific and Economics Research Challenge
 - Integrating Scientific and Economics Research in the Policy Process; and
 - Building Partnerships for Scientific and Economics Research.

The Conference provides a forum for international leaders to consider and discuss research questions that are critical to the policy process, such as:

- ◆ How well can we predict temperature trends in the decades ahead?
- ◆ How "good" are our global-scale models, such as models to predict temperature changes?
- ◆ How well can we predict the interconnections between global environment change and the resulting social and economic impacts?
- ◆ What are the economic costs of adapting to or mitigating global change?
- ◆ How "good" are the economic models used to compute these costs?
(See attached Conference Content Questionnaire)

By addressing such questions, it is hoped that the nations might pledge to support joint international research efforts related to global change that focus on rapid improvement of both scientific and economic knowledge and developing the necessary infrastructure, including:

- Establishing a more formal international mechanism to improve the coordination of global change science and economic research programs, and
- Participating in cooperative research efforts, such as the World Ocean Circulation Experiment and cooperative economic projects of the OECD.
- The Conference is a White House Conference, initiated by the President. Hence, the President has appointed three members of the Executive Office of the President in the relevant areas, to be the co-chairmen of the Conference. The three co-chairmen are: the Chairman of the President's Council of Economic Advisers, Dr. Michael J. Boskin; the President's Science Advisor and Director of the Office of Science and Technology Policy, Dr. D. Allan Bromley; and the Chairman of the President's Council on Environmental Quality, Mr. Michael R. Deland.
- The President stated, "this conference is a vital next step in a joint international approach to address changes in the global environment."

It is expected that each country or organization will send a ministerial-level official to represent each of their agencies of science, economics, and the environment, together with no more than two staff associates per official. It is suggested that one delegate in each of the three areas will be an individual who is currently active in scientific or economics research. It is recognized that the delegations are likely to have one "at-large" member. Thus, the total delegation size should not exceed ten per country. Once the delegations are determined, it is planned to consult with these countries on agenda details.

- The U.S. Delegation (total of ten) will be:
 - Secretary of the Treasury - Nicholas F. Brady
 - Secretary of Agriculture - Clayton Yeutter
 - Secretary of Commerce - Robert A. Mosbacher
 - Secretary of Energy - Admiral James D. Watkins (Ret)
 - Administrator, Environmental Protection Agency - William K. Reilly
 - Administrator, National Aeronautics and Space Administration - Richard H. Truly
 - Under Secretary of Commerce for Oceans and Atmosphere; and Director, National Oceanic and Atmospheric Administration - John A. Knauss

Conference Co-Chairmen:

- Chairman, Council of Economic Advisers - Michael J. Boskin
- Assistant to the President for Science and Technology - Dr. D. Allan Bromley
- Chairman, Council on Environmental Quality - Michael R. Deland

FACT SHEET
for
THE WHITE HOUSE CONFERENCE
on
SCIENCE AND ECONOMICS RESEARCH
RELATED TO GLOBAL CHANGE

April 17-18, 1990
Washington, D.C.

On February 5, 1990, the President invited the Heads of State from seventeen countries, the European Community (EC) and the Organization for Economic Cooperation and Development (OECD) to send ministerial-level delegates to a White House Conference on Science and Economics Research Related to Global Change.

The Conference will be held in Washington, D.C. on April 17-18, 1990.

The President formalized his intention to host such a Conference on this subject during his Summit meeting with President Gorbachev, on December 4, 1989, and later on Monday, February 5, 1990, during his speech to the United Nations Intergovernmental Panel on Climate Change.

The Conference is designed to address important next steps for substantially enhancing and broadening international understanding of science and economics research related to global change. The Conference seeks to frame a strategy for implementing joint international science and economics research efforts. It also seeks for the first time to integrate and link science and economic research results to both the domestic and international policy process.

The Conference focuses on "Global Change," a scope of research that has evolved out of the science that concerns itself with understanding the natural processes that govern the way the Earth functions as well as economics research related to global change. .

The conference is conceived as an integral part of the ongoing international process of trying to understand changes in the global environment. The need for substantially improved understanding of both the science and economics of global change has been noted by virtually all world leaders. This Conference will focus on science and economics research as a complementary effort to the on-going Intergovernmental Panel on Climate Change (IPCC). The President strongly supports the IPCC efforts and expects that the results of the Conference will contribute to the on-going international debate on climate change issues. Dr. Bert Bolin of the Intergovernmental Panel on Climate Change has been invited to take an active role in the Conference.

The Conference will convene a delegation of three ministerial-level officials from a representative group of nations, each representing a relevant discipline, (i.e., science, economics, energy and the environment). Participants were invited on

GOALS AND OBJECTIVES OF THE CONFERENCE:

President **George Bush** invited the Heads of State from seventeen nations and the leadership of the E.C. and the OECD to send ministerial-level delegations to the White House Conference on Science and Economics Research Related to Global Change. The Conference is designed to bring together government leaders in science, economics, energy, and the environment concerned with the central research issues of Global Change. The Conference is designed to advance understanding of Global Change phenomena, to enhance international cooperation, and to build the basis for future efforts among nations to integrate more fully science and economics research into the policy process. The Conference adds a new dimension to the international dialogue on Global Change — the proposition that economics, both analysis and research on economic policy and economic consequences, is an essential link between the science of Global Change and policy alternatives. Science and economics research can also serve to identify and develop technologies and policy instruments that relax the tension between growth and Global Change, allowing for greater progress on both fronts. To address these broad goals, the Conference will:

- Focus on science and economics research issues relevant to policy on Global Change,
- Address important next steps to substantially **enhance and broaden international understanding** of science and economics research issues that relate to Global Change,
- **Highlight the special role that economics plays** in integrating the science of Global Change with the policy process,
- **Demonstrate linkages between science and economics research** and domestic and international policy processes, and
- Seek to take the initial steps to **implement joint international science and economics research efforts.**

The Conference is conceived as an integral part of the ongoing international process to understand the science of and policy options relating to global environmental issues. The need to improve substantially understanding of both the science and economics of Global Change has been noted by many world leaders. The Conference, therefore, focuses on science and economics research issues as a complement to the ongoing Intergovernmental Panel on Climate Change (IPCC) and other international forums that seek to address the issue of Global Change. It is hoped that the results of the Conference will contribute to the IPCC process and other ongoing international debates and actions.

Mark Brennan
647-4213

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Statement of The
 Challenges Facing the
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 & Economics Research
 Related To
 Change

THE PRESIDENT HAS SEEN

SCIENCE AND ECONOMICS RESEARCH FOR GLOBAL STEWARDSHIP

Global stewardship is our shared responsibility and our shared opportunity. We must manage the Earth's natural resources in ways that assure the sustainability of humanity on this planet and in ways that maximize our potential for growth and opportunity for all. Global stewardship is a continuing process of political, economic and social decision-making that meets the needs of the present generation while expanding the opportunities of future generations.

Global stewardship will become a dominant scientific, economic and environmental issue of the 21st century. The experience of the past 45 years has shown that growth can be achieved only through the synergy of democratic political institutions and market economic systems. But just as democratic institutions are expanding, our ability to grow could be limited by changes in our already stressed environment. Solutions must be found which will protect the quality of our natural environment while allowing for the economic growth necessary to sustain and improve the living standards of a growing world population.

For perhaps the first time in human history, we now understand that our progress depends on *accounting* for our environmental resources and using them wisely. A new understanding of complex environmental systems is emerging. This understanding means that we are now called upon to create new directions for our creative energies and technologies. *Global stewardship is the key.*

To exercise effective stewardship, we must advance our knowledge of natural and human systems. We must create solutions that join economic growth with sound management of our environment. Meeting this challenge will require an integration of scientific, economic, and environmental concerns—an integration which moves global stewardship and human sustainability to center stage.

We need new tools to effectively evaluate how to respond to global environmental changes. Science and economics research can provide some of the tools needed to understand and properly manage our changing planet. Global change is concerned with such diverse but interrelated issues as ozone depletion, greenhouse gases, climate change, food security, water supply, sea level changes, wetlands, deforestation, biodiversity, population changes, and energy demands. A common ingredient in each of these issues is the level of uncertainty about the scale at which these changes are occurring and humanity's relative contribution to the change. There is also uncertainty regarding the social and economic consequences of change itself and of policy measures which might be taken to address it. As global stewards we must address these uncertainties by increasing our scientific and economic knowledge and take justifiable actions to manage global change...with due consideration given to the uncertainties which exist.

Therefore, the challenges of global stewardship require agreement in these three areas:

- Science and economics uncertainties—research challenges;
- Strategies for and challenges to integrating economics and science research; and
- Building better international partnerships for economics and science research.

J. Baker's speech

Our existence depends on our ability to draw sustenance from the natural world while supporting the systems that regenerate that world. Building an integrated program of economics and science research is the step we must take today. Global stewardship is not a fixed state but a process of change in which environmental and economic values are brought into balance to meet human needs and to expand human prospects. Let us join together and accept the challenge of Global Stewardship.

George Bush

CANDIDATE IDEAS FOR CONFERENCE OUTCOME/PRODUCTS

The overall outcome/products from the Conference should address the three tactical objectives for the Conference, namely:

1. To provide an occasion for the President to demonstrate America's ~~willingness to play a leadership role~~ in organizing ongoing international efforts to respond to potential risks and opportunities associated with Global Change.
2. To provide a setting for the President to present America's overarching vision of how environmental, economic, and related environmental needs and interests might best be balanced in the future given the emergence of worldwide concern about the potential of global environmental change.
→ dangerous world
3. To address the Major Foci (as listed on page one of this document) of the Conference, and in particular, to facilitate the development of a strategy for integrating worldwide scientific and economic research on global change issues and to establish and share research priorities for action by and among the participating countries.

The candidates (note: these might be rank ordered eventually, however, they are not so listed here - these are not in priority order) for outcome/products are:

OVERARCHING THEME TO GUIDE ALL OUTCOME/PRODUCTS

1. Develop and integrate into various parts of the Conference the concept of "Global Stewardship", as an integrating concept for world leaders. See attached draft, Attachment A. The concept of Global Stewardship was first articulated by President Bush at the Paris Economic Summit in July 1989 - see attached text of News Conference. The Global Stewardship concept will be integrated into a variety of speeches and presentations by the U.S., throughout the Conference. The Content Integration Team will develop the strategy for doing this by COB March 30.

CONFERENCE:

IMPORTANT OUTCOME/PRODUCTS

- changes to working groups

2. Focus on the central purpose of the Conference, to provide:

- o A substantially enhanced understanding of the scientific, economic, and environmental research agenda central to the needs of future global change policy development.
- o A substantive understanding of the uncertainties in both scientific and economics knowledge of the central issues associated with the changes in the global environment of the planet,
- o Increased mutual understanding of and sensitivity to the substances of scientific and economic research between both of those research communities.
- o Increased sensitivity by the two research communities to the policy needs evolving in such areas as environmental and energy policy, and vis verse.
- o Foster the concept of the need for a solid and well implemented scientific and economics research effort, as a pre-requisite for and parallel complement to, the evolving efforts by nations to address the international policy questions of global environmental changes.
- o Enhance the evolving communication and network of among national leaders, concerned with and responsible for, the research and policy agenda related to global change. More particularly, this Conference provides a "first-ever" opportunity to forge a partnership between the scientific and technical research communities and the policy-makers.

See [star in circle] for better session

To provide a vehicle to focus on these vital issues, it is propose a "Charter for Cooperation in the Science and Economics Research Related to Global Change" be develop, a sort of "magna charta" for Global Change Research that integrates the concepts outlined above and demonstrates a commitment by the participating nations,

to implement a world-wide program of global change research. A draft for such a Charter will be produced by COB March 30.

3. Demonstrate and detail, through the US/GCRP, the commitment of the U.S. to a comprehensive research program in the science and economics of Global Change, that is linked to and supports the policy process, both domestically and internationally. The US/GCRP FY91 Document and the July 1989 US/GCRP Research Plan will be used for the text materials. The Content Integration Team will draft an outline for do so by COB March 30.
4. Thoughtfully outline and "Showcase" the efforts that the U.S. has implemented that directly address the broad agenda of global change, i.e., energy conservation initiatives, etc. The Content Integration Team will draft an outline for meeting this objective by COB March 30.
5. Propose initiatives that demonstrate the U.S.'s willingness to foster and provide leadership for the concept of an international partnership in global change research, such as an International Institute for Research in the Science and Economics of Global Change. A preliminary draft of the concept is contained in Attachment B. A more detailed draft, with an analysis of the policy and budgetary issues, will be developed by COB March 30.
6. Propose initiatives that facilitate enhanced communications amongst the partners in international global change research, both science and economics, with such approaches as the "Global Change Communications Network", that builds on the available technology for data and information transfer, electronic mail and telecommunications technologies. A draft of the concept is enclosed in Attachment C. A more detailed draft will be completed by COB March 30.
7. It is proposed that the U.S. prepare and place before the Conference a "Statement of Principle" for a Strategy for Cooperation in Scientific and Economic Research in Global Change, with the goal that the Conference endorse it. The "Statement of Principles" would outline the strategy for international cooperation to implement joint research efforts, including

sharing of scientific and appropriate economic data, methodologies for the implementation of a global observing system which builds upon the "statements on cooperation adopted by the G-7 at the Paris Summit, and joint efforts to substantially enhance the capabilities of models to predict controlling global environmental processes that are key to policy process. Hence, if adopted, the "Statement" would outline an agreement in principle to cooperate internationally to join together the expertise, experience, and data available of each participating country in a more integrated and coherent fashion. Therefore, the plan for the Conference, is to review, amend as appropriate, and then endorse the "Statement of Principles" for developing during the 3-6 months following the Conference, a strategy and plan for implementing cooperative research programs. Thus a process would be established for further development and "in-country" review so that by mid-summer 1990 a strategy document would exist. Such a "Strategy Document", when completed, could be used in other fora in which "global change" agenda is a central issue, e.g., Summit meetings, the IPCC process, the Second World Climate Conference, etc.. It is posed that the recognition by this Conference of what might be called an "International Global Change Research Program" is an essential next step in supporting the needs of many nations to address key policy issues related to Global Change. A draft of the "Statement of Principles" will be completed by COB March 30.

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the basis that the meeting should include countries or representatives of country interests that have substantial populations, large land masses, industrialized economies or heavy future energy needs, substantial research infrastructures, or have provided international leadership on issues related to climate and global changed. The President has asked the Heads of State of the following countries and organizations to send a delegation:

1. Australia
2. Brazil
3. Canada
4. Federal Republic of Germany
5. France
6. India
7. Indonesia
8. Italy
9. Japan
10. Mexico
11. Netherlands
12. Nigeria
13. Norway
14. Poland
15. Soviet Union
16. United Kingdom
17. Zaire
18. European Community (EC)
19. Organization for Economic Cooperation and Development (OECD)

It is expected that each country or organization will send a ministerial-level official to represent their relevant agencies including science, economics, energy and the environment. It is suggested that one delegate in each of the three areas will be an individual who is currently active in science or economics research. It is recognized that the delegations are likely to have one "at-large" member. Thus, the total delegation size should not exceed ten per country. Once the delegations are determined, it is planned to consult with these countries on agenda details.

The U.S. delegation will be:

Secretary of the Treasury - Nicholas F. Brady

Secretary of Interior - Manuel Lujan, Jr.

Secretary of Agriculture - Clayton Yeutter

Secretary of Commerce - Robert A. Mosbacher

Secretary of Energy - Admiral James D. Watkins (Ret)

Administrator, Environmental Protection Agency - William K. Reilly

Administrator, National Aeronautics and Space Administration - Richard H. Truly

Under Secretary of Commerce for Oceans and Atmosphere; and Director, National Oceanic and Atmospheric Administration - John A. Knauss

Director, National Science Foundation - Erich Bloch

Member, Council of Economic Advisors - Richard Schmalensee

Conference Co-Chairmen:

Chairman, Council Economic Advisors - Michael J. Boskin

Assistant to the President for Science and Technology - D. Allan Bromley

Chairman, Council on Environmental Quality - Michael R. Deland

The Conference is designed to be a forum to bring a number of ministerial-level leaders together to enhance international cooperation and to build the basis for joint efforts in these vital areas. It is hoped that the delegates, working together, will agree upon those areas of opportunity for cooperative action in the areas of science and economics research. The goal would be to address three major themes:

- Uncertain Change: The Science and Economics Research Challenge
- Integrating Science and Economics Research in the Policy Process; and
- Building Partnerships for Science and Economics Research.

The Conference provides a forum for international leaders to consider and discuss research questions that are critical to the policy process, such as:

- * How well can we predict temperature trends in the decades ahead?
- * How "good" are our global-scale models, such as models to predict temperature changes?

- * How well can we predict the interconnections between global environment change and the resulting social and economic impacts?
- * What are the economic consequences of adapting to or mitigating global change?
- * How "good" are the models used to assess these economic consequences and their impact on the well-being of humanity?

