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OA/ID Number: 29183
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Folder Title:
Science and Technology (Bromley) (1990) [2]

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Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01. Memo	From D. Allan Bromley to John Sununu Re: Bernadine Healy (1 pp.)	9/13/90	P-2, P-5	

Collection:

Record Group: Bush Presidential Records
Office: Chief of Staff to the President, Office of the
Series: Sununu, John, Files
Subseries: White House Offices File
WHORM Cat.:
File Location: Science and Technology (Bromley) (1990) [2]

Open on Expiration of PRA
(Document Follows)
By JP (NLGB) on 10/28/05

Date Closed:	12/16/2004	**OA/ID Number:**	29183-007
FOIA/SYS Case #:	1998-0004-F[1]	**Appeal Case #:**	
Re-review Case #:	2005-0426-S	**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
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P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

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PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

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8

THE WHITE HOUSE

WASHINGTON

September 13, 1990

THE CHIEF of STAFF has seen

MEMORANDUM FOR GOVERNOR SUNUNU

FROM: D. ALLAN BROMLEY Allan

SUBJECT: BERNADINE HEALY

I hoped to have talked to you by the time you get this but just in case we miss contact I wanted to register my strong support for Bernadine Healy's nomination as Director of NIH.

I first met her more than 10 years ago when she was one of two top candidates for the Deanship of the Yale Medical School.

Subsequently, I worked closely with her while she was Deputy Director of OSTP and I was a member of the Reagan Administration Science Council. Specifically, I took her with the groups I led both to India and to Brazil where we negotiated the programs for the Gandhi-Reagan and Sarney-Reagan Science and Technology Programs. I also worked closely with her in the Science Council study on the Federal laboratories and that on the health of U.S. colleges and universities.

Finally, as you will recall, I nominated her to serve as vice-chairman of the President's Council of Advisors on Science and Technology.

In all of these interactions I have been much impressed by her intelligence, common sense, effectiveness, political sensitivity, and by her skills in dealing with people.

I was one of those who, from the very beginning of the search for a new NIH Director, had nominated Dr. Healy as someone who, in my considered opinion, combines the technical and professional competence, the professional recognition and visibility with the management skills and personal qualifications to do an outstanding job as NIH Director.

I support her candidacy enthusiastically.

Beyond that I would only emphasize how important it is for the Bush Administration to have the NIH Director appointment announced as soon as possible. NIH is regarded worldwide as one of our most effective research institutions; indeed a Japanese poll recently rated it first among all the world's research institution. It has been effectively leaderless for more than a year; morale has dropped badly and we are in the process of losing some very distinguished members of the NIH staff to universities and other external institutions.

I am entirely convinced that Bernadine could turn this situation around quickly and with style!

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
02. Memo	From D. Allan Bromley to John Sununu Re: Global Change Strategy Task Force Meeting (2 pp.)	10/5/90	~~P-5~~	

Collection:

Record Group: Bush Presidential Records
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THE WHITE HOUSE

WASHINGTON

October 5, 1990

THE CHIEF of STAFF has seen

MEMORANDUM FOR GOVERNOR SUNUNU

FROM: D. ALLAN BROMLEY
EDE HOLIDAY

SUBJECT: Global Change Strategy Task Force Meeting

The Global Change Strategy Task Force met on Wednesday, October 3. The State Department provided a debriefing on last week's preparatory meetings in Geneva on the framework convention negotiations and the Second World Climate Conference. In addition, the Department of Justice outlined the draft report of the Comprehensive/Incentives Task Force.

Framework Convention Negotiations: The United Nations Environment Programme and the World Meteorological Organization held a September 24-26 preparatory meeting to consider organizational issues for the first negotiating session and the schedule for future negotiating sessions.

The meeting produced several consensus recommendations:

- Negotiations will begin in Washington on February 4 and continue for nine working days. The lawyers will produce a first draft of a convention during the meeting, but actual negotiations will be deferred. Nine days are considered necessary for this process, which the U.S. should be able to influence.

- No draft convention will be distributed prior to February. It is clear that governments, and not Mostafa Tolba, will control the negotiating process.

- Decisions on the convention will be made by consensus, effectively giving all parties a veto.

- There will be a single negotiating forum, avoiding the prospect of the convention being renegotiated by the U.N. General Assembly. (LDCs will move this Fall to have the convention actually negotiated by the General Assembly; as this would likely doom chances of having a convention ready for signature at the June 1992 U.N. environment conference in Brazil, little support is anticipated.)

- o No agreement was reached on the timing of the negotiation of protocols, although it appears the prevailing sentiment is to work toward a simple, pure framework convention for 1992.

- o The IPCC First Assessment Report and supporting documents, including its legal measures paper, will serve as the primary documents for the negotiations. Political declarations such as those signed at Noordvijk and Bergen, will merely provide non-binding background information. The IPCC will provide "objective scientific and technical advice" to the negotiating process, with its exact role to be decided in February.

- o After the first session, most meetings will be held in Geneva, with at least one meeting in Nairobi. Meetings should be no longer than two weeks and will be held at three month intervals (May, August, and November 1991, with additional meetings in 1992.)

- o Non-governmental organizations (NGOs) with a "substantive interest" will be allowed to attend the negotiations as observers, but will be excluded from certain sessions.

A full list of recommendations from the meeting can be found at Tab A. A proposed agenda for the February Washington meeting can be found a Tab B.

Second World Climate Conference: State and Commerce led the U.S. delegation to the September 27-29 preparatory meeting. The draft ministerial declaration was considered and almost all of the language bracketed, which will make it difficult to produce a final declaration. State will propose an alternative draft declaration that is much shorter and more "ministerial" in tone and defers the substantive issues to the negotiations. Norway proposed a similar, though more political, draft in Geneva that was rejected, but State believes that its version may receive a warmer reception. The draft, a copy of which can be found at Tab C, is undergoing interagency review.

Thatcher, Mitterand and Kohl have tentatively accepted invitations to address the ministerial portion of the conference. Mulroney is considering going, but may defer to the U.S. lead. State sent a cable last week indicating that Dr. John Knauss will represent the U.S. at the ministerial.

Comprehensive/Incentives Task Force Report: Dick Stewart from Justice briefed on the draft "Interim Report: Research and Analysis to Support the Comprehensive and Incentives Approaches" (found at Tab D). The report discusses the correlation of the economic incentives approach and the comprehensive global change index based approach. The scope of the report is confined to issues of "how to" rather than "how much." Stewart also obtained approval for a set of priorities to accomplish the support work necessary to implement this approach (found at Tab E).

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
03. Report	Recommendations from ad-hoc working group prior to global change meeting (4 pp.)	n.d.	~~P-5~~	

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IV. RECOMMENDATIONS

The ad-hoc working group of government representatives to prepare for negotiations on a framework convention on climate change adopted by consensus the recommendations listed below in Section A, and identified the option below in Section B, regarding the organization of the negotiating process for a framework convention on climate change. Both sections are submitted for consideration initially by the forty-fifth session of the United Nations General Assembly in pursuance of its resolution 44/207 to recommend ways, means and modalities for further pursuing negotiations, taking into account the work of the Preparatory Committee of the UN Conference on Environment and Development, and then by the negotiating body at its first substantive session scheduled for February 1991 in Washington, D. C., USA.

A. Recommendations adopted by consensus

1. The negotiating process should be organized and conducted in such a manner as to ensure openness, transparency, universality and legitimacy. It should reflect the full participation and commitment of all States to the negotiations.

2. There should be a single negotiating process leading to a framework convention on climate change and any related legal instruments as might be agreed upon.

3. The negotiating body will discuss the policy issues. Governments will need to be represented at a level appropriate for this. The name of the body should also reflect this function in accordance with options suggested in this document.

4. The negotiating body should respond to UN General Assembly decisions. It should also regularly inform the Assembly, through appropriate channels, of progress in its deliberations.

5. The bureau of the negotiating body should reflect a proper geographical representation, balance of interests and specific concerns as mentioned in the Report, and be of strength sufficient to ensure equity and still limited to ensure effectiveness.

6. It is highly desirable that an effective framework convention on climate change, containing appropriate commitments, be ready for signing by governments and by regional economic integration organizations in conjuction with the United Nations Conference on Environment and Development (UNCED) in Brazil, in June 1992. Any related legal instruments might be developed on the basis of consensus decision by the negotiating body.

7. Participation of the maximum number of States and regional economic integration organizations in the negotiating process is considered essential for its success. Countries which have not done so, are urged to set up a national co-ordinating group to handle national information requirements relevant to the negotiations, and to serve as a link to the Secretariat of the negotiations. The special problems associated with ensuring the participation of developing countries, and the recommendations contained in the report of the IPCC to overcome these problems, should receive particular attention. To ensure adequate participation of the developing countries, small island states and least developed countries, a special Trust Fund should be created, on a similar basis to that for the UNCED and the IPCC, to assist in their adequate participation.

8. Rules of procedure of the negotiating body need to be elaborated for approval by the first negotiating session. They should be based on existing relevant rules of procedure, be acceptable by all States, Members of the UN, the Specialized Agencies, IAEA, and regional economic integration organizations, be compatible with the status of the negotiating body, and be such as to ensure active participation by all governments through fully accredited representatives, and be consistent with Recommendation 1 above.

9. Most negotiating sessions should have a maximum duration of two weeks, within available resources.

10. A tentative calendar, to be reviewed at the end of each negotiating session, should be as follows:

February 1991 - Washington D. C., USA
May - June 1991
August - September 1991
November -December 1991

and whichever meetings are needed in 1992, leading into the UN Conference on Environment and Development, Brazil, June 1992.

11. Non-governmental organizations with a substantive interest in the field should be permitted to attend negotiating sessions as observers. The practices of the UN and of the Preparatory Committee for UNCED will provide useful guidance before rules of procedure are finalized.

12. The negotiating body must have a strong, efficient secretariat at its disposal. This would be best assured if the secretariat were:

(1) located in Geneva and working closely with the IPCC Secretariat, although independent of it,

and

(2) the joint administrative responsibility of WMO and UNEP under the guidance of the negotiating body; this arrangement should be reviewed at the time of the first negotiating meeting in Washington in February 1991.

It should be of an appropriate size and quality, (the professionals consisting mainly of WMO and UNEP staff supplemented by professionals seconded by other UN agencies) and be adequately funded, to ensure that meetings are served to UN standards; in particular that documents were always to be available in the six official languages of the UN according to an agreed timetable and that interpretation in the six languages should be available at all negotiating sessions and at meetings of any sub-groups. It should work closely, and as necessary, with agencies of the UN and other international bodies concerned with climate related issues.

13. Taking into account paragraph 6 above, the Preparatory Committee of the UN Conference on Environment and Development should be kept informed of the progress of negotiations.

14. The negotiating body should have a link with the Intergovernmental Panel on Climate Change (IPCC) to ensure that the IPCC can respond to the needs and requests of the negotiators for objective scientific and technical advice.

15. Depending on the decision on ways, means and modalities to be taken in UN General Assembly, the negotiating body may establish sub-groups as needed. Some sub-groups might be required only at a later stage of the negotiations. If there are sub-groups to the negotiating body, not more than two meetings of the main body or sub-groups should be in session simultaneously.

16. The main documentation to serve as a basis for negotiations should be the IPCC First Assessment Report - including its legal and institutional mechanisms - and the background documentation. Other supplementary documents for consideration would include those resulting from previous international conferences on the subject and from the forthcoming Second World Climate Conference and such other documents as the negotiating body chooses.

17. A list of the elements identified by the IPCC for possible inclusion in the framework convention, or other related legal instruments, documents containing such elements, and comparative presentation of general principles of relevant treaties, should be before the negotiating body.

18. Individual governments are encouraged to present papers to the negotiating body, with help from the Secretariat within available resources.

19. The funding of the sessions of the negotiating body, and of the supporting secretariat, should be arranged through provisions in the regular budget of WMO and UNEP and/or with the use of a Trust Fund arrangement and/or other relevant funds.

20. After the first session of the negotiating body in Washington D.C. in February 1991, subsequent meetings should take place in Geneva with at least one of them in 1991 in Nairobi to be decided at the first session in Washington.

B. Option identified by the Ad-hoc Working Group

1. The negotiating body could be an "Intergovernmental Negotiating Committee for a framework convention on climate change", under the auspices of WMO and UNEP, or a "Specialized Conference for the Negotiation of a Framework Convention on Climate Change" with a Secretary-General appointed by the Secretary-General of the United Nations.

V. ADOPTION OF THE REPORT

29 The report of the meeting was adopted on 26 September 1990 at 11.25pm.

VI. CLOSURE OF THE SESSION

30. After usual exchange of courtesies the chairman declared the meeting closed at 11.30pm.

Annex 1

Proposed Agenda

First Negotiating Session

Framework Convention on Climate Change

Washington, D.C.

February 4 - 14, 1991

1. Welcoming Remarks

2. Opening of Meeting: Remarks by WMO Sec-Gen Obasi, UNEP Ex Director Tolba, IPCC Chair Bolin

3. Adoption of Rules of Procedure: Draft to be available

4. Adoption of Agenda

5. Election of Chair

6. Election of Bureau: Refer to Prepcom report and recommendations - would ahead of time

7. Organization of Work: To cover hours of sessions, meeting rooms, translation facilities (available only for negotiationg group and subgroups, not regional and other interest groups)

8. Credentials Committee

9. Statements by Governments: To be brief (10 min max) and focused on issues raised in IPCC and other supporting documents

10. Preparation of Legal Negotiating Text — key item on agenda
    a. work program
    b. establishment of subgroups } subsequent agenda to be discussed - Chairs of groups
    c. legal drafting group
    d. review of draft legal text

11. Future Work
    a. relationship with IPCC
    b. time and place of next meeting

12. Adoption of Report — cleared text, for annex, with brackets

13. Close of Meeting

MINISTERIAL DECLARATION

PREAMBLE

We, Ministers from __ countries, assembled in Geneva, Switzerland, from 6 to 7 November 1990 at the Second World Climate Conference.

Conscious of our responsibility to present and future generations to preserve, protect and defend our fragile planet;

Alarmed by recent evidence that our actions may be altering the atmosphere which nurtures life and sets Earth apart from all other planets;

Uncertain still of what may follow, and at what cost, but convinced that delay will constrain our ability to act;

We embark now with common resolve on an effort which will require strength, resolution and steadfast purpose, an effort which will test every virtue of our peoples, but without which we can have no hope of success.

RISKS AND UNCERTAINTIES

1. Science tells us that gases produced by human activities -- the so-called greenhouse gases -- are accumulating in the atmosphere. Many of these gases are produced naturally and are essential to the habitability of our planet; still, the human contribution, particularly since the dawn of the industrial age, has perturbed their delicate balance in the atmosphere.

2. Science also warns us that the accumulation of greenhouse gases produced by human activities will lead inevitably to a global warming, perhaps at rates faster than any experienced since life as we know it began. Science predicts that the warming will not be even, that it is likely to occur more rapidly at higher latitudes, but that, once begun, we may neither be able to control or reverse it.

3. The state of our knowledge is imperfect -- many important uncertainties remain. Still we are aware that a signficant warming may have harmful consequences for our planet and our peoples. Seas may rise, storms may increase and intensify and many species of life may not be able to adapt.

4. Facing such risks, but acknowledging great uncertainties, we must determine how extensively we must act, what the costs of action and inaction may be, and what measure of success will likely grace our efforts.

5. At this Second World Climate Conference we reaffirm our support for the World Climate Programme and for other cooperative scientific initiatives to resolve the questions before us.

PAST AND PROLOGUE

6. We recall that this endeavor is not without precedent. Our nations have already developed a common stragegy to address a related global crisis -- stratospheric ozone depletion. From a modest beginning in 1985, we have quickly narrowed scientific uncertainties and summoned the resolve to take more stringent but necessary action. That action is also the most significant first step to limit the accumulation in the atmosphere of greenhouse gases from human activities.

7. We have also concluded an unprecedented international effort to analyze the science, impacts, and response options for further dealing with climate change. This effort, initiated under the joint auspices of the World Meteorological Organization and the United Nations Environment Programme, has produced the First Assessment Report of the Intergovernmental Panel on Climate Change. The Report has heightened our awareness and enlisted an increasing number of nations in the search for solutions.

8. We have thus set the stage for negotiations on a framework convention on climate change. We note with satisfaction that these negotiations will begin in three months time and that all parties have resolved to complete the convention, together with any related legal instruments as may then be agreed, by the time of the United Nations Conference on Environment and Development in June 1992.

9. We further note that the United Nations General Assembly will shortly consider ways, means and modalities for further pursuing these negotiations on the basis of recommendations produced one month ago by government representatives.

CALL FOR A GLOBAL STRATEGY

10. While uncertainty complicates our task, it will neither delay nor deter us. We must develop a global strategy to preserve our atmosphere. Our strategy must seek both to slow the predicted rise in temperature and to help us adapt to its effects.

11. It must be <u>universal</u>, involving all nations of the world, for only together can we hope to prevail.

12. It must be comprehensive, addressing all sources and sinks of the gases we produce, for the problem has many aspects, which must be considered together if our efforts are to succeed.

13. It must be equitable, taking into account our differing abilities to act and our differing contributions to past and anticipated future accumulations of greenhouse gases.

14. It must be pragmatic, recognizing our common desire to grow and provide for our peoples, without which prospect hope for human prosperity and dignity will wither.

15. It must also be farsighted, recognizing that future innovation will open possibilities as yet unknown, if we but direct our collective ingenuity to shape that future.

THE EFFORT REQUIRED

16. The challenge before us is great. How we meet it may influence life to come on our planet. We are aware that the effort required will be among the most complex and difficult ever undertaken. Our negotiators must find ways to accomodate a wide range of legitimate concerns while ensuring that we develop a specific program of action.

17. Foremost among these concerns is that shared by all countries -- that the actions we agree to take not foreclose economic growth. This concern is particularly acute among developing countries who have not yet attained the level of prosperity that prevails among countries of the industrialized world. Still, it is not unique to them, for disparities exist as well within the industrialized world.

18. We are aware that negotiators must also find ways to accomodate:

--the concerns of countries now determined to limit and reduce growing emissions of greenhouse gases as well as the concerns of countries whose growth depends on fossil fuel production;

--the concerns of countries, whose forests are integrally tied to their economic development yet which provide a critical element of the world's defense against global warming;

--the concerns of countries which bear a proportionately large degree of risk from the anticipated impacts of climate change, particularly countries in arid and semi-arid regions and small, low-lying coastal and island countries; and

--the concerns of all who understand that the burgeoning growth in our planet's population must be taken into account in our efforts to deal with global climate change.

19. We acknowledge that we must also deal anew with issues we have encountered in other fora, issues whose resolution often still eludes us. In particular, negotiators must develop:

--ways to assure that adequate financial resources are made available to countries that would otherwise be unable to join fully in this common effort;

--ways to assure that know-how and technological innovation continue to advance and are made affordable and widely available to solve this common problem;

--ways to assure that knowledge and information are fully and openly shared; and

--ways to assure that the educational and scientific infrastructure in all countries, particularly in the developing countries, is extended and enhanced to enable each of us fully to appreciate the scientific basis for climate change, the potential impacts of such change and evaluations of practical response strategies.

OUR COMMON FUTURE

20. Generations past once relied on faith in moving toward the future. Later generations placed their faith in reason. As we move now toward the second millenium we must seek to marry the two. We must urgently resolve the uncertainties that confront us. We must also accept that full knowledge may elude us for some time. We must begin now to take sustained, pragmatic action to secure our common future. We dedicate ourselves henceforth to develop a phased, flexible response that will enable us to take action now even as we seek to resolve remaining uncertainties and develop a comprehensive action plan for the future.

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Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
04. Report	Task Force on Comprehensive and Incentives Approach to Climate (30 pp.)	10/2/90	P-5	

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Task Force on Comprehensive and Incentives Approaches to Climate

Interim Report:
Research and Analysis to Support the
Comprehensive and Incentives Approaches

October 2, 1990

Introduction

This Administration has developed new approaches to the design of potential climate change policy, the "comprehensive" and "economic incentives"[1] approaches. The United States first clearly presented these approaches to the Intergovernmental Panel on Climate Change (IPCC) by letter in December 1989. They were presented more fully through an "Informal Seminar" for the IPCC Response Strategies Working Group (RSWG) officers in February 1990, accompanied by a booklet of Discussion Papers that have since been widely distributed. The new approaches have been reflected in U.S. positions in the IPCC and now in the IPCC report itself, and in several speeches, including the President's April 18 closing remarks to the White House Conference on Science and Economics Research relating to Global Change, and his July 11 news conference following the Houston Economic Summit meeting.

The discussion to date has largely been of a conceptual nature. Work must now be done on the practical workings of these approaches, and to the research and analysis that would be needed to assess their utility and to support their implementation. This Task Force was organized in May 1990 to specify, encourage, and coordinate this work. The Task Force is an interagency effort chaired by DOJ and involving representatives of numerous agencies, including CEA, CEES, CEQ, DOC/NOAA, DOE, DOI, DOJ, EPA, NASA, NSF, OPD, OSTP, State, USDA, USTR, Treasury, and WH Counsel. This "Interim Report" is provided to identify the research and analysis needed, the current Administration efforts

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[1]The "economic incentives" approach was originally focused on emissions trading, but has since been broadened to encompass other market-based economic instruments, including emissions taxes.

in that direction, and the further work required. Work is needed in several scientific, economic and institutional research areas that bear on or underlie these approaches, including efforts to quantify sources and sinks of multiple greenhouse gases and fill gaps in information on those sources and sinks, to quantify the relative environmental impacts of these gases, to compare the cost-effectiveness of these approaches and their alternatives, and to develop institutional arrangements that could translate these approaches from concept to practicality. In light of the plethora of upcoming discussions, workshops, conferences, international meetings, ministerial conferences and full negotiations -- including the first session of negotiations on a framework convention on climate change, to be hosted by the United States in February 1991 -- prompt attention to these topics is needed to prepare U.S. representatives for effective participation and to assess choices the U.S. may need to make in responding to others' proposals or putting forward its own.

Policy context

These approaches address the "how to" question -- how to design any policy that might be adopted to respond to potential climate change. Their principal aim is to improve the framework of policy analysis and the cost-effectiveness of any proposed policy choice. They do not address the larger cost-benefit question of "how much" policy action should be taken -- what level of social investment, if any, is warranted by risks of potential climate change. The work of this task force does not imply that a choice has been made to implement some policy action.

Furthermore, the "comprehensive" and "economic incentives" concepts are "approaches" or heuristics that offer insight into any discussion of response strategies for potential climate change. The utility of these approaches is not limited to the design of emissions limitation policies. Whether the strategy is pursuing scientific research, promoting new technology, enumerating the measures justified on other grounds that also have potential climate benefits,[2] or designing actual

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[2]The major uncertainties surrounding potential climate change, potential response strategies, and the costs and benefits of both, have suggested a strategy of pursuing those policies which are justified on other (non-climate) grounds yet which also help to address potential climate change. More precisely, these are climate-relevant policies pursued in the face of uncertainties about predicted climate change which are so great that the present expected loss due to climate change (and thus the expected climate-related benefits of the policy) cannot

(continued...)

emissions limitations policies (whether domestic or international), these approaches suggest the desirable breadth, emphasis and direction of the strategy. The "comprehensive" and "economic incentives" approaches to potential climate change policy were originally developed in response to the piecemeal (CO2-focused), command-and-control regulatory approach then dominating the discussion in the IPCC, but the approaches apply to the full array of policy types and options. And they apply to domestic as well as international discussions.

For example, a nation following the strategy of enumerating climate-relavent measures justified on other grounds could use the comprehensive approach to calculate the aggregate impact on net greenhouse gas emissions made by its various measures. A framework convention on climate change could take a comprehensive approach to the cooperative scientific and economic research to which the parties commit, including the development of international monitoring networks, as well as to any national emissions reporting, or to credit to be given under any future obligation for nations' current voluntary emissions-limiting activities. An economic incentives approach could be applied to adaptation measures desirable in long-range investments, such as coastal construction or water use planning.

Summary of the Approaches

The two approaches are compatible, but need not be employed together. Both approaches offer the possibility of designing environmental policies that achieve goals at lower cost and that highten the possibility for diverse, innovative, flexible, and cost-effective responses.

Comprehensive approach. The "comprehensive" approach seeks to address all the important contributors to potential climate change, in contrast to a piecemeal focus on CO2 from the energy sector. It therefore addresses all radiatively active trace gases (RATGs), primarily consisting of the greenhouse gases (GHGs), and their sources and sinks. GHGs include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), halocarbons such as chlorofluorocarbons (CFCs) and related substances (HCFCs, HFCs),

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[2](...continued)
confidently be said to exceed a de minimis level. Examples include emissions-limiting or adaptive steps taken for non-climate reasons, such as phasing out CFCs, afforestation, improving energy efficiency, and developing more drought-resistant strains of crops. Other examples could include reducing landfill emissions of NMHCs and CH4, reducing auto emissions of CO and NOx, and encouraging coastal development to account for current subsidence trends.

and tropospheric ozone (O3), whose precursors include oxides of nitrogen (NOx), non-methane hydrocarbons (NMHCs) (also referred to as "volatile organic compounds," VOCs), and carbon monoxide (CO).[3] Different RATGs arise from different sources and are removed from the atmosphere by different sinks, yielding a "net emissions" budget. Different RATGs have different impacts on the environment; for example, each gas has a different ability to trap certain radiated energy ("radiative forcing") or to reflect it. In order to relate the comparative environmental impacts of the various RATGs, the comprehensive approach employs a parameter or "index" that calculates the relative contribution of increments of each gas to physical effects, such as radiative forcing, used as proxies for global externalities. The comprehensive approach thereby avoids ignoring the important gases that would be omitted from a CO2-only approach, and avoids ignoring important sources and sinks that would be omitted from an energy-only approach.

As a means of developing an agenda for science and economics research, such as research on the likelihood or impacts of potential climate change, the comprehensive approach suggests the scope of the research agenda: the range of relevant inquiry, the gases and sectors relevant as inputs to economic models of RATG emissions, and the relative environmental externalities (both negative and positive) related to emissions of each gas.

As an approach to technology development, the comprehensive approach assists in identifying and comparing the relative importance of technologies and practices affecting potential climate outcomes.

As a means of enumerating climate-relevant measures justified on other grounds, the comprehensive approach provides a metric for identifying and assessing the policy actions that are relavent in the climate context. It could form the basis for calculating the aggregate impact of various such measures on a nation's net RATG emissions.

As an approach to emissions limitation rules or obligations, the comprehensive approach provides an environmentally coherent and least-cost design for limitations policy. A piecemeal approach, focused on one gas (e.g. CO2) or one sector (e.g. energy), would omit salient RATGs, sources and

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[3]Other RATGs affect the radiative balance of the atmosphere, but unlike GHGs, their main influence is not through absorption of energy reradiated from the Earth's surface. Aerosol particulates such as sulfur dioxide (SO2), which generally reflect insolation and thus may exert a net cooling influence, are RATGs but not GHGs. A fully comprehensive approach would encompass all such RATGs.

sinks. By aiming narrowly, it could very well induce unintended shifts of economic activities to unregulated modes that offset or even increase emissions of RATGs, much as focusing on air emissions alone can shift pollutants to toxic solid sludge discharges. For example, focusing on CO2 alone could induce fuel-switching from high-CO2 coal to lower-CO2 natural gas, meanwhile leading to increased emissions of CH4 from natural gas transmission leaks. The comprehensive approach cures these defects of a piecemeal approach. It also allows the flexibility to choose the least-cost mix of policy options yielding the desired overall RATG limitation. And, by addressing "net emissions," it encourages sink enhancement such as through afforestation or safeguards against pollution of oceanic phytoplankton. The comprehensive approach can be applied to a variety of emissions limitation measures,[4] including emissions taxes and emissions trading, and including both domestic and international measures. If applied internationally, it has the additional benefit of affording each nation the flexibility and discretion to decide the mix of domestic policies regarding the array of gases, sources and sinks that that nation determines would best accomplish policy goals in light of its unique social, economic, cultural and institutional circumstances.

Economic incentives approach. The "economic incentives" approach similarly applies to a variety of policy options. In the emissions limitation area, it encompasses the panoply of market-based economic instruments, including emissions trading and emissions taxes, imposed to force internalization of the external environmental costs accompanying emissions. It includes the use of incentives to promote innovation in technologies and practices, and addresses adaptation as well as emissions limitation. These incentives could be applied domestically or internationally.

As one example, application of emissions trading to emissions limitation obligations would allow those emitting a substance to achieve compliance with limits on such emissions by voluntary agreements to reallocate emissions among individual emitters so long as the aggregate output did not exceed their overall limit. Thus, reductions would be obtained most at those places where reductions cost least. This could be accomplished by authorizing informal reallocations among emitters, or by formally issuing "allowances" and then authorizing a market in

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[4]In light of the relative weighting of the various RATGs according to their environmental externalities and the flexibility afforded to choose a least-cost mix of measures, it is possible that the comprehensive approach could achieve an aggregate net RATG emissions limit by restricting emissions of some gases while allowing emissions of other gas(es) to rise.

the allowances. Experience with emissions trading in the U.S. indicates that it can achieve environmental quality goals at substantially lower cost, and therefore could be of use to nations domestically as they implement any limits on greenhouse gases. Several U.S. applications of emissions trading have been highly successful, such as the phasedown of lead in gasoline; some others have been instructive of the limits of emissions trading, especially when it is applied in the context of other regulatory restrictions on emitters. Allowing emissions trading among nations -- probably initially as informal reallocations accomplished through bilateral national accords -- could similarly be advantageous in the context of any international efforts to develop new technologies or limit emissions.

Emissions taxes would in theory also produce least-cost results. In general, while emissions trading provides more certainty about the quantity of emissions limitation achieved, emissions taxes provide more certainty about the cost imposed on emitters. Domestic use of emissions taxes could be apt where certainty as to cost is more important, or where revenue raising is an important goal. Imposition of international emissions taxes could raise additional institutional, political and sovereignty concerns -- such as whether nations would cede their sovereignty to an international tax authority, how the tax would be set, how it would be made equivalent across economies, and how the potentially enormous revenues raised would be allotted and expended -- that would probably not attend informal bilateral international emissions trading or domestic taxes.

As another example, market mechanisms could be used to encourage efficient adaptation practices. Long-range investments, such as coastal construction or water use planning, might, because of market failures or other institutional failures, be undertaken without giving appropriate weight to any climate change risks (e.g. rising sea levels or shifting precipitation). Such failures might be addressed by informational or incentive-based policies, such as by requiring coastal construction to purchase subsidence insurance, or by fostering a market in water resources that provides incentives for efficient use and long-range risk management.

Research and Analyses

The remainder of this Interim Report describes the research and analysis tasks needed to develop and support the comprehensive and incentives approaches. Our interagency task force has endeavored to identify all of the current agency activities related to each task, although we expect to learn of additional activities as this report is shortly completed.

A companion report being prepared jointly by the CEES' two working groups, Global Change and Mitigation & Adaptation Research Strategies, titled "Research in Support of a Comprehensive Approach to Trace Gas Emissions" (draft 10 September 1990), provides substantial additional detail on the ongoing scientific research relavent to these approaches and the research needed in the future.

Priorities and Timelines

For each task described below, our interagency task force has suggested a priority value and a timeline on which work could and should be completed to be most useful. The suggested relative priority is identified for each task as "high," or "medium," with the understanding that this list is itself a capsule summary of the highest priority items and does not mention numerous tasks judged to be somewhat relevant but not warranting inclusion here.

A time horizon of 3 months, 18 months, or 5 years is typically suggested for each task.[5] The timeline developed is a combination of the practical pace of research, which suggested a breakdown of tasks into very short-term (3 months), near-term (18 months), or longer-term (5 years) horizons for each task; and the pace of international discussions, which suggested milestones at January 1991, the eve of the first negotiating session on a framework convention (3 to 4 months), June 1992, the target signing date for the convention (roughly 20 months), or 1995, the tentative time for the next full IPCC report (5 years).

The priorities and timelines suggested for each task are suggestions, and we anticipate further discussion and revision on these points.

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[5]For certain tasks the timeline is different due to particular scheduling dates; for example, the Second World Climate Conference will be held at the end of this month.

Research and Analysis Underlying the Comprehensive Approach

I. Measuring and Monitoring Atmospheric Greenhouse Gas (GHG) concentrations

Any environmental impacts resulting from GHGs would be associated with changing actual concentrations in the atmosphere, not emissions per se. The comprehensive approach underscores the necessity of gathering data on atmospheric concentrations of all relevant GHGs. Over the last decade much work along these lines has already been undertaken or accelerated, including (i) direct measurement through ground station, aerial, and satellite observation of atmospheric (tropospheric and stratospheric) concentrations of several trace gases (chiefly CO2, CH4, N2O, O3, and CFCs), and (ii) sample records of past climate change found in ice cores, tree rings, and other sites. Measuring and monitoring past, current and future concentrations, temporal and spatial (e.g. vertical) distributions, chemistry, removal, and other dynamics of GHGs will remain an essential function under a comprehensive approach.

-- Current Administration efforts:

- Under the U.S. Global Change Research Program, several CEES agencies are conducting relevant research. For example, DOE, NASA, NOAA and NSF are conducting or will soon conduct direct measurement of atmospheric concentrations and distributions of CO2, CH4, N2O, tropospheric O3, CFCs, CO, NOx and NMHCs. NASA, NSF and DOI are studying sample records of CO2 and CH4 in ice cores and tree rings. NASA and NOAA conduct direct observations of stratospheric O3 and related substances. EPA monitors ambient concentrations of NOx, O3, NMHCs, SO2, and CO. Internationally, the United States participates in the work of the World Meteorological Organization (WMO), the World Climate Program (WCP), the International Geosphere-Biosphere Program (IGBP), and many other monitoring efforts.

-- Future work:

- Ensure coverage of all relevant RATGs. Priority: high. Timeline: continuous.
- Advance the comprehensive approach in any framework convention on climate change. The science research section of the convention must address all the relevant RATGs. It should build networks of cooperative monitoring among nations. Priority: high. Timeline: 3 months to 18 months.

- Advance the comprehensive approach in the Second World Climate Conference. Priority: high. Timeline: 1 month and thereafter.
- Advance the comprehensive approach in the World Climate Program. Priority: high. Timeline: 1 month and thereafter.
- Ensure coverage of relevant temporal and spatial distributions.
- Advance understanding of chemical interactions among trace gases.
- Advance understanding of quantitative link between trace gases and radiative forcing.

II. **Impacts of RATGs: Comparative Indices**

Changing concentrations of RATGs in the atmosphere are of interest because those gases may yield environmental impacts on societies and ecosystems. Different substances in the atmosphere have different environmental impacts; it goes almost without saying that the environmental impacts of atmospheric oxygen, water vapor, and CO2 are quite varied, and are believed to be fundamental to the present habitability of the planet. Incremental changes in concentrations of trace gases such as GHGs will similarly have various impacts depending on the particular gas at issue.

(A) Radiative forcing index

In the climate change context, the principal impact of RATGs under study has been radiative forcing. Radiative forcing is not the ultimate environmental impact of actual concern to societies and ecosystems; it is rather an intermediate physical effect that serves as a useful proxy or metric for assessing the impacts of different RATGs on the potential for warming-induced climate change, including atmospheric temperature change, changing precipitation, changing soil moisture, sea level rise, and temporal and regional variations, all of which in turn could affect biological and other systems. Molecules of different RATGs have different radiative forcing properties, and estimates of the relative radiative forcing of incremental amounts of GHGs can provide a common scale along which to compare the gases. A comparative parameter of relative radiative forcing, sometimes called a "global warming potential" (GWP) index or an index of "CO2 equivalence," has been developed by several scientists. The index incorporates the instantaneous radiative forcing of each type of molecule, its dissipation function and hence its typical residence time in the atmosphere, and the discount rate applied

or the time horizon over which the forcing function is integrated.

-- Current Administration efforts:
- Considerable work has been done on the relative radiative forcing of many RATGs. Estimates of instantaneous radiative forcing, derived from laboratory tests of molecular properties, are well established, as are residence times for several RATGs.
Work in this area has been done by NASA, NOAA, NSF, EPA, and DOE, and has been reviewed and reported by IPCC WG I.

-- Overview of needed work:
Priority: In general, this task is extremely urgent, as it constitutes the technical focal point of the comprehensive approach.
Timeline: Current work on relative radiative forcing is very active; the science is maturing; and robust, reliable, consensus estimates will likely be ready in the near term (6 to 18 months), though with continued uncertainties on specific aspects.

-- Future work:
- Convene international workshop(s) to discuss current work and needed improvements, to build understanding among diverse and representative experts, and to encourage multidisciplinary efforts. EPA, NOAA and NASA are jointly planning to host such a conference in November 1990. Priority: high. Timeline: 3 months.
- Harmonize various quantitative approaches and extend international understanding of indices. Priority: high. Timeline: 3 to 18 months.
- Improve accuracy of dissipation functions and hence of estimated residence times of RATGs. Scientific uncertainties in the current estimates remain surrounding the residence time of CO2, due to complications in the carbon cycle and uncertainties in CO2 sink removal processes. Atmospheric chemical reactions involving other gases, such as CH4 and precursors to tropospheric O3, complicate estimates of their residence times. Recent work at NOAA is substantially improving estimates of the dissipation rate and residence time of CH4. As work is ongoing, uncertainties in best estimates can be expressed and revised. Priority: high. Timeline: 3 months to 5 years, varying by gas.
- Incorporate indirect effects attributable to various gases' atmospheric reactions. Certain trace gases react to form other radiatively important trace gases,

or react with substances that would otherwise affect RATG abundances. Much of this work has already been conducted, hence: Priority: medium. Timeline: 18 months to 5 years, depending on gas.
- Take account of "saturation" effects. Radiative forcing by each RATG occurs within a different segment of the electromagnetic spectrum; as that segment or "band" becomes occluded, additional increments of the gas have diminishing marginal radiative forcing impacts. Radiative forcing estimates thus depend on, and need to be expressed in terms of, projected concentrations of relevant RATGs. Much of this information is already available and needs to be incorporated into expressed estimates. Priority: medium to high, depending on significiance of the effect for each gas. Timeline: 18 months.
- Take account of the implications that vertical and other distribution of RATGs in the atmosphere may have for calculated index values. This factor is quite important for O3 and its determinants -- CH4, CO, NOx, NMHCs. Priority: high for relavent gases. Timeline: 18 months.
- Improve use of discount rates/time horizons. IPCC WGI expresses GWPs in three selected time horizons; analysis is needed of which of these three horizons, or which other horizon, is appropriate for policymaking. More broadly, better understanding is needed of the scientific and economic basis for choosing different discount rates. Priority: high. Timeline: 3 to 18 months.
- The indices calulated to date have often focused on GHGs and omitted other RATGs. Assess implications of including other relevant substances, such as anthropogenic aerosol particulates (e.g. SO2), in the index. Priority: medium. Timeline: 3 to 18 months.
- Develop institutional mechanisms for adopting a consensus index and adjusting it to new research results. Because uncertainties remain in certain aspects of the index, index values may change as new scientific information is discovered. If an internationally agreed index is used as a tool for design of national policy portfolios to limit net index-weighted RATG emissions, changes in the index values could mean changes in the costs to each nation of its policy package. Mechanisms should be developed for giving advance indication of index uncertainties and likely changes in the index, incorporating new scientific information, and smoothing transitions to new index values. Such mechanisms could include objective science panels and periodic reassessments. Priority: high. Timeline: 3 to 18 months.

(B) Global change index

As indicated above, radiative forcing is only an intermediate physical effect of trace gases, and is really a proxy used as a common metric to compare diverse RATGs.[6] But RATGs have multiple attributes; they yield other, non-warming environmental impacts of global and local significance which may be more important (in magnitude, timing, or other features) than their contributions to radiative forcing. For example, CO, NOx, urban O3, and SO2 are reactive and/or toxic; CFCs and related substances deplete the stratospheric ozone layer; higher CO2 concentrations increase plant photosynthesis and increase plants' water use efficiency. Optimal policy choices would entail developing a comparative index that incorporates the full externalities (social and ecological costs) imposed by increments of each RATG. Without such a "complete" index, a simple radiative forcing index could provide signals or incentives that yield desirable changes in aggregate radiative forcing but undesirable changes in other impacts; in other words, significant externalities will remain uninternalized.[7]

At the same time, a fully "complete" index poses quite difficult analytic and technical problems. Data are not adequate on important aspects of the magnitude and variations of the diverese impacts; for example, data are lacking on the effects of ozone depletion on UV-B irradiance, and on the effects of changes in UV-B irradiance on biota. Comparing the dissimilar warming and non-warming impacts on a common scale, something like comparing apples and oranges, is a challenge requiring serious analytic efforts.

A somewhat more realistically achievable index would incorporate only the key "global change" attributes of each RATG, namely their radiative forcing and the other salient non-warming global impacts of GHGs, such as the direct effects of CO2 on vegetation and the ozone depletion impacts associated with CFCs and other halocarbons. Essentially local attributes of the

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[6]Measurement of the ultimate impacts of warming itself on biological and other systems, though critical for assessing the costs and benefits of climate change, are not incorporated into the radiative forcing index because such impacts stem from warming generically, and do not vary depending on the type of gas enhancing the warming.

[7]It is worth noting that, in contrast to the warming-specific term GWP, the phrase "CO2 equivalence," though unfortunate for its focus of attention on CO2, does offer the opportunity to introduce non-warming effects into the generic concept of "equivalence."

gases, such as their toxicity, would be left to local policy strategies. This "global change" index would capture the main global externalities associated with the gases, providing significantly more optimal policy signals than an index limited to radiative forcing. It would nonetheless require effort and time to construct.

The desirability of a "global change" index faces a dilemma: pushing too hard for a more complete index could undercut the legitimacy of the radiative forcing index, leading to the latter's disparagement or rejection by other nations, or perhaps to the view that one must wait years for a more complete index. This in turn could encourage the reinvigoration of gas-by-gas policy proposals. A two-pronged effort is therefore needed, to build, improve and promote the radiative forcing index, and at the same time to work on a global change index without undercutting the radiative forcing index.

-- Current Administration efforts:
- Conceptual thinking about design of a global change index. (DOJ, USDA)
- Efforts to quantify direct environmental impacts of CO2 enrichment, chiefly its impacts on agricultural and forestry output, and on water resources. (DOE, USDA, DOI, EPA, NSF). These efforts are high priority in any event.
- Efforts to quantify environmental impacts of stratospheric ozone depletion and resultant UV-B irradiance due to halocarbon emissions, such as impacts on agriculture, phytoplankton, and cancers. (USDA, EPA). These efforts are high priority in any event.

-- Future work:
- Address technical and analytic issues in a global change index. Whereas the common proxy or metric used in current indices is radiative forcing, a global change index would require a common metric among the various warming and non-warming impacts. It would also require application of discount rates because different impacts may occur at different times; for example, CO2 enrichment will likely occur much sooner than any observed warming due to CO2. (DOJ, USDA, DOI). Priority: medium. Timeline: 18 months.
- Undertake preliminary design and rough quantitative estimate of a global change index, in order to assess the difference between the relative RATG values obtained in a global change index versus a radiative forcing index. This effort would also indicate whether a global change index is sufficiently different to be worth developing. Priority: medium. Timeline: 3 to 18 months.

- Improve understanding of direct environmental impacts of CO2 enrichment, including the impact of CO2 in concert with changes in other environmental variables such as temperature, moisture, and other pollutants. (DOE, USDA, DOI, EPA, NSF). Priority: high. Timeline:
- Improve understanding of impacts of ozone depletion, including measuring UV-B irradiance and assessing impacts of UV-B radiation on biological systems. (USDA, EPA). Priority: high. Timeline:

III. **Measuring and Monitoring net GHG emissions**

Assessment of current and future net emissions is critical to the task of predicting the contribution of net emissions to atmospheric concentrations and hence to forecasting potential climate change, regardless of whether any emissions limitations are ever adopted.

The comprehensive approach emphasizes attention to all RATGs, sources and sinks. Baseline data on all of these is not always currently available. In addition, much of the data that are available derives from estimates using data on inputs (e.g. fuel quantities) and knowledge of or assumptions about input-output ratios associated with technologies or practices. Better measurement, forecasting and actual monitoring of net RATG emissions is suggested by, and needed to support, the comprehensive approach.

The ability to better monitor future emissions could also be useful in verifying the implementation of limitation actions and in assuring others' compliance with their claims and with international obligations. This is true of domestic limitations rules as well as international obligations; if a domestic GHG emissions limitation policy is to be effective and, in particular, is to employ performance standards rather than technology-based standards, it will require sound emissions monitoring techniques.

(A) Measuring net GHG emissions

-- Current Administration efforts:

- Numerous agencies collect and analyze data on various gases, sources, sinks, sectors, and industries, and thereby measure emissions from a variety of sources (e.g. energy utilities, mobile sources, land use, agriculture) and uptake by a variety of sinks (e.g. oceans, forests, soils, grasses).
- Efforts are underway to assemble "inventories" of net

emissions of GHGs for many nations,[8] chiefly EPA's analysis of CO2, CH4, CFCs, HCFCs, N2O, CO, NOx, and NMHCs for the US and other nations.
- Data are generally adequate on US and other industrialized nations' emissions of GHGs from fossil fuel combustion (generally measured by data on fuel inputs and knowledge of typical combustion techniques), and on world emissions of halocarbons (generally measured by production, consumption and storage rates).

-- Future work:
- Ensure that measurement covers all relevant GHGs, sources and sinks. Priority: high. Timeline: continuous.
- Improve data on other nations. Data on developing nations are particularly scant. The framework convention could call for development of information on all nations, including through a network of cooperative international measuring. Priority: high. Timeline: 18 months to 5 years.
- Develop technologies for measuring net GHG emissions, including direct observation and remote sensing. Priority: medium. Timeline: 18 months to 5 years.
- Develop a data set of emissions/uptake factors for current and potential technologies and practices, covering all relevant gases, sources and sinks. Priority: high. Timeline: 18 months.
- Develop practical proxies or surrogates, such as fuel or fertilizer input data coupled with assumed output rates (e.g. combustion or cultivation techniques), or acreage or livestock data coupled with assumed output rates, to generate emissions factors to assist in measuring emissions. Ensure that measurement uncertainties and assumptions, and use of

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[8] Efforts outside the government include: OECD project, soliciting data from member states on all GHGs; WRI project (in conjunction with UNEP/UNDP) on all nations' net emissions of CO2, CH4, CFCs; Harvard Kennedy School survey of many nations' emissions of CO2 and CFCs.

proxies/surrogates, do not distort policy responses.[9] Priority: high. Timeline: 18 months.
- Improve understanding of the processes involved in natural emissions and sink uptake, and how these activities might be influenced by climate change. Priority: high. Timeline: 3 months to 5 years.
- Ensure that data presentations are comprehensive, e.g. avoid CO2-only or fossil fuels-only charts in IPCC, NES, OTA, and other reports except as adjuncts to complete GHG presentation. Priority: high. Timeline: continuous.
- Ensure that data presentations include the scientific uncertainties involved. Priority: medium. Timeline: continuous.

(B) Forecasting future net emissions

-- Current Administration efforts:
- Use of economic models to generate scenarios of future emissions. EPA, DOE, and NSF are conducting such work, using a variety of economic models. U.S. agency work was reviewed and reported in the IPCC WGI/WGIII emissions scenarios.

-- Future work:
- Current economic models tend to focus on CO2, separate sectors, and industrialized nations. Need to make use of new and expanded models that overhaul and elaborate current economic models to cover multiple RATGs, multiple sectors, and other important improvements. Ensure that these models include GHG sinks and other aspects of the comprehensive approach. DOE has a three-year phased project underway to accomplish this; EPA is working on improving its models. Priority: high. Timeline: 18 months to 5 years.

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[9]For example, measurement of CH4 emissions based on a proxy such as total acreage of rice cultivation might imply that the only option to reduce emissions is reduced rice cultivation, whereas changed practices using existing or new rice strains might accomplish the same at lower socioeconomic cost. In general, the use of proxies should not be allowed to conceal opportunities for changing the emissions factors or other assumptions from which the proxies derive.

(C) Monitoring net emissions in the future

This task is useful to test empirically the effects on RATG net emissions of observed changes in economic activity, economic structure, and technologies and practices. It is also useful to evaluate accomplishment of nations' espoused policies and of any limitation agreements reached in international accords.

-- Current Administration efforts:
- Efforts to improve monitoring of non-point emissions, including CH4 emissions from rice cultivation (EPA) and ruminant animal husbandry (EPA); and GHG emissions from biomass burning (deforestation) (EPA, NASA, USDA).
- Efforts to improve monitoring of CH4 emissions from energy systems such as natural gas transmission and fossil fuels extraction (DOE, EPA).

-- Future work:
- Use proxies/surrogates, developed for measurement of net emissions (section (A) above), to monitor emissions through monitoring of inputs, technologies and practices. Priority: high. Timeline: 18 months.
- Expand monitoring capacity and data to cover all relevant gases, sources, and sinks: data are especially needed on non-point sources of CH4 and N2O, e.g. agriculture, livestock; hydroxyl chemistry and atmospheric chemical reactions yielding tropospheric O3; non-point sources and sinks of CO2, including oceanic biota, terrestrial biota, long-term sequestration, plant lifecycles, grasses, soils, and trees, extent and effects of deforestation, and sink behavior. Priority: high. Timeline: 18 months to 5 years.
- Expand monitoring capacity and data to cover all nations. Current data generally cover industrialized nations. Develop an international network of cooperrative net emissions monitoring. Priority: high. Timeline: 18 months to 5 years, depending on gas and sources/sinks.
- Harmonize techniques and data among nations and analysts. For example, resolve differences among nations monitoring deforestation (Brazil is urging that only its satellites produce reliable estimates of Brazilian land use). Priority: high. Timeline: 18 months to 5 years.
- Develop monitoring technologies and capabilities, as described under "(A) Measuring net GHG emissions" (above). Priority: medium. Timeline: 18 months to 5 years.
- Identify potential international and national methods for monitoring net GHG emissions; assess institutional,

political, social, and economic constraints on such monitoring, and means to overcome such constraints. Priority: high. Timeline: 3 to 18 months.
- Assess options for monitoring arrangements, including arrangements for monitoring and reporting and their relation to sovereignty concerns, e.g. voluntary or mandatory national reporting; "national technical means" of observation of other nations' activities; remote sensing; atmospheric observations; international oversight bodies (e.g. UNEP investigators); permission for on-site inspections; bilateral trade partner review under emissions trading; incentives and institutional designs to encourage development and application of accurate monitoring & reporting, for example by assuring credit for net GHG limitation actions (e.g. climate-relavent actions justified on other grounds) upon a showing by the emitter of successful monitoring practices (see section VI below); verification and enforcement procedures and their rules, reporting and enforcement procedures, burdens of proof, forum (international or bilateral, political or scientific adjudicators, etc.). Examine role of nongovernmental organizations and public. Priority: high. Timeline: 18 months.

IV. **Evaluating current national policies and proposals**

Whether or not international agreement is reached on response strategies to potential climate change, nations are already announcing their intention to restrict emissions of one or more RATGs or to expand RATG sinks. The U.S. policy of pursuing climate-relavent measures justified on other grounds has been articulated in qualitative form; at some point the U.S. -- or others -- may choose to present quantifications of the net RATG effects of these U.S. measures. The comprehensive approach provides the basis for computing the aggregate impact of such diverse measures. In addition, it may be valuable for the U.S. to assess the policy claims and policy proposals being made by other nations, using the comprehensive approach, and to examine the policy opportunities that would face other nations under a comprehensive approach.

(A) Extent and costs of net GHG limitations achieved by U.S. policy options within a comprehensive framework.

As described in the Introduction, it is useful to identify actions taken for other (non-climate) reasons but which influence net RATG emissions. One may calculate the percent limitations or reductions achieved by these policy actions using the comprehensive approach, and also calculate the marginal, average, and total cost per policy action.

This could be a first step toward assessing the marginal and total costs of RATG avoidance from different gas/source/sink policy options and hence toward assessing the relative cost-effectiveness of the comprehensive versus piecemeal approaches.

-- Current Administration efforts:
- analysis of US policies in EPA Cost Study/"Comprehensive Budget" analysis (covering U.S. energy efficiency and clean energy initiatives, CFC phaseout, afforestation, landfill rules, and other policies) through 2000. Priority: high. Timeline: 3 months.
- DOE/NES analysis of US energy policies through 2030, including NES options, afforestation, and CFCs. Priority: high. Timeline: 3 months.
- DOC study of future emissions under different tax options and under EC-wide strategy or global strategy. Priority: high. Timeline: 3 months.

-- Future work:
- Improve basis for projecting emissions limitations achieved by current policies
- Expand to cover influence of changes in agricultural subsidies, other relevant policy measures
- Look beyond 2000.

(B) Analysis of net GHG limitations achieved by other nations' policies

Analysis similar to that described for U.S. "no regrets" measures above should be undertaken for the policies announced and implemented by, proposed by, or available to, foreign nations. Certain nations have suggested unilateral limits on CO2 emissions (e.g. Sweden, possibly Japan), on nuclear power (Sweden, GDR), on SO2, NOx, and NMHCs (U.S.); and others have announced willingness to enact CO2 limits if others do too (e.g. U.K., Netherlands), and others have endorsed the Noordwijk Declaration's suggestion of CO2 emissions stabilization by industrialized countries by 2000.

-- Current work:
- Obtain information on each nation's policies.

-- Future work:
- Using a comprehensive approach, calculate the value of current policies in place in nations abroad, as

described above for U.S. actions.[10] Assess how other nations would fare under a comprehensive approach. Priority: high. Timeline: 3 months.
- Include consideration of foreign nations' agricultural subsidies and other relevant policies regarding non-point sources. Priority: high. Timeline: 3 months.
- Expand to cover developing nations. Priority: high. Timeline: 3 months.
- Using a comprehensive approach, calculate the influence each foreign proposal would have on net RATG emissions and GHG concentrations. Priority: high. Timeline: 3 months.
- Include modeling of international energy markets and effect of price responses to unilateral demand reductions. Priority: high. Timeline: 3 to 18 months.

V. **Evaluating the comparative cost-effectiveness of piecemeal, partial, and comprehensive approaches.**

Advocacy of the comprehensive approach is based in part on the intuitively strong hypothesis that the marginal costs of control vary across gases, sources, sinks, and nations, so that for any assumed limitation obligation,[11] each nation's least-cost mix of limitation strategies would be different and all nations, regardless of their current RATG inventories, would be better off under a comprehensive approach than under an approach which placed separate limitation obligations on each gas or sector.[12]

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[10]Special attention may be due the range of CFC-substitutes to be used by each nation. Japan, for example, is apparently presenting figures that show larger reductions in radiative forcing from phasing out unit amounts of CFCs than is the U.S., suggesting that Japan may be counting on selecting CFC-substitutes with lower GWPs than those to be used in the U.S. This also suggests that the Montreal Protocol, although potentially helpful as a no regrets measure, may not by itself be sufficient to address climate concerns associated with ozone-depleting substances.

[11]As stated in the Introduction, given an assumed objective, the task is to assess the comparative costs of achieving it under different policy designs. This task does not assess the overall rationality or economic efficiency of the chosen objective.

[12] The aggregate shares calculated in the inventories (in Part III(B), above) do not indicate the costs of incremental limitations for each nation. Simply because a nation currently has a large share in methane, for example, does not mean that

(continued...)

This task is needed to test that hypothesis and, if confirmed, to demonstrate the value of the comprehensive approach.

(A) Marginal costs: information and analyses needed to map full comparative cost-effectiveness functions and variations by gas, source, sink, sector, nation.