By addressing such questions, it is hoped that the nations might agree to support joint international research efforts related to global change that focus on rapid improvement of both scientific and economic knowledge and developing the necessary infrastructure, including:

- Establishing a more formal international mechanism to improve the coordination of global change science and economic research programs, and
- Participating in cooperative research efforts, such as the World Ocean Circulation Experiment and cooperative economic projects of the OECD.

The Conference is a White House Conference, initiated by the President. Hence, the President has appointed three members of the Executive Office of the President in the relevant areas to be the co-chairmen of the Conference. The three co-chairmen are: The Chairman of the President's Council of Economic Advisors, Dr. Michael J. Boskin; the President's Science Advisor and Director of the Office of Science and Technology Policy, Dr. D. Allan Bromley; and the Chairman of the President's Council on Environmental Quality, Mr. Michael R. Deland.

The President stated, "this conference is a vital next step in a joint international approach to address changes in the global environment."

As of 4/6; 9:00 p.m.

HEADS OF DELEGATIONS

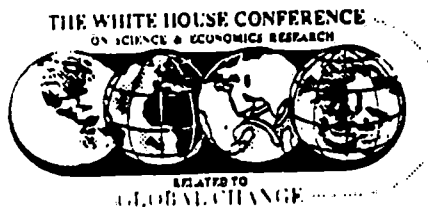
COUNTRY	NAME OF DELEGATE	TITLE
Australia		
Brazil		
Canada	Lucien Bouchard	Federal Environment Minister
Federal Republic of Germany	Klaus Toepfer	Federal Environment Minister
France	Hubert Curien	Minister of Research & Technology
India	Maneka Gandhi	Min. of State for Environment
Indonesia	B.J. Habibie	Min. of State for Res. & Tech.
Italy	Adolfo Battaglia	Minister of Industry
Japan	Ishimatsu Kitagawa	Minister of Environment
Mexico	Patricio Chirinos	Sec. of Urban Dev. & Ecology
Netherlands	Hans Alders	Minister of Environment
Nigeria		
Norway	Kristin Hille Valla	Minister of Environment
Poland	Jan Janowski	(also Head of S&T Cooperation) Deputy Prime Minister
Soviet Union	Nikolay Laverov	Chmn. St. Cmte. Sci. & Tech.
United Kingdom	David Trippier	Minister for Environment
United States	Nicholas Brady	Secretary of Treasury
Zaire	Citoyen Lobo Kanza Kanza	Depty. Minister of Environment
European Community (EC)	**Laurens Jan Brinkhorst	Director-General for Environment
OECD	Robert Cornell	Deputy Secretary-General

**Some confusion between EC and Irish. We now have 14 names; also indications that delegation head might be Filippo Maria Pandolfi, Commissioner (Vice President) in charge of Science, Research and Development.



**THE WHITE HOUSE CONFERENCE
ON SCIENCE AND ECONOMICS RESEARCH
RELATED TO GLOBAL CHANGE**

**April 17-18, 1990
Washington, D.C.**



THE WHITE HOUSE

WASHINGTON

April 5, 1990

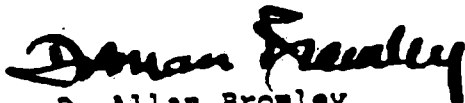
Dear Colleague:

On behalf of President Bush, we are honored that you will be coming to the United States April 16-18 to serve as a delegate to the White House Conference on Science and Economics Research Related to Global Change.

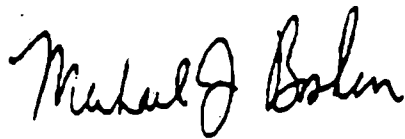
By contributing your country's expertise in identifying the critical needs in the fields of science and economics research, you will advance international cooperation and understanding in dealing with the uncertainties of global change.

The United States welcomes a free and open discussion of the science and economics research issues related to global change. As co-chairmen of the Conference, we look forward to joining you in that effort.

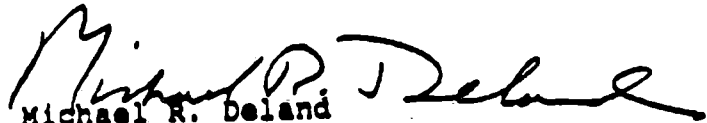
Yours Sincerely,



D. Allan Bromley
Assistant to the President
for Science and Technology



Michael J. Boskin
Chairman
Council of Economic Advisers



Michael R. Deland
Chairman
Council on Environmental
Quality

**PRE-CONFERENCE MATERIAL
FOR DELEGATES**

TABLE OF CONTENTS

- Overview of the Conference
- Preliminary Delegation List
- Conference Co-Chairmen Biographies
- U.S. Delegation Biographies
- Hotel/Transportation/Logistics

OVERVIEW OF THE CONFERENCE

The Conference will provide a forum for international leaders to address the complex science and economics research issues central to the policy process, including:

- How well can we predict temperature trends in the decades ahead?
- How "good" are our global scale models, such as models to predict temperature changes?
- How well can we predict the interconnections between global environmental change and the resulting social and economic impacts?
- What are the economic consequences of adapting to or mitigating Global Change?
- How "good" are the models used to assess these economic consequences and their impact on the well-being of humanity?

By addressing such questions, it is hoped that the nations might pledge to enhance joint international research efforts that focus on rapid improvement of both scientific and economic knowledge and development of the necessary infrastructure to implement such efforts.

To address these complex and interrelated issues, President Bush invited heads of state from a small group of nations to send delegations led by ministerial-level officials. The Conference was conceived with the idea that a representative group of countries would be invited to participate. Their selection was based on the simple criteria that the meeting should include countries or organizations of countries that have substantial populations, large land masses, industrialized economies, heavy future energy needs, major research infrastructures, or have provided international leadership on issues related to climate and Global Change. These countries and organizations were selected:

1. Australia
2. Brazil
3. Canada
4. Federal Republic of Germany
5. France
6. India
7. Indonesia
8. Italy
9. Japan
10. Mexico
11. Netherlands
12. Nigeria
13. Norway
14. Poland
15. Soviet Union
16. United Kingdom
17. Zaire
18. European Community
19. OECD

PRELIMINARY DELEGATION LIST

Current as of April 4, 1990; 12:00 Noon

BRAZIL

(tentative)

Name	Title
Jose Lutzenberger	Environment Secretary
Jose Goldemberg	Science Secretary

CANADA

(tentative)

Name	Title
Lucien Bouchard	Federal Environment Minister
Derek Burney	Ambassador to the U.S.
Dr. Ann White	Director, Canadian Global Change Program
Dr. Arthur W. May	President, the Natural Science and Engineering Research Council

FEDERAL REPUBLIC OF GERMANY

(confirmed)

Name	Title
Professor Dr. Klaus Töpfer	Federal Minister for Environment, Nature Protection and Nuclear Safety
Dr. Gebhard Ziller	State Secretary, Ministry for Research and Technology
Dr. Wilhelm Knittel	State Secretary, Ministry for Transportation
Baldur Wagner	Assistant Secretary, Federal Chancellery
Dr. Mario Graf von Matuschka	Assistant Secretary, Foreign Ministry
Dr. Horst Glatzel	Deputy Assistant Secretary, Federal Chancellery
Walter Lötze	Deputy Assistant Secretary, Ministry of Economics
Professor Dr. Ansgar Vogel	Deputy Assistant Secretary, Ministry for Environment, Nature Protection, and Nuclear Safety
Dietrich Kupfer	Director, Office of International Cooperation, Ministry for Environment, Nature Protection and Nuclear Safety
Professor Dr. Hartmut Grossl	Scientist, Max Planck Society, Hamburg

FRANCE

(tentative)

Name	Title
Minister Hubert Curien	Minister of Research and Technology
Minister Brice Lalonde	Secretary of State for the Environment
Jean Audouze	Science Advisor to the President
Claude Alegre	Special Advisor to the Minister of Education
Ambassador Jean Ripert	Ministry of Foreign Affairs (Environment)
Yves Martin	Chairman of the Interministry Committee on Greenhouse
Madame Borione	Ministry of Foreign Affairs
Andre LeBeau	General Director of the Meteorological Center
M. Nasse	Ministry of Economy and Budget
Sylvie Faucheux	Professor of Economy at Paris I

INDIA

(tentative)

Name	Title
Ms. Maneka Gandhi	Minister of State for Environment and Forests
Vasant Gowariker	Secretary of Department of Science and Technology
Mahesh Prasad	Secretary of Ministry of Environment and Forests
Dr. A.P. Mitra	Director General of Council for Science and Industrial Research

INDONESIA

(confirmed)

Name	Title
Prof. Dr. Ing. B.J. Habibie	Minister of State for Research and Technology; Chairman of the Agency for the Assessment and Application of Technology
Prof. Dr. Samaun Samadikun	Chairman of the Indonesian Institute of Science
Prof. Dr. John A. Katili	Deputy Chairman of the National Research Council
Prof. Dr. Gunawan Satari	Permanent Secretary, Ministry of State for Research and Technology
Mr. Poedji Kuntarso, MA	Director General for Foreign Economic Relations; Ministry of Foreign Affairs
Prof. Dr. Rustam Didong	Deputy Chairman (Economics), National Development Planning Agency
Prof. Dr. Harsono Wiryosumarto	Deputy Chairman (Technology Development); Agency for the Assessment and Application of Technology
Prof. Dr. S.B. Joedono	Assistant Minister (Industry, Energy and Mining), Office of the Coordinating Minister for the Economy, Finance, Industry and Development Supervision
Dr. M. Alwi Dahlan	Assistant Ministry (Population), Office of the Minister of State for Population and the Environment
His Excellency Abdulrachman Ramly	Ambassador of the Republic of Indonesia to the United States of America

ITALY

(tentative)

Name	Title
Hon. Adolfo Battaglia	Minister of Industry, Head of Delegation
Prof. Umberto Colombo	Director of the National Agency for Nuclear and Renewable Energies
Prof. Giuseppe Biorci	Vice President of the National Research Council
Prof. Giuseppe Bianchi	Director General for Energy Sources, Ministry of Industry
Prof. Antonio Praturlon	President of the CNR Committee on Geological Sciences
Prof. Roberto Frassetto	CNR Institute of the Dynamics of Great Masses
Prof. Emilio Gerelli	Economic Counselor to the Minister of Environment
Dr. Corrado Clini	Director General for Pollution Prevention, Ministry of Environment
Prof. Guido Visconti	Department of Physics, University of L'Aquila
Dr. Giovanni Sacco	Vice Director General of Treasury, Ministry of Treasury

MEXICO

(tentative)

Name	Title
Lic. Patricio Chirinos	Secretary of Urban Development and Ecology
Dr. Jose Sarukhan	Rector, National Autonomous University
Dr. Herminio Blanco	Undersecretary for Foreign Commerce, Secretariat of Commerce and Industrial Development
Ing. Alberto Escofet	Undersecretary for Energy, Secretariat of Energy, Mines and Parastatal Industries
Lic. Jose Angel Gurria	Undersecretary for International Financial Affairs, Secretariat of the Treasury
Fis. Sergio Reyes	Undersecretary for Ecology
Amb. Alberto Szekely	Legal Counsel, Secretariat of Foreign Affairs
Dr. Julian Adem	Director, Center for Atmospheric Studies, National Autonomous University
Dr. Manuel Ortega	Director General, National Council for Science and Technology
Hector Santana	Staff Aide to Secretary Chirinos

THE NETHERLANDS

(tentative)

Name	Title
Hans Alders	Minister for Housing, Physical Planning and Environment
Dr. B.C.J. Zoeteman	Deputy Director-General for Environment
Dr. Pier Vellinga	Coordinator for National Climate Programs
N.D. Van Egmond	Director for Chemistry and Physics, State Institute for Public Health and Environmental Hygiene
I.G. Roos	Directorate-General for European Cooperation, Ministry of Foreign Affairs
Dr. H.M. Fijnaut	Director of the Royal Dutch Meteorological Institute
Dr. A.P.M. Baede	Head of the Department for Dynamical Meteorology
D.F.W.T. Pietermaat	Environmental Coordinator in the Directorate-General for Energy, Ministry of Economic Affairs
Prof. J.B. Opschoor	Professor of Ecology, Free University, Amsterdam

NORWAY

(confirmed)

Name	Title
Kristin Hille Valla	Minister of Environment
Einar Steensnaes	Minister of Education and Research
Ambassador Kjeld Vibe	Norwegian Ambassador to the United States
Oddmund Graham	Secretary General, Ministry of Environment
Kaare Bryn	Director General, Ministry of Foreign Affairs
Dr. Tore Olsen	Director General, Ministry of Education and Research
Per M. Bakken	Coordinator, Air Pollution, Ministry of Environment
Lorents Lorentsen	Director of Research, Central Bureau of Statistics
Professor Dr. Ivar Isaksen	University of Oslo
Leif Westegaard	Science Officer, Norwegian Embassy in Washington

THE OECD

(tentative)

Name	Title
Robert Cornell	Deputy Secretary-General
William L. Long	Director for Environment
John Ferriter	Deputy Executive Director, International Energy Agency
Andrew Dean	Administrator, Department for Economic Affairs and Statistics
George Kowalski	Head of the Division of Economic Analysis, International Energy Agency

POLAND

(tentative)

Name	Title
Jan Janowski	Deputy Prime Minister; Head of the Office of Scientific and Technological Progress
Andreyewski	Deputy Minister of the Environment
Tadeusz Diem	Deputy Minister of Education
Rybicki	Central Planning Office
Kazimierz Duchowski	Department of Economic Cooperation, Ministry of Foreign Affairs
Wiackowski	Chairman, Parliamentary Commission on Environmental Protection
Stakel	Professor, Polish Academy of Sciences
Sadowski	Institute of Metallurgy and Water Management
Wlodzimierz Bojarski	Senator
Jan Kinast	Polish Ambassador to the United States

SOVIET UNION

(tentative)

Name	Title
Nikolay P. Laverov	Chairman of the USSR State Committee on Science and Technology
Yuriy A. Izrael	Chairman of the State Committee on Hydrometeorology
V.F. Kostin	Deputy Chairman, State Committee for Nature Protection
Aleksander A. Metalnikov	Deputy Chairman, State Committee for Hydrometeorology
A.A. Troitsky	Deputy Chairman, State Planning Committee
V.M. Kotliakov	Director, Institute of Geography, USSR Academy of Sciences
Yu. L. Golubev	Assistant to Chairman, State Committee for Hydrometeorology
Yu. V. Vakajuk	Chief, Division of Global Geophysical Problems, Climate Change and Economic Consequences, State Committee for Hydrometeorology
Yu. V. Pikhanov	State Committee for Hydrometeorology, Department of International Cooperation
Mrs. N. Yu. Vail	State Department Committee for Hydrometeorology, Department of International Cooperation

UNITED KINGDOM

(tentative)

Name	Title
David Trippier RD, JP, MP	Minister for the Environment and Countryside
Sir John Fairclough	Chief Scientific Adviser, the Cabinet Office
Sir Crispin C.C. Tickell, GCMG, KCVO	United Kingdom Permanent Representative to the United Nations
Dr. John T. Houghton CBE	Director-General, Meteorological Office
J.G. Odling-Smee	Deputy Chief Economic Adviser; HM Treasury
Dr. David J. Fisk	Chief Scientist, Department of Environment
Dr. W. David Evans	Chief Scientist, Department of Energy
Dr. Eileen Buttle	Secretary, Natural Environment Research Council

UNITED STATES OF AMERICA

(confirmed)

Name	Title
Nicholas F. Brady	Secretary of the Treasury
Manuel Lujan, Jr.	Secretary of the Interior
Clayton Yeutter	Secretary of Agriculture
Robert A. Mosbacher	Secretary of Commerce
Admiral James D. Watkins (Ret)	Secretary of Energy
William K. Reilly	Administrator, Environmental Protection Agency
Richard H. Truly	Administrator, National Aeronautics and Space Administration
John A. Knauss	Under Secretary of Commerce for Oceans and Atmosphere; and Director, National Oceanic and Atmospheric Administration
Erich Bloch	Director, National Science Foundation
Richard Schmalensee	Member, Council of Economic Advisers

ZAIRE

(tentative)

Name	Title
Citoyen Lobo Kanza Kanza	Secretary of State (Deputy Minister); Ministry of Environment and Conservation of Nature



CONFERENCE CO-CHAIRMEN BIOGRAPHIES

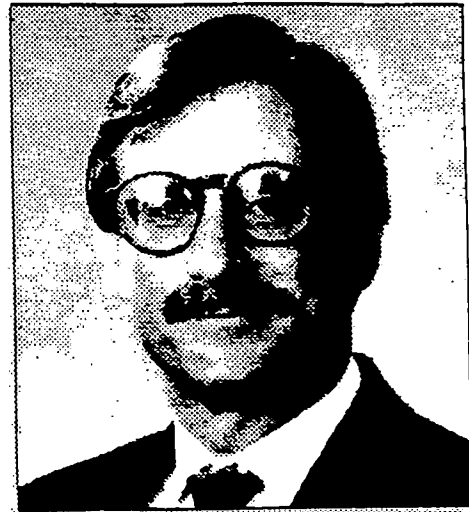
MICHAEL J. BOSKIN

D. ALLAN BROMLEY

MICHAEL R. DELAND



**Michael J. Boskin
Chairman
President's Council of
Economic Advisers**



Michael J. Boskin is the Chairman of the President's Council of Economic Advisers. He was appointed to this post by the President on February 2, 1989, following unanimous confirmation by the Senate. As Chairman, he provides economic analysis and advice directly to the President and assists in formulating national economic policies. Dr. Boskin is on leave from Stanford University, where he is the Burnet C. and Mildred Finley Wohlford Professor of Economics, and was the founder and Director of the Center for Economic Policy Research. He is also on leave as a Research Associate of the National Bureau of Economic Research.

Dr. Boskin is the recipient of numerous professional awards and citations, ranging from the Chancellor's Award and the Department Citation as outstanding undergraduate at the University of California in 1967 and the first National Tax Association Outstanding Doctoral Dissertation Award in 1971 to the Abramson Award for Outstanding Research from the National Association of Business Economists in 1987 and Stanford University's Distinguished Teaching Award in 1988. He is the author of more than 80 books and articles in the areas of government spending, tax theory and policy, public debt, Social Security, retirement patterns and behavior, U.S. saving behavior, capital formation, U.S. economic growth, and the economic status of the elderly.

Dr. Boskin received his B.A. degree with highest honors in 1967 from the University of California at Berkeley, where he received his M.A. in 1968 and his Ph.D. in 1971.

Previously, Dr. Boskin had served as a consultant and adviser to the White House, Department of Health and Human Services, Treasury Department, National Science Foundation, and other government agencies, and various congressional committees.

Dr. Boskin is a member of the Economic Education Committee of the American Economic Association. He and his wife Chris moved to Washington, D.C. from California. They both enjoy skiing and tennis.



**D. Allan Bromley
Assistant to the President
Science and Technology**



D. Allan Bromley is Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy (OSTP) in the Executive Office of the President. He is on leave from his former position as Henry Ford II Professor of Physics at Yale University, where he was founder and Director of the A.W. Wright Nuclear Structure Laboratory.

One of the world's leading nuclear physicists, he has carried out pioneering studies on both the structure and dynamics of nuclei and is considered the father of modern heavy ion science, one of the major areas of nuclear science. He has also played major roles in the development of accelerators, of detection systems, and in computer-based data acquisition and analysis systems. An outstanding teacher, over the past two decades his laboratory at Yale graduated more Ph.D.'s in experimental nuclear physics than any other institution worldwide. He has published over 450 papers in science and technology as well as edited eighteen books and has received numerous honors and awards, including the National Medal of Science.

For more than two decades, Dr. Bromley has been a leader in the national and international science and science policy communities. As Chairman of the National Academy's Physics Survey in the early 1970s, he contributed in a central way to charting the future of that science in the subsequent decade. As President of the American Association for the Advancement of Science, the world's largest scientific society, and the International Union of Pure and Applied Physics, the world coordinating body for that science, he has been one of the leading spokesmen for U.S. science and for international scientific cooperation.

Prior to his present appointment, Dr. Bromley served as a member of the White House Science Council throughout the Reagan Administration and as a member of the National Science Board in 1988-1989. As the U. S. chairman for both the Gandhi-Reagan, Indo/U.S. and the Sarney-Reagan, Brazil/U.S. Science and Technology Initiatives, he led four Presidential missions to conduct negotiations for bilateral cooperation in science and technology.

Born in Westmeath, Ontario, Canada, he received the B.Sc. degree with highest honors in 1948 in the Faculty of Engineering at Queen's University, Ontario, Canada. He received the M.Sc. degree from Queen's University in 1950 and the Ph.D. degree from the University of Rochester in 1952, both degrees in nuclear physics. He subsequently has been awarded ten honorary degrees from universities in Canada, France, Germany, Italy, South Africa, and the United States.

Dr. Bromley is married to the Former Patricia J. Brassor, and they have two children, David John and Karen Lynn.



Michael R. Deland
Chairman
White House Council
on Environmental Quality



Michael R. Deland was appointed by President Bush to be Chairman of the White House Council on Environmental Quality on August 1, 1989, following unanimous confirmation by the United States Senate. In this capacity he serves as environmental adviser to the President as well as Director of the Office of Environmental Quality which oversees the development of environmental policy, interagency coordination of environmental quality programs and environmental data acquisition and assessment. In addition, Mr. Deland is responsible for overseeing implementation of the National Environmental Policy Act.

Prior to Mr. Deland's appointment as CEQ Chairman, he was the New England Regional Administrator for the U.S. Environmental Protection Agency (EPA). In that capacity, from 1983 to 1989, he administered the federal government's programs dealing with air and water pollution control, hazardous waste management, drinking water, toxic substances, radiation, and pesticides.

Mr. Deland was counsel at Environmental Research and Technology, Inc., a national firm headquartered in Concord, Massachusetts from 1976 to 1983. While in the private sector, Mr. Deland published numerous papers and articles, including the Regulatory Focus monthly column in *Environment, Science and Technology*. Between 1971 and 1976, Mr. Deland served in EPA's Office of Regional Counsel in New England (Region I) in several capacities, including Chief of the Agency's Legal Review Section and Chief of the Enforcement Branch.

Mr. Deland received his Bachelor of Arts degree from Harvard College in 1963 and served as an officer in the U.S. Navy before obtaining his law degree from Boston College in 1969. He is a member of the Massachusetts Bar and the American Bar Association and its Natural Resources Committee. Mr. Deland was President of the Business Associates Club (Boston) from 1981 to 1982 and is a former Director of the Environmental Lobby of Massachusetts and the Center for Environmental Intern Programs, a national non-profit organization headquartered in Boston.

Mr. Deland has received numerous awards and citations, including the Massachusetts Audubon Society Award for his leadership in cleaning up Boston Harbor and the New England Environment Leadership Award for the New England Environmental Network. In 1987, he was honored as "Environmentalist of the Year" by the Massachusetts Association of Conservation Commissions. In March of 1989, he was awarded the National Wildlife Federation's Special Achievement Award for his role in prompting the cleanup of Boston Harbor, for his efforts at protecting valuable fishing areas from off-shore oil drilling, and for his early endorsement of environmentally-based growth controls on Cape Cod. Mr. Deland resides in Washington with his wife Jane and three children.

U.S. Delegation Biographies

As part of the Conference handout materials, we are preparing an information/reference booklet which will include:

- one-page narrative biography of each delegate
- an 8" x 10" photograph of each delegate
- the delegate's organization's logo/seal

The biographies, logos and photographs of the U.S. delegation included in this section are representative of the materials we are seeking from each foreign delegation member.

Please provide this information to the White House Conference as soon as possible.



Nicholas F. Brady
Secretary
Department of the Treasury



Nicholas F. Brady became the 68th Secretary of the Treasury on September 15, 1988.

Secretary Brady served in the United States Senate from April 20, 1982 through December 27, 1982. During that time he was a member of The Armed Services Committee and the Banking, Housing and Urban Affairs Committee.

In 1984 President Reagan appointed Secretary Brady Chairman of the President's Commission on Executive, Legislative and Judicial Salaries. He has also served on the President's Commission on Strategic Forces (1983), the National Bipartisan Commission on Central America (1983), the Commission on Security and Economic Assistance (1983), and the Blue Ribbon Commission on Defense Management (1985). Most recently, Secretary Brady chaired the Presidential Task Force on Market Mechanisms (1987).

Secretary Brady's career in the banking industry spans 34 years. He joined Dillon, Read & Co., Inc. in New York in 1954, rising to Chairman of the Board. He has been a Director of the NCR Corporation, the MITRE Corporation, and the H.J. Heinz Company, among others.

He has also served as a trustee of Rockefeller University and a member of the Board of the Economic Club of New York. He is a member of the Council on Foreign Relations, Inc. He is a former trustee of the Boys' Club of Newark.

Mr. Brady was born April 11, 1930 in New York City. He was educated at Yale University (B.A., 1952) and Harvard University (M.B.A., 1954). He and his wife, Katherine, have four children.



Manuel Lujan, Jr.
Secretary
Department of the Interior

POLITICAL

President George Bush selected Manuel Lujan, Jr., who had just completed a 20-year career in the House of Representatives, to be his Secretary of the Interior. He was sworn in on February 3, 1989.

The 46th Secretary of the Interior, Lujan was first elected to the House of Representatives from New Mexico in 1968. When he left the Congress on January 3, 1989, he ranked 15th in seniority among all Republicans and 52nd in seniority among all House members.

A member of the House Interior and Insular Affairs Committee since 1969, Lujan was its second ranking Republican. The Committee has jurisdiction over all activity in the U.S. Department of the Interior as well as the Nuclear Regulatory Commission. Lujan was also the senior Republican on the Energy and Environment Subcommittee.

Lujan was the Vice-Chairman of the House Science, Space and Technology Committee. As senior Republican, Lujan was a member of all subcommittees, including Space Science and Applications which has oversight over NASA.

PERSONAL

Born May 12, 1928 in San Ildefonso, New Mexico. Raised in Santa Fe where Lujan's father, Manuel Lujan, Sr., served three elected terms as Mayor.

A graduate of the College of Santa Fe with a B.A. degree, Lujan also attended St. Mary's College in California.

Prior to entering Congress, the Secretary was a partner in a family insurance and real estate business with three offices in New Mexico. His brother, Edward Lujan, is the managing partner of the business.

Married to the former Jean Couchman of Santa Fe, the Lujans have four children; Terra Everett, Jay, Barbara and Jeff. Secretary and Mrs. Lujan maintain residences in both Washington, D.C. and Albuquerque.

LEGISLATIVE

Economy in Government: Lujan was a Congressional leader in the battle against wasteful government spending. *"The effort to stop inflation boils down to a fight against needless government intervention and spending,"* stated Lujan.

Environmental Protection: Lujan has co-sponsored seven major environmental protection bills including the Clean Air Act of 1970 and the Clean Water Act. More recently, Lujan successfully sponsored legislation setting aside more than 600,000 acres of New Mexico land as wilderness areas, ensuring its beauty and enjoyment for future generations.

Education: Lujan strongly supported student loan programs in the public and private sectors. His work led to New Mexico adopting a student loan program that is a model for other states.

Technology: Lujan believes strongly that scientific research is the key to our future. *"Science and technology can help us meet the challenges of the 21st century,"* said Lujan.



**Clayton Yeutter
Secretary
Department of Agriculture**



Clayton Yeutter was sworn in as the 23rd United States Secretary of Agriculture on February 8, 1989.

Yeutter's career includes distinguished public and private-sector service in agricultural policy development, law, economics, marketing and trade.

From July 1985 until shortly before his new cabinet appointment, Yeutter served as U.S. Trade Representative. His previous USDA posts include Assistant Secretary for International Affairs and Commodity Programs from March 1974 to June 1975, Assistant Secretary for Marketing and Consumer Service from January 1973 to March 1974 and Administrator of the Consumer and Marketing Service from October 1970 to December 1971.

Yeutter's other career highlights: President and Chief Executive officer, Chicago Mercantile Exchange, July 1978 to June 1985; senior partner, law firm of Nelson, Harding, Yeutter & Leonard, Lincoln, Nebraska, April 1977 to June 1978; Deputy U.S. Special Trade Representative, June 1975 to February 1977; Director, University of Nebraska Mission in Colombia (a large agricultural technical assistance program), September 1968 to October 1970; executive assistant to the governor of Nebraska, January 1966 to September 1968; faculty member, Department of Agricultural Economics, University of Nebraska, January 1960 to January 1966; operator of a 2,500 acre farming-ranching-cattle feeding enterprise in central Nebraska, 1957-1975; and enlistee, later commissioned officer, U.S. Air Force, 1952-1957.

Yeutter was graduated with high distinction from the University of Nebraska in 1952 with a Bachelor of Science degree in animal husbandry. In 1963, he obtained his law degree from the same university, graduating *cum laude* and ranked first in his class. In 1966, he received his Ph.D. in agricultural economics, again from the University of Nebraska, and was named outstanding graduate student in the program.

Yeutter is a former member or chairman of many private and public-sector boards of directors, councils and trusteeships, including: the President's Export Council; the Chicago Association of Commerce and Industry; the Chicago-Tokyo Bank; the U.S. Meat Export Federation; the Chicago Council on Foreign Relations; the Farm Foundation, Oak Brook, Illinois; Tri-Valley Growers, San Francisco, California; and ConAgra, Inc., Omaha, Nebraska.

Yeutter was born in Eustis, Nebraska, December 10, 1931. He and his wife, Jeanne Vierk Yeutter, have four children. He retains ownership of his Nebraska farm, which is currently operated by a tenant. Yeutter's permanent home is in Lincoln, Nebraska, but he currently resides in McLean, Virginia.



Robert A. Mosbacher
Secretary
Department of Commerce

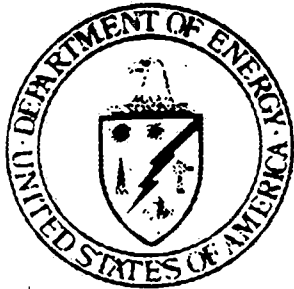
Nominated Secretary of Commerce by President-Elect George Bush on December 6, 1988. He was confirmed 100-0 by the United States Senate on January 31, 1989.

Formerly:

Chief Executive Officer and Chairman of Mosbacher Energy Company
Director of Texas Commerce Bancshares, Houston, Texas
Director, Enron Corporation, Houston, Texas
Director, New York Life Insurance Company, New York
Past Chairman of the National Petroleum Council
Charter member and past Chairman of the All American Wildcatters Association
Member of the Executive Committee and Board of Directors of the American Petroleum Institute
Past Chairman of the Mid-Continent Oil and Gas Association
Twice Past Chairman of the Board of Visitors of the Texas M.D. Anderson Cancer Institute
Former member of Board of Trustees of the Texas Heart Institute
Former National Trustee, Boys Clubs of America Southwest Region
Past Active Trustee of the Aspen Institute for Humanistic Studies
Member of Washington Roundtable and Co-Chair of Houston Roundtable of the Center for Strategic and International Studies
National Finance Chairman for George Bush for President
National Finance Chairman of the Fund for America's Future
Chairman of Victory 88'
Co-Chairman of the Republican National Finance Committee
Member of the Executive Committee for Reagan-Bush
National Finance Chairman for the President Ford Committee in 1976
Won both the North American and World Sailing Championships in the Olympic classes (Dragon and Soling)
Won the Southern Ocean Racing Circuit
Won the Gold Cup twice

Born in White Plains, New York, Mosbacher has lived in Houston, Texas since 1948. He graduated from Washington and Lee University in Lexington, Virginia in 1947.

Mosbacher is married to the former Georgette Paulsin and is the father of four (Diane, Robert Jr., Kathryn and Lisa) and grandfather of five. The Mosbachers reside in Washington, D.C.



James D. Watkins
Secretary
Department of Energy



James David Watkins was nominated by the President to be the sixth Secretary of Energy on January 20, 1989. Admiral Watkins was confirmed by the United States Senate and sworn into office on March 1, 1989.

Admiral Watkins was born in California on March 7, 1927, and claims the city of Pasadena as his home. A 1949 graduate of the U.S. Naval Academy, his tours as flag officer included Chief of Naval Personnel; Commander of the Sixth Fleet; Vice Chief of Naval Operations; and Commander-in-Chief of the Pacific Fleet. Admiral Watkins was selected by President Reagan to become the 22nd Chief of Naval Operations on June 30, 1982. His military decorations include several Distinguished Service and Legion of Merit medals, the Bronze Star with combat "V" and other medals, campaign and service ribbons, and decorations from many foreign nations.

Following his retirement on June 30, 1986, Admiral Watkins devoted his time to issues regarding America's youth, and worked with a number of philanthropic organizations to establish a national program for personal excellence. He also served as a member of advisory boards in both the education and energy fields and has received several honorary doctorates and public service awards.

In October 1987, Admiral Watkins was appointed Chairman of the Presidential Commission on the Human Immunodeficiency Virus (AIDS) Epidemic, submitting the Commission's final report to the President on June 24, 1988.

Admiral Watkins received his master's degree in mechanical engineering in 1958, and is a graduate of the reactor engineering course at the Oak Ridge National Laboratory. He was selected by Admiral Hyman G. Rickover to enter the Navy's nuclear-powered submarine program in 1959, and was qualified as an **Engineering Officer of the Watch** at one of the Navy's land-based reactor plants. He served for three years in the Atomic Energy Commission as Admiral Rickover's assistant for Naval Nuclear Propulsion and later, in a variety of assignments associated with the management of the nuclear navy. These assignments included Commanding Officer of a nuclear-powered submarine and Executive Officer of the world's first nuclear-powered cruiser.

Admiral Watkins married Sheila Jo McKinney of San Diego, California, in 1950. They have six children: Katherine Watkins Coopersmith, Laura Jo Watkins Kauffmann, Susan, Charles, James Jr., and Edward. Admiral and Mrs. Watkins have eight grandchildren.