This task moves beyond analyses of specific existing policy programs and evaluates the full marginal cost functions facing policy makers and private actors.

-- Current Administration efforts:
- DOE/NES analysis for US energy sector policies and afforestation

-- Future work:
- Expand to cover all relevant gases, sources, sinks, sectors. Priority: high. Timeline: 3 months.
- Expand to cover other nations. Priority: high. Timeline: 3 months.
- Assess full social costs, using general equilibrium model rather than expenditures by the regulated industry.[13] Make use of forthcoming models. Analyze costs over time, relation to innovation.[14] Priority: high. Timeline: 18 months.
- Include (qualitative) evaluation of non-economic costs to response options, e.g. cultural or institutional barriers to certain policies. Priority: medium. Timeline: 18 months.
- Assess informational, administrative, and other transactions costs of piecemeal, partial and

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[12](...continued)
that nation would find methane reductions costlier than CO2 reductions, at the margin. Economic analysis is needed to test the hypothesis of varying costs and to demonstrate the benefits to every nation of being afforded the cross-gas, cross-sector, and source-sink flexibility of the comprehensive approach.

[13] The comparative impacts on macroeconomic and international variables (e.g. trade, competitiveness, economic growth) would require separate study.

[14] Evaluation should also address the likely economic impacts in the US and worldwide of potential future changes in the understanding of the gas-comparison index, and means to cushion adverse impacts (e.g. periodic public science reviews).

comprehensive approaches. Priority: medium. Timeline: 18 months.
- Evaluate the benefits (effectiveness) of policies, in terms of RATGs avoided. Priority: high. Timeline: 3 to 18 months.

(B) Use cost-effectiveness analyses to evaluate costs and benefits to the US and other nations of possible piecemeal, partial and comprehensive options that will be suggested for international policy design

This task moves beyond the analysis of current policy proposals suggested in section IV above to examine the marginal costs of policy designs, and to consider both proposed and hypothetical policy designs. It also focuses on international accords rather than national actions. This task is essential if U.S. policy makers and negotiators are to be able to assess policy proposals that inevitably be made as negotiations on a framework convention on climate change unfold.

Potential policy designs to be compared include: CO2 only, all RATs, or all RATGs except those covered under the Montreal Protocol; sources only, point sources only, all sources and sinks, or sources and terrestrial sinks only; all sectors, or certain sectors (e.g. energy, industry, transport, agriculture, forestry).

Priority: high. Timeline: 3 to 18 months.

(C) Evaluate the environmental effectiveness of comprehensive and piecemeal approaches: propensity and impact of induced shifts in residuals

Thus far, for any given policy goal, a piecemeal (e.g. CO2-only) approach and a comprehensive approach have been assumed to yield identical results in terms of aggregated GWP (or full environmental impacts). In other words, whether a reduction in net index-weighted ("CO2-equivalent") emissions were achieved in CO2 or in a combination of gases, the overall calculated effect on the index value of concern would be the same.

But such analysis fails to account for actual economic and social responses to policy interventions. Advocacy of the comprehensive approach is based in part on the intuitively strong hypothesis that including all gases, sources and sinks ensures better effectiveness in any effort to limit contributions to potential radiative forcing (or full impacts), because piecemeal rules applying to one gas, source (or sector), or sink will engender shifts of

socioeconomic activity from regulated to unregulated modes, undercutting achievement of policy goals. Case studies will be especially helpful to illustrate these issues.

-- Current Administration efforts:
- Understanding of prior piecemeal approaches in environmental regulation and their resultant shifts of residuals, including single-medium approaches, e.g. to discharges into air, land, and water; and single-pollutant approaches, e.g. to SO2.
- DOE/NES study will address CO2 and CH4 emissions from energy sector; it should consider potential GHG-related environmental effects of fuel switching, new energy sources, and sectoral shifts.

-- Future work:
- Develop "crisp retorts" to piecemeal approaches: Conduct case studies of cross-gas shifts: e.g. fossil fuel switching (coal to natural gas) induced by CO2-only policies could have attendant impacts on CO2-to-CH4 emissions shifts due to CH4 leakage from natural gas transport.[15] Expand cross-gas shift studies, e.g. apply coal-to-gas CO2-CH4 shift analysis to actual global GHG output and in light of likely GHG emissions/leaks from future coal and gas facilities. Priority: high. Timeline: 3 months.
- Evaluate cross-source/sector shifts: e.g. under a transport-only policy (such as a high CAFE statute), possible shift from fossil fuel combustion on board vehicles to electric cars powered by central utility combustion, or to use of intensely cultivated biomass fuels; e.g. under an energy-only or fossil fuel-only policy, possible shift to biomass fuels whose cultivation emits other GHGs. Priority: high. Timeline: 3 months.
- Include consideration of international market responses to unilateral policy choices. Assess cross-boundary shifts, through price effects and industry flight, of unilateral or OECD-only policies. Priority: high. Timeline: 3 months.

(D) Evaluate the environmental benefits of a "net emissions" approach

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[15] See, e.g., Rodhe, Science 8 June 1990. Using a 100-year time horizon and a CO2-equivalent GWP for CH4 of 10, Rodhe estimates that if a CO2-reduction policy were accomplished by fuel switching from coal to natural gas, a 3-6% CH4 leakage rate from natural gas transport facilities would fully offset all the CO2 reductions resulting from the fuel switch.

A net emissions approach, encompassing both sources and sinks, would encourage sink protection and expansion, whereas a source-only approach would not. Sink policies encouraged could include afforestation and protection of marine phytoplankton from pollution. This task is to evaluate the side benefits of likely sink policies, e.g. reduced soil erosion, enhanced biodiversity, protected phytoplankton, and better timber management.

VI. **Bridging from piecemeal to comprehensive approaches**

(A) Addressing the objection that the comprehensive approach is technically difficult or infeasible

As discussed in the introduction, the comprehensive approach can be applied to assist in design of various policies, including research strategies, technology development strategies, enumeration of steps justified on other grounds, and emissions limitation strategies. For most of these options, the comprehensive approach can be applied immediately, despite potential uncertainties, as a general guide to intelligent analysis of the scope and relative importance of policy choices.

For implementing emissions limitations, however, prompt application of the comprehensive approach might be somewhat more difficult. In principle, a comprehensive approach appears to be the most appropriate way to design any emissions limitation policy. But as indicated above, there are noteworthy gaps and uncertainties in the information on emissions of certain gases from certain sources and uptake by certain sinks. If emissions limitations were to be imposed today, a fully comprehensive approach would not be available. If emissions limitations are not needed immediately, work on the comprehensive approach can continue toward a time when limitations might be agreed. If emissions limitations are to be agreed at some point before all informational gaps are filled, a partially comprehensive approach could be employed with a mechanism for moving to a fully comprehensive approach as these gaps are filled.[16]

The issue for policy makers is not whether the comprehensive approach is "feasible," but whether at any point the social costs of implementing an incompletely comprehensive approach -- in terms of environmental effectiveness and economic efficiency, as

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[16]Yet it must be recognized that piecemeal approaches, once adopted, generally attract vested interests who resist any efforts to expand toward a comprehensive approach.

described in section V above -- are outweighed by the social costs of obtaining additional information (including costs of delay). Such costs would also include transactions costs and administrative costs. In other words, one must ask whether the marginal value of additional information (leading to a more comprehensive approach) exceeds the marginal cost of obtaining additional information. Another way of examining the issue is to ask at what point would one know enough to proceed comprehensively; and to ask how (and at what cost) a comprehensive approach could evolve from incremental steps. Further, one would consider institutional means to incorporate incentives into any partial strategy that encourage evolution toward a comprehensive approach.

The scientific building blocks of the comprehensive approach are described above in sections I-III. Any framework convention should foster scientific research through a comprehensive approach. In addition, consideration of the need to bridge from a partial to a comprehensive approach would include:

-- Future work:
- Assess the time and expense needed to answer scientific questions, develop proxy measurement devices, and build monitoring capabilities to achieve a workable comprehensive approach.
- Assess other constraints to employment of a fully comprehensive approach, including institutional, political, cultural and economic obstacles.
- Compare the costs of acquiring this needed information to the socioeconomic and environmental costs (and foregone benefits) of adopting a piecemeal policy design for want of such information.
- Develop policy and institutional designs that offer incentives for needed research. For example, an emissions limitation obligation in an international agreement could be framed in a piecemeal fashion but offer the opportunity to emitters to achieve compliance through limitation actions addressing other GHGs, sources or sinks, so long as the emitter demonstrates the accomplishment. This would give emitters incentives to undertake the research needed to develop new monitoring capabilities.
- Consider intermediate approaches such as incremental or phased-in designs toward comprehensivity, and means to bridge from them to a fully comprehensive approach.

Overview: Priority: high. Timeline: 3 to 18 months.

(B) Integrating prior and concurrent law and policies into a comprehensive approach.

Even if a fully comprehensive approach were available for use in emissions limitations at any relevant point, it is apparent that other treaties, laws and policies will already be addressing discrete RATGs, sources, and sinks. Some means would be needed to accommodate and integrate these diverse endeavors into the comprehensive approach. Several options are available for such integration. One option is to use a comprehensive approach to net RATGs in any emissions limitation protocol while varying the baseline of allowed credit according to prior treaty obligations. Another option is to have the convention mandate that any future protocol (if any) employ a comprehensive approach. A related option is to incorporate in a framework convention on climate the assurance to nations, in advance of any hypothetical future protocol obligations (not yet agreed to), that they would receive credit against any such obligations for current or past (after a certain date) net emissions limitations actions, whether taken pursuant to treaties or national policies; the convention would further calculate the value of such actions according to the comprehensive approach. This would assure credit for measures justified on other grounds, avoid disincentives to those actions, and give root to the comprehensive approach, while not yet committing to emissions limitations obligations.

-- Current Administration efforts:
- devising means to ensure that international agreement integrates (gives credit for) current actions, other international agreements (forestry, VOCs, GHGs covered by ozone agreements), other domestic laws and initiatives. (DOJ, EPA, State)

-- Future work:
- Demonstrate incentive advantages of integration
  - lack of integration would yield perverse disincentives to take actions, even actions that are justified on other grounds, lest they be denied credit once emissions limitations are agreed. Priority: high. Timeline: 3 months.
- Address possible overclaiming (see "monitoring" and "verification," above). Priority: medium. Timeline: 18 months.
- Analyze advantages for other nations under integrated design. Priority: high. Timeline: 3 months.
- Analyze environmental advantages of integration. Priority: medium. Timeline: 3 months.
- Address issues of legal grafting presented by terms or design of other agreements, laws. Priority: high. Timeline: 3 months.

- Consider possible offset model (e.g. defining any limitation obligations in terms of CO2 emissions, to satisfy those eager for CO2 limits, but authorize offsets for any verifiable limits on any GHG, source, or sink, thus effectively constructing a comprehensive approach). Priority: medium. Timeline: 3 to 18 months.

Research and Analysis Underlying the Incentives Approach

As described in the Introduction, a variety of market-based incentives might be considered in the climate change context. The possible uses and advantages of these approaches are summarized in the Introduction.

I. **Emissions trading**

(A) Domestic trading

-- Current Administration efforts:
- review of past and current experience, e.g. lead phasedown, netting/bubble/offset program, CFCs trading, new acid precipitation trading scheme. Primarily EPA, DOE, CEA.
- consider application to GHGs; consider issues of implementation, e.g. informal versus formal trading; who would trade; duration of allowances; means of distributing allowances; market power; hoarding; scope of GHGs, sectors, sources and sinks; monitoring trades; etc.

-- Future work:
- Evaluate the comparative cost-effectiveness of emissions trading and command-and-control approaches. Priority: high. Timeline: 3 to 18 months.

(B) International trading

-- Current Administration efforts:
- present US experience and suggestions at international discussion on application to climate

-- Future work:
- Extend analysis of above issues to international context, e.g. informal versus formal trading; who

would trade; duration of allowances; means of distributing allowances; market power; hoarding; scope of trading among GHGs, sources, sinks, sectors, industries, geographical areas, stages of development; monitoring trades. Priority: medium. Timeline: 3 to 18 months.
- In addition, consider international institutions; trade, assistance and national income implications; sovereignty issues; cultural or ethical objections to so-called "selling the right to pollute"; trading as a decentralized, market-based vehicle for resource and technology transfers.[17] Priority: medium. Timeline: 3 to 18 months.
- Assess informational, administrative, and other transactions costs of emissions trading and command and control policies. Priority: medium. Timeline: 3 to 18 months.
- Identify opportunities for cross-national trades, and hence likely trading partners (for the US and worldwide). Priority: high. Timeline: 3 months.
- Evaluate the comparative cost-effectiveness of emissions trading and command-and-control approaches. Priority: medium. Timeline: 3 months.

II. Emissions fees

Fees might be employed domestically or internationally to address GHG emissions. Options discussed to date include carbon taxes based on the carbon content of energy fuels, and energy taxes. Other options include an energy sector tax that covers both CO2 and CH4 emissions from energy activities, using their GWP index ratings to weight the tax; and a more general multi-sector tax calibrated to the GWP index (or full environmental impacts index) rating of each gas.

-- Current Administration efforts:
- analysis of energy sector taxes in DOE/NES
- analysis of various fees in EPA "Comprehensive Budget" analysis
- related efforts: numerous studies have used assumed taxes to examine costs of GHG limitations policies. E.g. CBO (Montgomery), Manne & Richels, Nordhaus. See CEA overview of Economics of Global Change.

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[17] In addition, consider the options for trading within regional associations such as OECD, EC, ASEAN. Evidently the EC and OECD are both considering association-wide policies.

-- Future work:
- Improve assessment of tax implications. Consider international fuels market impacts; use general equilibrium models; address fiscal concerns. Priority: high. Timeline: 3 months.
- Consider variety of tax policy designs, including, carbon, energy, GWP within energy sector, etc. Priority: high. Timeline: 3 months.
- Much of this kind of consideration must be deferred to budget negotiations.

III. Adaptation Incentives

Market mechanisms and institutional reforms could be used to encourage efficient adaptation practices. Because of current institutional or market failures, long-range investments, such as coastal construction or water use planning, might be undertaken without giving appropriate weight to any climate change risks (e.g. rising sea levels or shifting precipitation). Such institutional or market failures might be addressed by informational or incentive-based policies, such as requiring coastal construction to purchase subsidence insurance, or encouraging long-range water use planning to take account of potential precipitation patterns. Some of these types of policies were addressed in the IPCC/RSWG RUMS and CZMS reports.

IV. Economic instruments in general

-- Future work:
- Pursue contacts with OECD regarding Environment Ministerial in January, Economic Instruments analytic workplan (experts meeting now tentatively slated for October 1990), and potential OECD Workshop on Economic Instruments.[18] Priority: high. Timeline: 3 to 18 months.

- Develop suggestions for economic analysis and study of economic instruments in upcoming IPCC Future Workplan discussions (tentatively slated for December or January). Priority: high. Timeline: 3 to 18 months.

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[18] Preparing for the suggested OECD Workshop on Economic Instruments, tentatively slated for December 1990, will involve considerations of forum and cosponsorship, logistics and timing, relation to other OECD meetings, relation to other international meetings, invitees, topics to address, an October experts meeting, relation to the upcoming IPCC meeting on Future Work of the IPCC, and US presentation(s) at the December Workshop.

- Continue to work with CEES groups, including the new Ad Hoc Economics task group, to develop economic analysis of policy proposals and designs (addressing "comprehensive approach" issues as well as "incentives" approach issues). Priority: high. Timeline: 3 months to 5 years.

Withdrawal/Redaction Sheet
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Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
05. Report	Task Force on Comprehensive and Incentives Approach to Climate: Research and Analysis Priorities for the Next Three Months (2 pp.)	10/2/90	P-5	

Collection:

Record Group: Bush Presidential Records
Office: Chief of Staff to the President, Office of the
Series: Sununu, John, Files
Subseries: White House Offices File
WHORM Cat.:
File Location: Science and Technology (Bromley) (1990) [2]

Open on Expiration of PRA
(Document Follows)
By JL (NLGB) on 10/28/05

Date Closed:	12/16/2004	**OA/ID Number:**	29183-007
FOIA/SYS Case #:	1998-0004-F[1]	**Appeal Case #:**	
Re-review Case #:	2005-0426-S	**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

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(Submitted to Global Change Strategy Group, Oct. 3)

October 2, 1990

TASK FORCE ON COMPREHENSIVE AND INCENTIVES APPROACHES TO CLIMATE

RESEARCH AND ANALYSIS PRIORITIES FOR THE NEXT THREE MONTHS

1. Assist State in drafting a possible framework convention that

-- includes a science research section that addresses all GHGs, sources and sinks;

-- provides for an international monitoring agenda for all GHGs, sources and sinks

-- adopts or provides for development of a GHG index based on the radiative forcing and other environmental effects of all GHGs, and possibly incorporating radioactively active trace gases (e.g. sulfate aerosols)

-- provides that any protocol(s) shall, to the extent feasible, be comprehensive.

-- provides that any limitation protocol(s) shall (a) provide for voluntary trading among nations in net GHG reductions (b) provide "credit" for net GHG reductions achieved by nations unilaterally through measures justified on other grounds, or through other international, regional, or bilateral agreements (e.g. forestry).

2. Develop an improved GHG index and an international process for refining the index. Include, to the extent possible, environmental effects other than radiative forcing.

3. Develop a plan for developing an international net GHG monitoring system.

4. Prepare "crisp retorts" to proposals for piecemeal measures by pointing out the environmental and economic drawbacks of agreements limited to particular GHGs, sources and sinks, sectors, or groups of nations, or that use command and control approaches. These also apply to congressional proposals.

5. Develop quantitative analysis and empirical examples to show the environmental and economic advantages of a comprehensive approach.

6. Update "report card" on the contributions to reducing net GHG of US actions being taken on other grounds. Conduct similar analyses for selected other nations.

7. Development of a concise but sophisticated vision of decision making under uncertainty to counter simplistic versions of the "precautionary principle."

8. Develop capacity to analyze economic and environmental costs and benefits of likely proposals by other nations.

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
06. Memo	From D. Allan Bromley to John Sununu Re: The Letter from Dr. J.F. Kenney Concerning the Role of "Juvenile Methane" in the Greenhouse System and More (8 pp.)	9/7/90	P-5	

Collection:

Record Group: Bush Presidential Records
Office: Chief of Staff to the President, Office of the
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THE WHITE HOUSE

WASHINGTON

September 7, 1990

MEMORANDUM FOR GOVERNOR SUNUNU

FROM: **D. ALLAN BROMLEY**

SUBJECT: **THE LETTER YOU RECEIVED FROM DR. J. F. KENNEY CONCERNING THE ROLE OF "JUVENILE METHANE" IN THE GREENHOUSE SYSTEM - AND MORE**

Just before we left on vacation you gave me a copy of this letter with its very surprising conclusion. Because I was intrigued by it I asked Berrien Moore of the University of New Hampshire (who is one of the world experts in this area) and Bob Watson of NASA to take a close look at Kenney's assertions which would, obviously, be very important - if correct. I enclose herewith the resulting memorandum from Moore and Watson because I thought that you would find it interesting. I also enclose a somewhat revised illustration of the global carbon cycle.

At the same meeting in your office you raised the question of whether current climate models assumed a linear relationship between greenhouse gas concentrations and resulting infra-red radiation absorption. Bob Correll and a number of associates have researched this for me and again I enclose their memorandum. The answer, in brief, is no but I thought that you would be interested in the background for that answer.

We had a meeting of the Global Climate Change Strategy Committee yesterday to review what happened at the Sundsvall IPCC meeting and to plan for the forthcoming international meetings. In brief, although the IPCC meeting was chaotic in the extreme, the outcome was relatively in our favor. The draft Bolin report that was reviewed in your office was scrapped and replaced with a relatively brief overview, to which was appended the policymaker's summaries of the three IPCC working groups.

We will move forward to coordinate preparation for the forthcoming meetings and keep you well informed. Should it be of interest to you, I would be happy to arrange for Bernthal and Watson to brief you on what actually happened in Sweden.

Among the interesting aspects were:

a) The fact that the Northern Europeans backed off their extreme positions,

b) the fact that Brazil, with more or less overt support from India, China and the developing countries tried to derail the entire process so that there would be <u>no</u> report from the IPCC.

Please let me know if you wish to hear more details.

Critique of J.F.Kenney Letter to J.H.Sununu

Although most of the scientific and technical information presented in Dr. J. F. Kenney's letter is correct, the author draws a totally erroneous conclusion about the source of the increase of atmospheric carbon dioxide. Juvenile methane is not the cause of the recent (since pre-industrial times) increase in atmospheric carbon dioxide. All of the information presented in this letter was available, and taken into account, during the IPCC scientific review. This memo will present the correct interpretation of the carbon cycle.

While there is no dispute that the carbon cycle is complex, and the magnitude of many of the reservoirs and gross fluxes between reservoirs are quite uncertain (i.e., by about 20% or more), there is little doubt about the following facts:

CARBON DIOXIDE

(1) The current (1990) average mixing ratio (often referred to as atmospheric concentration) of carbon dioxide is 353 ppmv (750×10^{15}g C)--known to better than 0.5%. This contrasts to the pre-industrial (1750-1800) atmospheric mixing ratio of carbon dioxide of about 280 ppmv (594×10^{15}g C)--decadal averages for a period of about one thousand years prior to 1750 were constant to within about ±2%, i.e., about ±5-6 ppmv. Therefore, the atmospheric mixing ratio of carbon dioxide has increased by about 25% since the pre-industrial era.

(2) The atmospheric loading of carbon dioxide is currently increasing at an annual rate of 1.8ppmv (3.8×10^{15}g C). This is three times greater than the annual rate of increase of 0.6 ppmv (1.3×10^{15}g C) in 1958 when precise atmospheric measurements began.

(3) The interhemispheric gradient of carbon dioxide abundances between the northern and southern hemispheres has increased from about 1 ppmv in 1960 to about 3 ppmv today.

(4) The annual gross fluxes of carbon dioxide between the atmosphere and the oceans are about 90×10^{15}g C, and the annual gross fluxes of carbon dioxide between the atmosphere and the terrestrial biosphere are about 100×10^{15}g C. In each case the fluxes are probably only known to about 30%. As stated earlier, the ice core record shows that the atmospheric concentration of carbon dioxide prior to 1750 was constant to within about ±2% (±5-6ppmv) indicating that the gross fluxes of carbon dioxide between the atmosphere and the oceans and between the atmosphere and the terrestrial biosphere were in a quasi-steady state. The contemporary net fluxes are smaller and better known (see next three points) than the gross natural fluxes, hence the uncertainty about the current carbon cycle is less than one might suppose by examination of only the gross fluxes and their associated uncertainties.

(5) The current annual emissions of carbon dioxide from the combustion of fossil fuel are about 6×10^{15}g C per year (last accurate assessment was $5.7 \pm 0.5 \times 10^{15}$g C in 1987). The cumulative release of carbon dioxide from the combustion of fossil fuels is estimated at $200 \pm 20 \times 10^{15}$g C between 1850 and 1987.

(6) The annual emissions of carbon dioxide from "tropical deforestation" were estimated (IPCC) to be between 0.6 and 2.5×10^{15}g C in 1980, i.e., ($1.5 \pm 1.0 \times 10^{15}$g C). Recent increases in the rate of tropical deforestation suggest that the lower limit is too low, and that the most likely current value is towards the central or upper end of the range. The

cumulative release of carbon dioxide from tropical and extratropical deforestation is estimated at 115±35 $x10^{15}$g C between 1850 and 1985.

(7) The sum of the current annual emissions of carbon dioxide from tropical deforestation and the combustion of fossil fuels is 7.5±1.2 $x10^{15}$g C, of which only about 3.5 x 10^{15}g C remain in the atmosphere. The remaining 4±1.2 $x10^{15}$g C is being taken up by the oceans and terrestrial biosphere, but the relative proportions are poorly quantified.

(8) The net annual uptake of carbon dioxide by the oceans is (2±1 $x10^{15}$g C).

(9) The net annual uptake of carbon dioxide by "non-tropical" terrestrial ecosystems is highly uncertain (0-3 $x10^{15}$g C), and it has been suggested that it may have increased in recent decades through a number of plausible mechanisms, including enhanced productivity due to a warmer climate, carbon dioxide and/or nitrogen fertilization, and improved forest management.

CARBON 14

(10) ^{14}C (half-life of 5700 years) is produced in the atmosphere through the partial conversion of ^{14}N by cosmic radiation.

(11) Because of the rapid exchange of carbon dioxide (about 190±40 $x10^{15}$g C per year) between the atmosphere and the terrestrial biosphere and ocean waters, ^{14}C is rapidly equilibrated throughout the atmosphere, terrestrial biosphere and surface waters of the ocean.

(12) The ^{14}C content of atmospheric carbon dioxide resulting from the combustion of fossil fuels (coal, natural gas, or oil) is zero, because the age of fossil fuels greatly exceeds the half-life of ^{14}C.

(13) The atmospheric abundance of $^{14}CO_2$ was approximately constant prior to 1750, then decreased approximately 25% over the 200 year period prior to nuclear bomb testing and nuclear power plant operation. This pattern (known as the Suess effect) is due primarily to emission of ^{14}C-free fossil fuel CO_2, which diluted the pre-industrial ^{14}C content of the atmosphere. The burning of biomass also contributed to this dilution since vegetation is partly depleted, relative to the atmosphere, in ^{14}C because of fractionation against the heavier isotope at the air-leaf interface. The atmospheric concentration of ^{14}C increased rapidly after 1952, reaching a peak in 1963/4, from which it has decreased to a value about 40% above the 1952 value.

METHANE

(14) The atmospheric loading of methane is known to about 1%. The current (1990) average mixing ratio of methane is 1.72 ppmv (3.7$x10^{15}$g C), compared to a pre-industrial value of about 0.6 to 0.8 ppmv (1.3 to 1.7$x10^{15}$g C). Note that the corresponding contemporary and pre-industrial values for CO_2 are 750 and 594 $x10^{15}$g C, respectively.

(15) The atmospheric loading of methane is currently increasing at an annual rate of 0.014 to 0.017 ppmv (0.03 to 0.036 $x10^{15}$g C).

(16) The current annual emissions of methane from both natural and anthropogenic sources is between 0.3 and 0.5 $x10^{15}$g C, of which about 60 to 70% is believed to be due to anthropogenic activities. The ice core record suggests that the natural sources of methane were relatively stable for several centuries prior to 1850.

(17) The magnitude of the sources is largely constrained by knowledge of the atmospheric sink, primarily removal by reaction with tropospheric hydroxyl radicals. The atmospheric lifetime is about 10 to 12 years, with an uncertainty of about 20-30%.

(18) The magnitude of the individual anthropogenic and human-influenced sources of methane are quite poorly quantified, including rice paddies, cattle rearing, biomass burning, landfills, permafrost, natural wetlands, coal mining and venting of natural gas, e.g., the annual flux of methane from rice paddies is estimated to range from 0.019 to 0.13 $x10^{15}$g C.

(19) Methane from coal mining, and venting of natural gas, as well as "juvenile methane emissions" (if any), would contain no ^{14}C, where-as methane emissions arising from biological sources would contain a modern day ^{14}C signature. The best estimate of the percentage of methane emissions with no ^{14}C signature has recently been determined to be about 20%, although some estimates reach as high as 32%.