William K. Reilly
Administrator
Environmental Protection Agency

William Kane Reilly was sworn in as Administrator of the U.S. Environmental Protection Agency by President Bush on February 8, 1989. The President announced his appointment on December 22, 1988, and officially nominated him on January 20, 1989. The U.S. Senate unanimously confirmed his nomination on February 2, 1989.

Prior to becoming EPA Administrator, Reilly held five environment-related positions during the previous two decades. He was President of World Wildlife Fund-U.S. (1985-1989) and President of the Conservation Foundation (1973-1989). Those two organizations joined in a formal affiliation in 1985 and Reilly became President of both organizations. He was Executive Director of the Task Force on Land Use and Urban Growth from 1972-1973. From 1970 to 1972, he was on the staff of the President's Council on Environmental Quality and, from 1968 to 1970, was Associate Director, Urban Policy Center and the National Urban Coalition. He also served as Chairman of the Natural Resources Council of America, an association of all major conservation groups, from 1981-1983.

During his presidency of World Wildlife Fund-U.S., Reilly intensified his mission, the protection of the diversity of life on earth. Between 1961 and 1989, the organization supported 1,371 wildlife and endangered habitat projects in 103 countries. At the Conservation Foundation, he continued its long-standing interest in land programs and initiated new programs in environmental dispute resolution, water toxic substances control, and urban conservation and energy. In 1976, Reilly began a program advocating direct cooperation between business leaders and conservationists in resolving polarizing issues in resources and environmental policy, which resulted in several major consensus-building policy dialogues, including the National Groundwater Policy Forum and the National Wetlands Policy Forum.

Reilly has written and lectured extensively on environmental issues, has served on the boards of various private and public sector organizations and received the Horace Albright Medal for his contributions to national parks and the Alfred B. LaGasse Medal for his contributions to environmental progress.

An alumnus of Yale University, Reilly holds a law degree from Harvard University and a master's degree in urban planning from Columbia University. He was born in Decatur, Illinois on January 26, 1940, grew up in Fall River, Massachusetts, and served as a U.S. Army captain (1966 to 1967).

He is married to Elizabeth "Libbie" Bennet Buxton Reilly. They have two daughters, Katherine Buxton Reilly, age 19, and Margaret Mahalah Reilly, age 14. The family resides in Alexandria, Virginia.



Richard H. Truly
Administrator
National Aeronautics and
Space Administration

Richard H. Truly became the eighth Administrator of NASA on July 1, 1989. One day earlier, he concluded his naval career of more than 30 years, retiring as a Vice Admiral, United States Navy. He is the first astronaut to head the nation's civilian space agency.

Truly became NASA's associate administrator for space flight on February 20, 1986. In this position, he led the painstaking rebuilding of the Space Shuttle program. This was highlighted by NASA's celebrated "return to flight" on September 29, 1988, when Discovery lifted off from Kennedy Space Center, Florida, on the first Shuttle mission in almost three years.

Before returning to NASA, the former Shuttle astronaut served as the first commander of the Naval Space Command, Dahlgren, Virginia, established October 1, 1983. His career in the U.S. Navy began in 1959, when he was commissioned an ensign. This coincided with his graduation from Georgia Institute of Technology, which he attended as a Naval R.O.T.C. midshipman and earned a bachelor's degree in aeronautical engineering.

Following flight school, he was designated a naval aviator in 1960. His initial tour of duty, Fighter Squadron 33, was aboard USS Intrepid and USS Enterprise, and he made more than 300 carrier landings. From 1963 to 1965, he was a student and then instructor at the U.S. Air Force Aerospace Research Pilot School, Edwards Air Force Base, California.

In 1965, Truly became one of the first military astronauts selected to the Air Force's Manned Orbiting Laboratory program in Los Angeles, California, and transferred to NASA as an astronaut in August 1969. He served as capsule communicator for all three of the manned Skylab missions in 1973 and the Apollo-Soyuz mission in 1975. As a naval aviator, test pilot, and astronaut, Truly has logged over 7,500 hours in numerous military and civilian jet aircraft.

He was pilot for one of the two-man crews that flew the 747/Space Shuttle Enterprise approach and landing test flights during 1977. He then served as backup pilot for STS-1, the first orbital test of the Shuttle. His first flight in space was November 12-14, 1981, as pilot of Space Shuttle Columbia (STS-2), significant as the first manned spacecraft to be reflown in space. His second flight (STS-9, August 30-September 5, 1983) was as commander of Space Shuttle Challenger, the first night launch and landing in the Shuttle program.

On January 18, 1989, Truly was awarded the Presidential Citizen's Medal by President Reagan. His NASA awards include two NASA Distinguished Service Medals, the NASA Outstanding Leadership Medal, two NASA Exceptional Service Medals, and NASA Space Distinguished Service Medal, the Defense Superior Service Medal, two Legions of Merit, the Navy Distinguished Flying Cross, and the Meritorious Service Medal.

Truly was born in Fayette, Mississippi, on November 12, 1937 and attended school in Fayette and Meridian, Mississippi. He is married to the former Colleen (Cody) Hanner of Milledgeville, Georgia. They have three children: Mike, Dan and Lee, and three grandchildren: Ashley, Courtney and Peter.



John A. Knauss
Under Secretary
Department of Commerce

John A. Knauss, Under Secretary for Oceans and Atmosphere and Administrator of the Department's National Oceanic and Atmospheric Administration (NOAA), took office August 7, 1989.

A noted oceanographer and educator, Knauss was a professor of oceanography at the Graduate School of Oceanography at the University of Rhode Island (URI). He also served as dean of the URI Graduate School of Oceanography from 1962 to 1987, and as the university's provost for marine affairs from 1969 to 1982.

Knauss has been a member of two presidential commissions on marine affairs: the Commission on Marine Science, Resources, and Engineering (the Stratton Commission) in 1967 to 1968 and the National Advisory Committee on Oceans and Atmosphere (NACOA), 1978 to 1985. He served as Chairman of NACOA from 1981 to 1985. He has been President of the Association of Sea Grant Program Institutions, Chairman of the Ocean Science Committee of the National Academy of Sciences/National Research Council, and Chairman of the Marine Division of the National Association of State Universities and Land-Grant Colleges.

He has served as President of the oceanographic section of the American Geophysical Union (AGU), Vice President of the Marine Technology Society (MTS), Vice Chairman of the American Association for the Advancement of Science's (AAAS) Atmospheric and Hydrospheric Sciences Section, and a council member of the American Meteorological Society. He was a co-founder of the Law of the Sea Institute and served on its governing board from 1965 to 1976 and 1981 to 1987. He has been elected a fellow of the AAAS, the AGU, and the MTS.

Knauss graduated from Massachusetts Institute of Technology (B.S., 1946), the University of Michigan (M.S., 1949), and the University of California, Scripps Institution of Oceanography (Ph.D., 1959).



Erich Bloch
Director
National Science Foundation



Erich Bloch was confirmed by the Senate to be Director of the National Science Foundation on August 6, 1984. As Director, he is responsible for an agency charged with strengthening the national scientific and engineering research potential and with improving science and engineering education at all levels. The Foundation has an annual budget exceeding \$1.7 billion and the annual award of 12,000 to 14,000 grants for research in all fields of natural, social sciences, and engineering.

Before joining NSF, Mr. Bloch was a corporate Vice President for Technical Personnel Development at IBM Corporation, which he joined in 1952 as an electrical engineer. During his career at IBM, Mr. Bloch was the engineering manager of IBM's STRETCH supercomputer system in the late 1950's and early 1960's. In 1962, he headed development of the Solid Logic Technology program, which provided IBM with microelectronic technology for its System/360 computer. Subsequently, Mr. Bloch was appointed a vice president of the company's Data Systems Division and general manager of the East Fishkill facility, which is responsible for the development and manufacture of semiconductor components used in IBM's product line. He was elected an IBM vice president in 1981.

From 1981 to 1984, Mr. Bloch served as Chairman of the Semi-conductor Research Cooperative, a group of leading computer and electronics firms that fund advanced research in universities and shares in the results, and was the IBM representative on the board of the Semiconductor Industry Association.

In February 1985, Mr. Bloch was awarded the National Medal of Technology by President Reagan. The award was made for his part in pioneering developments related to the IBM/360 computer that revolutionized the computer industry. In 1989, Mr. Bloch was the recipient of the IEEE United States Activities Board Award for Distinguished Public Service and the IEEE 1990 Founders Medal. He also received honorary Doctorate of Engineering degrees from the Colorado School of Mines, the University of Notre Dame, and Rensselaer Polytechnic Institute; honorary Doctorate of Science degrees from the University of Massachusetts at Amherst, George Washington University, State University of New York at Buffalo, the University of Rochester, Oberlin College, and Washington College; and an honorary Doctorate of Science and Engineering degree from the Ohio State University.

He is a member of the National Academy of Engineering and is a Fellow of the American Association for the Advancement of Science and of the Institute of Electrical and Electronics Engineers and a member of its Computer Society. He received his education in electrical engineering at the Federal Polytechnic Institute of Zurich, Switzerland, and a Bachelor of Science degree in electrical engineering from the University of Buffalo in 1952.



**Richard Schmalensee
Council of Economic Advisers
Office of the President**



Richard Schmalensee is a Member of the Council of Economic Advisers. He has primary responsibility for the analysis of microeconomic and regulatory policy. Dr. Schmalensee is on leave from the Massachusetts Institute of Technology (MIT), where he is the Gordon Y. Billard Professor of Economics and Management.

Dr. Schmalensee's research and teaching have focused on industrial organization and on anti-trust and regulatory policy. He has written numerous articles in professional journals and is the author of three books and co-author of three others. He has extensive consulting experience on anti-trust and regulatory matters. He has served on the editorial boards of several economics journals, is co-editor of the *Handbook of Industrial Organization*, and is founding editor of the MIT Press *Regulation of Economic Activity* monograph series. Dr. Schmalensee has also served on various committees of the American Economic Association and the Econometric Society, of which he is a Fellow.

Dr. Schmalensee attended the public schools of Belleville, Illinois and received his B.S. (Economics, Politics and Science; 1965) and Ph.D. (Economics; 1970) degrees from MIT. Prior to joining the MIT faculty in 1977, he taught at the University of California, San Diego. He is married to the former Diane Hawk; they have two sons.



HOTEL/TRANSPORTATION/LOGISTICS

Dr. Franmarie Keel

White House Conference on Global Change

Suite 615

1019 19th Street, N.W.

Washington, D.C. 20036

Phone: (202) 653-5980

Fax: (202) 653-2034

Telex: 249118SDAVISUR

Telemail (OMNET): GLOBAL.CHANGE

HOTEL

The White House Conference is being held at:

The J.W. Marriott Hotel
1331 Pennsylvania Avenue, N.W.
Washington, D.C. 20004
Telephone: 202-393-2000

- The White House Conference has reserved rooms for each official delegation member. **Charges for the hotel room April 16th and 17th, 1990 and for Conference meals served April 17 and 18, 1990, will be paid for by the White House Conference.**
- Hotel room check-in is 3:00 p.m. Conference registration begins at 12:00 noon, Sunday, April 15, for delegates arriving in Washington early. Registration will continue Monday all day and until 12:00 noon on Tuesday, April 17. Special arrangements should be made with White House Conference coordinators for early or late arrivals/departures and check-in.
- To cover any personal incidental expenditures (such as telephone calls, charges at the hotel restaurants and gift shops, and additional room service), each delegation member must present *one* of the following upon registration at the hotel to guarantee incidentals:
 - credit card (American Express, VISA, Master Card, Diners Club, JCV)
 - a letter received by April 14th, 1990 from the delegation's embassy stating embassy will cover its delegation's incidentals prior to delegation's departure from the hotel

TRANSPORTATION

- Delegations will be met by White House Conference personnel at Washington National Airport, Washington Dulles Airport, Baltimore-Washington International Airport, and Andrews Air Force Base and will be escorted to the hotel beginning Sunday, April 15.
- White House Conference personnel meeting flights can be identified by a White House Conference sign. Delegations arriving in Washington domestically will be met at the gate. International arrivals will be met at the exit of the mobil lounge at the entrance to U.S. Immigration and Customs.
- Procedures have been established by the Conference to assist in the facilitation of U.S. Customs.

- Transportation will be provided for delegations' return to those designated airports after the close of the Conference Wednesday, April 18, through Thursday evening, April 19.
- All transportation for official Conference events held outside of the J.W. Marriott Hotel will be provided by the White House Conference.
- All airline arrival and departure times must be confirmed as soon as possible with the White House Conference at 202/653-5980.
- Please inform the White House Conference immediately if flight plans change at departure (i.e. cancelled flight, family emergency, etc.)

SPECIAL REQUIREMENTS

- Any special room, bed, dietary, or medical requirements should be forwarded to White House Conference coordinators as soon as possible.

MISCELLANEOUS

- Simultaneous interpretation in Russian, Spanish, and French will be provided during the Conference meetings.
- Please note the dinner at the State Department, on Tuesday, April 17, is business attire.

**WHITE HOUSE CONFERENCE ON SCIENCE AND ECONOMICS
RESEARCH RELATED TO GLOBAL CHANGE**

Delegate Travel Accommodation Registration

PLEASE PRINT OR TYPE

Name: _____

Title: _____

Country Delegation: _____

HOTEL ACCOMMODATIONS:

In order to facilitate your registration upon arrival at the Conference site at the J.W. Marriott Hotel, it will be necessary to provide the information requested in this form. The White House Conference provides each delegate with a hotel room from check-in April 16th to check-out on April 18th. The J.W. Marriott Hotel requires guarantee of payment for incidentals, such as telephone, room service, gift shop, laundry, restaurants, etc., with cash, a credit card or a Letter of Guarantee from your Embassy. A Letter of Guarantee should include delegate's name, check-in date, Embassy Financial Officer, and any stipulations, and must be received by April 14, 1990.

Credit Card # _____ Expiration Date: _____

Type (*American Express, Visa, Master Card, Diners Club, JCV*): _____

Name as it appears on card: _____

Signature: _____ Date: _____

This should be completed and sent by fax (202-653-2034) to Susan Thoren at the White House Conference in Washington, D.C., or delivered by April 12th to 1019 19th Street NW, Suite 615, Washington D.C. 20036

Arnold

(Lange/Cawley)
April 11, 1990
3:45 P.M.
[GLOBAL.DOC]

PRESIDENTIAL ADDRESS: WHITE HOUSE CONFERENCE ON GLOBAL CHANGE
[PLACE]
WEDNESDAY, APRIL 18, 1990
[2:30 P.M.]

[Acknowl.] I'd begin by thanking all of you for sitting through what, at times, might have seemed like the American lecture series on global change. I understand some of the talks went on so long, there was concern about the onset of the next Ice Age.

*in
obeyance*

→ enough hours to put off

But after all of the working sessions, plenaries, and what I'm sure was an atmosphere of lively debate, I'd begin with thanks, and a moment of perspective: for the work you have been doing is profoundly important to the fate of the planet. It offers the promise of a quieter, more thoughtful, more careful tenancy of ~~this~~ nature's legacy to humanity.

after all of you have today, April

The growing sense of global stewardship shared by the people and the nations we represent, arises of a natural sense of obligation. A sense that we owe our existence, all that we know and are, to the miraculous big blue ball that sustains us.

Such stewardship finds expression and reward in moments unexpected and unforgettable. To see the glint of light in a snow-leopard's eye, to feel the cold rush of water falling from an ancient glacier, to stand in silent witness to the timeless beauty of a heron's flight: Such are instances of the greatest grace mankind might know on this abundant earth.

Sweeping Such moments, even in imagination, have a special power, a resonance that at once ~~sweeps and~~ ^{an} elevates the mind's eye -- and yet humbles us as well. Before such beauty the works of man seem somehow small -- inconsequential on any ultimate scale.

We may build cathedrals, temples and mosques; monuments and mausoleums to great men and high ideals. And still, we know we can build no monuments like these. Our greatest creations cannot equal God's smallest.

Yet as our tools and minds advance, we've learned of our power to alter the earth. We understand that small actions, taken together, have profound global consequences for the environment we share, and the humanity we share it with.

Ours is a prosperous planet -- with greater hopes now than ever before that more of its people may come to know an unexpected peace, and an unprecedented prosperity. So let this

be understood: We can allow neither the planet, nor mankind's prospects for [health and] prosperity, to be put at risk by intemperate minds or ill-considered actions.

The minds at work here are among the very best we have. Here, for the first time, we have gathered economic and scientific talent from around the world -- to assess the environmental and developmental future of the planet. That alone is reason for optimism.

Surely you've raised more questions than conclusions here. But while diversity is expected, unity is crucial. In an atmosphere of **uncertainty**, we must foster a climate of good will, ^{g PR} and a stubborn hope, that we might forge a solution without excessive heat of politics or passion.

2

(Lange/Cawley)
April 11, 1990
3:45 P.M.
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[PLACE]
WEDNESDAY, APRIL 18, 1990
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[Eden.]

After all of the work that has taken place here -- in what I'm sure was an atmosphere of lively debate -- I'd begin with thanks, and a moment of perspective: for your purpose here is profoundly important to the fate of the planet. *world*

It offers hope for a new era of environmental cooperation around the world -- and the promise of a quieter, more thoughtful, more careful tenancy of nature's legacy to humanity. *state of nature, and the*

The growing sense of global stewardship, shared by all of you here, -- and by the nations you represent -- arises out of a natural sense of obligation. A sense that we owe our existence, all that we know and are, to the miraculous big blue ball that sustains us. *that prompted us to host this conf --*

Such stewardship finds expression in many ways -- from public demonstration to landmark legislation. *at times* *at times* it is rewarded in many ways -- moments unexpected and unforgettable. To see the glint of light in a ~~snow leopard's~~ eye, to feel the cold rush of water falling from an ancient glacier, to stand in silent witness to the timeless beauty of a heron's flight: Such *from this* *are instances of the* greatest grace mankind might know on this abundant earth.

Such moments, whether locked in memory or imagination, have a special power, a resonance that at once elevates the mind's eye -- and yet humbles us as well. Before such beauty the works of man seem somehow small -- inconsequential on any ultimate scale. *1*

We may build cathedrals, temples and mosques, monuments and mausoleums to great men and high ideals. And still, we know we can build no monuments to compare with nature. Our greatest creations cannot equal God's smallest.

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But while diversity is expected, unity is crucial. In an atmosphere of uncertainty, we must foster a climate of good will, And a stubborn hope, that we might forge ~~a~~ solution ^s without excessive heat of politics or passion.

[Three paragraphs on specific U.S. conference proposals, T.B.D. noon Wednesday 4/18 per Dr.s Bromley/Maynard]

[concl:]

Brower?

Let nature's majesty remind us of the seriousness of our task.

That the earth cannot, must not be sacrificed ^{for survival} on the altar of material ambition -- nor can the health of millions be sacrificed by intemperate policies. That we can meet the needs of this generation while preserving the world's wealth, its majesty and wildness... ours is an unprecedented opportunity, in the service of coming generations...

intro:

[Acknowl.] I'd begin by thanking all of you for sitting through what, at times, might have seemed like the American lecture series on global change. I understand some of the talks went on so long, there was concern about the onset of the next Ice Age. / I understand we Americans produced enough warm air to delay the next Ice Age.

Global Warming Becomes Hot Issue for Bromley

A disagreement within the Administration over plans for an international meeting on global change was aired in the press and on Capitol Hill last week

PRESIDENTIAL SCIENCE ADVISER D. Allan Bromley last week found himself in the hot seat when he was called before a Senate subcommittee to explain his views on global warming. The Senators were angered by press reports that Bromley had opposed sending a U.S. delegation to an international ministerial meeting on global change, to be held in The Hague next week.

Bromley was recently appointed by President Bush to chair a Domestic Policy Council working group on global change, a position that gives him a prominent role in formulating U.S. policy. According to Administration sources, at the working group's first meeting on 20 October, Bromley and White House chief of staff John Sununu opposed a recommendation by Environmental Protection Agency administrator William Reilly and the State Department that the United States attend The Hague conference, which will be held on 6 and 7 November.

At the meeting, which will draw together environment ministers from some 60 countries, the Netherlands is expected to propose that carbon dioxide emissions be stabilized at present levels by the year 2000 and that the feasibility of a 20% cut worldwide by 2005 be studied.

The Netherlands is hoping that the meeting will produce a consensus statement on global warming. But Bromley, Sununu, and others are reportedly worried that the United States, which produces one-fifth of the world's carbon dioxide emissions, could suffer economic damage if stabilization levels or reductions are agreed to.

Administration officials are also divided over whether the United States should honor a pledge made by Bush last year to host an international conference in 1990 on global change. At the 20 October meeting, Bromley, Sununu, and others opposed the proposal while Reilly and the State Department pushed for it. On 30 October, 40 U.S. senators, all Democrats, signed a letter to Bush, urging him to keep his commitment to convene the conference.

At the congressional hearing last week, Bromley dodged, for the most part, repeated questioning by Senators Albert Gore (D-

TN) and John Kerry (D-MA) about his views on global warming and whether he approved of U.S. participation at The Hague meeting. Bromley would only say, "My belief is that we should not move forward on major programs until we have a reasonable understanding of the scientific and economic consequences of those programs."

Asked by Gore whether the scientific evidence is inadequate to justify curbs on

New responsibility. Bromley now chairs a global change working group.



Ken Heinen

greenhouse emissions, Bromley responded that recent adjustments to climatic models by British climate modeler John Mitchell have made him uneasy about the reliability of predictions that the earth is warming up significantly.

Mitchell's model of the climate system previously predicted that the earth's temperature would rise 5°C when greenhouse gases double sometime in the next century. But he recently halved this figure after he added a new factor to his model—the effects of ice crystals. Bromley said, "That such simple and obvious changes in [Mitchell's] model can make major changes in predictions underscores my own feeling and many of my colleagues in the scientific community that we have a substantial distance to go yet."

Gore asked, "Do you believe that the doubling of carbon dioxide in the atmosphere, which will occur in the next 40 years or so, is likely to result in global warming?" Bromley replied, "It's certainly possible, and probable to some degree, but that's as far as I can say on the basis of the evidence." Given the changes in the Mitchell model, he said, "my answer is that I simply don't know."

Steven Schneider of the National Center for Atmospheric Research and many other atmospheric scientists have said that while current models are relatively crude and flawed in some ways, their predictive reliability has been validated to a substantial degree. Moreover, they point out that the fundamental theories of how greenhouse gases trap heat have been substantiated by billions of observations of the atmosphere.

Thomas Lovejoy, an ecologist and assistant secretary for external affairs of the Smithsonian Institution, said in an interview that the Administration "could be taking a

San Andreas fault approach" in formulating national policy on global warming. "It's resisting change until it's catastrophic."

Lovejoy, whom Bromley has nominated as a member of the White House science council, last week wrote a letter to Bromley himself, urging that the President and the Cabinet be given a full briefing by scientists on global warming. "There are a lot of actions associated with cutting greenhouse gases that will make us more competitive," Lovejoy says.

At the congressional hearing, Bromley also repeatedly stressed the importance of allowing a United Nations group, the Intergovernmental Panel on Climate Change, or IPCC, to finish a report on evaluating greenhouse effects. The report could lead to an international framework convention acknowledging the problem of global warming and then to a protocol with specific goals to cut emissions of greenhouse gases.

This process is similar to the one that led to an international agreement on a phaseout of chlorofluorocarbon gases.

But a few other countries, including the Netherlands, together with environmentalists and some members of Congress, contend that the IPCC process is moving too slowly. Although the IPCC report is due out at the end of next year, they say that the IPCC may take several years to arrive at specific goals for emission reductions.

As for The Hague meeting, Reilly has won a partial victory: the United States will be sending a delegation, which Reilly will head. But an Administration source says that Reilly "is going with a bare portfolio." Bromley will be part of the delegation.

■ MARJORIE SUN

See Petrus' paper for Annex Report (Spartan)
Project made; challenge remaining.

Reyn. ago we had a green movement
a decade of laws
cut under some pressure was

Enforcement (criticism always in press)

1990 - off the clock complaints 70s
not at @ was back
in one agency
of the same type
Nixon - "penetration with a 'hole'"
New say million. Environment.

Anda & Parks

1970 - very little Envtl data.
All reactive, slow from
a non active
fire, "hey,
let's get some rest
not coord.
not consistent

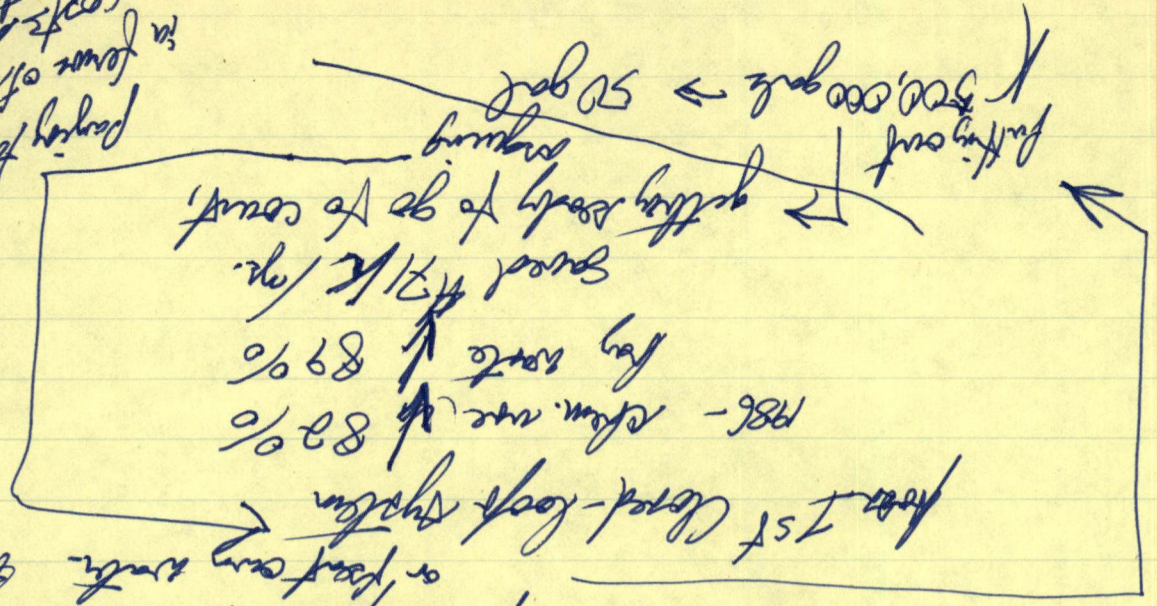
1990 - many agencies / activities / long term
coord.
\$500-600 million; integrity, coord.
Cof. Learning

Max Ems. Pol. Act
NEPA
- Envtl impact statement (see impact in front)
free cap

(It's see as bureaucracy - but they do
1990 - we reorganized entire concerns w/ us.
action Pol. gov. take

ie. Energy efficiency - low-income housing
water in wastewater, flood risk's

paying for itself
in lower off-peak
costs - more
in lower off-peak
costs - more



Rebating (from them) electricity

BASF - monitor by name
reduce prod. by 1 ton from, save \$1,000
concrete fac. (1/2), use by-products
reducing different
resource - 1/2 price
it cheaply, effectively, at the
level - how do we stop
delete the: spend on change
our pollution or not?

Energy Efficiency

Pollution free - Year. Δ from 70s

Germany - sulfur control

are looked globally.
likely used with 10 years
i.e., large from France
Newspaper from & Germany
Parisian plan

Sci. & Tech - we may lead, but don't
Euro. center technology

(B)

in spite of help given by 7 a. 11/11
for even yet grows > 3x fast as pop.
Between 70 & 87 / and GNP (70-87) increase of 72%
Food - down 96% - Sugar - down 28%
Total hydrocarbon & @ same time ↓ 28% and 38% resp.
Particulates ↓ 61%.

The idea that pollution is inevitable by-product
of progress (not to exist), however.
SATISFIED? NO. What is why Mr. C.M.A.

→ PATRIERSHIP ←
→ SUSTAINABLE DEVELOPMENT ←

Colquhoun This is our shared goal. We need to work with you

Miss Lady Mrs. Brooks / Miss part of this army.
[Bourne, Deane, Ellis, MATTHEWS]

your front at that.

copy of E.I. captured on cs. of Mr. Water. Holgarin

New - 137 notes, 7 contacts. Part to look at work,

and at ourselves, as a whole.

Our intention. We are able to anticipate Montreal.

Richard, E. in favour as cap. strike, Calcutta
Proof of what we're doing about
can. growth & future. Probe.
of Parliament

— Central Interactions

90s
70s experimental

the first step in a way of open
globally that we need more of.

Optimal Protocol: 1st time when world starts, open.

— it was in anticipation, not response

(Habit to be seen sci, are stopped for
or want.

— req. mode of dev. routine
(e.g. consistency toward
specific needs
of dev. routine.

— req. info. of cons. participation.
of dev. routine.

— Learning (There is not a consensus)

Conflict of dev. countries.
O2: low carb. f.b. /
Overabundance
A common understanding.

Prof. ~~_____~~

Nurse - when U.S. again → with Middle East price

Ken. a ~~_____~~ ~~_____~~ ~~_____~~

→ notes covered a lot of the handwriting.

Notes made from program -

exp. last report E. May → 7 contracts

this week, self program.

can help some countries

(copy ahead)

offered food.

Climate Change ACTION INSERT 8

We don't believe -- we have never believed --
that ^{further} research is any substitute for action.
"no regrets" or "all weather" policies -

Worried ^{Staff} admin. has
discussed them
in detail
can no separate now

- CFCS
- CAA
- Doc - Nat'l Energy Strat
- planting trees
- Diplomacy - rain forests, left branch

at Brandy 9, 10

The President has just submitted a budget for Fiscal Year 1991. It includes over \$2 billion in new spending to protect the environment. Further, funding for the U.S. Global Change Research Program will increase by nearly 60 percent, to over \$1 billion. The President's commitment, by far the largest ever made by any nation, reflects the administration's determination to increase our understanding of the science of climate change.

Energy:

Goal: incr. production
Now: reduce consumption

We have a comprehensive nat'l energy policy

Pollution:

At source, rather than miti./biti

Technology on a human scale

THE WHITE HOUSE

Office of the Press Secretary
(Brussels, Belgium)

For Immediate Release

December 4, 1989

FACT SHEET

The President's Initiatives During the Malta Meeting

December 2 - 3, 1989

The President and Chairman Gorbachev exchanged views on a variety of issues during their meetings in Malta, including the remarkable events leading to peaceful and democratic change in Eastern and Central Europe.

The President noted his strong support for perestroika and suggested that the two leaders work to give major new impetus to the U.S.-Soviet relationship. The President conveyed his strong personal commitment to this goal.

In this spirit, the President put forward the following ideas:

Next Steps

1. Holding the Summit in the United States during the last two weeks in June.
2. Having the next meeting of Foreign Ministers next month in the Soviet Union to prepare for the Summit.

Economics and Commercial Relations

1. Targeting the 1990 Summit for completion of a trade agreement granting Most Favored Nation status to the Soviet Union, so that the President can grant a Jackson-Vanik waiver at that time. To reach that goal, the President proposed beginning negotiations on a trade agreement now and urged the Supreme Soviet to complete action on its emigration legislation early next year.
2. Supporting observer status for the Soviet Union in GATT after the Uruguay Round is completed next year. The President urged the Soviet Union to use the intervening time to move toward market prices at the wholesale level so its economy will become more compatible with the GATT system.
3. Expanding U.S.-Soviet technical economic cooperation. The President presented a paper proposing specific economic projects, covering topics such as finance, agriculture, statistics, small business development, budgetary and tax policy, a stock exchange, and anti-monopoly policy.
4. Exploring with Congress the lifting of statutory restrictions on export credits and guarantees after a Jackson-Vanik waiver.
5. Beginning discussions of a bilateral investment treaty that would provide protections for American business people who want to invest in the Soviet Union.
6. Improving ties between the Soviets and the OECD, and East-West economic cooperation through the economic basket of the CSCE process.

Human Rights

Resolving all divided family issues by the time of the 1990 Summit. In this regard, the President handed over a list of people wishing to emigrate.

Regional Issues

Expressed disappointment with Soviet policy on Central America, noting it was out of step with the new Soviet direction domestically in Eastern Europe and in arms control. Nicaragua/Cuba remains the single most disruptive factor in the relationship.

Arms Control

1. Speeding achievement of a chemical weapons ban by offering to end U.S. production of binary weapons when the multilateral convention on chemical weapons enters into force, in return for Soviet acceptance of the terms of our UN proposal to ban chemical weapons.
2. Proposing to sign an agreement at the 1990 Summit to destroy U.S. and Soviet chemical weapons down to 20 percent of the current U.S. level.
3. Suggesting joint U.S.-Soviet support for a CFE Summit to sign a CFE treaty in 1990.
4. Accelerating the START process in order to resolve all substantive issues and to conclude a treaty, if possible, by the 1990 Summit. To this end, the President suggested that Secretary Baker and Foreign Minister Shevardnadze concentrate on resolving at their January meeting three of the outstanding START issues: ALCMs, non-deployed missiles, and telemetry encryption.
5. Completing work on the Threshold Test Ban Treaty (TTBT) and the Peaceful Nuclear Explosions Treaty (PNET) for signature at the 1990 Summit.
6. Proposing that the Soviet Union join efforts to constrain missile proliferation more effectively by observing the limits developed by the U.S. and its allies in the Missile Technology Control Regime.

Military Openness

Making public more information on military programs. The President suggested that the Soviet Union make public the details of its military budget, force posture, and weapons production figures, just as the United States now does.

Olympics

Suggesting joint U.S.-Soviet support for Berlin as the site of the 2004 Olympic Games.

Environment

1. Hosting a conference next fall to negotiate a framework treaty on global climate change, after the working groups of the UN-sponsored Intergovernmental Panel on Climate Change submit their final report.
2. Convening an international meeting at the White House next spring for top level scientific, environmental, and economic officials to discuss global climate change issues. The President expressed hope that the Soviets will join us by sending their top officials in the field.