Conclusions:

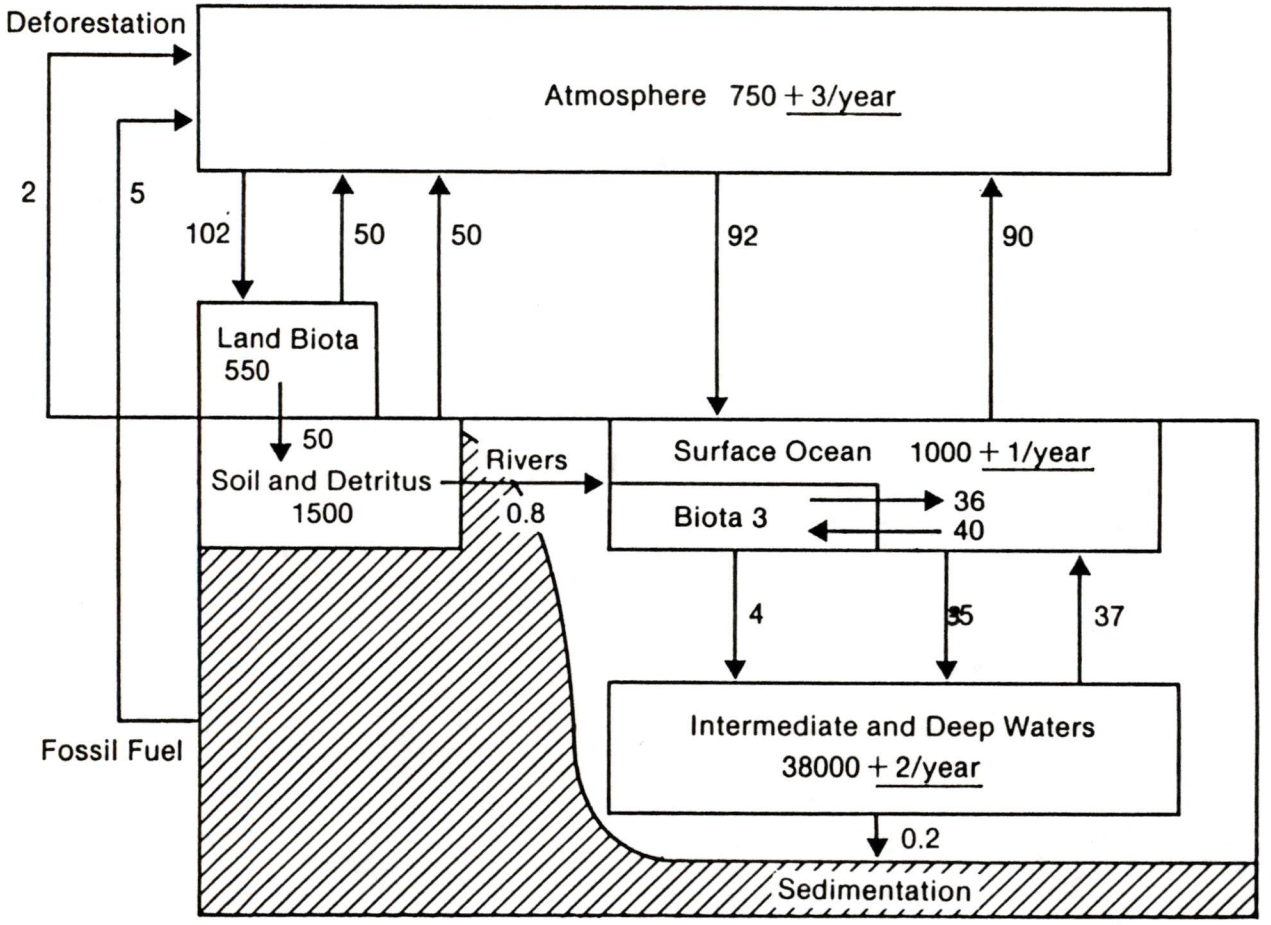
The total annual flux of atmospheric carbon dioxide arising from natural and anthropogenic methane emissions is between 0.3 and 0.5 $x10^{15}$g C, of which about 60 to 70% are thought to arise from the direct influence of human activities, i.e., 0.18 to 0.35 $x10^{15}$g C. It is clear that this annual flux is relatively unimportant, in terms of total carbon, compared to the annual fluxes of carbon dioxide arising from the combustion of fossil fuels (5.7±0.5 $x10^{15}$g) and tropical deforestation (0.6 and 2.5 $x10^{15}$g C).

The observed decrease, prior to 1952, in the atmospheric abundance of $^{14}CO_2$, compared to $^{12}CO_2$, over the last 200 years is consistent with the source of atmospheric carbon dioxide containing no ^{14}C, i.e., from the combustion of fossil fuels (completely depleted of ^{14}C) and the atmospheric oxidation of ^{14}C free CH_4 (the magnitude of this source, $<0.15x10^{15}$g C per year, is only a few percent of the fossil fuel source).

The observed change in the interhemispheric gradient in carbon dioxide over the past 30 years parallels the increased combustion of fossil fuels in the northern hemisphere.

The anthropogenic fluxes of carbon dioxide are much smaller (factor of about 25) than the natural sources and sinks, but are still large enough to perturb the natural carbon cycle and account for the observed ~25% increase in atmospheric carbon dioxide since pre-industrial times. The ice core record suggests that the atmospheric concentrations of carbon dioxide and methane were in quasi-steady state (natural sources and sinks balanced) prior to the industrial revolution, with rapid increases thereafter.

The sum of the annual emissions of carbon dioxide from tropical deforestation and the combustion of fossil fuels is between 6 and 9 $x10^{15}$g C, of which only about 3.5 x 10^{15}g C remain in the atmosphere. The remaining 2 to 5.5 $x10^{15}$g C is being taken up by the oceans and terrestrial biosphere, but the relative proportions are poorly quantified. The lack of a quantitative knowledge of the sinks, hence atmospheric lifetime, of carbon dioxide means that there is uncertainty associated with our understanding of the relationship between future emissions and atmospheric concentrations of carbon dioxide.


Deforestation
Atmosphere 750 + 3/year
2
5
102
50
50
92
90
Land Biota
550
50
Soil and Detritus
1500
Rivers
0.8
Surface Ocean 1000 + 1/year
Biota 3
36
40
4
35
37
Fossil Fuel
Intermediate and Deep Waters
38000 + 2/year
0.2
Sedimentation

Question: Do climate models assume a linear relationship between changes in the atmospheric concentrations of greenhouse gases and changes in the absorption of infra-red (terrestrial) radiation, i.e., changes in radiative forcing.

Answer: No.

Climate models do not assume a linear relationship between changes in the atmospheric concentrations of greenhouse gases and changes in radiative forcing. Changes in radiative forcing due to changes in the atmospheric concentration of species A depends upon the spectral properties of species A, the atmospheric concentration of species A, and the concentration of other gases with spectrally overlapping bands.

The forcing of some atmospheric species (most notably carbon dioxide, methane, and nitrous oxide) is markedly non-linear in absorber amount. Therefore, changes in radiative forcing are critically dependent on the concentrations for which the calculations are performed.

Carbon dioxide: The atmospheric concentration is currently about 353 ppmv. There is a logarithmic dependence between changes in atmospheric concentrations of carbon dioxide and changes in radiative forcing (in Wm^{-2}), that can be expressed by the following simple (approximate) relationship:

* Delta Forcing $= 6.3 \ln (C/C_0)$, where C is CO_2 in ppmv for C <1000ppmv.

Methane and Nitrous Oxide: The atmospheric concentrations of methane and nitrous oxide are currently 1.7 ppmv and 0.31 ppmv, respectively. There is a square root dependence between changes in the atmospheric concentrations of methane and nitrous oxide and changes in radiative forcing (in Wm^{-2}), that can be expressed by the following simple (approximate) relationships:

* Delta Forcing $= 0.036 (M^{0.5}-M_0^{0.5}) - (f(M,N_0) - f(M_0, N_0))$
where M is CH_4 in ppbv for M<5 ppmv.

* Delta Forcing $= 0.14 (N^{0.5}-N_0^{0.5}) - (f(M_0,N) - f(M_0, N_0))$
where N is N_2O in ppbv for N<5 ppmv.

The second term in each equation is due to the fact that the spectral bands of methane and nitrous oxide are significantly overlapped, therefore this has to be taken into account with the following overlap term:

$$f(M,N)=0.47 \ln [1+2.01\times10^{-5}(MN)^{0.75}+5.31\times10^{-15}M(MN)^{1.52}];$$

Chlorofluorocarbons (CFCs): Because of the low (a few parts per billion by volume(ppbv)) atmospheric concentrations of CFCs 11 and 12, and the fact that they absorb in a "spectrally transparent \\\\\\\\\\\\\\\\\\\\ \\\" region of the spectrum, there is a linear relationship between changes in atmospheric concentrations of CFCS 11 and 12 and changes in radiative forcing that can be simply expressed:

* Delta Forcing (CFC-11) $= 0.22 (X-X_0)$, where X is CFC-11 in ppbv<2 ppbv

* Delta Forcing (CFC-12) = 0.28 ($Y-Y_0$), where Y is CFC-12 in ppbv<2 ppbv

Ozone: The relationship between changes in the atmospheric concentrations of tropospheric and stratospheric ozone and changes in radiative forcing are somewhat more complex than for the long-lived, well mixed gases, such as discussed above. Changes in radiative forcing are sensitive, with a linear response, to changes in the vertical distribution of ozone, particularly near the tropopause.

Global Warming Potentials:

It should be noted that the concept of global warming potentials (GWPs) requires an understanding of not only the dependence of the radiative forcing of a gas on its concentration and the concentration of other gases with spectrally overlapping bands, but also of:

(1) the atmospheric lifetimes of the various gases
(2) the specification of the most appropriate time period over which to perform the integration

The reference gas for the table of GWPs listed by IPCC is carbon dioxide, yet the atmospheric lifetime of carbon dioxide is quite poorly defined because of uncertainties associated with understanding its sources and sinks. This limitation, which was recognized by IPCC means that significant research will be needed before relative GWPs can be determined with confidence.

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
07. Memo	From D. Allan Bromley to John Sununu Re: Forthcoming IPCC Plenary Session in Sweden (2 pp.)	7/12/90	P/~~5~~	

Collection:

Record Group: Bush Presidential Records
Office: Chief of Staff to the President, Office of the
Series: Sununu, John, Files
Subseries: White House Offices File
WHORM Cat.:
File Location: Science and Technology (Bromley) (1990) [2]

Open on Expiration of PRA
(Document Follows)
By ___ (NLGB) on 10/28/05

Date Closed:	12/16/2004	**OA/ID Number:**	29183-007
FOIA/SYS Case #:	1998-0004-F[1]	**Appeal Case #:**	
Re-review Case #:	2005-0426-S	**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
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C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

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(b)(9) Release would disclose geological or geophysical information

file

THE CHIEF of STAFF
has seen

THE WHITE HOUSE

WASHINGTON

July 12, 1990

HHS suggests Bob Grady as Chair of Task Force/ Working Group
7/31/90

I talked to Ede. She will pass response (pg 2) to Bromley.
AHC
7/31

MEMORANDUM FOR JOHN H. SUNUNU

FROM: D. ALLAN BROMLEY

SUBJECT: FORTHCOMING IPCC PLENARY SESSION IN SWEDEN

As you know, the final plenary session in the first round of activities of the IPCC is scheduled to take place in Sweden in early August. This memorandum is intended as a heads up concerning aspects of U.S. participation in that meeting.

Fred Bernthal, as Deputy Director of NSF, recognizes that the meeting coincides with Erich Bloch's last week on the job as Director of NSF and feels that he should be in place at NSF. In my discussions with him, however, he has agreed that if it is felt that his services are required in Sweden, he would be reluctantly willing to go and perform his swan song as Chairman of Working Group #3. I believe that it is important that he be present because otherwise we will have very little continuity with the discussions that have led up to this final meeting and very little effective input toward affecting the report that emerges from it. In his absence, also, we in the U.S. will have little chance of holding the chairmanship of this Working Group.

John Knauss, the Director of NOAA, called me to volunteer to head up the U.S. Delegation to the Swedish meeting but in order to make plans for the latter part of the summer, he requests that he be told as soon as possible whether he should plan on attending. Here again I think it is important for John to attend because he brings an extensive technical background to the discussions and in that role can complement Bernthal.

Finally, Bill Reilly has urged that Buff Bohlen, who has now been confirmed as Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs, be named as Bernthal's replacement as Chairman of Working Group #3, if, as seems probable, that Working Group and the entire IPCC structure continues to function after the forthcoming plenary. Unfortunately, although Bohlen has extensive experience in other aspects of international environmental matters, he has had very little contact thus far with the global climate change question and in particular, has had no contact whatsoever with the detailed IPCC discussions.

My recommendation to you would be that Bernthal, Knauss, and Bohlen should all attend this IPCC plenary; Bernthal, to wind up his activities and make sure that U.S. views are properly represented in the closing discussions leading to the final IPCC report; John Knauss, because of his technical competence and because I believe that he would be the logical replacement for Bernthal as Chairman of Working Group #3 if it continues and if, indeed, the U.S. is allowed to retain its chairmanship--something that is far from certain at this point. Finally, Buff Bohlen, to give him an opportunity to become acquainted with some of the issues, meet some of the people and become sensitized to some of the very important political undercurrents that are conditioning activities in the global change area.

I would have some concern about naming Bohlen to the working group chairmanship if we are given the opportunity to name the chairman at least until he has had considerably more exposure to this whole international area, but I am quite prepared to admit that, after some decent interval and with such exposure, he might well be an appropriate person to replace John Knauss, if such replacement were deemed desirable. Knauss is not an accomplished chairman although a great scientist and I am told that Bohlen has demonstated very real abiality in running meetings--both national and internationally--very effectively.

Finally, I would welcome an opportunity, at your convenience, to discuss with you what role you see in the future for the DPC Working Group on Global Climate Change.

per HHS
Bernthal chairman for
last mtg. then lets see
who should be chair of wg #3
(HHS suggests Bohlen already.)

THE WHITE HOUSE

WASHINGTON

July 5, 1990

7/6/90
Dud to Houston

MEMORANDUM FOR JOHN H. SUNUNU

FROM: D. ALLAN BROMLEY

SUBJECT: THE HUBBLE TELESCOPE

NASA has now had the time to model the performance of the Hubble telescope and identify the problem with reasonable certainty. The attached figures illustrate the situation.

As you know the Hubble has a Cassegranian mirror setup and focus is achieved by moving the mirrors relative to one another.

As illustrated in Figure 1 (a computer simulation) as the focusing adjustment is moved through the actual focus--from inside to outside--for a point source the image moves symmetrically as shown here from the form at the upper left to that at the lower right.

If, however, there is spherical aberration in the system the focussing behavior is no longer symmetric (as illustrated in Figure 2) and in particular, outside the focus characteristic diffraction rings appear. In Figure 3, the actual Hubble star image inside the focus is compared with the model calculations assuming a 0.5 wave length spherical aberration (2 micron center-to-edge) surface error in the figure of the primary mirror. The agreement is excellent. So also is that outside the focus as shown in Figure A.

This rather clearly shows that we have a classic error in one or both mirror figures--but fortunately one that can very readily be corrected fully. NASA had originally planned to replace one camera in 1993 and the second in 1996. Currently plans are being developed to replace both as soon as possible with both having a corrective lens to regain full optical performance; it may well be 2.5 years before this can be accomplished however.

It is interesting to note that the most recent European telescope installed in Chile was found to have the same defect as the Hubble but, in its case, sufficiently powerful hydraulic actuators had already been installed on the primary mirror so that it could be distorted to the proper figure. Hubble also has actuators but at best they could only remove 10% of the defect and NASA believes it better not to attempt this because--if one or more actuators failed--the resulting figure would be much more difficult to correct when the cameras are changed.

I watched the mirror that Perkin-Elmer made being tested and as an old mirror grinder am totally convinced that the error was in design not in manufacture.

The system was never tested before launch because the mirror was gravitationally distorted and NASA concluded that mocking-up a zero G environment would be exceedingly expensive and unnecessary.

No one has yet pinpointed the source of the design error but unfortunately it does nothing for the image of either science or NASA. Now Allen will chair a committee that will look into the whole question.

Fortunately, the ultraviolet program for the Hubble can continue until the camera change occurs since it does not require the full resolution and does take full advantage of the Hubble's location outside of the earth's atmosphere.

You may well already have all this but in case you didn't I thought that you would be interested.

Attachments

Coarse focus run, 0.0 spherical

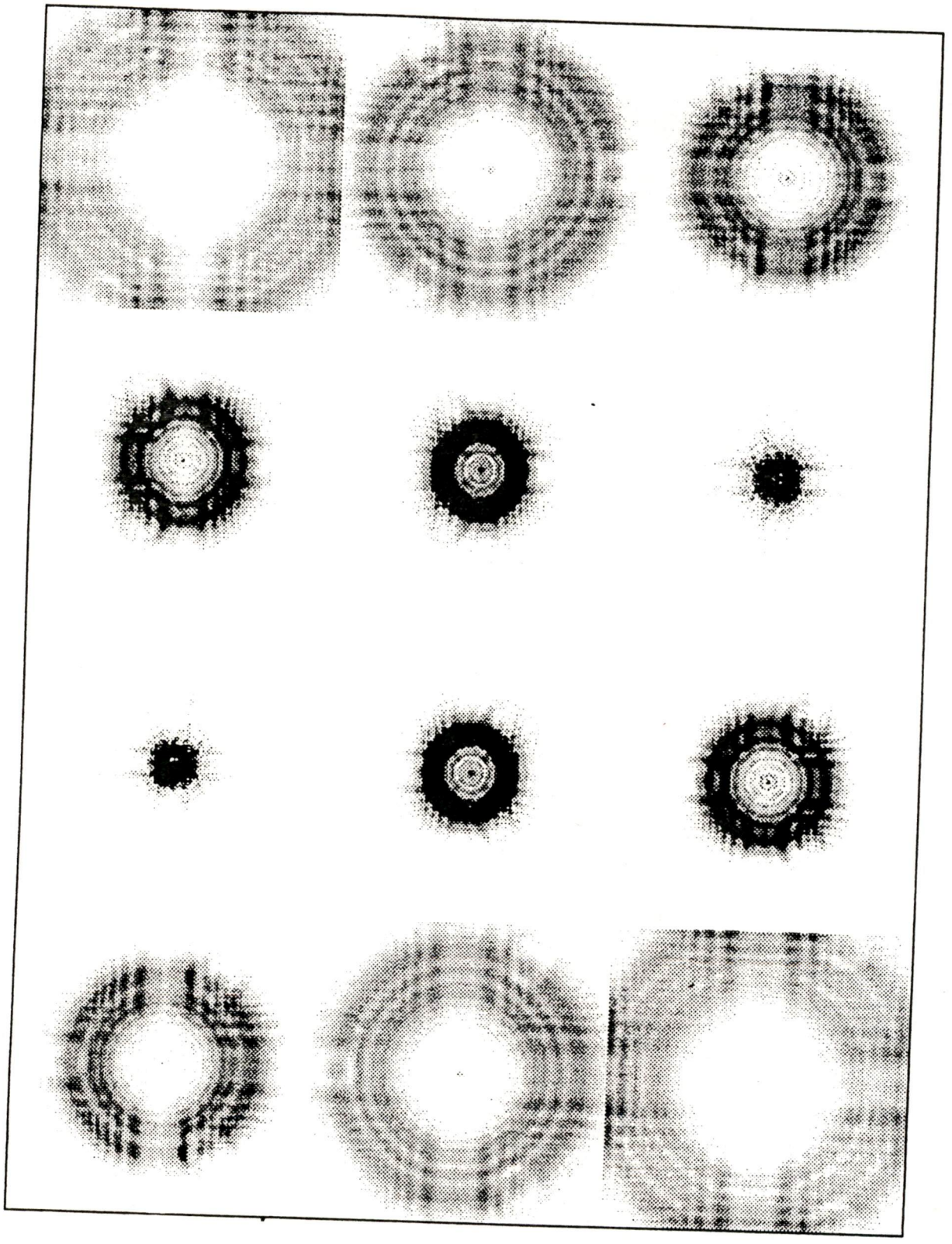


FIGURE 1.

Coarse focus run, 0.5 spherical

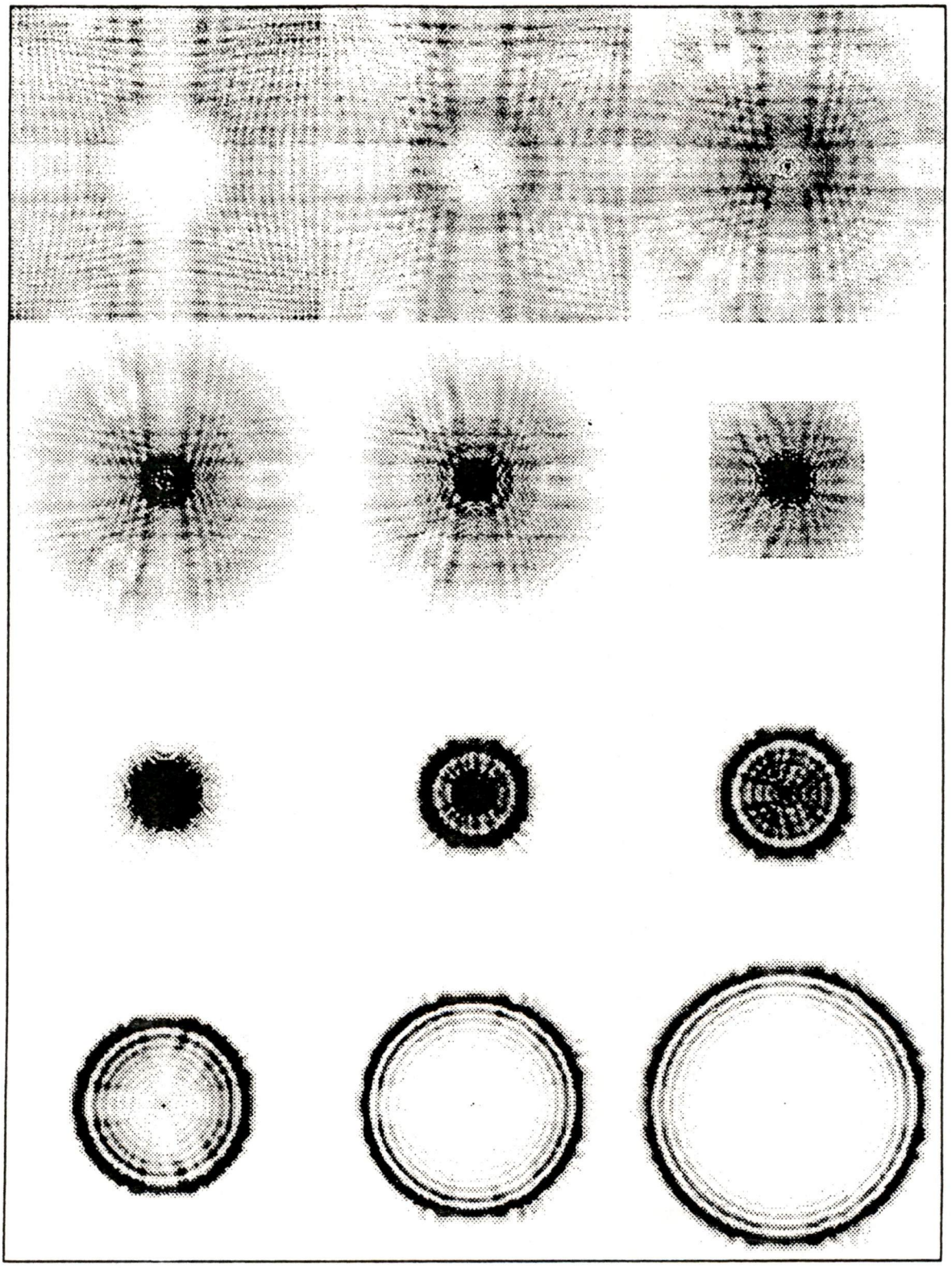
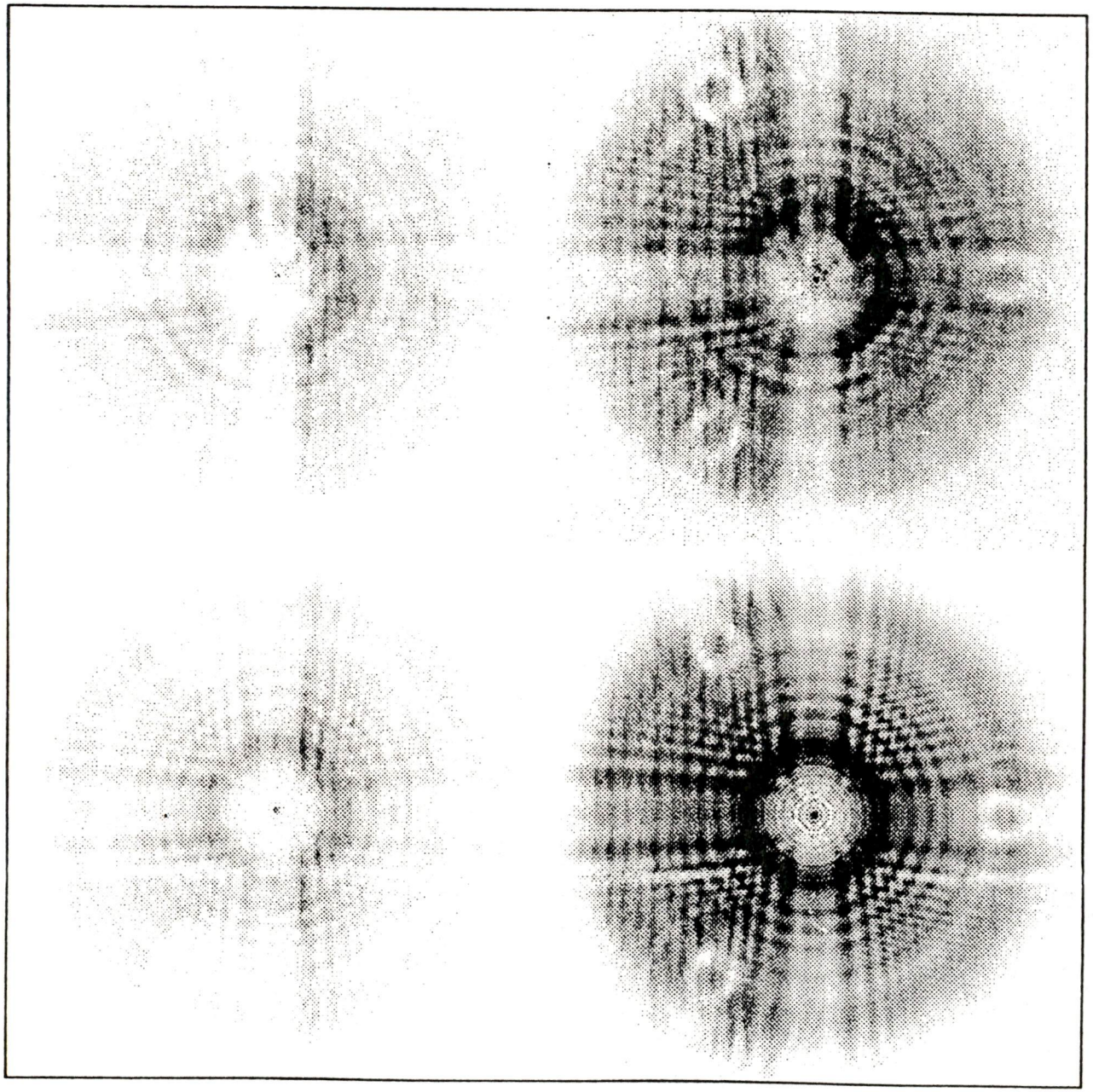


FIGURE 2.

PC5 star from 6/21, focus: -300 INSIDE FOCUS

P. C. IMAGE



MODEL

FIGURE 5.

PC5 star from 6/23, focus: +333 OUTSIDE FOCUS

P.C. IMAGE

MODEL

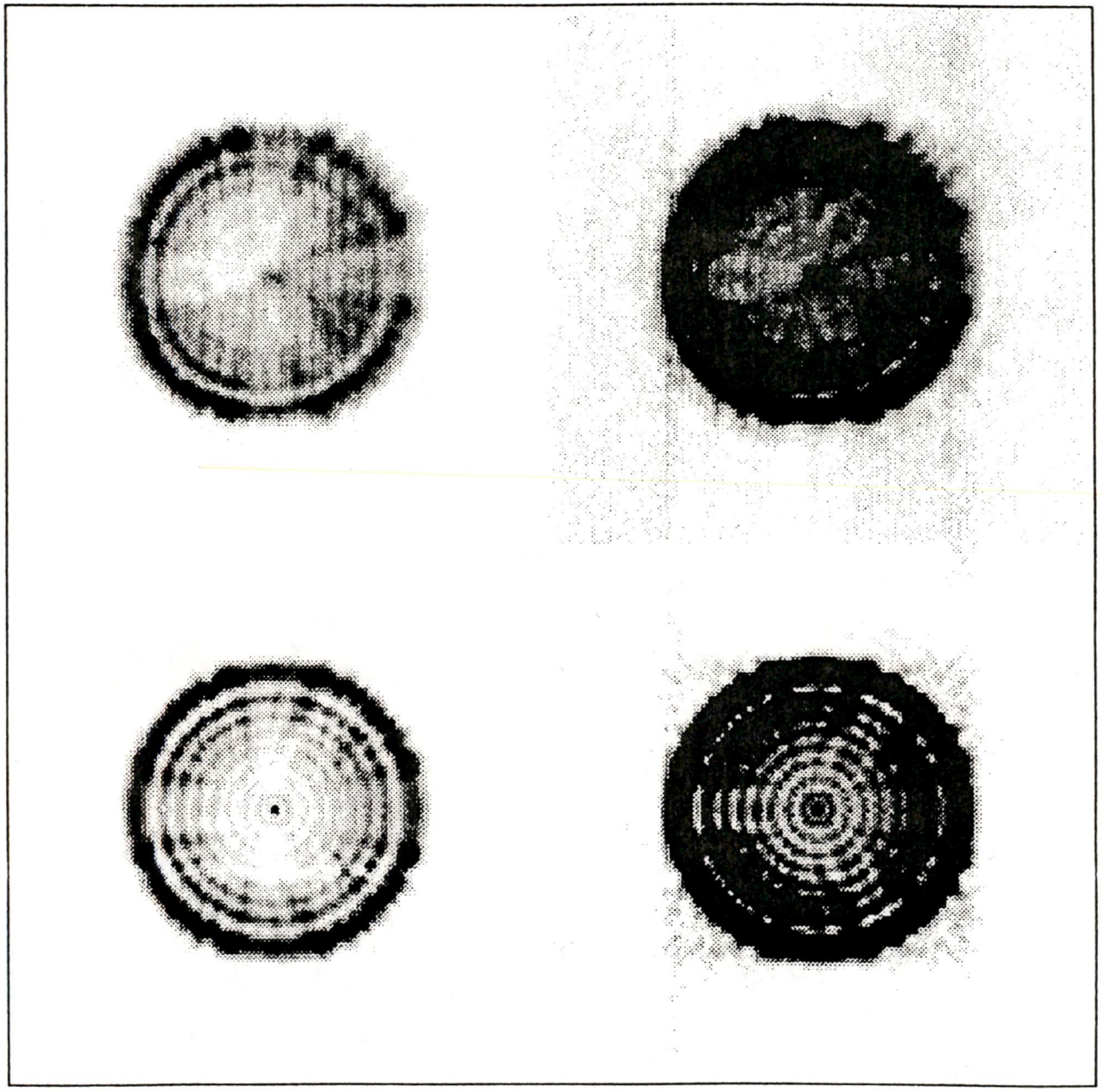


FIGURE 4.

FYI

THE WHITE HOUSE
WASHINGTON

DATE: July 5, 1990

TO: Governor

FROM: **JACKIE KENNEDY**

Leo Wright called, he'd like John Lego of Westinghouse be invited to the King Fahd dinner, he's the Chairman.

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
08a. Memo	From James A. Baker, III to Secretary Brady, John Sununu Re: Uruguay Round (1 pp.)	6/29/90	P-5	

Collection:

Record Group: Bush Presidential Records
Office: Chief of Staff to the President, Office of the
Series: Sununu, John, Files
Subseries: White House Offices File
WHORM Cat.:
File Location: Science and Technology (Bromley) (1990) [2]

Open on Expiration of PRA
(Document Follows)
By JP (NLGB) on 10/28/05

Date Closed:	12/16/2004	**OA/ID Number:**	29183-007
FOIA/SYS Case #:	1998-0004-F[1]	**Appeal Case #:**	
Re-review Case #:	2005-0426-S	**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

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(b)(9) Release would disclose geological or geophysical information

THE SECRETARY OF STATE

WASHINGTON

June 29, 1990

MEMORANDUM FOR SECRETARY BRADY
GOVERNOR SUNUNU
BRENT SCOWCROFT

FROM: JAMES A. BAKER, III

The attached is self-explanatory, but sounds to me like it might not be a bad idea to emphasize the importance we attach to the successful conclusion of the Uruguay Round.

This would be an exceptional event that would be designed simply to send a strong message -- not to create a precedent or to result in trade ministers attending regularly scheduled summit sessions.

It could afford a way to enhance public support and attention for one of our primary goals.

Attachment

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
08b. Memo	From Clayton Yeutter to James A. Baker, III Re: Uruguay Round (1 pp.)	6/19/90	P~~5~~	

Collection:

Record Group: Bush Presidential Records
Office: Chief of Staff to the President, Office of the
Series: Sununu, John, Files
Subseries: White House Offices File
WHORM Cat.:
File Location: Science and Technology (Bromley) (1990) [2]

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THE SECRETARY OF AGRICULTURE
WASHINGTON
20250-0100

June 19, 1990

MEMORANDUM FOR: **JAMES A. BAKER III**
SECRETARY OF STATE

FROM: **CLAYTON YEUTTER**

Jim, I mentioned this to Dick McCormack on the airplane a couple of weeks ago, but wanted to follow up with a note to you. Senator Bentsen's recent letter strongly recommending that Ambassador Hills be invited to participate at the Summit reminded me to do this.

I'm told that near the end of the Tokyo Round (1978 I believe) the applicable trade ministers were called to the summit on very short notice, and instructed by the chiefs of state to promptly bring the Round to a successful conclusion. You may wish to consider repeating this at Houston, particularly in view of the wide disagreements on agriculture which surfaced at the OECD Ministerial.

Frans Andriessen will already be there as your counterpart, and he can represent the entire European Community since the Uruguay Round negotiations are in his portfolio. I'm told that the Japanese will be bringing Muto, the MITI Minister, so he'll already be on the scene. That means you are missing only Carla and John Crosbie of Canada. Since both of them are nearby it would be very easy to call them to Houston to join Andriessen and Muto in receiving such a message.

Following this format, or something like it, will also avoid the problem of adding the trade ministers (or anybody else) as official members of the delegation.

Withdrawal/Redaction Sheet
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Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
09a. Memo	From James Watkins to John Sununu Re: Global Climate Change Issues at the Houston Summit (1 pp.)	7/3/90	~~P-5~~	

Collection:

Record Group: Bush Presidential Records
Office: Chief of Staff to the President, Office of the
Series: Sununu, John, Files
Subseries: White House Offices File
WHORM Cat.:
File Location: Science and Technology (Bromley) (1990) [2]

Open on Expiration of PRA
(Document Follows)
By JP (NLGB) on 10/28/05

Date Closed:	12/16/2004	**OA/ID Number:**	29183-007
FOIA/SYS Case #:	1998-0004-F[1]	**Appeal Case #:**	
Re-review Case #:	2005-0426-S	**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
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RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

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155362

The Secretary of Energy
Washington, DC 20585

July 3, 1990

MEMORANDUM FOR: The Honorable John H. Sununu
The Chief of Staff
The White House

FROM: James D. Watkins
Secretary of Energy

SUBJECT: Global Climate Change Issues at the Houston Summit

I have been asked by both Bob Grady and Andy Card to pass along my reaction to the Deland proposal to have the U.S. "cap" its greenhouse gas emissions.

Conclusion

Based on our analysis in Attachment A, I still believe that agreeing to specific caps or targets at this time is premature and unwise until we better understand the impacts of what we are proposing. Many of the ideas proposed here are currently under review within the Administration. Whether under the auspices of the DPC, IPCC, or the National Energy Strategy, the G-7 nations should appreciate that the Administration is studying a number of options. Our position should remain that until initiation of international negotiations, we should oppose consideration of targets. However, we will continue to investigate and take further actions beyond those already taken or identified here based on their usefulness for other policy initiatives or their cost-effectiveness. This approach is paying off. Because of the actions over the past 18 months, we now project substantial reductions in greenhouse emissions as compared to those of several years ago.

On the other hand, we understand that France, Germany, the United Kingdom and Canada will press for specific actions at the Summit on greenhouse gas reductions and funding for developing countries. If this is true and a U.S. response in the form of specific actions is necessary, then we recommend an approach along the lines of Attachment B.

John, our past position is solid and we should not deviate far from it. We are doing a lot to reduce greenhouse gases while others are jawboning. Steady as she goes...

Attachments

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
09b. Report	Attachment A: DOE Assessment of Deland Proposal (1 pp.)	n.d.	P-5	

Collection:

Record Group: Bush Presidential Records
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Attachment A

DOE Assessment of Deland Proposal

The Deland proposal is good to the extent that it puts the comprehensive approach to greenhouse gas emission on center stage. The analytical basis for the proposal is an EPA exercise prepared for Boyden Gray. Based on a series of assumptions, most importantly, that a common measure of carbon dioxide equivalents for all greenhouse gases could be developed, EPA has calculated greenhouse gas emission reductions due to initiatives currently underway. By EPA's own admission, these estimates are very preliminary. However, EPA believes that by taking credit for some initiatives underway, (e.g., the tree planting initiative, Montreal Protocol controls on CFCs and halons, and passage of the Clean Air Act) and by accounting for some planned, but not yet concrete actions, such as a proposed EPA rulemaking for capturing methane from landfills, the U.S. could stabilize greenhouse gas emissions by the year 2000.

We see a number of problems in using these estimates as the basis for the proposal to cap emissions.

1. EPA estimates that stabilization could occur in the year 2000. In other words, it would take 10 years to achieve. Mike Deland is using the estimates to say that we are at stabilization now.

2. To achieve stabilization in 2000, a 24 percent reduction in greenhouse gas emissions is needed. Of the 24 percent, 17 percent is calculated to come from phase-out of CFCs. What happens after 2000? We can only phase-out CFCs once.

3. Will counting CFC reductions against a stabilization target be regarded by other nations as legitimate? In other words, the international community has already agreed to phase out most CFCs. Obviously without the CFC phase-out credit, we cannot even come close to stabilization.

Withdrawal/Redaction Sheet
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Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
09c. Report	Attachment B: Recommended Alternative Approaches (3 pp.)	n.d.	P/~~5~~	

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Attachment B

Recommended Alternative Approaches

1. The need for improving scientific understanding should be linked to future actions. The U.S. should urge the G-7 to support linking future protocols on mitigating greenhouse gas emissions to the scientific evidence. The stronger the evidence, the bigger the response.

2. Most G-7 countries have announced that they will stabilize or reduce CO2 emissions below 1990 levels by 2010. To avoid comparison to these initiatives and to avoid being isolated for not proposing specific actions on CO2, an alternative approach would be to seek agreement that all greenhouse gas sources and sinks, and not just CO2, must be addressed. The U.S. could put forward the concept that the G-7 support a comprehensive approach, or one that considers net greenhouse gas emissions including all sources and sinks on a CO2 equivalent basis, not on a gas-by-gas basis, as the best way to achieve international agreement on reducing greenhouse gases.

   As you know, this approach is consistent with current U.S. policy to advocate a comprehensive approach in any follow-on protocols on climate change.

3. As part of the comprehensive approach, study of a global greenhouse gas emission trading system should be proposed. Developing countries will more than double their greenhouse gas emissions over the next 30 years. An effective emissions trading scheme could prove to be a very cost-effective way for developed countries to assist developing countries. For example, it may be cheaper for the U.S. to cut global emissions by building new, clean coal or gas plants in Eastern Europe than to shut down a coal-fired power plant in the U.S. This emissions trading would expedite the transfer of technology to developing countries. Consideration might be given to a proposal that G-7 nations support an evaluation of an emissions trading scheme as an effective implementation strategy for any international agreement on reducing greenhouse gases.

4. A major decrease in the rate of deforestation would contribute significantly to slowing down the rate of carbon dioxide accumulation in the atmosphere. Consider proposing that specific actions be taken now to protect the global environment. For example, the G-7 nations should commit to a major reforestation initiative and agree to take joint actions to stop deforestation in all countries. This

approach is consistent with the current Administration proposal to plant one billion trees a year over the next five years.

5. Announce a major energy efficiency initiative. In the Working Group III Report of the Intergovernmental Panel on Climate Change (IPCC), it was noted that:

   -- improved energy efficiency reduces emissions of carbon dioxide, the most significant greenhouse gas, while improving overall economic performance and reducing other pollutant emissions and increasing energy security.

   Consider proposing that G-7 nations should commit now to double their funding of energy efficiency technologies or take similar actions to encourage private sector initiatives to increase energy efficiency.

6. To understand better the role that the energy sector can play in reducing greenhouse gases, each of the G-7 countries should prepare strategic plans that identify policy options and technologies, as well as the costs associated with these actions, that could be deployed to reduce greenhouse gases as well as serve the broader needs of providing options for future energy supply. The National Energy Strategy (NES) could provide a good model for this approach. By preparing such a plan, each G-7 country will be better prepared to discuss the appropriate next steps in dealing with global climate change.

7. The need for sound economic analysis will be evident from the IPCC Report to be released in August. The U.S. should propose that the G-7 support the establishment of a standing IPCC Working Group on Economics.

ID# 155362

THE WHITE HOUSE
CORRESPONDENCE TRACKING WORKSHEET

INCOMING

DATE RECEIVED: JULY 05, 1990

NAME OF CORRESPONDENT: ADMIRAL JAMES D. WATKINS

SUBJECT: FORWARDS HIS REACTION TO THE DELAND PROPOSAL FOR A CAP ON GREENHOUSE GAS EMISSIONS

ROUTE TO: OFFICE/AGENCY (STAFF NAME)	ACTION ACT CODE	ACTION DATE YY/MM/DD	DISPOSITION TYPE RESP	DISPOSITION C D	DISPOSITION COMPLETED YY/MM/DD
JOHN SUNUNU	ORG	90/07/05		_	__/__/__
REFERRAL NOTE:					
		__/__/__		_	__/__/__
REFERRAL NOTE:					
		__/__/__		_	__/__/__
REFERRAL NOTE:					
		__/__/__		_	__/__/__
REFERRAL NOTE:					
		__/__/__		_	__/__/__
REFERRAL NOTE:					

COMMENTS: _____

ADDITIONAL CORRESPONDENTS: MEDIA:L INDIVIDUAL CODES: ____ ____ ____

CS MAIL USER CODES: (A)_____ (B)_____ (C)_____

ACTION CODES:	DISPOSITION	OUTGOING CORRESPONDENCE:
A-APPROPRIATE ACTION	A-ANSWERED	TYPE RESP=INITIALS OF SIGNER
C-COMMENT/RECOM	B-NON-SPEC-REFERRAL	CODE = A
D-DRAFT RESPONSE	C-COMPLETED	COMPLETED = DATE OF OUTGOING
F-FURNISH FACT SHEET	S-SUSPENDED	
I-INFO COPY/NO ACT NEC		
R-DIRECT REPLY W/COPY		
S-FOR-SIGNATURE		
X-INTERIM REPLY		

REFER QUESTIONS AND ROUTING UPDATES TO CENTRAL REFERENCE (ROOM 75,OEOB) EXT-2590
KEEP THIS WORKSHEET ATTACHED TO THE ORIGINAL INCOMING LETTER AT ALL TIMES AND SEND COMPLETED RECORD TO RECORDS MANAGEMENT.

U.S. House of Representatives

Congressional Sunbelt Caucus
Task Force on Wetlands

June 28, 1990

The Honorable John Sununu
Chief of Staff
The White House
Washington, D.C. 20500

Dear Governor Sununu:

On June 20, 1990, we expressed in a letter to you that we would be writing again shortly to clarify our concerns about the interagency Federal Manual for Identifying and Delineating Jurisdictional Wetlands and the Memorandum of Agreement issued by the Army Corps of Engineers and the Environmental Protection Agency. We have been inundated with calls and letters from constituents who are frustrated with the recent regulatory changes. This letter will outline some of the primary concerns that we, and those we represent, have regarding the effect of the changes on "wetlands" in our districts.

First, we commend you and the agencies involved in seeking to develop a single, unified definition for identifying and delineating wetlands. It is important to have a valid scientific method for this complex process and to resolve some of the jurisdictional differences that had been occurring among the agencies.

However, the new wetlands rules do not adequately or scientifically differentiate between lands which have little or no environmental value as functioning wetlands, and those lands which do have those important values. The result has been that as much as 85 percent of the land area of some counties could be declared off limits for traditional development even though most of that land has no significant wetland value.

Although the Corps and EPA state that the Memorandum of Agreement (MOA) only puts in writing the policies that had already been in effect, our constituents have presented overwhelming evidence that this is not so. In effect, we have had one of the most significant changes of federal regulatory policy in recent years, but without normal public review and comment. The consequence is a flawed process that ultimately may generate a backlash of public opinion against protection of functioning wetlands.

561 HOUSE ANNEX 2
WASHINGTON, D.C. 20515
202-226-2374

We believe that the MOA should be opened to public comment and review. Furthermore, we think that an administrative rule-making may be in order to, among other things, differentiate between high value wetlands and those with little or no value. This distinction of wetland types, in consideration of permit requests, should be incorporated into the MOA sequencing process.

The consequences of not effectively differentiating the value of possible wetland tracts are extreme. It could result in the devaluation of land values and a reduction in local tax revenue. As one resident of Brunswick, Georgia, writes,

> "individuals who have acquired land over a period of years and generations would find that 85% (assuming that 85% of the land in the county is classified as "wet") of their effort was in vain; banks with land as collateral would realize that the loans are not properly secured and call in the debts, our young people would not return to the area because with so little land left for development,the economy would wither and jobs would be scarce. Finally, the cost of owning a home would be driven even higher and made more unattainable to the citizens in the county."

Another constituent writes from Jacksonville, North Carolina: "Never before has the combination of all regulations, policies, and the anti-growth positions of boards and councils had nearly the potentially devastating effect on the economy of Eastern North Carolina as do the regulations affecting these "high ground" wetlands."

The interagency Wetlands Delineation Manual is currently undergoing a public review through hearings held in different parts of the country. We understand that the hearings are intended to focus only on the technical aspects of the Manual, yet at the first hearing in Baton Rouge, Louisiana, most of the public comment centered on policy. Like the MOA, the Manual was not open to public comment before it was released. We believe that, upon completion of the regional hearings, policy amendments should be considered in addition to the technical amendments. Again, we stress a value system for determining which wetlands are to be subject to the sequencing process set forth in the MOA and which lands would not require a permit.

As they stand now, the MOA and the Manual, combined, effectively stymie rational development of lands for infrastructure systems, hospitals, schools and homes. As the public learns more about this, many are asking the legitimate question of how policy makers can be allowed to implement such rules without even soliciting public opinion and with no new laws to permit such actions.

We hope to meet with you soon to further discuss our concerns. We are pleased to know, as you expressed to a few of us at the White House cookout on June 26, that you also look forward to such a meeting.

Sincerely,

Lindsay Thomas
Task Force Co-Chair

E. Clay Shaw, Jr.
Task Force Co-Chair

Jimmy Hayes, M.C.

Greg Laughlin, M.C.

Mike Espy, M.C.

Herbert Bateman, M.C.

Sonny Callahan, M.C.

Beryl Anthony, Jr., M.C.

Bill McCollum, M.C.

Billy Tauzin, M.C.

Andy Ireland, M.C.

Lindy Boggs, M.C.

H. Martin Lancaster, M.C.

Norman Sisisky, M.C.

Robin Tallon, M.C.

Walter B. Jones, M.C.

Craig James, M.C.

Tom DeLay, M.C.

Bob Livingston, M.C.

Withdrawal/Redaction Sheet
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Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
10. Memo	From Carla Hills to John Sununu Re: Textiles (1 pp.)	7/5/90	P-5	

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THE UNITED STATES TRADE REPRESENTATIVE
Executive Office of the President
Washington, D.C. 20506

JUL - 5 1990

MEMORANDUM FOR JOHN H. SUNUNU
CHIEF OF STAFF

FROM: Carla A. Hills

SUBJECT: Textiles

You should be aware that the textile industry is determined to push their legislation through the Congress before the August recess, and will use any movement we make in the Uruguay Round meeting in Geneva next week to try to put together a framework agreement on textiles which would serve as the basis for a decision by ministers in December on the future of textile trading rules. It is likely, therefore, that any decisions made in Geneva will be used by the industry against us on Capitol Hill. Also, Senator Helms probably will continue to press very hard for another meeting with you on textiles.

The bill has been sent by the Finance Committee, without recommendation, to the floor of the Senate. There is no schedule at present for a floor vote. Once the bill passes the Senate, the North and South Carolina delegations will intensify pressure on the House leadership to pass the bill and, at that point, it is not likely that the Ways and Means Committee and Chairman Rostenkowski will resist. It is virtually certain that the bill will pass both chambers -- there are 54 cosponsors (and probably 60 votes) in the Senate and 242 cosponsors in the House.

In my view, the impact of any movement in Geneva on the domestic legislative process will be marginal. I do not believe that a framework agreement in Geneva will materially change the substance of our objectives in textiles. However, as the industry and many Democrats have decided to push the bill quickly in any case, we may be looking at a veto override battle sooner, rather than later.

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11. Memo	From Allan Bromley to John Sununu Re: Global Change (2 pp.)	7/5/90	P-5	

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THE WHITE HOUSE
WASHINGTON

July 5, 1990

Memo to: John Sununu
From: Allan Bromley
Re: Global Change

In case you haven't seen it, I am enclosing herewith a copy of the ICSU document on this topic. It is the best single statement that I have seen in the public domain thus far. We would have been better served if the IPCC report were more like this one.

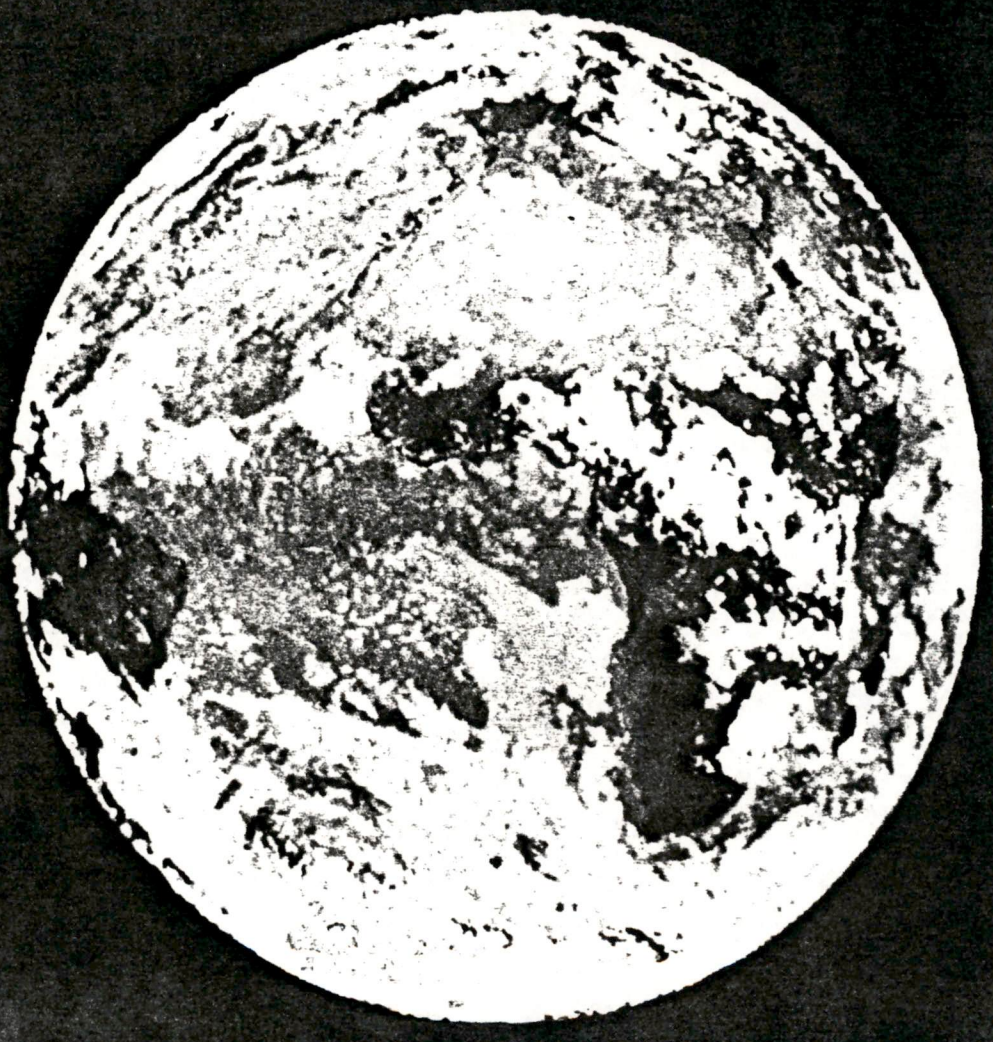
I have met with Bob Watson and Jim Baker, with their full support, have focused Bolin's attention on a number of changes

In the draft document that you read at Kennebunkport that are essential if the final document is to have US support.

As it turns out either Bob or Fred had, at various times, had most of these points in the document only to find them removed by Baker either on his own initiative or under pressure from other countries.

I agree that it is certainly time for us to take a firm stand.

GLOBAL CLIMATE CHANGE



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JOSEPH J. JACOBS, PH.D
CHAIRMAN OF THE BOARD

July 5, 1990

Governor John H. Sununu
Chief of Staff
The White House
Washington, D.C. 20500

Dear John:

Peter Tanous sent you a copy of the statement titled, "Facing Realities About a Middle East Negotiation." An extra copy is enclosed in case the other got lost in the shuffle of your voluminous mail.

I'm nonplussed that this forthright statement with powerful names on it has gone relatively unnoticed.

This suggests that a parallel effort to the one you have asked us to help with, be explored by the Administration. They are not mutually exclusive.

The story behind the formation of this joint Arab-American, Jewish-American (note the deliberate selection of the adjectives here) discussion group will provide a basis for the Administration's interacting with this group.

I organized and started this group in the early eighties because of my obvious ethnic interest, but also because I had been traveling the Middle East on business for 20 years -- mostly to Jordan. I had heard and participated in thousands of discussions about the Arab-Israeli problem, had given repeated speeches on the subject, and had come to some hard conclusions. They are:

1. The Arabs can never win the public relations battle. No matter how justified the Arab arguments about their mistreatment are, they pale by comparison with the 2,000 year old Jewish story of oppression. Forty years of whining by the Arabs has made little impression in the U.S.

2. Rhetoric, legalisms, and U.N. resolutions are no match for pragmatism. The Arab tendency to believe that what <u>should</u> be, therefore <u>is</u>, prevents them from facing reality.

3. The real key to Middle East peace is with Jewish-Americans and their blind support of every Israeli <u>political</u> action. The massive guilt of this community over the holocaust (the Arnold Toynbee thesis!) and the intense peer pressure, prevents public criticism that most thoughtful Jewish-Americans will admit to privately.

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4. I therefore established very quickly that the thrust of our discussions should be, "What actions are in Israel's own self-interest? I.e., to insure Israel's survival as a peaceful member of the Middle East Community." We avoided such rhetorical time bombs as to fairness, equity, redressing wrongs, terrorism (one man's "terrorist" is the other man's "freedom fighter"), or all the other emotional litter of the last 40 years.

5. To accomplish this, the most difficult obstacle was to get the Jews to separate their justifiable emotional support of Israel from their critical judgment of the actions of the political leaders of Israel. It took many years of urging before they were willing to brave the ostracism and peer pressure from AIPAC and others to make the attached statement. I can assure you that they are even more critical privately.