Student Exchanges

Increasing significantly university exchanges so that an additional 1,000 American and 1,000 Soviet college students are studying in each other's country by the beginning of the 1991 school year.

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MANAGING PLANET EARTH



The Changing Climate

Global warming should be unmistakable within a decade or two. Prompt emission cuts could slow the buildup of heat-trapping gases and limit this risky planetwide experiment

by Stephen H. Schneider

In 1957 Roger Revelle and Hans E. Suess of the Scripps Institution of Oceanography observed that humanity is performing a "great geophysical experiment," not in a laboratory, not in a computer, but on our own planet. The outcome of the experiment should be clear within decades, but it essentially began at the start of the Industrial Revolution. Since then human beings have increased the atmospheric content of carbon dioxide by about 25 percent by burning coal, oil and other fossil fuels and by clearing forests, which releases carbon dioxide as the litter is burned or decays.

Carbon dioxide makes up only a thirtieth of 1 percent of the atmosphere, but together with water vapor and other gases present in much smaller quantities, such as methane and the chlorofluorocarbons (CFC's), it plays a major role in determining the earth's climate. As early as the 19th century it was recognized that carbon dioxide in the atmosphere gives rise to a greenhouse effect. The glass of a greenhouse allows sunlight to stream in freely but blocks heat from escaping, mainly by preventing the warm air inside the greenhouse from mixing with outside air. Similarly, carbon dioxide and other greenhouse gases are relatively transparent to sunshine but trap heat by more efficiently absorbing the longer-wavelength infrared radiation released by the earth.

STEPHEN H. SCHNEIDER is head of the interdisciplinary climate-systems program at the National Center for Atmospheric Research (NCAR) in Boulder, Colo. Schneider, who holds a Ph.D. from Columbia University, has written more than 100 scientific papers and has often been a spokesman for climatology—as a witness before Congress, an adviser to the federal government and an author of several popular books. The views expressed in this article are not necessarily those of the National Science Foundation, NCAR's sponsor.

By now the atmosphere's heat-trapping ability has been well established. For example, as seen from space, the earth radiates energy at wavelengths and intensities characteristic of a body at -18 degrees Celsius. Yet the average temperature at the surface is some 33 degrees higher: heat is trapped between the surface and the level, high in the atmosphere, from which radiation escapes. There is virtually no doubt among atmospheric scientists that increasing the concentration of carbon dioxide and other gases will increase the heat trapping and warm the climate.

What, then, is the question that the ongoing geophysical experiment will settle? Even though there is virtually no debate among scientists about the greenhouse effect as a scientific proposition, there is controversy. Will the rising concentrations of greenhouse gases raise the earth's temperature by one, five or eight degrees C? Will the increase take 50, 100 or 150 years? Will it be drier in Iowa or wetter in India? There is still more controversy when it comes to policy: Should steps be taken to reduce the greenhouse warming or to anticipate its effects? What steps, and when? In the face of so much controversy, an understanding of what is well known, known slightly and not known at all about the greenhouse warming is essential.

Circumstantial evidence from the geologic and historical past bears out a link between climatic change and fluctuations in greenhouse gases. Between 3.5 and four billion years ago the sun is thought to have been about 30 percent fainter than it is today. Yet life evolved and sedimentary rock formed under the faint young sun: at least some of the earth's surface was above the freezing point of water. Some workers have proposed that the early atmosphere contained as much as 1,000 times today's level of carbon dioxide, which

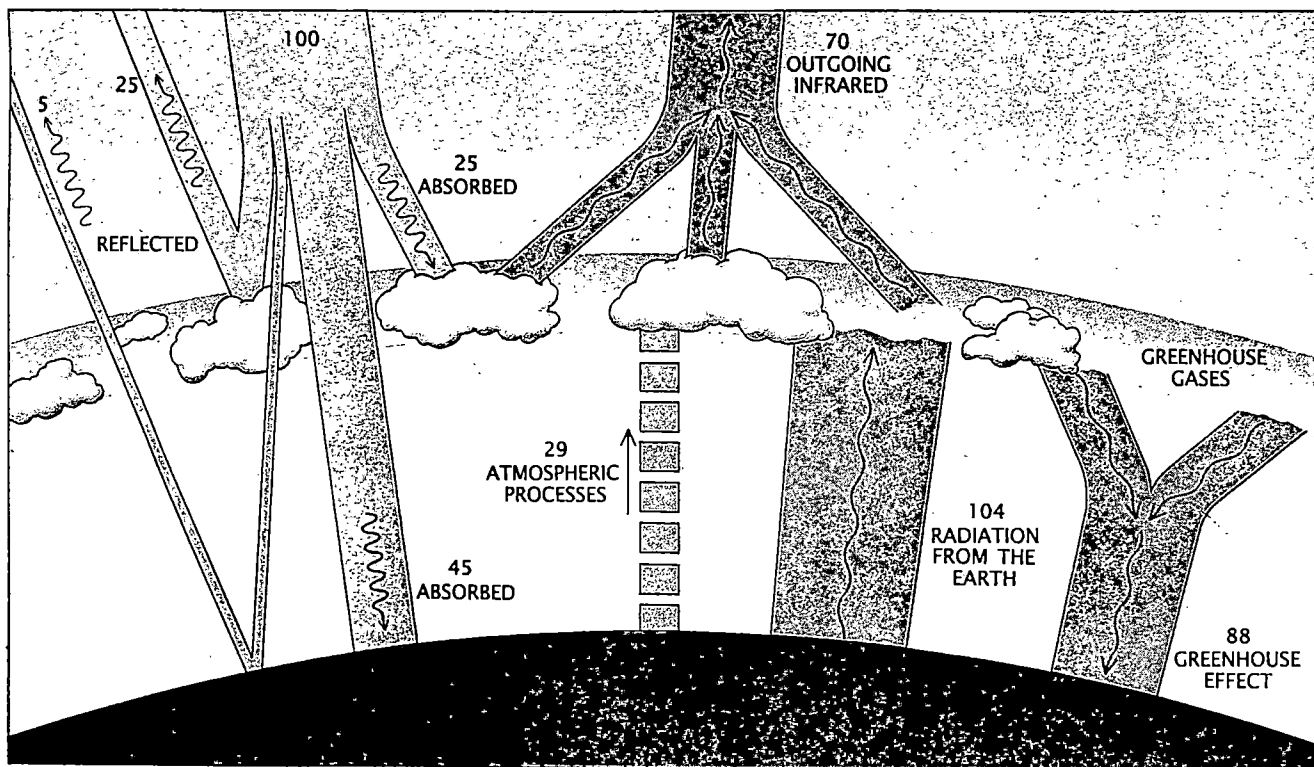
compensated for the sun's feeble radiation by its heat-trapping effect.

Later an enhanced greenhouse effect may have been partly responsible for the warmth of the Mesozoic era—the age of the dinosaurs—which fossil evidence suggests was perhaps 10 or 15 degrees C warmer than today. At the time, 100 million years ago and more, the continents occupied different positions than they do now, altering the circulation of the oceans and perhaps increasing the transport of heat from the Tropics to high latitudes. Yet calculations by Eric J. Barron, now at Pennsylvania State University, and others suggest that paleocontinental geography can explain no more than half of the Mesozoic warming.

Increased carbon dioxide can readily explain the extra heating, as Aleksandr B. Ronov and Mikhail I. Budyko of the Leningrad State Hydrological Institute first proposed and as Barron, Starley L. Thompson of the National Center for Atmospheric Research (NCAR) and I have calculated. A geochemical model constructed by Robert A. Berner and Antonio C. Lasaga of Yale University and the late Robert M. Garrels of the University of South Florida suggests that the carbon dioxide may have been released by unusually heavy volcanic activity on the mid-ocean ridges, where new ocean floor is created by upwelling magma [see "The Geochemical Carbon Cycle," by Robert A. Berner and Antonio C. Lasaga; SCIENTIFIC AMERICAN, March].

Direct evidence linking greenhouse gases with the dramatic climatic changes of the ice ages comes from bubbles of air trapped in the Antarctic ice sheet by the ancient snowfalls that

PARCHED FIELDS turn to sand during a 1983 dry spell in Texas. Such images could multiply if, as several computer models predict, global warming reduces soil moisture in midcontinental regions, where grain production is concentrated.



HEAT TRAPPING in the atmosphere dominates the earth's energy balance. Some 30 percent of incoming solar energy is reflected (left), either from clouds and particles in the atmosphere or from the earth's surface; the remaining 70 percent is absorbed. The absorbed energy is reemitted at infrared wave-

lengths by the atmosphere (which is also heated by updrafts and cloud formation) and by the surface. Because most of the surface radiation is trapped by clouds and greenhouse gases and returned to the earth, the surface is currently about 33 degrees Celsius warmer than it would be without the trapping.

built up to form the ice. A team headed by Claude Lorius of the Laboratory of Glaciology and Geophysics of the Environment, near Grenoble, examined more than 2,000 meters of ice cores—a 160,000-year record—recovered by a Russian drilling project at the Vostok Station in Antarctica. Laboratory analysis of the gases trapped in the core showed that carbon dioxide and methane levels in the ancient atmosphere varied in step with each other and, more important, with the average local temperature (determined from the ratio between hydrogen isotopes in the water molecules of the ice).

During the current interglacial period (the past 10,000 years) and the previous one, a 10,000-year period around 130,000 years ago, the ice recorded a local temperature about 10 degrees C warmer than at the height of the ice ages. (The earth as a whole is about five degrees warmer during interglacials.) At the same time, the atmosphere contained about 25 percent more carbon dioxide and 100 percent more methane than during the glacial periods. It is not clear whether the greenhouse-gas variations caused the climatic changes or vice versa. My guess is that the ice ages were paced by other factors, such as changes in

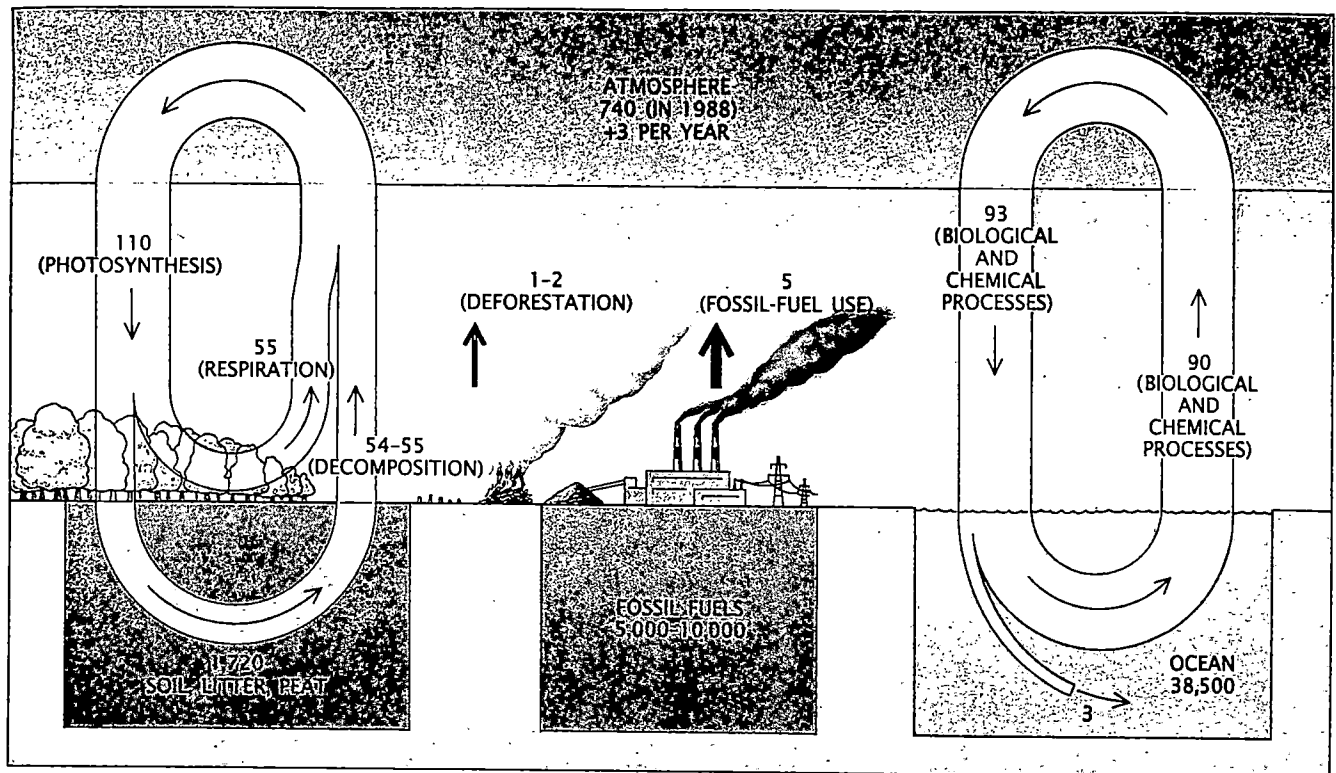
the earth's orbital parameters and the dynamics of ice buildup and retreat, but biological changes and shifts in ocean circulation in turn affected the atmosphere's trace-gas content, amplifying the climatic swings.

A still more detailed record of greenhouse gases and climate comes from the past 100 years, which have seen a further 25 percent increase in carbon dioxide above the interglacial level and another doubling of atmospheric methane. Two groups, one led by James E. Hansen at the National Aeronautics and Space Administration's Goddard Institute for Space Studies and the other by T. M. L. Wigley at the Climatic Research Unit of the University of East Anglia, have constructed records of global average surface temperature for the past century. The workers drew on data from many of the same recording stations around the globe (the Climatic Research Unit also included readings made at sea), but they had different techniques for analyzing the records and compensating for their shortcomings. Certain recording stations were moved over the course of the century, for example, and readings from city centers may have been skewed by heat released by machinery or stored by buildings and pavement.

This "urban heat island" effect is likely to have been disproportionately large in developed countries such as the U.S., but even when the same correction calculated for the U.S. data (by Thomas R. Karl of the National Climatic Data Center in Asheville, N.C., and P. D. Jones of East Anglia) is applied to the global data set, about half a degree C of unexplained "real" warming over the past 100 years remains in both records. In keeping with the trend, the 1980's appear to be the warmest decade on record and 1988, 1987 and 1981 the warmest years, in that order.

Is this the signal of the greenhouse warming? It is tempting to accept it as such, but the evidence is not definitive. For one thing, instead of the steady warming one might expect from a steady buildup of greenhouse gases, the record shows rapid warming until the end of World War II, a slight cooling through the mid-1970's and a second period of rapid warming since then.

What trajectory will the temperature curve follow now? Three basic questions must be answered in forecasts of the climatic future: How much carbon dioxide and other greenhouse gases will be emitted? By how much will atmospheric



CARBON IS EXCHANGED between the atmosphere and reservoirs on the earth. The numbers give the approximate annual fluxes of carbon (in the form of carbon dioxide) and the approximate amount stored in each reservoir in billions of metric tons. The existing cycles—one on land and the other in the oceans—remove about as much carbon from the atmosphere as they add, but human activity (deforestation and fossil-fuel burning) is currently increasing atmospheric carbon by some three billion metric tons yearly. The numbers are based on work by Bert Bolin of the University of Stockholm.

levels of the gases increase in response to the emissions? What climatic effects will the resulting buildups have, after natural and human factors that might mitigate or amplify those effects are taken into account?

Projecting emissions is an intricate exercise in social science. How much carbon dioxide humanity as a whole will be emitting in the future depends primarily on the global consumption of fossil fuels and the rate of deforestation (which accounts for perhaps half of the buildup since the year 1800 and 20 percent of current emissions). Each factor in turn is affected by many others. Growth in fossil-fuel use, for example, will reflect population growth, the rate at which alternative energy sources and conservation measures are adopted and the state of the world economy. Typical projections assume that global fossil-fuel consumption will continue increasing at about its current pace—much slower than it grew before the energy crisis of the 1970's—yielding increases in carbon dioxide emissions of between .5 and 2 percent a year for the next several decades at least.