The chairmanship of Jeeb Halaby and Al Tahmoush was a natural evolution, since my being 3,000 miles away prevented me from attending a number of the meetings as the discussions evolved -- and they did an admirable job in holding things together and producing this statement (with all of the signatories editing and contributing language).

The group met periodically, and quietly, over about seven years, and many "heavy hitters" from both sides participated at one time or another. On the Arab side, people like Charley Zraket, Bob Abboud and Ray Irani. On the Jewish side were Larry Tisch, Bob Arnow, Arthur White and others.

My suggested strategy:

1. Invite representatives of this group to the White House, preferably with President Bush but perhaps Scowcroft or Baker.

2. Pose to them the thesis that the Administration feels that the political regime in Israel is harming Israel's cause severely and that they are following a dangerous path in rejecting talks with PLO, as the group statement recommends.

3. Ask the group to organize and support political action with Congress and the Administration to neutralize to some extent Tom Dine or at least to let the political system know that there is a strong pro-Israel group who have different views as to how the U.S. Government should act vis-a-vis Israel than the single party line of AIPAC. The presence of prominent Arab-Americans stating that they are "pro-Israel" will attenuate the resentment of hysterical Jews here.

The line such statements or action will take will require debate, understanding and coaching from the Administration. I would hope that one course would be a recommendation that the Administration be firmer with Shamir, et al. -- that bowing to every whim and Congressional pressure does <u>not</u> serve Israel's long range interests.

Hopefully, the group would agree with the Administration and to persuade Congress especially, that abject dependency upon the U.S. diminishes Israel's self-respect, which they are now seeking by outbursts of defiance and vituperation.

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The group would hopefully lobby Congress intensively for a more mature relationship with Israel. For Israel to be a long time participant in the community of the Middle East, Congress should take responsibility to help Israel act with more foresight and maturity vis-a-vis the Arabs and Palestinians.

It should be argued that this is the only sensible antidote to the woefully immature political stance that the Arabs and the Palestinians exhibit as well. It's pretty obvious that both sides have little experience in acting as responsible nations.

John, these are ill formed ideas that may be unrealistically idealistic, but perhaps thoughtful people in the Administration can bring these ideas into the realm of the reasonable and possible.

I believe, perhaps immodestly, that I have a special personal rapport with members of this group -- especially the Jewish members -- and that they respect my judgment and lack of guile.

Call upon me if I can help.

Sincerely,

Joseph J. Jacobs

JJJ:jp

Enclosure

March 12, 1990

The enclosed statement represents the consensus of a group of Arab American and Jewish American business, academic, and professional leaders who, together with former Secretary of State Cyrus Vance, have met over the past seven years to discuss a basis on which the parties to the Mid-East conflict may find their way to the peace table.

The undersigned have served as Co-Chairmen to facilitate the dialogue between the members who have signed this statement. We hope that you will find it useful and constructive.

Lester Crown

Najeeb Halaby

Albert Tahmoush

Howard Squadron

FACING REALITIES ABOUT A MIDDLE EAST NEGOTIATION

We are a group of Americans of Arab background and Jewish background who along with former Secretary of State Cyrus Vance, have been working together for seven years. We have focused on two areas -- economic development for the Palestinian Arab population of the West Bank and Gaza, and how to get the parties to the Middle East conflict to the peace table. We have involved ourselves in these efforts, as Americans, because we believe the United States has a vital and continuing role to play in the Middle East peace process. We expect our government to be even more deeply involved in that process in the next few years.

We have made very modest contributions in both areas, partially because the problems are so difficult, and partially because we have quite deliberately set limited goals. Thus, we have never tried to agree on, or to recommend, the terms of any possible settlement. We have recognized that only the parties, at a peace table, can work out such terms.

In the areas of our concentration we have informed ourselves through meetings with very high officials in the Israeli, Jordanian, Egyptian and American governments. We have also met with Americans affiliated with the PLO.

The actions of, and resulting from, the intifada in the West Bank and Gaza have prevented, for the time being, all efforts in the area of economic development. On the other hand, they have highlighted the necessity for finding a way to get to the peace table. Although we have avoided public statements, we now believe that some truths about getting to the table

deserve public expression. Our group reflects a broad spectrum of views and backgrounds, and we trust that its observations and conclusions will be given serious consideration.

Each of the parties to the Middle East dispute has stated publicly from time to time that it is prepared to commence peace negotiations "without any preconditions". We believe that the parties would long since have been at the table if that particular rhetorical phrase had been sincere and had been acted upon. In fact, each of the parties has raised unrealistic preconditions to a peace negotiation. We urge that these preconditions, which we regard as obstacles, be discarded.

The first obstacle is the demand that the Palestinians be represented by persons independent of the PLO.

We understand that internal political considerations in the United States and Israel may dictate a Palestinian delegation that does not include prominent PLO officials. We believe that, at the present time, the Bush administration and most of the Arab world, accept that necessity; and are prepared accordingly to work with Israel in the selection of the initial Palestinian delegation. However, in the real world, no Arab country (not even Egypt) - nor any Palestinian delegation - will participate in a peace negotiation, if the members of that delegation have not previously been approved by the PLO. It is time to acknowledge that no Palestinian delegation will make any proposal that has not received PLO sanction, and that no Palestinian delegation will agree to any solution that does not have PLO endorsement. That reality should be honestly faced.

Next, there is the demand that the discussion be limited to particular issues. Naturally, if the first meeting is to discuss procedures for an election, the agenda for the meeting should conform to that purpose. But it is inevitable that there will be some conversation about the next step after the election - if only in terms of process, timetable, and the agenda for the meeting after the election. Any attempt to circumscribe the initial discussion more closely is unrealistic.

The third obstacle is the consistent reiteration by one party or the other of ultimate goals. Depending on the party, the demand is articulated that the goal be "sovereignty", "autonomy", "confederation" -- or whatever. In the real world, Israel's security concerns as well as the political needs of the Palestinians for maximum self-governance will ultimately have to be addressed, after delegations are selected, elections are held, and the parties are finally discussing substantive issues. The problems do not lend themselves to traditional solutions. New modes of relationship and new arrangements for living together will have to be developed. There will have to be lengthy and complicated negotiations directly between the parties involved, with the assistance of the United States, and possibly Egypt, if the parties want such assistance.

Finally, there is the question whether an Israeli-Palestinian agreement, if it can be achieved, is sufficient. What constitutes a comprehensive peace? Israel expects, not unreasonably, peace commitments from the entire Arab world. The Arab states take the position that the Palestinian problem must first be solved "in all its aspects" -- and comprehensive peace will follow. This chicken-egg obstacle must be addressed. In some manner, the other players - particularly Syria and Jordan - must be brought into the

Our own experience -- with strong ties to both sides -- teaches us that it is possible to resolve deep differences if parties with opposing viewpoints are willing to sit together and talk. We have been impressed by how our differences have narrowed over the years, because we chose to talk to each other.

We urge that the prior demands and preconditions, the proposed formulas and frameworks, the unrealistic expectations and dreams -- the obstacles to progress -- be put aside. We urge that sincere and serious attention be paid to taking the first step on what will be a very long and difficult road - by agreeing on the composition of a Palestinian delegation, elections, and an agenda consistent with reality.

Jesse Aweida

Stephen Cohen

Lester Crown

Philip Habib

Najeeb Halaby

Joseph Jacobs

Zahi Khouri

Henry Rosovsky

Lewis Rudin

Donna Shalala

Stephen Shalom

Howard Squadron

Albert Tahmoush

Cyrus Vance

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TO: Governor John Sununu FAX NO. 202/456-2397
The White House
Washington, D.C.

FROM: Joseph V. Jacobs Ext. 6800

TOTAL PAGES 10 (including cover sheet)

REMARKS:

TIME SENT:

Our Changing Planet:

A U. S. Strategy for Global Change Research

A Report by the Committee on Earth Sciences

To Accompany the
U. S. President's Fiscal Year 1990 Budget

This photograph of the Earth was taken from the Apollo 10 Spacecraft. Much of the Earth is heavily cloud covered. A portion of the United States from the Great Lakes to Southern California, including the Rocky Mountain area, is visible. The North American coastline from Southern Mexico to Alaska can be seen.

Our Changing Planet:

A U. S. Strategy for Global Change Research

A Report by the Committee on Earth Sciences

To Accompany the
U. S. President's Fiscal Year 1990 Budget

Federal Coordinating Council for Science, Engineering, and Technology

Committee on Earth Sciences

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S. Fred Singer, Department of Transportation
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(See Appendix A for the CES Charter)

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D. C. 20506

MEMBERS OF CONGRESS:

I am pleased to forward with this letter the research strategy report of the Committee on Earth Sciences (CES) of the Federal Coordinating Council for Science, Engineering, and Technology. The report, "Our Changing Planet: A U. S. Strategy for Global Change Research ," is the product of an intense interagency effort by experts in various earth sciences and other disciplines. This report, which has benefited greatly from close interaction between CES and the National Academy of Sciences Committee on Global Change, outlines the goals, implementation strategy, and research budget of the U. S. Global Change Research Program. The report accompanies the President's FY 1990 Budget. The strategy will be further expanded into a detailed, comprehensive research plan in 1989.

Changes in the Earth system such as desertification, drought, volcanism, and global warming can have tremendous economic and societal impact. The relative roles of human activity and natural phenomena in global change are of great importance but are, at present, scientifically undefined. Improving our ability to understand and to predict global changes, whether natural or human-induced, is essential for providing our Nation with a sound basis for developing policies and response strategies. An effective and well-coordinated federal research program is crucial to this effort. The program must be both national and international, since global change crosses political as well as physical boundaries.

The Committee on Earth Sciences' report provides an excellent foundation for the comprehensive research plan being developed and provides a keystone for planning for many decades to come. Chairman Dallas Peck and his interagency committee members, associates, and staff have done an excellent job and should be commended.

Sincerely,

William R. Graham

William R. Graham
Director

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Prologue: Our Changing Planet

The Earth is a changing place: over the past million years deserts, forests, and grasslands have migrated across the land, great ice sheets have appeared and disappeared, and wet and dry periods have come and gone.

Until recent times, severe weather, seasonal extremes, and longer term climatological patterns of temperature and precipitation appeared to be driven by unknown forces. It was not easy to discern the influences of even familiar things, like vegetation, the oceans, or the Sun. The focus of human activity was on providing better shelter and improved agriculture.

The industrialization of the planet in the 19th and 20th centuries has given rise to a new set of concerns, namely, that human activity may be adversely affecting the earth system. Recent events, such as the discovery of the Antarctic "ozone hole" and the 1988 North American drought, have led to calls for fundamental change in the economic and social policies of both industrialized and developing nations.

In the past several decades, science has provided increased insight into how the earth and its global environment functions. Science and technology have now evolved sufficiently to begin to unravel the complex processes that dominate the life-sustaining earth, including how human activities may influence life on our planet. The capability to understand how the global earth system will evolve provides the opportunity for a new and more productive partnership with nature and a sound scientific basis for making policy decisions on global change issues.

Executive Summary

- Global changes can have tremendous impact on human welfare. These changes may stem from natural processes that began millions of years ago. Responding to these changes without a strong scientific basis could be futile and costly.

- This report presents an initial strategy for a comprehensive, long-term U. S. Global Change Research Program.

- The goal of the Program is to provide a sound scientific basis for developing national and international policy on global change issues.

- The scientific objectives of the Program are to monitor, understand, and ultimately predict global change.

- The Program is broad in scope, encompassing the full range of earth system changes, including climatic, volcanic, seismic, ecological, and biological changes. The Program addresses both natural phenomena and the effects of human activity. Global warming, an issue that has received much public attention this past year, is an important element of this Program.

- The Program is described in terms of the following seven integrated and interdisciplinary science elements (see Appendix B for amplification) in order to provide a view of global change activities from the interdisciplinary level instead of from the traditional single-discipline or single-agency level:

    1. Biogeochemical Dynamics
    2. Ecological Systems and Dynamics
    3. Climate and Hydrologic System

4. Human Interactions
5. Earth System History
6. Solid Earth Processes
7. Solar Influences

- The Program's goals, objectives, and strategy are consistent with other national and international global change research program plans, including those of the U. S. National Academy of Sciences' Committee on Global Change and the International Council of Scientific Unions' International Geosphere-Biosphere Programme.

- In FY 1989, funding for focused global change research activities totals $133.9 million. The President's FY 1990 budget proposes a funding level of $190.5 million. This budget will enable the Program to expand and accelerate its research activities in all areas of global change.

- A more detailed research plan will be developed in 1989.

- This strategy was developed by a U. S. Federal interagency group, the Committee on Earth Sciences (CES) of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), under the directive of the President's Science Advisor. The CES consists of Federal agencies with programmatic responsibilities related to global change issues. There are thirteen CES members. Seven CES members are Federal agencies conducting research in global change.

Introduction

The Purpose and Scope of this Report

The purpose of this document is to provide an initial research strategy to guide planning and conduct of the U.S. Global Change Research Program. This strategy will be expanded into a more detailed and comprehensive U.S. Global Change Research Program plan in 1989.

The comprehensive research plan will present the details of the U.S. Global Change Research Program, including evaluating how well the current activities address the key scientific questions and program goals, identifying the gaps in knowledge and the priorities among research needs, and defining individual Federal agency roles.

Specifically, this research strategy report will:

- present the overall program goals, objectives, budget, and key scientific questions;
- identify the important national and international global change studies and organizations;
- summarize the research plan and implementation strategy; and
- inventory the current U.S. Federal agencies' research activities.

This research strategy has been developed in close collaboration with other national and international planning groups and activities, including the National Academy of Sciences, the International Geosphere-Biosphere Programme, and the programs outlined in the five year plan of the National Climate Program.

What is Global Change?

Manifestations of global change are numerous and complex: volcanic activity, widespread desertification on some continents, the dramatic changes in many mid-latitude forests

over the past several centuries, changing water tables in numerous regions, earthquakes, the retreat of glaciers, the accumulation of "greenhouse" gases and ozone-depleting chemicals in the atmosphere, the appearance of the Antarctic "ozone hole", acidification of some soils and lakes, and the reduction in genetic diversity of animals and plants.

The earth system is very dynamic and these changes occur on all time and geographic scales. The Earth itself holds testimony of ancient steaming bogs and crushing ice sheets, variations far beyond those known to modern civilization.

Many of these changes are the result of a variety of interrelated natural processes, including changes in the climate system, in solar processes, in the earth's orbit, in volcanic processes, and in the distribution of biological species and land masses that may have been ongoing for centuries. Although human activities may have the potential to alter the earth system, it is clear that variations occur naturally over a wide range. The broad study of all of these interrelated earth processes constitutes global change research.

What is Man's Role in Changing the Environment?

Most humans experience changes as seasonal-to-decadal regional weather and climate changes (e.g., last summer's drought). For this reason these changes, and the influences that human activities might have on them, have dominated public concern. In the past, policymakers have understandably focused on needs perceived as the most immediate, such as weather forecasting, urban smog, and acid rain.

In recent years, the attention of both scientists and policymakers has extended to more global-scale, longer-term changes, such as the question of global warming which may occur when additional heat radiated from the earth is trapped by increases in atmospheric "greenhouse" gases.

Although there are many other "greenhouse" gases, carbon dioxide (CO_2), generated by natural processes and by the burning of wood, coal, oil, gasoline, and natural gas, is currently believed to be the most important contributor to global warming because of its long atmospheric lifetime and ability to trap heat. CO_2 concentration in the atmosphere has increased by 25% over the past two centuries. Part of this increase is a by-product of energy consumption and deforestation to meet human needs.

However, global warming has occurred in pre-industrial eras. The potential for future global warming, and the relative contributions of natural processes and human influences are still poorly known. A better scientific understanding of these changes and an improved predictive capability are important elements of the U.S. Global Change Research Program.

Why is Reliable Global Change Prediction Important?

The effects of natural variability and human activity in the global system can have profound economic, environmental, social, and national security implications. For example, the single 1982-1983 "El Niño" event caused billions of dollars in economic losses worldwide, and this natural fluctuation in the climate system is known to be a recurring event of varying magnitude and periodicity.

Potential changes accompanying a global warming trend might have even greater impact on regional temperature regimes and precipitation patterns. These could result in changes in agricultural policies, modes of energy production and usage, utilization and protection of natural resources, and coastal-zone management. Reliable estimates of the magnitude and rate of these changes would be needed at many decision levels within society: individuals (e.g., farmers), industry (e.g., energy producers), and governments (e.g., regulators).

Improving the capability to predict and respond to such changes, whether naturally-occuring or the result of man's activities, will provide a great benefit to our Nation. A well coordinated Federal global change research program will be critical to realizing these improvements.

The U. S. Global Change Research Program

Key Global Change Scientific Questions. A better predictive understanding of global change requires improved answers to the following four major questions that form the core of the U.S. Global Change Research Program research agenda:

1. What Forces Initiate Global Change? These forces include changes in solar irradiance, in the abundance of atmospheric trace gases and aerosols, in land use, in biota, and in the earth's orbit.

2. How Does the Earth System Respond to Changes in Forcing Functions? These responses or "feedbacks" include interactions among the climate, the ocean, the land, the biota, and the atmosphere.

3. How Has the Earth's Environment Changed in the Past? Differentiating between natural and human-induced global change requires clear documentation of the history of earth system variations over long time scales, especially prior to the influence of human activity. This documentation is provided by fossils, tree rings, pollen, soil composition, and sediments from the ocean, land, and ice.

4. How Well Can Global Change be Predicted? These evaluations include the ability of models to simulate past and present global changes and the biological responses to these changes.

Program Goal. Rational response strategies and sound policy can only be built upon reliable information, predictions, and assessments of the complex phenomena of the global earth system. It is in this context that the U.S. Global Change Research Program goal has been developed.

U. S. Global Change Research Program Goal
To Establish the Scientific Basis for National and International Policymaking Related to Natural and Human-induced Changes in the Global Earth System.

The Program is based on the premise that three developments have converged to make this goal feasible in the 1990's:

1. The science essential to an understanding of global change has matured dramatically in the past several decades and can begin to address the full range of global change research issues.

2. The methodologies and research tools to address the global scales of change are rapidly maturing and can be fully operational in the 1990's (e.g. earth-observing satellites, supercomputers for global scale models and for information management systems, advanced instrumentation and measurement systems, and platforms for ground and ocean-based observations).

3. The national and international infrastructures and commitment to the global change research agenda are basically in place, with such elements as the International Geosphere-Biosphere Programme, the World Climate Research Program, the CES, and the National Academy of Sciences.

Implementation Strategy. The U.S. Global Change Research Program's implementation strategy includes: (1) the identification of three major scientific objectives, (2) the integration of the various scientific disciplines, and (3) the integration of the Program with other national and international global change activities.

(1) Three Major Scientific Objectives

The U.S. Global Change Research Program has three parallel scientific objectives: monitoring, understanding, and predicting global change (see box on page 12 for further details).

The aim of these objectives is to provide detailed assessments of the state of the knowledge of natural and human-induced changes in the global earth system. Appropriate predictions on time scales ranging from years to decades, including projections 20 to 40 years into the future, will be developed periodically. These assessments and predictions will provide information in such areas as: ecosystem dynamics, the biological influence on the climate system, concentrations of significant atmospheric constituents, oceanic and atmospheric circulation, and regionally useful information such as predicted changes in growing seasons, precipitation, and soil moisture. Assessments of uncertainties in these predictions will be an integral part of these predictions.

(2) Integration of Scientific Disciplines

The U.S. Global Change Research Program recognizes the need to achieve a greater level of integration among both single-disciplinary and multi-disciplinary scientific activities. The current foundation of earth science research rests primarily on single-disciplinary activities. However, such individual disciplines have limited capability to explain and predict global and regional scale interactive phenomena. Therefore, multi-

disciplinary programs are a necessary next step to improve the knowledge base and to obtain better predictive capability. Through these interdisciplinary studies, we have recognized the need for an even broader, more integrated view of the global earth system.

The U.S. Global Change Research Program is the national effort to meet that need. It must simultaneously maintain and strengthen the foundation of single-discipline and multi-discipline science, the building blocks of an integrated understanding of the total earth system.

To facilitate this integration process the Program focuses on the following seven interdisciplinary science elements:

- Biogeochemical Dynamics
- Ecological Systems and Dynamics
- Climate and Hydrologic System
- Human Interactions
- Earth System History
- Solid Earth Processes
- Solar Influences

A more detailed discussion of these scientific elements is contained in Appendix B.

The seven science elements were developed in close collaboration with the National Academy of Sciences' Committee on Global Change, which is developing the U.S. component of the International Geosphere-Biosphere Programme. They are designed to maintain a broad and robust research capability, while focusing on those earth system processes and interactions most likely to lead to a practical predictive capability. As a result of this integrating process, each of the agency programs has become increasingly important to the overall success of the U.S. Global Change Research Program.

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U. S. Global Change Res

1. Establish an Integrated, Comprehensive Monitoring Program for Earth System Measurements on a Global Scale

There is no substitute for actual observation of global change. Observations not only provide direct indications of a changing world, but also serve to test models and predictions. Observations sometimes expose surprising phenomena. The Antarctic "ozone hole" and the rapid increase in atmospheric methane are examples.

Knowledge of past global change is essential. Prehistoric changes are recorded in tree rings, sediments, glacier ice, and other parts of the natural record.

Long-term records derived from frequent and well calibrated global measurements of environmentally important parameters are critically needed. Global measurements from satellites and surface-based networks are crucial.

2. Conduct a Program of Focused Studies to Improve Our Understanding of the Physical, Chemical, and Biological Processes that Influence Earth System Changes and Trends on Global and Regional Scales

Substantial progress has been made in understanding the sources, sinks, reservoirs, and fluxes of chemicals and energy through the earth system, but much remains to be learned. The earth systems seem to be capable of adjusting to change, particularly through "feedback" mechanisms. Some global processes tend to amplify change, while others tend to stabilize or oppose further change. Still other processes may respond minimally to changes in the system until a critical magnitude of change is reached, only to trigger and operate in a dramatically different mode. It has been suggested, for example, that ocean circulation may behave this way.

earch Program Objectives

A number of key earth system processes are only beginning to be understood. Examples are: the exchange of heat and chemicals at the ocean-atmosphere interface, ocean circulation, atmospheric heating and cooling effects of clouds, the chemical and climatic effects of atmospheric gases and volcanic products, the general chemical and physical influences on the atmosphere from land plants, and the underlying physiological responses of biological organisms. These processes are the building blocks of earth system models, and their definition requires sophisticated interdisciplinary studies.

3. Develop Integrated Conceptual and Predictive Earth System Models

The rapidly expanding knowledge of earth system behavior permits the development of improved conceptual and computer-based models. The ultimate objective is to produce predictive models (e.g., climate change, environmental response, etc.) that will be useful at both global and regional scales and on many time scales.

While scientific understanding is increasing, there remains much to do if truly integrated models of the earth system are to be developed. Many of the more serious uncertainties arise from limitations in computing capability and from gaps in our scientific understanding of important physical, chemical, and biological processes. Some of the most significant human impacts of global change are expected to be regional in scope, but current climate models cannot forecast at regional scales. Even with enhanced computing capability, scientists modeling the climate have found that the current characterization of the land and of plants to be inadequate for their models' needs and have called upon hydrologists and botanists to provide better descriptions of heat and water transfer.

(3) Integration with National and International Global Change Research Activities

Both U. S. and foreign governments, collaborating closely with researchers at universities and in the private sector, have begun in the last few years to develop a cohesive approach to studying the global earth system. Examples of recent studies that focus on the study of the Earth as a single, integrated system include:

- "Earth System Science: A Program for Global Change" published in 1986 by the National Aeronautics and Space Administration's Earth System Sciences Committee;

- "Global Change in the Geosphere-Biosphere: Initial Priorities for an IGBP" published in 1986 by the National Academy of Sciences; and

- the International Council of Scientific Unions has organized the International Geosphere-Biosphere Programme and recently published a plan of action.

Building on these and related studies, the Program will develop national and international partnerships between governmental bodies, the academic science community, and the private research sector to achieve the specific objectives and long-term goals of the U. S. Global Change Research Program.

Major National and International Organizations Involved in Global Change Research Activities

National Organizations

- FCCSET Committee on Earth Sciences
- National Climate Program
- National Academy of Sciences Committee on Global Change
- Other Boards and Committees of the National Academy of Sciences

International Organizations

- International Council of Scientific Unions: International Geosphere-Biosphere Programme and related activities
- World Meteorological Organization: World Climate Research Program and related activities
- United Nations Educational, Scientific, and Cultural Organization: Intergovernmental Oceanographic Commission and related activities
- United Nations Environmental Programme
- Intergovernmental Panel on Climate Change

FY 1990 U. S. Global Change Research Program Budget

Over the past year, the CES conducted several interagency global change research budget planning and analysis activities to ensure that the President's Budget includes requests that are well integrated and responsive to the Program's goals and priorities.

The U.S. Global Change Research Program budget includes only research efforts specifically focused on global change issues. Some agency programs that contribute to global change research, but were initiated for and continue to serve other primary purposes, are not included in the focused U.S. Global Change Research Program budget (e.g., the National Aeronautics and Space Administration's Upper Atmospheric Research Program and Topex/Poseidon mission, the National Oceanic and Atmospheric Administration's meterological satellites, and several programs from the Department of Defense). It is anticipated, over the next several years, that some of these contributing programs will be incorporated into the focused Program.

In FY 1989, funding for focused global change research activities totals $133.9 million. The President's FY 1990 budget proposes a funding level of $190.5 million for these programs. (See Table 1 on pages 24 for additional details.) The budget includes important ongoing and new research efforts. Some of these ongoing efforts, like the National Science Foundation's Global Geosciences program and the Department of Energy's carbon dioxide program, have laid the foundation for the proposed FY 1990 effort. This budget will allow the Program to expand and accelerate its research activities across all areas of global change.

Figure 1
U.S. Global Change Research Program
by Science Element

Budget by Science Element

From a scientific perspective, the best way to understand the global change research budget is to examine it by the major science elements. Figure 1 presents the FY 1989 and FY 1990 budgets by science element.

- **Biogeochemical Dynamics:** These programs concentrate on the study of the biogeochemical constituents (e.g., oxygen, carbon, nitrogen, etc.) within the earth system and their influence on the life-sustaining envelope of the earth, including global warming. The FY 1990 budget proposes $44.9 million for this element, a 51 percent increase over the FY 1989 level.

- **Ecological Systems and Dynamics:** These programs focus on how ecological systems both impact and respond to a wide range of global changes. The FY 1990 budget proposes $39.5 million for this element, a 41 percent increase over the FY 1989 level.

- **Climate and Hydrological System:** This research examines the physical processes that govern the climate and hydrologic system, including the atmosphere, hydrosphere, cryosphere, land surfaces, and biosphere. These efforts are clearly central to the description, understanding, and prediction of global change. The FY 1990 budget proposes $59.3 million for this element, a 56 percent increase over the FY 1989 level.

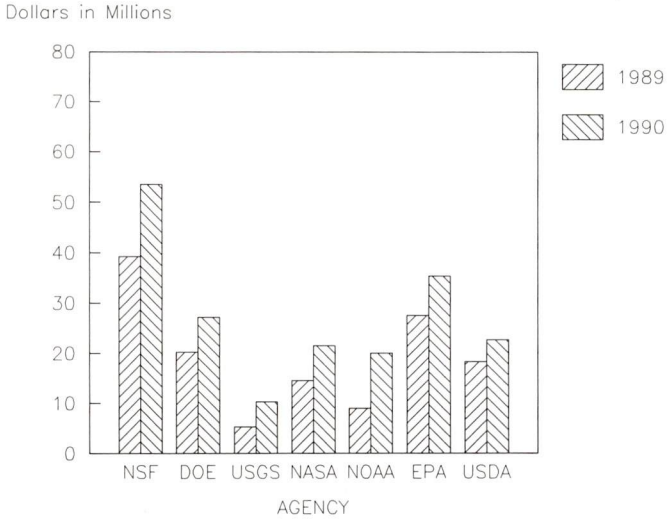
- **Human Interactions:** These programs study the interface between natural processes and human activities. Roughly two-thirds are policy studies and not earth science research. However, these studies benefit greatly from close association with the research activities. The FY 1990 budget proposes $22.0 million for this element.