Other greenhouse gases, such as methane, the CFC's, oxides of nitrogen and low-level ozone, together could contribute as much to global warming

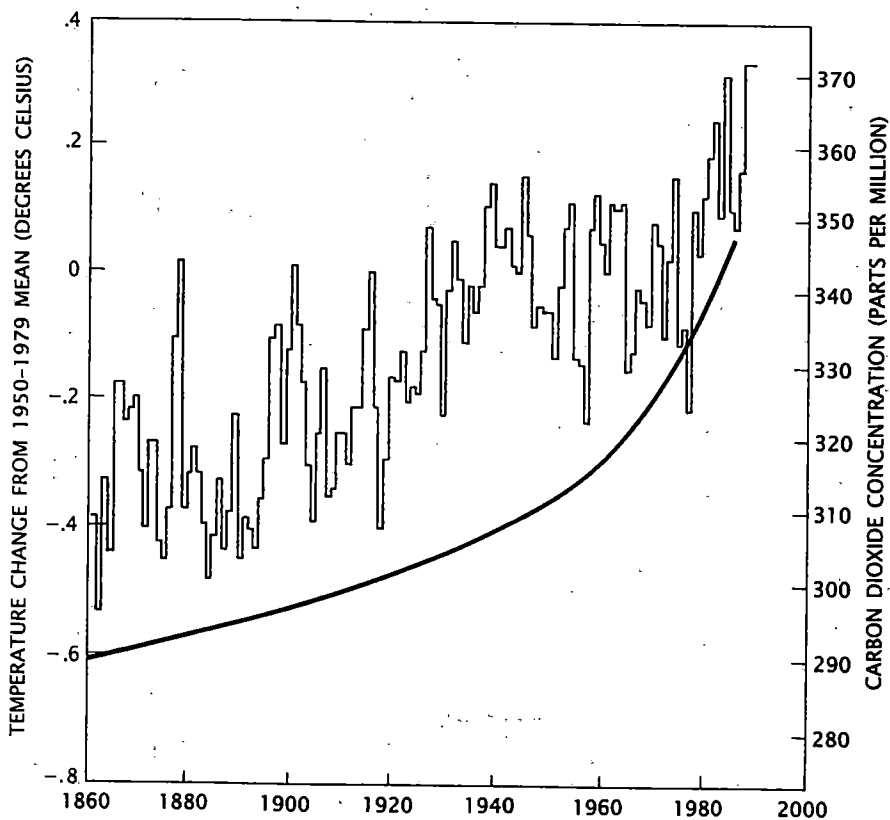
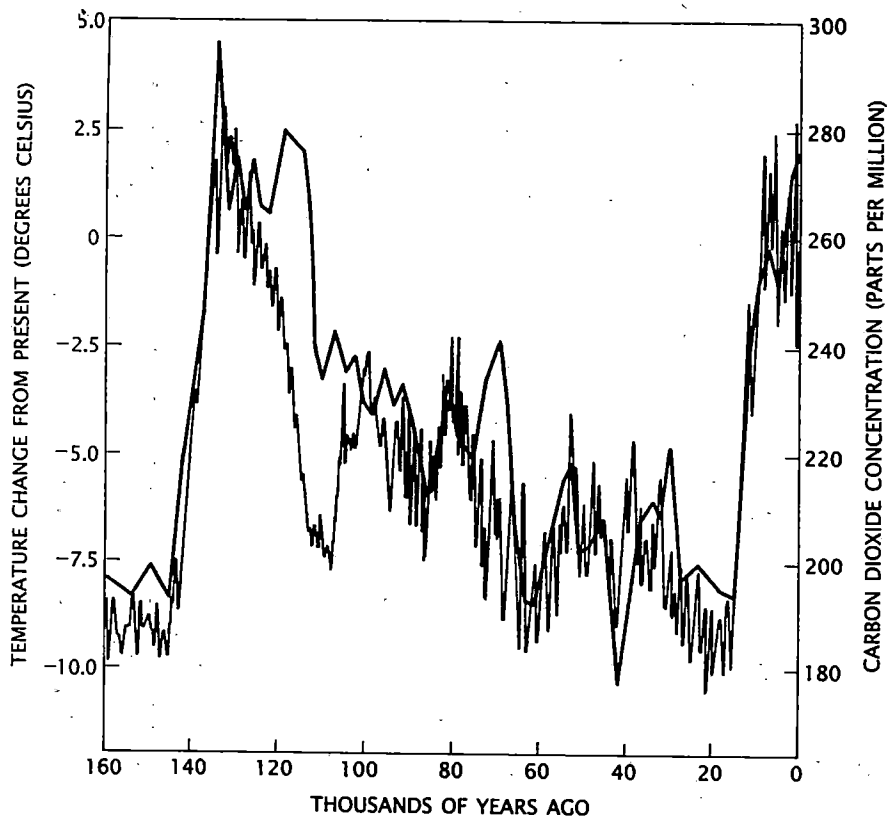
as carbon dioxide, even though they are emitted in much smaller quantities: they are much better at absorbing infrared radiation. But predicting future emissions for these gases is even more complicated than it is for carbon dioxide. The sources of some gases, such as methane, are not well understood; the production of other gases, such as the CFC's and low-level ozone, could rise or fall sharply depending on whether specific technological or policy steps are taken.

Given a plausible scenario for future carbon dioxide emissions, how fast will the atmospheric concentration increase in response? Atmospheric carbon dioxide is continuously being absorbed by green plants and by chemical and biological processes in the oceans. The rate of carbon dioxide uptake is likely to change as the atmospheric concentration changes; that is, feedback processes will enter the equation. Because carbon dioxide is a raw material of photosynthesis, an increased concentration might speed the uptake by plants, counteracting some of the buildup. Similarly, because the carbon dioxide content of the oceans' surface waters stays roughly in equilibrium with that of the atmosphere, oceanic uptake will slow the buildup to some extent. (The slow-

er the buildup is in the first place, the more effective, proportionally, oceanic uptake is likely to be.)

It is also possible, however, that an increased concentration of carbon dioxide and other greenhouse gases will trigger positive feedbacks that would add to the atmospheric burden. Rapid change in climate could disrupt forests and other ecosystems, reducing their ability to draw carbon dioxide down from the atmosphere. Moreover, climatic warming could lead to rapid release of the vast amount of carbon held in the soil as dead organic matter. This stock of carbon—at least twice as much as is stored in the atmosphere—is continuously being decomposed into carbon dioxide and methane by the action of soil microbes. A warmer climate might speed their work, releasing additional carbon dioxide (from dry soils) and methane (from rice paddies, landfills and wetlands) that would enhance the warming. Large quantities of methane are also locked up in continental-shelf sediments and below arctic permafrost in the form of clathrates—molecular lattices of methane and water. Warming of the shallow waters of the oceans and melting of the permafrost could release some of the methane.

In spite of all these uncertainties,



CARBON DIOXIDE AND TEMPERATURE are very closely correlated over the past 160,000 years (top) and, to a lesser extent, over the past 100 years (bottom). The long-term record, based on evidence from Antarctica, shows how the local temperature (color) and atmospheric carbon dioxide rose nearly in step as an ice age ended about 130,000 years ago, fell almost in synchrony at the onset of a new glacial period and rose again as the ice retreated about 10,000 years ago. The recent temperature record shows a slight global warming (color), as traced by workers at the Climatic Research Unit of the University of East Anglia. Whether the accompanying buildup of carbon dioxide in the atmosphere caused the half-degree warming is hotly debated.

many workers expect uptake by plants and by the oceans to moderate the carbon dioxide buildup, at least for the next 50 or 100 years. Typical estimates, based on current or slightly increased emission rates, put the fraction of newly injected carbon dioxide that will remain in the atmosphere at about one half. Under that assumption, the atmospheric concentration will reach 600 parts per million, or about twice the level of 1900, by sometime between the years 2030 and 2080. Some other greenhouse gases are expected to build up faster than carbon dioxide, however.

What effect will a doubling of atmospheric carbon dioxide have on climate? The historical record offers no clear quantitative guidance. Nor can climate—the product of complicated interactions involving the atmosphere, the oceans, the land surface, vegetation and polar ice—be physically reproduced in a laboratory experiment. In exploring the future of the earth's climate, my colleagues and I rely on mathematical climate models.

The models, which have been built at Princeton University's Geophysical Fluid Dynamics Laboratory, the Goddard Institute for Space Studies, here at NCAR and elsewhere, consist of expressions for the interacting components of the ocean-atmosphere system and equations representing the basic physical laws governing their behavior, such as the ideal gas laws and the conservation of mass, momentum and energy. Given values for, say, the input of energy from the sun and the composition of the atmosphere, a model calculates "climate"—temperature and, in sophisticated models, pressure, wind speed, humidity, soil moisture and other variables.

To keep the task computationally manageable, the calculations are done at discrete points in a simplified version of the real world. In the most complicated models—global-circulation models (GCM's), which were first developed for long-term weather forecasts—the atmosphere is represented as a three-dimensional grid with an average horizontal spacing of several hundred kilometers and an average vertical spacing of several kilometers; climate is calculated only at the intersections of the grid lines. In spite of the simplification, running such a GCM for only one simulated year can take many hours on the fastest available supercomputers.

To study the effect of a trace-gas buildup, a modeler simply specifies

the projected amount of greenhouse gases and compares the model results with a control simulation of the existing climate, based on the present atmospheric composition. The results of the most recent GCM's are in rough agreement: a doubling of carbon dioxide, or an equivalent increase in other trace gases, would warm the earth's average surface temperature by between 3.0 and 5.5 degrees C. Such a change would be unprecedented in human history; it would match the five-degree warming since the peak of the last ice age 18,000 years ago but would take effect between 10 and 100 times faster.

The shortcomings of computer models limit the reliability of such forecasts. Many processes that affect global climate are simply too small to be seen at the coarse resolution of a model. Such climatically important processes as atmospheric turbulence, precipitation and cloud formation take place on a scale not of hundreds of kilometers (the scale of the grid in a GCM) but of a few kilometers or less. Since such processes cannot be simulated directly, modelers must find a way of relating them to variables that can be simulated on the model's coarse scale. They do so by developing a parameter—a proportionality coefficient—that relates, say, the average cloudiness within a grid cell to the average humidity and temperature (something the model can calculate).

This strategy, known as parameterization, has the effect of aggregating small-scale phenomena that could act as feedbacks on climatic change, either amplifying or moderating it. Clouds, for example, reflect sunlight back to outer space (tending to cool the climate) and also absorb infrared radiation from the earth (tending to warm it). Which effect dominates depends on the clouds' brightness, height, distribution and extent. Recent satellite measurements have confirmed two-decade-old calculations showing that clouds currently have a net cooling effect; the earth as a whole would be much warmer under cloudless skies. But climatic change might cause incremental changes in cloud characteristics, altering the nature and amount of the feedback. Present models, crudely reproducing only average cloudiness, can say little that is reliable about cloud feedback—or about the many other feedbacks that depend on parameterized processes.

Another shortcoming of present models is their crude treatment of the oceans. The oceans exert potent effects on the present climate and will



ICE CORE—a segment of a two-kilometer core drilled from the Antarctic ice sheet at the Soviet Union's Vostok Station—contains trapped bubbles of ancient air. Analysis of the bubbles and of the ratio of hydrogen isotopes in the ice, which varies with local temperature, enabled Claude Lorius and his colleagues at the Laboratory of Glaciology and Geophysics of the Environment, near Grenoble, to reconstruct a 160,000-year record of trace gases and temperature (see top illustration on opposite page).

surely influence climates to come. Their enormous thermal mass will act as a "thermal sponge," slowing any initial increase in global temperature while the oceans themselves warm up. The magnitude of the effect will depend on ocean circulation, which in turn may change as the earth warms. In principle, a climate model should couple a simulated atmosphere with oceans whose dynamics are simulated in equal detail. The computational challenge is staggering, however, and in most GCM's applied to greenhouse warming the dynamics of the oceans are simplified, treated at coarse resolution or left out.

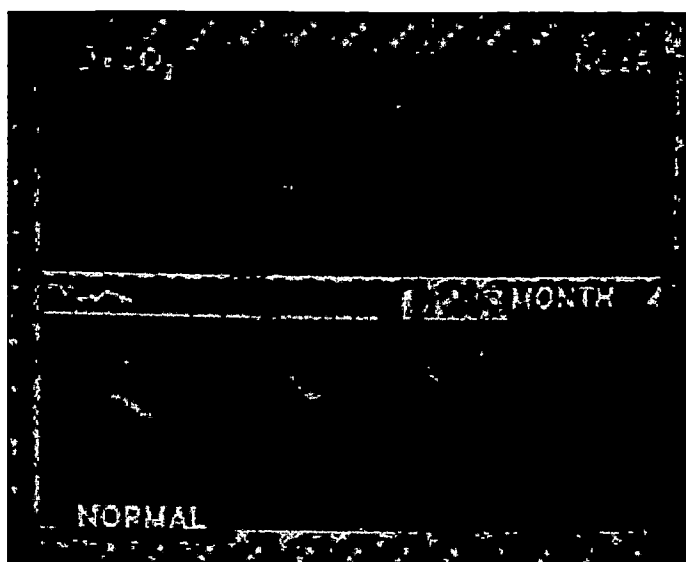
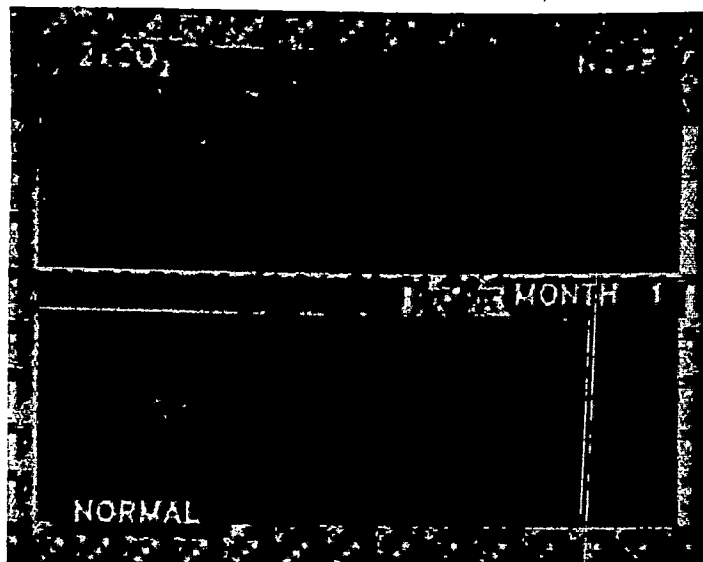
In addition to limiting the reliability of global forecasts, the simplified treatment of the oceans also prevents the models from giving a definitive picture of how climate will change over time in specific regions. Ideally one would like to know not only how much the world as a whole will warm but also whether it will, say, get drier in Iowa, wetter in India or more humid in New York City. Yet, as long as the oceans are out of equilibrium with the atmosphere, their thermal effects will be felt differently at different places. An area in which there is little mixing between surface waters and cold, deep waters might warm quickly; high-latitude regions where deep water is mixed up to the surface might warm more slowly. These thermal effects could in turn affect wind patterns, thereby altering other regional variables, including humidity and rainfall. (Regional forecasts are also compromised in many models by simplified representations of vegetation, which ignore climatically important process-

es such as the release of water vapor by plants and their effect on surface albedo, or reflectiveness.)

Nevertheless, climatologists have grounds for considerable confidence in their models' forecasts of global surface-temperature change. Individual model elements can be verified by comparing them with the results of a more detailed submodel—a smaller, finer-scale simulation—or with real data. Cloud parameterizations, for example, can be tested against actual measurements of the relation of temperature and humidity to cloudiness within an area corresponding to a cell in the model.

The skill of a model as a whole, and in particular its ability to account for relatively fast processes, such as changes in atmospheric circulation or average cloudiness, can be verified by checking its ability to reproduce the seasonal cycle—a twice-yearly change in hemispheric climate that is larger than any projected greenhouse warming. In spite of parameterization, most GCM's map the seasonal cycle of surface temperature quite well, but their ability to simulate seasonal changes in other climatic variables, including precipitation and relative humidity, has not been studied as thoroughly.

During the course of decades (the expected time scale for unmistakable global warming), other, slower processes that do not affect the seasonal cycle come into play: changes in ocean currents or in the extent of glaciers, for instance. Simulations of past climates—the ice ages or the Mesozoic hothouse—serve as a good check on the long-term accuracy of climate



SNAPSHOTS OF A GREENHOUSE WORLD come from a climate model used by the author and Starley L. Thompson at the National Center for Atmospheric Research. The model traced

surface temperatures over the year for an atmosphere with twice the present level of carbon dioxide (top); the findings were compared with the results of a yearlong simulation for

models. To such tests of overall validity can be added simulations of the climates of other planets, such as Venus, where a dense greenhouse atmosphere maintains a surface temperature of about 450 degrees C.

The record of the past 100 years provides the only direct test of the models' ability to simulate the effects of the ongoing greenhouse-gas increase. When a climate model is run for an atmosphere with the composition of 100 years ago and then run again for the historical 25 percent increase in carbon dioxide and doubling in methane, does it "predict" the observed half-degree warming? Actually most models yield a somewhat larger warming, of at least a degree.

If the observed temperature increase really is a greenhouse warming and not just "noise"—a random fluctuation—one might account for the disparity in various ways. Perhaps the models are simply twice too sensitive to small increases in greenhouse gases, or perhaps the incomplete and inhomogeneous network of thermometers has underestimated the global warming. Conceivably some other factor, not well accounted for in the models, is delaying or counteracting the warming. It might be that the heat capacity of the oceans is larger than current models calculate, that the sun's output has declined slightly or that volcanoes have injected more dust into the stratosphere than is currently known, thereby reducing the solar energy reaching the ground.