- **Earth System History:** This element is crucial to documenting past natural changes. Climate information from the past will be very important in distinguishing the relative roles of natural phenomena and human activity in global change. The FY 1990 budget proposes $7.0 million for this element, roughly doubling the FY 1989 level.

- **Solid Earth Processes:** Interactions between the earth's surface and the atmosphere, hydrosphere, cryosphere, and biosphere are the key elements of this program. The FY 1990 budget proposes $10.5 million for this element, an 18 percent increase over the FY 1989 level.

- **Solar Influences:** These programs are designed to study the impact of solar variability on the atmosphere and climate. The FY 1990 budget proposes $7.3 million for this element, a 78 percent increase over the FY 1989 level.

Figure 2
U.S. Global Change Research Program by Agency



Budget by Agency

Figure 2 shows the FY 1989 and FY 1990 proposed budget level by agency. The individual agency efforts reflect their particular mission, and build upon their respective scientific and technical strengths.

- **National Science Foundation (NSF):** NSF primarily supports university-based basic research in all areas of earth, atmospheric, and ocean sciences. NSF's efforts encompass all seven science elements except human interactions. The FY 1990 budget proposes $53.5 million for NSF, a 36 percent increase over FY 1989. This increase reflects Administration and Congressional commitment to doubling the level of NSF's support for university-based basic research over the next five years.

- **Department of Energy (DOE):** DOE maintains a program of research directed at how energy production and use affect global earth systems and how possible responses to such change may affect future energy options. As a result,

the DOE global change program is focused primarily on climate and ecosystem response research. The FY 1990 budget proposes $27.2 million for DOE, a 35 percent increase over FY 1989.

- **Department of the Interior/United States Geological Survey (DOI/USGS):** DOI/USGS carries out research in past climate change, regional hydrology, the carbon cycle, coastal erosion, volcanic activity, and glaciology. The FY 1990 budget proposes $10.3 million for DOI/USGS, a 94 percent increase over FY 1989.

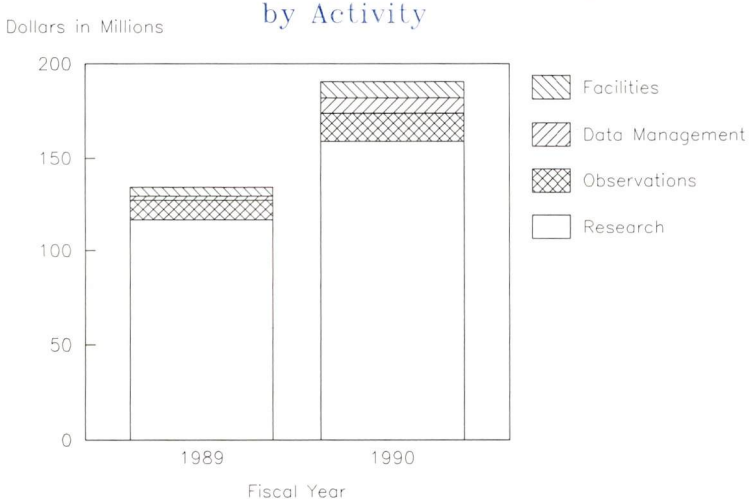
- **National Aeronautics and Space Administration:** (NASA) is responsible for earth sciences research from space, including broad scientific studies of the planet as an integrated system. This research effort supports advanced technology development studies of the Earth Observing System (EOS). These studies will focus on defining the remote sensing instruments, space infrastructure, and data management systems needed to study a broad range of global change processes. EOS is under consideration as a new initiative sometime over the next several years. The FY 1990 budget proposes $21.5 million for NASA, a 48 percent increase over FY 1989.

- **Department of Commerce/National Oceanic and Atmospheric Administration (DOC/NOAA):** Building on its base of oceanic and atmospheric science and services, DOC/NOAA's focused programs emphasize improving predictions of climate change and its regional implications, on time scales from a single season to centuries. NOAA's mission-directed activities include research on physical and biogeochemical processes in the climate system, *in situ* measurements, climate modeling, and diagnostic techniques for detecting global changes. The FY 1990 budget proposes $20.0 million for DOC/ NOAA, roughly doubling the FY 1989 level.

- **Environmental Protection Agency (EPA):** EPA research is focused on ecological systems and human interactions. These research efforts reflect EPA's regulatory mission to assess and evaluate the ecological, environmental, and health-related consequences of global change. The FY 1990 budget proposes $35.3 million for EPA, a 29 percent increase over FY 1989. Roughly 40 percent of the FY 1990 program is for policy studies.

- **United States Department of Agriculture (USDA):** The USDA global change research programs deal with the impact of the climate on agricultural and ecological systems and the impact of these systems on the climate. Many of the USDA vegetation, soils, and ecology research programs are critical to the success of the Program. The FY 1990 budget proposes $22.7 million for USDA, a 24 percent increase over FY 1989.

Figure 3
U.S. Global Change Research Program
by Activity



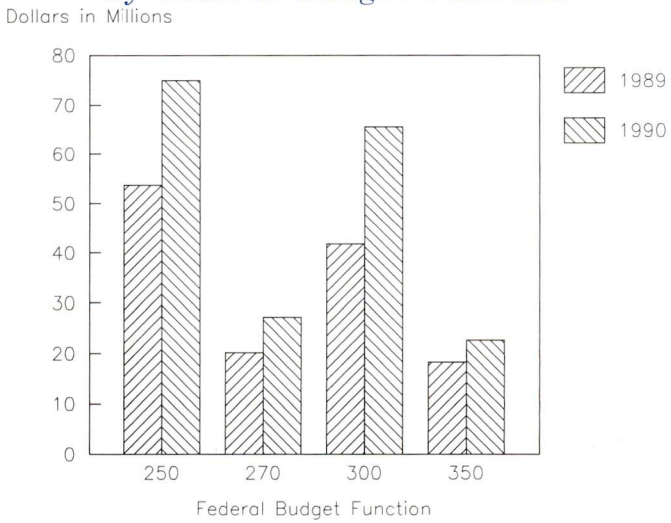
Budget by Type of Activity

The Program has been divided into the four types of activities that are highlighted in Figure 3. The FY 1990 budget

proposes $158.9 million for research, 83 percent of the total FY 1990 budget. However, it is anticipated that the ratio between the four types of activities will change significantly over the next several years. Planning funds have been included for future observing systems, their data management needs, and associated facilities. These planning efforts and the Program's coordination mechanisms will ensure the most efficient use of these capital investments. In particular, the CES is working with the interagency Working Group on Data Management for Global Change to address the future data management needs of the Program. The CES plans to maximize the use of existing archive systems (e.g., DOI/USGS's Earth Resources Observations Satellite Data Center and DOC/NOAA's National Climate Data Center).

Figure 4

U.S. Global Change Research Program by Federal Budget Function



Budget by Federal Budget Function

Scientific, environmental, energy, and agricultural resources are very important to our Nation. All either impact or are impacted by global change.

Figure 4 illustrates the Program's funding level by the Federal budget functions that encompass these national resources. As would be expected, the budget proposes significant increases for budget functions 250 and 300. In FY 1990, $75.0 million is proposed for function 250, a 40 percent increase over FY 1989. For function 300, $65.6 million is proposed for FY 1990, a 57 percent increase over FY 1989.

Despite the broad distribution across these budget functions and, hence, across many Executive Branch and Congressional decision making paths, it is crucial to view the Program as a single integrated research effort. The success of many of the science objectives is dependent on the cooperation and contributions of all the individual agency programs. Thus, decisions concerning these investments should attempt to recognize the full scope and structure of the U.S. Global Change Research Program.

Table 2
1989-1990 U. S. Global Change Research Program Budget by Budget Function
(Dollars in Millions)

Budget Function	Budget Function Number	1989	1990
TOTAL		133.9	190.5
General Science, Space and Technology	250	53.7	75.0
NASA		14.5	21.5
NSF		39.2	53.5
Energy (DOE)	270	20.2	27.2
Natural Resources & Environment	300	41.7	65.6
DOI/USGS		5.3	10.3
EPA		27.4	35.3
DOC/NOAA		9.0	20.0
Agriculture (USDA)	350	18.3	22.7

Table

1989-1990 U. S. Global Change

(Dollars

Focused Program	Total Budget		Biogeochemical Dynamics		Ecological Systems and Dynamics	
	1989	1990	1989	1990	1989	1990
Agency Totals	133.9	190.5	29.8	44.9	28.1	39.5
NSF	39.2	53.5	13.5	18.3	1.9	1.9
DOE	20.2	27.2	6.0	5.5	4.2	6.7
DOI/USGS	5.3	10.3	0.0	0.0	0.0	0.3
NASA	14.5	21.5	3.0	4.4	4.3	6.4
DOC/NOAA	9.0	20.0	0.0	3.0	0.0	0.0
EPA	27.4	35.3	0.8	3.5	7.4	13.2
USDA	18.3	22.7	6.5	10.2	10.3	11.0
Activity	133.9	190.5	29.8	44.9	28.1	39.5
Research	116.4	158.9	26.9	40.1	24.9	35.0
Observations	10.7	15.0	0.0	1.5	2.0	2.5
Data Management	2.3	8.1	0.4	0.8	0.2	1.0
Facilities	4.5	8.5	2.5	2.5	1.0	1.0

1

Research Program Budget

in Millions)

Climate and Hydrologic System		Human Interactions		Earth System History		Solid Earth Processes		Solar Influences	
1989	1990	1989	1990	1989	1990	1989	1990	1989	1990
38.0	59.3	22.0	22.0	3.0	7.0	8.9	10.5	4.1	7.3
13.2	17.0	0.0	0.0	2.0	4.7	6.2	6.5	2.4	5.1
7.0	10.2	2.0	3.6	0.0	0.0	0.0	0.0	1.0	1.2
2.3	5.0	1.5	2.0	1.0	2.3	0.5	0.7	0.0	0.0
4.3	6.4	0.0	0.0	0.0	0.0	2.2	3.3	0.7	1.0
9.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.7	2.2	18.5	16.4	0.0	0.0	0.0	0.0	0.0	0.0
1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38.0	59.3	22.0	22.0	3.0	7.0	8.9	10.5	4.1	7.3
31.6	46.1	22.0	20.8	3.0	3.5	5.4	8.1	2.6	5.3
5.0	8.5	0.0	0.0	0.0	0.0	3.5	2.2	0.2	0.3
1.4	4.7	0.0	1.2	0.0	0.0	0.0	0.2	0.3	0.2
0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	1.0	1.5

Epilogue: The Fundamental Rationale

In the coming decades, global change may well represent the most significant societal, environmental, and economic challenges facing this Nation and the world. The national goal of developing a predictive understanding of global change is, in its truest sense, science in the service of mankind.

APPENDIX A

CHARTER
COMMITTEE ON EARTH SCIENCES
of the
Federal Coordinating Council for Science, Engineering, and Technology

The Committee on Earth Sciences (CES) is hereby established by action of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET). FCCSET derives its current authority from executive Order 12039 of February 24, 1978.

Purpose and Functions

A goal of earth sciences is to understand, on a global scale, how the highly interactive system comprised of the solid Earth, the oceans, the atmosphere and magnetosphere, and the biosphere has evolved, how it functions today, and how it will evolve in the future. In addition to basic research, earth science R&D includes continued development of the technology needed for observations of the earth system and increased emphasis on collection, analysis, and archiving of data on a global scale from satellite and ground-based measurements needed for long-term research efforts and addressing national policy issues which depend on a characterization of humankind's impact, or potential impact, on the global environment. The purpose of the Committee on Earth Sciences is to increase the overall effectiveness and productivity of Federal R&D efforts directed toward an understanding of the Earth as a global system. In fulfilling this purpose the Committee addresses significant national policy matters which cut across agency boundaries.

Specifically the CES:

a. reviews Federal R&D programs in earth sciences including both national and international programs;
b. improves planning, coordination, and communication among Federal agencies engaged in earth sciences R & D;

c. identifies and defines earth sciences R&D needs;
d. develops and updates long-range plans for the overall Federal R&D effort in earth sciences;
e. addresses specific programmatic and operational issues and problems which affect two or more Federal agencies;
f. provides reviews, analyses, advice and recommendations to the Chairperson of FCCSET on Federal policies and programs concerned with earth sciences R&D, particularly in assessing human kind's impact on the global environment;
g. develops the Administration's response to the call in the NSF Authorization Act of 1987 for a report to Congress, in the NSF Authorization Act of 1987, concerning Federal Government action with respect to the establishment of an International Year of the Greenhouse Effect mandated in calendar year 1991.

Structure

The Chairperson and Vice-Chairperson of the CES are appointed by the Chairperson of FCCSET; the Vice-Chairperson is from an agency other than that which the Chairperson represents. The Executive Secretary is designated by the CES Chairperson. Additional staff assistance is provided by member agencies as required by the Committee. Chairpersons of CES task forces or working groups arrange assistance from their own agencies.

The following departments and agencies are represented on this Committee:

Department of Agriculture
Department of Commerce
Department of Energy
Department of the Interior

Department of State
Department of Transportation
National Science Foundation
Environmental Protection Agency
National Aeronautics and Space Administration
Office of Science and Technology Policy
Office of Managment and Budget
Council on Environmental Quality

Other Federal agencies participate, as appropriate, upon invitation by the Committee Chairperson or the Chairperson of FCCSET.

The CES Chairperson approves the establishment, continuation, or termination of task forces and working groups as necessary to achieve the Committee's purposes. Membership on such task forces and working groups is not restricted to Committee members and is established as the Committee may determine appropriate.

The Committee meets at the call of the CES Chairperson who also approves the agenda. Meetings are held not less than two times a year. Meetings of task forces and working groups are held as necessary to meet their specific objectives. Minutes of meetings are prepared by the Committee Executive Secretary and distributed to all members of the Committee, the leaders of task forces and working groups, and to the Executive Secretary of FCCSET.

Compensation

All members are full-time Federal employees who are allowed reimbursement for travel expenses by their agencies plus per diem or subsistence while serving away form their duty stations and in accordance with standard governmental travel regulations.

Documentation

Agendas and records of actions of Committee meetings are prepared and disseminated to members by the Executive Secretary. Records of actions are submitted to members for approval. Complete records of all committee activities, including those of task forces and working groups, are maintained in the office of the Chairperson. The Committee prepares a report for the Chairperson of FCCSET not later than 60 days after the end of each fiscal year. The report contains, as a minimum, the Committee's functions, a list of members and their business addresses, the dates and places of meetings, and a summary of the Committee's activities and recommendations during the year.

Termination date

Unless renewed by the Chairperson of FCCSET prior to its expiration, the Committee on Earth Sciences of FCCSET shall terminate not later than December 31, 1990.

Determination

I hereby determine that the formation of the Committee on Earth Sciences is in the public interest in connection with the performance of duties imposed on the Executive Branch by law and that such duties can best be performed through the advice and counsel of such a group.

Approved:

March 6, 1987
Date

William R. Graham
Chairman, FCCSET

Appointment of New Member and Amendment to the Charter of the Committee on Earth Sciences (FCCSET)

APPOINTMENT: By my authority as Chairman, Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), I appoint the Department of Transportation as a permanent member of the Committee on Earth Sciences (CES).

AMENDMENT: Charter of the Committee on Earth Sciences of the Federal Coordinating Council for Science, Engineering, and Technology as signed and approved on March 6, 1987, by the Chairman, FCCSET, is amended as follows.

Under the Section "Structure," add the following new member:

"Department of Transportation"

August 24, 1988

Date

William R. Graham

William R. Graham, Chairman
Federal Coordinating Council
for Science, Engineering,
and Technology

APPENDIX B:

DEFINITIONS OF SCIENCE ELEMENTS AND TYPE OF ACTIVITY

Definition of Science Elements

1. Biogeochemical Dynamics- The study of (1) the sources, sinks, fluxes, and interactions between mobile biogeochemical constituents within the Earth system, with a particular focus on oxygen, and other key elements, including carbon, nitrogen, sulfur, phosphorus, and the halogens; (2) the cycling of biogeochemical elements in the atmosphere, oceans, terrestrial regions, biota, and other sediments over Earth's history; (3) the influence of biogeochemical elements on the regulation of ecological systems and contribution to potential "greenhouse" constituents (for example CO_2, CH_4, etc.) that might have a direct influence on climate and the life-sustaining envelope of the Earth. Hydrology is excluded here and included in #3. For consistency, ozone studies will be included here.

2. Ecological Systems and Dynamics- The study of the responses of ecological systems, both aquatic and terrestrial, to changes in global environmental conditions and of the influence of biological communities on the atmospheric, climatic, and ocean systems. It includes studies of plant succession, terrestrial and aquatic biodiversity, extinctions, relationship with geological substrate, etc. Contemporary monitoring and specific ecosystem experiments can provide information on multiple stresses influencing the biota and on the biotic response to environmental stresses both natural and cultural; such information is needed to achieve the basic understanding required for the development of models. Identification and study of particularly sensitive and indicative ecosystems will be especially informative.

3. Climatic and Hydrologic System- The study of the physical

processes that govern the climate and hydrologic system--incorporating the atmosphere, hydrosphere (oceans, surface and ground water, etc), cryosphere, land surface, and biosphere. These are clearly central to the description, understanding, and prediction of global change, particularly in terms of impacts on global climate conditions and upon the pervasive and critical hydrologic system.

4. Human Interactions- The study of the impacts of changing global conditions on human activities. The global environment is a crucial determinant of humanity's capacity for continued and sustained development. Research should focus on the interface between human activities and natural processes. An example would be the studies of the impacts on agriculture from changes in length of growing season.

5. Earth System History- The natural record of environmental change is contained in the rocks, terrestrial and marine sediments, glaciers and ground ice, tree rings, geomorphic features (including the record of changes in sea level), and other direct or proxy documentation of past environmental conditions. These archive the Earth's history and document the evolution of life, past ecosytems, and human societies. Past geological epochs with warmer or cooler climates relative to present are of particular scientific interest and should illustrate the range of natural variability. As past analogues of possible future climates, they contribute both to the understanding of the present Earth system and to the prediction of its future.

6. Solid-Earth Processes- The study of solid-Earth processes that affect the life-supporting characteristics of the global environment and especially those processes that take place at the interfaces between the solid earth and the atmosphere, hydrosphere, cryosphere, and the biosphere. Solid-Earth processes that directly affect the environment are of primary interest; processes that have only indirect effects are excluded.

7. Solar Influences- Studies of variability in solar brightness and its impact in atmospheric density, chemistry, dynamics, ionizations, and climate. Studies of the effects of solar variability on biogeochemical cycles as well as the ultraviolet impact on biology and chemistry would be included here. Included are studies of present-day variations and the historical record. This may include examination of causal mechanisms to explain linkages between solar flux variation and subsequent atmospheric responses that have important implications for the biosphere.

Definitions of Type of Activity

1. Research- The research element includes basic and applied science, theory, analysis, modeling, prediction, and assessment which are fundamental to understanding global change or some portion of the Earth system.

Examples are process studies, analyses of processes, exploratory field measurement programs, measurements other than long-term sustained observations, and basic laboratory studies. Also included is applied mission- or problem-oriented research, for example acid rain research. Activities such as policy option studies, emission estimates, and economic modeling would be included here but should be labeled as such.

Model development and use is included here, that is, the development, improvement, and application of quantitative numerical models that simulate processes of the global environment and components of its subsystems, coupled models exploring processes between subsystems, models of human activities and their impacts, assessment models, and predictive models, including operational forecasting models.

2. Long-term Observations- This element includes observations made periodically or continuously over three years or more, and is essentially the documentation of global change. It includes monitoring aimed at developing a long-term observational record of environmental parameters for research on decadal time scales.

Examples: Documentation of variations and changes in the atmosphere's concentration of trace gases; documentation of variations and changes in global atmospheric circulation; satellite measurements of ocean parameters.

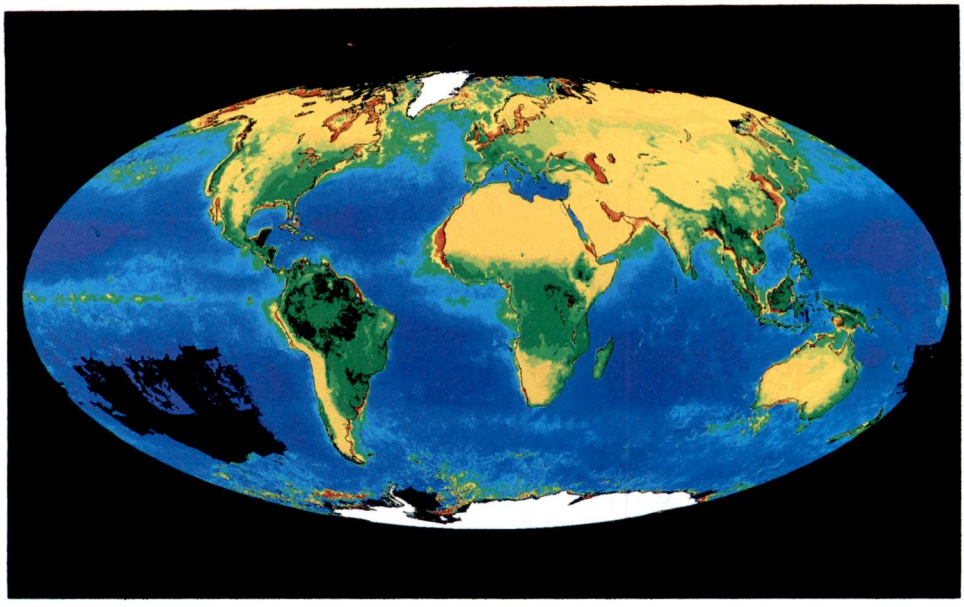
Facilities supporting these observations are included along with the actual activities and costs of taking the measurements, developing the algorithms to analyze the data, and the reduction of the data.

3. Data Management- This category includes operational expenses for organizing, archiving, preserving, and making data available for global change research. This includes all activities related to global change data management beyond those short-term activities reported under the research activity.

4. Facilities- Some programs may include major investments in logistics or facilities (satellites, research vessels, supercomputers, telecommunications hardware, etc.) that are essential to the success of a program.

Global patterns of biological productivity showing land and ocean vegetation. Land patterns are determined from measurements taken from the NOAA-7 polar orbiting satellite and ocean patterns from the NASA Nimbus-7 satellite. Ocean productivity patterns represent an average over 18 months and range from red (most productive) to purple (least productive). Land patterns represent the potential productivity averaged over 3 years and range from deep green (representing rain forests) to beige (representing deserts and barren regions).

A U. S. Strategy
for Global Change Research



PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY
WASHINGTON

June 20, 1990

THE CHIEF of STAFF
has seen

MEMORANDUM FOR THE PRESIDENT

FROM: D. Allan Bromley, On Behalf of the President's Council of Advisors on Science and Technology

SUBJECT: Your Fiscal Year 1991 S&T Budget

The President's Council of Advisors on Science and Technology (PCAST) has stated its strong support of your overall Science and Technology (S&T) budget for Fiscal Year 1991. Within the fiscal constraints you face, your budget proposal provides appropriate balance between investing in the future and meeting our current national needs. The Administration proposals provide a strong start in revitalizing our education system and maintaining our nation's strong S&T base.

PCAST believes that your Science and Technology budget proposals are critical to the future of this country. The Council members pledge to convey their support for your FY 1991 request to leaders in the academic and industrial communities, as well as to political leaders at the grass roots. We urge the Administration to continue to convey to Congress the importance of the Science and Technology budget proposals.

Should the Congress not act to maintain strong support for Science and Technology, we risk erosion of our S&T base in this country. Of particular concern are the many individual and small-group researchers; in the aggregate, these researchers produce the stream of new knowledge that is science and becomes technology. Thus, it is vital that we protect those programs which provide support for investigator-initiated research programs.

One of the PCAST concerns is that federal support for various "big science" projects, in the context of constrained budgets, could crowd out support for these individual investigators. As Director of the Office of Science and Technology Policy, I will strive to continue the Administration's attentiveness to this concern as we work with OMB in the preparation of the Fiscal Year 1992 budget.

THE WHITE HOUSE

WASHINGTON

June 21, 1990

90 JUN 23 A9:26

MEMORANDUM FOR THE PRESIDENT

FROM: **D. ALLAN BROMLEY**

SUBJECT: **DOD-ACADEMIC RELATIONS**

I am enclosing herewith a copy of a memorandum that I have sent, at the request of PCAST, to Dick Cheney concerning the desirability of rebuilding, even under current budgetary stringencies, the DOD-university bridges that served the nation so well during the post World War II decades.

Enclosure

THE WHITE HOUSE

WASHINGTON

June 19, 1990

MEMORANDUM FOR THE SECRETARY OF DEFENSE

FROM: D. Allan Bromley, On Behalf of the President's Council of Advisors on Science and Technology

SUBJECT: DOD-UNIVERSITY RELATIONSHIP

The pace of political change around the globe is so fast and so profound that our defense-related research must be both broad and deep. As you are only too well aware, we must prepare for the unexpected. This means searching for new ideas whose application is not immediately obvious and investing in our most flexible resource, people. Accordingly, I would like to convey that the President's Council of Advisors on Science and Technology was pleased to learn from Mr. Atwood that the Department places high priority on maintaining the strength of its technology base -- especially the so-called 6.1 and 6.2 programs. PCAST applauds the wisdom of such long-term strategic planning.

In this regard, PCAST would like to draw your attention to an opportunity and a need: the strengthening of the DoD-University partnership. The DoD has over the years supported science and technology emphasizing both new knowledge and the education of scientists and engineers. New interdisciplinary programs were created at research universities, helping to advance new fields such as artifical intelligence, computing and materials science and engineering. The latter, for example, produced whole new classes of materials, including polymer composites, rapidly solidified metals, sensor materials and new laser materials.

An important by-product was the training of thousands of graduate students. Indeed, a large portion of the nation's technical leaders received their graduate education through DoD support. This support of research and education has been a wise investment. The new technologies that have emerged have become essential to DoD and to the nation as a whole in ways not anticipated at the time.

In this changing world, PCAST urges that DoD continue its important role in stimulating more Americans to become scientists and engineers and in creating new knowledge even under the stringent budgetary limitations that you currently face. Such an effort would be fully consistent with the President's initiatives in education and basic research. We believe that strong DoD-academe bridges that served the nation so well in the past will prove equally important in the decades ahead.

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
12. Memo	From N.G. Maynard to John Sununu Re: NAS/NAE/IOM Panel on Policy Implications of Greenhouse Warming (2 pp.)	1/23/90	P-5	

Collection:

Record Group: Bush Presidential Records
Office: Chief of Staff to the President, Office of the
Series: Sununu, John, Files
Subseries: White House Offices File
WHORM Cat.:
File Location: Science and Technology (Bromley) (1990) [2]

Open on Expiration of PRA
(Document Follows)
By JG (NLGB) on 10/28/05

Date Closed:	12/16/2004	**OA/ID Number:**	29183-007
FOIA/SYS Case #:	1998-0004-F[1]	**Appeal Case #:**	
Re-review Case #:	2005-0426-S	**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
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P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

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(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

January 23, 1990

THE CHIEF OF STAFF
has seen

To: D. Allan Bromley

From: N. G. Maynard

Subject: NAS/NAE/IOM Panel on Policy Implications of Greenhouse Warming

I. Background

As you know, there was a Congressional directive to EPA to commission the Academy to evaluate policy options for mitigating and responding to climatic change. It also asked the Academy to "establish the scientific concensus on the rate and magnitude of climatic change". In response, the NAS Panel on Policy Implications of Greenhouse Warming, chaired by the Honorable Daniel J. Evans, set up a discussion of the scientific controversies surrounding the "greenhouse effect" to be held at study panel at the Academy on January 24, 1990.