It may be significant that the transient cooling interrupting the warm-

ing trend began around 1940 and was most pronounced in the Northern Hemisphere, coinciding in time and place with a sharp increase in emissions of sulfur from coal- and oil-burning factories and power plants. The sulfur, a major cause of acid rain, is emitted as a gas, sulfur dioxide, but is transformed into fine sulfate particles once in the atmosphere. The particles can travel long distances and serve as condensation nuclei for the formation of cloud droplets, and so they may make some clouds denser and brighter, increasing their cooling effects. In addition, if no soot is bound to the sulfate, it forms a reflective haze even in cloudless skies. Sulfur emissions could be one factor that has held a greenhouse warming down somewhat in the Northern Hemisphere, especially since World War II.

The discrepancy between the predicted warming and what has been seen so far keeps most climatologists from saying with great certainty (99 percent confidence, say) that the greenhouse warming has already taken hold. Yet the discrepancy is small enough, the models are well enough validated and other evidence of greenhouse-gas effects on climate is strong enough, so that most of us believe that the increases in average surface temperature predicted by the models for the next 50 years or so are probably valid within a rough factor of two. (By "probably" I mean it is a better-than-even bet.) Within a decade or so, warming of the predicted magnitude should be clearly evident, even in the noisy global temperature record. But waiting

for such conclusive, direct evidence is not a cost-free proposition: by then the world will already be committed to greater climatic change than it would be if action were taken now to slow the buildup of greenhouse gases. Of course, whether or not to act is a value judgment, not a scientific issue.

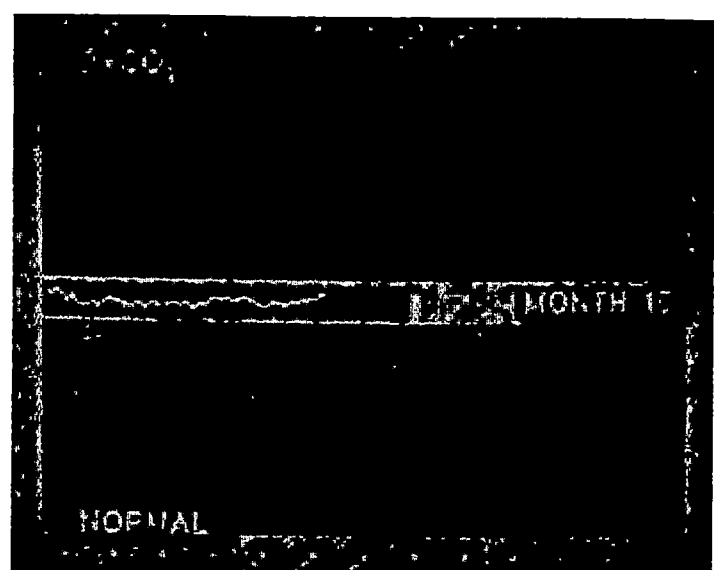
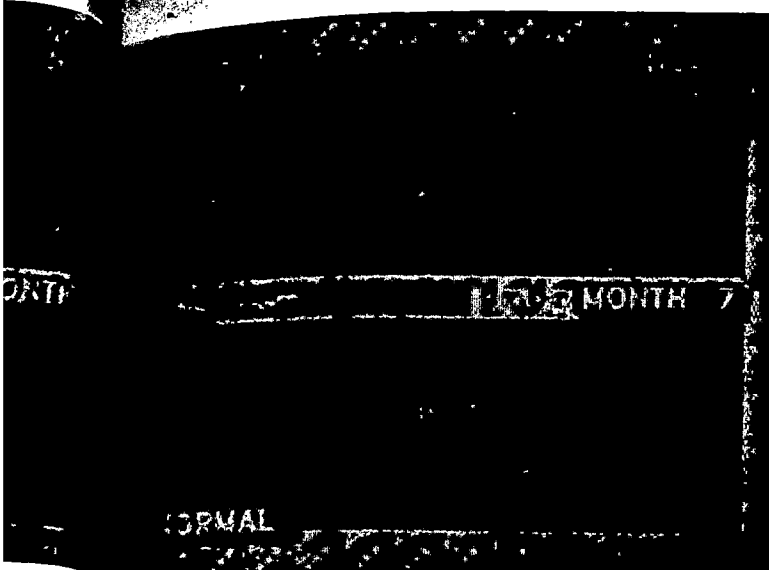
Why worry about changes in climate on the scale predicted by the models? Changes in temperature and precipitation could threaten natural ecosystems, agricultural production and human settlement patterns. Particular forest types, for example, grow in geographic zones defined largely by temperature. The belt of spruce and fir that now spans Canada grew far to the south at the end of the last ice age 10,000 years ago, hugging the edge of the ice sheet. As the climate warmed by one or two degrees every 1,000 years and the ice retreated, the forest belt migrated northward, at perhaps one kilometer a year. Forests probably could not sustain the much faster migration required by the projected warming, and many ecosystems cannot migrate in any case: they exist only in preserves, which might become marooned in a newly inhospitable climate zone.

Human activities could be affected directly if a warming speeded the evaporation of moisture, reducing stream runoff; in the western U.S. a temperature increase of several degrees C could decrease runoff in the Colorado basin substantially even if precipitation held steady. As water ran short, faster evaporation would in-

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the present atmosphere (bottom). The red areas were more than six degrees C warmer than the model-calculated normal for that time of year under existing conditions; the light

blue areas were more than six degrees colder. The weather anomalies steadily changed position, shape and size, but heating always predominated in the greenhouse simulation.

crease the demand for irrigation, adding to the strain on water supplies. At the same time, water quality might suffer as the same waste volume was diluted in lower stream volumes.

What is more, several climate models predict that summer precipitation will actually decline in midcontinental areas, including the central plains of the U.S. The late Dean F. Peterson, Jr., of Utah State University and Andrew A. Keller of Keller-Bliesner Engineering in Logan, Utah, estimated the effects on crop production of a three-degree warming combined with a 10 percent drop in precipitation. They found that based on increased crop water needs and a reduction in available water, the viable acreage in arid regions of the western states and the Great Plains would fall by nearly a third. (A western drying might also result in an increased frequency of wildfires.)

Coastal areas, meanwhile, might face a rise in sea level. Most workers expect a global temperature increase of a few degrees C over the next 50 or 100 years to raise sea level by between .2 and 1.5 meters as a result of the thermal expansion of the oceans, the melting of mountain glaciers and the possible retreat of the Greenland ice sheet's southern margins. (Ice could actually build up in Antarctica owing to warmer winters, which would probably increase snowfall.) The rising sea would endanger coastal settlements and ecosystems and might contaminate groundwater supplies with salt. In spite of many local factors that make it difficult to isolate a consistent global signal, one group of workers

recently claimed to have found a uniform worldwide rise in sea level of about two millimeters a year in long-term tide-gauge records. That rise is somewhat larger, however, than one would have expected from the warming seen so far.

Clearly these direct effects of climatic change would have powerful economic, social and political consequences. A decline in agricultural productivity in the Middle West and Great Plains, for example, could be disastrous for farmers and the U.S. economy. By cutting into the U.S. grain surplus, it might also have serious implications for international security.

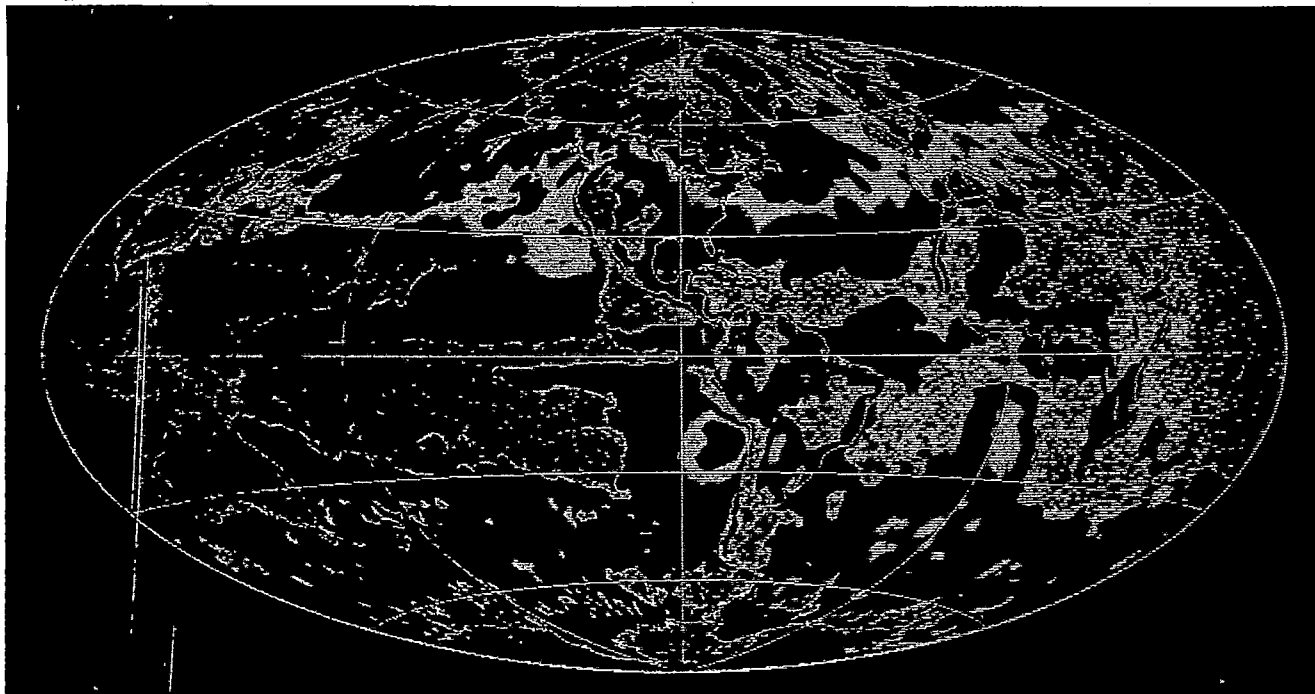
To be sure, not everyone would lose. If the corn belt simply moved north by several hundred kilometers, for example, Iowa's billion-dollar loss could become Minnesota's billion-dollar gain. But how could the losers be compensated and the winners charged? The issue of equity would become still more thorny if it spanned borders—if the release of greenhouse gases by the economic activities of one country or group of countries did disproportionate harm to other countries whose activities had contributed less to the buildup.

In the face of this array of threats, three kinds of responses could be considered. First, some workers have proposed technical measures to counteract climatic change—deliberately spreading dust in the upper atmosphere to reflect sunlight, for instance. Yet if unplanned climatic changes themselves cannot be pre-

dicted with certainty, the effects of such countermeasures would be still more unpredictable. Such "technical fixes" would run a real risk of misfiring—or of being blamed for any unfavorable climatic fluctuations that took place at the same time.

Many economists tend to favor a second class of action: adaptation, often with little or no attempt to anticipate damages or prevent climatic change. Adaptive strategists argue that the large uncertainties in climate projections make it unwise to spend large sums trying to avert outcomes that may never materialize. They argue that adaptation, in contrast, is cheap: the infrastructure that would have to be modified in the face of climatic change—such as water-supply systems and coastal structures—will have to be replaced in any case before large climatic changes are due to appear. The infrastructure can simply be rebuilt as needed to cope with the changing environment.

Passive adaptation relies mostly on reacting to events as they unfold, but some active adaptive steps could be taken now to make future accommodation easier. An American Association for the Advancement of Science panel on climatic change made a strong, potentially controversial but, I believe, compelling suggestion for active adaptation: governments at all levels should reexamine the technical features of water systems and the economic and legal aspects of water-supply management in order to increase the systems' efficiency and flexibility. As the climate warms and precipita-



CLOUDS AFFECT SURFACE TEMPERATURES because they both reflect sunlight, preventing it from warming the earth, and absorb infrared radiation from the surface, contributing to the greenhouse effect. In this image, based on satellite data gathered in April, 1985, clouds had a net cooling effect in some

regions (*blues and green*) and a heating effect in others (*red*). On the whole, clouds cool the planet more than they warm it, but the characteristics of clouds and their effect on climate might change unpredictably in a greenhouse world. The image was provided by V. Ramanathan of the University of Chicago.

tion and runoff change, water shortages may grow more common and needs for regional transfers more complex. Even if climate did not change, more flexible water systems would make it easier to cope with the normal extremes of weather.

The third and most active category of response is prevention: curtailing the greenhouse-gas buildup. Energy-conservation measures, alternative energy sources or a switch from coal to natural gas and other fuels with a lower carbon content could all reduce carbon dioxide emissions, as could a halt to deforestation. Stopping the production of CFC's, already notorious because of their ability to erode the stratospheric ozone layer, would eliminate another component of the buildup. A far-reaching proposal for an international framework for reducing emissions was put forward in 1976 by Margaret Mead and William W. Kellogg of NCAR: a "law of the air," which would keep emissions of carbon dioxide below a global standard by assigning polluting rights to each nation.

Proposals for immediate action are controversial because they often entail large immediate investments as insurance against future events whose details are far from certain. Is there some simple principle

that can help us to choose which preventive or adaptive measures to spend our resources on? I believe it makes sense to take actions that will yield "tie-in" benefits even if climatic changes do not materialize as forecast.

Pursuing energy efficiency is a good example of this tie-in strategy. More efficient fossil-fuel use will slow the carbon dioxide buildup, but even if the sensitivity of climate to carbon dioxide has been overstated, what would be wasted by taking this step? Efficiency usually makes economic sense, and a reduction in fossil-fuel use would curb acid rain and urban air pollution and lessen the dependence of many countries on foreign producers. Developing alternative energy sources, revising water laws, searching for drought-resistant crop strains, negotiating international agreements on trade in food and other climate-sensitive goods—all these steps could also offer widespread benefits even in the absence of any climatic change.

Often such steps will nonetheless be costly and politically controversial. Regulations or incentives to foster energy-efficient technologies might burden some groups—coal miners and the poor, perhaps—more than others, and the costs may be proportionally greater for poor countries than for rich ones. Actions to prevent a green-

house warming will have to be coupled with domestic- and foreign-policy measures that attempt to balance fairness and effectiveness. Still, I believe it is better to fight poverty and foster development through direct investment rather than through artificially low energy prices that neglect the costs of the resulting environmental disruptions.

Some people argue that the free market, not government regulation or tax incentives, should dictate increases in energy efficiency, say, or the elimination of CFC's. But it cannot be logically argued that the market is "free" when it does not include some of the potential costs of environmental damage caused by goods or services. Moreover, even political conservatives agree that an economic calculus must give way to a strategic consciousness when national or global security is at stake.

Security is indeed at stake here, as the implications of a global temperature rise of several degrees or more over the next century make clear. Adding to the predicted threats are surprises that may be lurking in the greenhouse century: a sharp positive feedback in the greenhouse-gas buildup from accelerated decay of soil organic matter, dramatic changes in

regional climates because of a shift in ocean circulation, or the outbreak of new diseases or agricultural pests as ecosystems are disrupted. In my value system—and this is a political and not a scientific judgment—effective tie-in actions are long overdue.

I am often asked whether I am pessimistic because it will be impossible to avert some global change: at this stage, it appears, no plausible policies are likely to prevent the world from warming by a degree or two. Actually I see a positive aspect: the possibility that a slight but manifest global warming, coupled with the larger threat forecast in computer models, may catalyze international cooperation to achieve environmentally sustainable development, marked by a stabilized population and the proliferation of energy-efficient and environmentally safe technologies. A much larger greenhouse warming (together with many other environmental disruptions) might thereby be averted.

The developed world might have to invest hundreds of billions of dollars every year for many decades, both at home and in financial and technical assistance to developing nations, to achieve a stabilized and sustainable world. It is easy to be pessimistic about the prospects for an international initiative of this scale, but not long ago a massive disengagement of NATO and Warsaw Pact forces in Europe also seemed inconceivable. Disengagement now seems to me to be possible, even likely. Perhaps the resources such an agreement would free and the model of international cooperation it would provide could open the way to a world in which the greenhouse century exists only in the microchips of a supercomputer.

FURTHER READING

THE GREENHOUSE EFFECT, CLIMATIC CHANGE, AND ECOSYSTEMS. Edited by Bert Bolin, B. R. Döös, Jill Jäger and Richard A. Warrick. John Wiley & Sons, 1986.

AN INTRODUCTION TO THREE-DIMENSIONAL CLIMATE MODELING. Warren M. Washington and Claire L. Parkinson. University Science, 1986.

CLOUD-RADIATIVE FORCING AND CLIMATE: RESULTS FROM THE EARTH RADIATION BUDGET EXPERIMENT. V. Ramanathan et al. in *Science*, Vol. 243, No. 4887, pages 57-63; January 6, 1989.

GLOBAL WARMING: ARE WE ENTERING THE GREENHOUSE CENTURY? Stephen H. Schneider. Sierra Club Books, 1989.

POSSIBLE CLIMATE CHANGE DUE TO SO₂-DERIVED CLOUD CONDENSATION NUCLEI. T. M. L. Wigley in *Nature*, Vol. 339, No. 6223, pages 365-367; June 1, 1989.

Festive

A painted elephant at a spring fair, Varanasi.

Majestic

A view of the Himalayas, Darjeeling.

Timeless

Ancient stone temple carvings, Konarak.

Wild

The Tiger Reserve, Sunderbans.

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