II. Selection of the Panel

Since the reputation, strength, and pride of the Academy rests on absolute fairness and equal representation of all points of view on any issue, bias or unfairness is simply never a real issue. However, because of the scientific importance and political sensitivity of the greenhouse warming issue, it is my impression that the Academy was even more diligent than usual in attempting to insure fairness and balance in setting up this panel. I am aware of the following specific actions which would support this impression:

1. Dr. Robert White, President of the NAE and Dr. Frank Press, President of NAS were both directly involved in trying to provide the best representation on the panel. This included (among many other similar efforts with other scientists) many calls trying to entice one of the authors of the Marshall Institute Report to appear on the panel. Evidentally, Drs. Nierenberg, Seitz, and Jastrow were all inextricably involved in other activities and, despite considerable attempts to rearrange their schedules, they were not able to participate.

2. The Marshall Institute Report authors did provide several names of possible alternatives for their own viewpoints, including, Lindzen and Newell, among others.

3. Lindzen was chosen based upon his ability to supply information to the discussions on a much broader background relevant to global change.

4. Nierenberg approved of this choice and, in fact, wrote a letter containing some of his views, as well as confirming his approval of Lindzen to represent his point of view.

5. Staff at NAS was not aware that there was ny feeling that Newell or any other person or point of view considered themselves underrepresented.

6. Later in the process, NAS felt that since solar variation, which comprised an important component of the Marshall Institute discussions, was so critical to the discussions, they added a person with a strong background in this area to the attendees who would be prepared to address uncertainties in the area as well as present status of knowledge. (Dr. Sally Balunis, Harvard)

Having worked as a staff directer of the Ocean Studies Board at the National Academy of Sciences for 2 years, I can personally assure you that staff, officers, and members of committees of the Academy insist upon absolute fairness and complete lack of bias as a routine matter. I can not conceive of the Academy ever doing business in any questionable way. It is, after all, the very factor upon which the reputation of the Academy rests.

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6 December 1989

Dr. D. Allan Bromley
Science Adviser to the U.S. President
Executive Offices of the President
Washington, DC 20500

CHIEF OF STAFF
as seen

Dear Dr. Bromley:

In an article in the 20 November 1989 issue of *Newsweek*, John Sununu referred to the new climate-change modeling research by Washington and Meehl (1989) at the National Center for Atmospheric Research (NCAR). (Another editorial, also on 20 November, in *The Wall Street Journal*, incorrectly quoted results from the same research.) When I saw the *Newsweek* article, I telegrammed Dr. Sununu and invited him to call me if he wanted more information on our experiments. In our ensuing telephone discussions about the state of climate modeling and our research, he suggested that I contact you directly.

My purpose in writing you, therefore, is to correct the media statements and to clarify the conclusions to be drawn from the model results at NCAR. Our modeling group is one of the few research groups that has successfully coupled a global atmospheric model to a global dynamical ocean model. The ocean model is driven by heat fluxes to and from the atmosphere, by wind forcing, and by salinity differences caused by atmospheric precipitation and evaporation. Although the coupled model can experience many problems from lack of constraints, its advantage is that it can be used to examine climate sensitivity to a gradual increase of carbon dioxide in addition to an instantaneous doubling of carbon dioxide.

The Wall Street Journal's editorial says that we have "cut in half" our estimates of climate change. This assumption is erroneous for the following reasons. In previous climate-change experiments, we used a simple, mixed-layer upper ocean with a thickness of 50 m. Although such an ocean model does not include vertical or horizontal heat transport mechanisms and other important ocean processes (such as mixing with intermediate and deep ocean layers), it does include some important aspects of the seasonal heat storage in the upper oceans, that is, heat is stored in summer and released in winter. The GISS model used by James Hansen is an example of a simple, mixed-layer model with a specified poleward flux of heat from the tropics.

Because of the prohibitive expense in running our new model with a dynamical ocean to equilibrium, we cannot say exactly what the new equilibrium would be, but it certainly would be larger than the value quoted in *Newsweek*. In fact, we have run it farther than reported in the referenced article and it continues to show globally averaged warming in the oceans and atmosphere. Our research and that of NOAA's Geophysical Fluid Dynamics Laboratory have revealed new insights into global warming. Previous studies indicated that land and ocean areas usually warm, but our recent studies show, for the first time, that some ocean regions actually cool. In our experiments with a gradual increase of carbon dioxide, the lands are warmer and in certain regions the North Atlantic and North Pacific Oceans are cooler—a pattern similar to that observed by Karoly (1989). Although our coupled dynamical models are not precise enough for climate prediction, they yield behavior patterns heretofore unseen in other model studies with simple oceans, and this behavior is only one part of a myriad of climate

system interactions we are beginning to explore. The simplified picture of using some globally averaged warming number is not meaningful for the observations or for the models. The large-scale regional patterns that appear are likely to be quite complex with a great deal of natural variability.

The *Wall Street Journal* editorial also recommended that George Bush, John Sununu, Bill Reilly, Congress, and the governors gather together on C-SPAN to hear top climate modelers discuss and "settle" the issues surrounding the greenhouse effect. We do not believe that this is the best method of dealing with scientific uncertainties. Rather, we should consider the recommendations to be made in 1990 by the Intergovernmental Panel on Climate Change (IPCC)—a study involving worldwide experts on climate change. We at NCAR are participating in this IPCC study, as well as in intercomparisons of models under the Department of Energy's Carbon Dioxide Program. Both efforts are extremely critical to our understanding of what the models are really telling us.

Your statements to the press and public indicate that you are an advocate of global-change research. We urge your continued support. Climate modelers must continue to refine the uncertain aspects of physical processes, such as clouds, and to improve resolution.

If you would like more information, please call me at (303) 497-1321; my FAX number is (303) 497-1137.

Sincerely,

Warren M. Washington

Warren M. Washington, Director
Climate & Global Dynamics Division

Enclosures

cc: John Sununu
Nancy Maynard
Richard Anthes
Peter Gilman
Ari Patrinos
Michael Riches
Robert Serafin
Deborah Stirling

References:

Karoly, D., 1989: Northern Hemisphere temperature trends: A possible greenhouse gas effect *Geophys. Res. Lett.*, in press.

Washington, W.M. and G.M. Meehl, 1989: Climate sensitivity due to increased CO_2: experiments with a coupled atmosphere and ocean general circulation model. *Climate Dynamics*, **4**, 1–38.

Is It All Just Hot Air?

New computer models question the severity and timing of the greenhouse effect

How worried should we be about the greenhouse effect? Last week British Prime Minister Margaret Thatcher, hardly an eco-freak, called on the United Nations to adopt a binding treaty restricting emissions of gases that threaten to warm the planet, causing deadly floods and food shortages. Yet just the day before, at an international meeting in a Dutch seaside resort, only 30 of the 68 nations in attendance supported a Dutch proposal to freeze the level of emissions of greenhouse gases by the end of the century and cut them 20 percent by 2005. Japan, the Soviet Union, China and the United States—which together account for 58 percent of the world's output of these gases—agreed only that stabilizing them "should be achieved as soon as possible."

Environmentalists lambasted the empty statement as "either a failure of nerve or a cynical ploy," as Brooks Yeager of the National Audubon Society put it. Perhaps, but it also reflects the uncertainty of greenhouse science. Predictions of global warming rest on the observation that certain gases—carbon dioxide (CO_2), nitrous oxides, methane, chlorofluorocarbons (CFCs)—act like glass in a botanical greenhouse, trapping heat and thus warming the planet. That much remains unquestioned: a greenhouse of some magnitude is coming some time. The debate turns on three points:

- Have greenhouse gases affected our weather yet?
- How much will temperatures rise once greenhouse gases in the atmosphere reach twice their current levels, around 2030? A degree, or an apocalyptic 5.5 degrees?
- How long does it take for the mercury to shoot up?

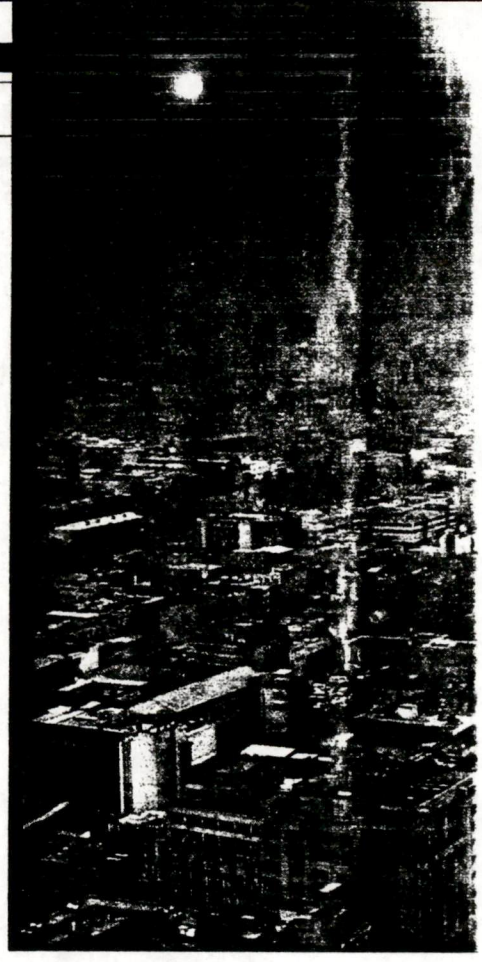
For answers, climatologists turn to computer models. But these mathematical formulations are crude approximations at best, as the modelers are the first to admit. For instance, greenhouse contrarians charge, the models do not even "predict" the past very well. Gases released since the 19th century should have warmed the planet 3 degrees Celsius, according to the models—but the world has warmed no more than half a degree. The discrepancy may be due to a delay between the emission of greenhouse gases and their warming effect, a delay determined in part by how much CO_2 the oceans absorb and by how long it takes the waters to warm up. But critics don't accept that. "The most conservative climate model overestimated warming by a factor of six," says climatologist Patrick Michaels of the University of Virginia. "Isn't that enough to give you pause about [forecasts of] the end of the world?"

Although computer models say greenhouse warming has begun, the data are controversial. Climatologist James Hansen of NASA's Goddard Institute for Space Studies, using global-temperature data covering the last 100 years, concludes that the greenhouse effect has indeed kicked in: the readings have gone up an average of 0.4 degree Celsius. But skeptics argue that the tiny warming is due largely to urban heat islands—cities heating their surroundings. And since the thermometers are on land they may not reflect the (mostly watery) planet as a whole. "Ocean temperatures show no change since the 19th century," contends geophysicist Richard Lindzen of Massachusetts Institute of Technology.

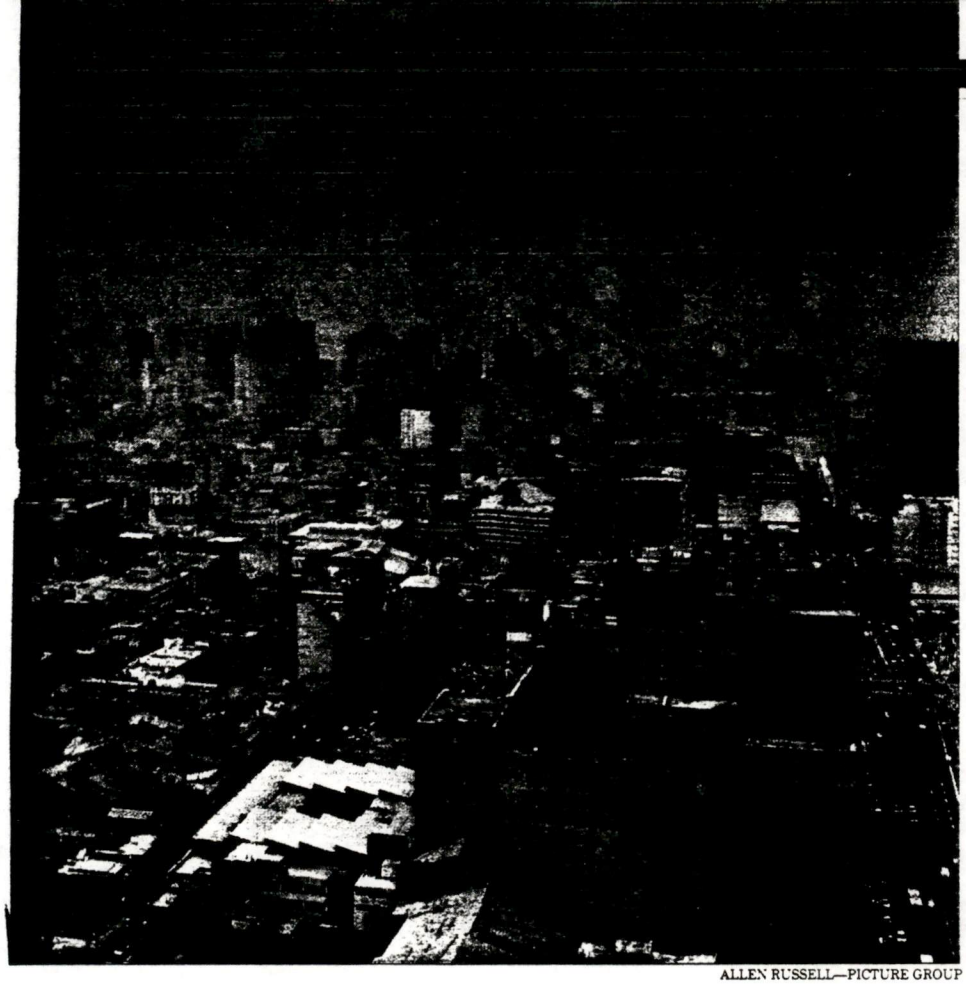
Tibetan glacier: New data, however, strengthen the case for the greenhouse. Next month, at a meeting of the American Geophysical Union, mathematicians from AT&T Bell Labs will report that, by ruling out other explanations of global warming—from chance to solar oscillations—they were able to conclude that "there is a 99.99 percent chance that the warming and the CO_2 rise are causally related," says David Thomson. And researchers from Ohio State University announced this month that ice cores from a glacier in Tibet show that Central Asia has warmed 1 to 3 degrees Celsius in the last 100 years—something that cannot be attributed to warm cities.

The more pressing question is what the climate will be like by, say, 2030. To answer that, researchers are making their models more realistic. In one recent fine-tuning, researchers led by J.F.B. Mitchell of the British Meteorological Office rewrote their equations to simulate clouds containing ice crystals, not only water vapor as before. The effect: overcast increases, which cools the world just as does a passing cirrus on a July afternoon. The result, the BMO group wrote in the journal Nature, is a global warming of 1.9 degrees Celsius, not the 3 to 5.5 degrees predicted by most current models. (In Fahrenheit, that's a warming of 3.4 degrees, rather than 5.4 to 9.9 degrees.)

White House chief of staff John Sununu (an MIT-trained engineer) and science adviser D. Allan Bromley (a physicist) have seized on this result to argue against taking steps to mitigate the greenhouse. "You do not establish policies on the basis of incomplete models," Sununu told NEWSWEEK. "We have the time and obligation to find out what's going on. We're going to do the right thing. We want to know what the right thing is." True enough. But the White House may be taking more comfort from the new results than is warranted. V. Ramanathan a University of Chicago geophysicist not noted for apocalyptic rhetoric, explains that cloud behavior "involves about 25 different interactions, and our models simulate only one or two. When we



Villainous CO_2: *Polluted Mexico City*



ALLEN RUSSELL—PICTURE GROUP

have all 25 in there, greenhouse predictions may get *worse.*"

Caution like Sununu's may be prudent; unbridled optimism is not. He cites another new study that lowers projections of greenhouse warming. Warren Washington and Gerald Meehl of the National Center for Atmospheric Research in Boulder, Colo., used more sophisticated simulations of the oceans' circulation and heat exchange than did earlier computer runs. In their worst-case scenario—an overnight doubling of CO_2—the pair found that the world would warm 1.6 degrees Celsius within 30 years, again a more mild greenhouse. But Meehl points out that their model did not run long enough to show *all* the warming CO_2 would produce. Some remained bottled up in the great heat sink of the ocean. (The seas absorb most of the CO_2 produced on the planet.) Running the models out another few decades would produce more heating. Says Meehl, "It may take longer to see climate change, but you do see it."

Stormy weather: Even increases of a degree or two can have unpleasant effects. Droughts would be more likely. Storms would be more severe and frequent, because the atmosphere holds more energy. Agricultural belts would shift, possibly causing crop failures. Although many skeptics argue that crops would thrive on the extra CO_2, in fact plants have responded to past CO_2 increases by developing fewer of the tiny pores that breathe in this gas. Most worrisome, while a mild greenhouse may not be a great place to live, no one can rule out the chance of a hellish tomorrow. "Although a 1-degree warming is much more probable," says climatologist (and skeptic) Robert Balling of Arizona State University, "it is ludicrous to say 5.5 degrees cannot happen."

But when? Current inhabitants of the White House don't have to worry. Because the oceans absorb so much heat, it will be decades before the world gets appreciably hotter because of CO_2 already loosed on the planet—unless some of the unknown forces that shape climate bring on more warming more quickly (table). Says climatologist Michael Schlesinger of the University of Illinois, "Our children will ask why their folks didn't do something about greenhouse warming when they had the chance."

That leaves society with a painfully familiar choice: how to act in the face of uncertainty. As NCAR climatologist Stephen Schneider puts it in his new book, "Global Warming," "Can we base trillion-dollar decisions about global economic development strategies on ... these admittedly cloudy crystal balls?" He says yes—procrastinating would be reckless. But MIT's Lindzen recommends wait-

Keeping a Weather Eye on the Mercury

Even sophisticated formulas used to predict the greenhouse can't account for all of nature's forces. Several variables may make the climate mild or hellish.

LARRY DOWNING—NEWSWEEK

More data, please: *Sununu*

Silver Linings

Clouds: Higher temperatures increase evaporation and hence clouds, which are made of water vapor and help cool the planet.

Volcanoes: Eruptions spew tiny particles into the atmosphere that deflect sunlight, causing cooling.

Plankton: Warmth and extra CO_2 might promote the growth of these tiny marine organisms, which absorb CO_2 and take it out of circulation.

Oceans: Their heat-absorbing capacity might delay warming for more than a century.

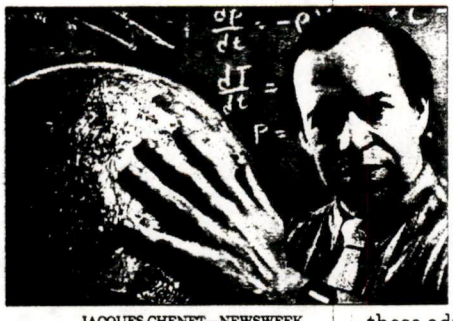
Start Building an Ark

Sea ice: Once it starts to melt, less sunlight will be reflected away, exacerbating the warming.

Acid rain: Sulfur dioxide, which causes acid rain, also cools the earth. Controlling acid rain might thus accelerate the greenhouse effect.

Permafrost: Warming might melt the frozen soil, releasing buried methane—a greenhouse gas.

Soil: Warming ordinary soil would increase the rate at which bacteria convert dead organic matter into CO_2, intensifying the man-made greenhouse.



JACQUES CHENET—NEWSWEEK

Early warnings: *Hansen*

ing, since "most of these questions will be on significantly surer ground in five years." Other experts think 10 or 20 years is more like it, and that what we learn is as likely to point to a worse greenhouse. Says Mohammed El-Ashry of the World Resources Institute, a Washington think tank, "When we waited for more research on acid rain, we ended up realizing that everything we knew 10 years earlier was true." And waiting exacts a price. Gradually replacing oil with solar energy, for instance, is much less painful than a sudden switch. And the longer greenhouse gases are emitted, the more warming we may ultimately confront.

How we respond to the greenhouse threat will depend not only on science but also on the palatability of the required changes. The industry-sponsored Global Climate Coalition opposes singling out American companies to "cure" the greenhouse. Ford Motor Co., for instance, points out that U.S. passenger cars account for 1.2 percent of global CO_2 emissions; doubling fuel efficiency would cut that to .6 percent. "It would throw industry into a tailspin and have minimum environmental impact," argues Ford's Kelly Brown. But vehicles account for 32 percent of America's CO_2 emissions; utilities, for 34 percent. Of course, America alone cannot stop the greenhouse, but if a rich, technologically advanced nation won't put its own house in order, then developing countries—potentially worse greenhouse villains—have a perfect excuse to do nothing.

Foreign oil: Changes that would mitigate the greenhouse would actually bring other benefits. Energy conservation reduces dependence on imported oil; fuel-efficient cars and planting trees clean the air. Some changes would improve competitiveness. At least the Japanese, whose models show a temperature increase of 1.5 to 3 degrees Celsius by 2030, seem to think so. They are researching ways to recycle CO_2 released in industrial processes, develop energy sources to replace fossil fuels and capture CO_2 by using marine algae to "fix" it.

For those who fear that the greenhouse will arrive—and no responsible scientist denies that possibility—it seems imperative to take immediate steps to mitigate it. For those who fear such changes, it seems more prudent to postpone action until the effect is indisputably upon us. The Bush administration has budgeted $250 million this fiscal year for climate modeling, money that would go to both scientific camps. Some of the uncertainties might be resolved by the next world climate conference, in late 1990. But the debate will not be over by then. Society will have to face its demons and decide which it fears most.

SHARON BEGLEY *with* MARY HAGER *in Washington,* LARRY WILSON *in New York and bureau reports*

K. BRUSATE—COMMERCIAL DIVING SERVICES

From the deep: *Mussel magnified three times*

ENVIRONMENT

Showdown at Mussel Beach

Marauding crustaceans terrorize Great Lakes

It may lack the girth of the Blob or the menacing chirp of Hitchcock's birds, but the zebra mussel is staging a classic creep-show routine on the western shores of Lake Erie. The striped freshwater clam invaded North America just three years ago, when a European tanker flushed its ballasts into Lake St. Clair. Since then, populations have spread through the Detroit River and into Lake Erie at a clip of 160 miles a year. The prolific crustaceans are now entombing boat hulls and beaches, disrupting a large fishing industry and clogging waterlines that support cities and factories. Unless the invasion is stopped, experts speculate, 26 million people could lose their water supplies within five years.

For Great Lakes fishermen, the immediate threat is not the thumb-size grown-ups but the subvisible larvae they spawn by the tens of thousands. Off the shores of Toledo and Cleveland and near Leamington, Ont., a single cubic meter of water often contains a half-million mussel larvae. "I don't think it has reached its peak even there," says Gerry Mackie, a biologist at the University of Guelph. The voracious youngsters have increased water clarity threefold—but they've done it by gobbling up the plankton and algae that support the rest of the aquatic food chain. Food shortages are already affecting the walleyed pike, a perchlike species that accounts for most of Ohio's $500 million sports-fishing industry and is harvested commercially in Canada. This year Ohio's catch will be off by an estimated 600,000 fish (down from 4.9 million to 4.3 million), and Canadian fishermen say the walleyes they're catching are smaller than usual.

That's just the beginning. Mature zebra mussels use tough, threadlike membranes to latch onto hard surfaces in layered colonies, and they seem particularly fond of the huge intake pipes that provide water supplies throughout the Great Lakes Basin. The town of Monroe, Mich., had to ban lawn sprinklers this summer, after the crustaceans colonized its 30-inch-wide, 10-mile-long intake pipe, reducing its capacity by a third. Musselbound waterlines have brought a halt to development in the town of West Lorne, in southwest Ontario, and caused a series of equipment failures at the Ford Motor Co.'s Windsor (Ont.) Casting Plant, where engine blocks are cast from molten iron.

Ford officials were able to kill the invaders with 300-pound doses of chlorine, leaving cleanup crews to contend with mountains of malodorous dead. But municipal officials have to think about purity as well as quantity. Since chlorine and mussel proteins can mix to form suspected carcinogens, Monroe officials are trying to develop a whirling scrubber that will unseat the intruders mechanically. Other communities are trying to concoct filters that will keep the mussels from entering the pipes in the first place. These devices will cost an estimated $50 million apiece, and dozens of towns may require them. "Many of us are moving quickly to contain this mussel," says Michael Donahue of the Great Lakes Commission, an eight-state consortium of governments. "But I can tell you that the cost will be much more than the Exxon oil spill."

Natural predators may offer the best hope of all. No amount of garlic or butter will turn a zebra mussel into restaurant fare, but the striped pests have turned up in the stomachs of several species of fish. Diving ducks like them, too, and large flocks will spend the next two months in the Great Lakes, en route from Canada to the southern United States. Let us hope they're hungry.

GEOFFREY COWLEY *with* LOUIS AGUILAR *in Detroit*

Chill Out

We keep reading that the debate over the greenhouse effect is "settled" and that all "serious" scientists subscribe to it. Such a strong sense of consensus in science is a remarkable thing, no matter what the subject. We continue to wonder, though, if the greenhouse debate is really over.

In January, for instance, the New York Times publicized a study which reported that there has been no warming trend in the United States over the past century. Scientists at the National Oceanic and Atmospheric Administration reported that since 1895, the climate in the U.S. has grown neither warmer nor colder, wetter nor drier. The chorus quickly responded that the U.S. results are an anomaly, and that when a wider sample came in, its theory would be vindicated.

A wider sample has just arrived. Three MIT scientists—Reginald Newell, Jane Hsiung and Wu Zhongxiang—recently processed ocean-temperature data taken all over the world by merchant mariners since the mid-19th century. Their results were summarized in the current issue of Technology Review: "One of the most striking results suggested by the data is that there appears to have been little or no global warming over the past century." The computer models that foretell a greenhouse effect predict that there already should have been about a 1.8 degree rise in global temperature. But that hasn't happened. Also, the uncongenial MIT report has been virtually ignored. Science may still be about surveying all the available facts but, increasingly, public policy isn't.

Today, much public policy, especially as practiced by many environmental advocates, is mainly about making doubters or opponents reluctant to challenge the consensus. Strobe Talbott of Time magazine, for example, recently announced that "no respectable scientist denies" the greenhouse phenomenon.

No doubt, participants of all stripes in the policy game these days have become frustrated at their inability to enact their agendas. What seems to sometimes work, though, is whipping up a kind of mass-media fervor behind one's ideas. The danger in this is that it may cause the public to think that science is now primarily about politics, and in politics about half the people usually think that you're not telling the truth.

NASA scientist James Hansen is widely credited with launching the highly politicized crisis atmosphere around the greenhouse question. Mr. Hansen went before a congressional committee and said that he was 99% sure that the earth was getting warmer, and he had "a high degree of confidence" that warming was caused by the greenhouse effect. This of course got the desired effect—tremendous press play. But some of Mr. Hansen's scientific colleagues were dismayed.

In an article titled "Hansen vs. the World on the Greenhouse Threat," the journal Science reported that Mr. Hansen's colleagues found his greenhouse assertions "unforgivable," largely because of their absolutist certitude. But absolutism ("no respectable scientist denies") is a commandment of modern environmentalism.

Mr. Hansen is a highly respected modeler, but he resists acknowledging the possibility of shortcomings in his computer creation. However as models have begun to grow slightly more realistic recently, the greenhouse predictions have varied enormously. Researchers at the National Center for Atmospheric Research have cut their greenhouse prediction in half. Lacking empirical confirmation of their primitive models, scientists and environmentalists have adopted a fallback position. They say the greenhouse effect may or may not be serious, but we should take insurance precautions anyway. But the cost over 20 years has been estimated to run between $1 trillion and nearly $4 trillion.

The final greenhouse argument is that it is far cheaper to address the problem now, than later, when information is more reliable. This recalls to mind the 19th-century scientists who worried that the world was running out of coal.

Maybe there's a way out of this:

Let's put all the relevant policy players in a room together—George Bush, John Sununu, Bill Reilly of EPA, Congress and governors. They'll listen while the top academic climate modelers discuss the available evidence around the greenhouse effect. The public will watch on C-SPAN. And when it's over, the politicians can go before the microphones and tell us what they think is "settled" about global warming and, most important, how much they want to spend on it. We agree with the absolutists. Time is money. Let's settle it.

Cardinal Law

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782-2544