

The Asilomar International Conference on Climate Intervention Technologies

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Chief Scientist for Climate Change Programs
Climate Institute
and
Chair of the Scientific Organizing Committee

Members of the Scientific Organizing Committee

Dr. Michael MacCracken, Climate Institute (**Chair**)

Dr. Paul Crutzen, Max Planck Institute, and Scripps Institution of Oceanography (**corresponding member**)

Dr. Scott Barrett, Lenfest Professor of Natural Resource Economics, Columbia University

Dr. Roger Barry, Director of the World Data Center for Glaciology and Distinguished Professor of Geography, University of Colorado

Dr. Steven Hamburg, Chief Scientist, Environmental Defense Fund

Dr. Richard Lampitt, Senior Scientist, National Oceanography Center and Professor, University of Southampton

Dr. Diana Liverman, Director of the Institute of the Environment and Professor of Geography and Regional Development, University of Arizona, US. Senior Fellow in the Environmental Change Institute, Oxford University

Dr. Thomas Lovejoy, Heinz Center Biodiversity Chair at the Heinz Center for Science and the Environment

Dr. Gordon McBean, Professor, Departments of Geography and Political Science and Director of Policy Studies at the Institute for Catastrophic Loss Reduction, The University of Western Ontario

Dr. John Shepherd, Professorial Research Fellow in Earth System Science, School of Ocean and Earth Science, National Oceanography Centre, University of Southampton, and Deputy Director (External Science Coordination) of the Tyndall Centre for Climate Change Research

Mr. Stephen Seidel, Vice President for Policy Analysis and General Counsel at the Pew Center on Global Climate Change

Dr. Richard Somerville, Distinguished Professor Emeritus and Research Professor at Scripps Institution of Oceanography, University of California San Diego

Dr. Tom M.L. Wigley, Professor, University of Adelaide and Senior Scientist, National Center for Atmospheric Research

The proposed purpose of the meeting was to establish a framework for possible research

Quoted from the invitation letter:

The goal of the Conference will be to propose strategies to minimize risk associated with scientific experimentation and research on approaches for climate intervention. The specific objectives of the conference will be to:

- 1) **identify the potential risks associated with climate intervention experiments;**
- 2) **propose a system to assess experiments for their potential categorical risks and suggest precautions necessary for the experiments; and**
- 3) **propose research standards and guidelines for use by the international science community.**

The participants in the Conference represented an unprecedented set of experiences and backgrounds

Total of expert participants = 172 (after accounting for dropouts and the IPCC Climate Extremes meeting in Hanoi); about 75-80% received support from the Climate Response Fund for travel and/or food and lodging at the Asilomar Conference Center

Academic institutions = 97 (including 10 young scientists who served as rapporteurs) from ~63 entities

Non-governmental organizations = 40 from ~30 groups

Governments and government laboratories = 20 from ~12 entities

Other (retired, consultants, industry, etc.) = 15

The primary affiliations of the expert participants covered 14 nations*

International representation:

Australia	6	Japan	1
Austria	1	The Netherlands	3
Brazil	2	South Africa	2
Canada	3	Spain	2
Germany	3	Sweden	2
India	2	United Kingdom	16
Israel	1	United States	137

* A number of the participants were multi-national, some holding more than one passport, and a number were based at institutions other than their likely citizenship

The Asilomar International Conference on Climate Intervention Technologies

March 22-26, 2010
Asilomar Conference Center
Pacific Grove, California



CLIMATE RESPONSE FUND



The Conference was open to the media,* and there was significant participation

Total media participation included 19 individuals, representing:

- The American Scholar
- Canadian Broadcasting Corporation, documentary (3)
- Chemical and Engineering News
- The Economist
- Monterey County Herald
- Mother Jones
- Nature
- New Scientist
- Science
- Science News
- University of California
- Independent writers, local and freelance journalists, filmmakers (6)

* In addition to the press attending the plenary and breakout group sessions, there were interviews outside of the Conference sessions, and there was also a conference call/briefing for the press at the end of the meeting

All Conference participants, including media, were asked to respect three rules

The three rules were:

1. Chatham House Rule (modified)—Information learned at Conference can be used, provided there is no quoting of or attributing statements to specific individuals without their specific permission (and speakers granted their permission on talks).
2. Information learned at Conference is embargoed until the end of the Conference.
3. Recording only allowed in plenary sessions, and subject to the Chatham House Rule (modified) shown above.

Under these rules, there have been quite a number of articles about the Conference coming out since it concluded.

The Conference program* was structured to generate discussion regarding potential guidelines for research activities, not deployment (1)

- Monday evening: Experiences with guidelines in other fields
- Tuesday morning: Plenary talks on approaches to climate and carbon intervention
- Tuesday afternoon: Plenary talks on legal, ethical, societal, economic, and governance issues
- Tuesday evening: Panel on actions/plans by governments
- Wednesday morning: Plenary talks introducing the notion of guidelines that might be applied to research on climate intervention

* In addition to the time in the Conference sessions, that everyone had rooms on the grounds and ate meals together provided significant opportunities for interactions

Presentations on the approaches to climate intervention for which research is being proposed

John Shepherd FRS, University of Southampton: Introduction and Overview of Proposed Approaches to Climate Intervention

Phil Rasch, Pacific Northwest National Laboratory: Model Analyses of the Potential for Aerosols in the Troposphere or Stratosphere to Limit Incoming Solar Radiation

David Keith, University of Calgary: Experimenting with Solar Radiance Engineering: Possibilities, Limits and their Policy Implications

Richard Lampitt, National Oceanography Centre: The Potential for and Challenges of Enhancing Ocean Uptake of Carbon

Jerry Melillo, Marine Biological Laboratory: The Potential for and Challenges of Storing More Carbon in the Terrestrial Biosphere

David Keith/Rob Socolow (subbing for Klaus Lackner), University of Calgary/Princeton University: Status of Air Capture Techniques

Presentations on the social science context for research on potential climate intervention

Catherine Redgwell, University College, London: The International Legal Framework for Climate Intervention

Oran Young, University of California Santa Barbara: Governing Climate Intervention: Lessons from the Study of International Institutions

David Morrow, University of Chicago: Ethical principles for trials of climate intervention technologies

Steve Smith, PNNL: The economic context for climate intervention

Scott Barrett, Columbia University: Geoengineering: Incentives and Institutions

David Victor, University of California San Diego: Regulating the Testing of Geoengineering Systems

Granger Morgan, Carnegie-Mellon University: Decision-making Frameworks for Geoengineering Policies

The Conference program was structured to generate discussion regarding potential guidelines for research activities, not deployment (2)

- Wednesday and Thursday mornings: Breakout groups on various types of approaches, focusing Wednesday on how to ensure a thorough scientific peer review and Thursday on how to ensure a responsible public and governmental review;
- Wednesday and Thursday afternoons: Parallel plenary sessions on Wednesday for solar radiation management and for carbon management; joint plenary on Thursday;
- Wednesday evening: Plenary presentations on results of surveys of the public and of studies of press coverage on climate change;
- Thursday evening: Plenary presentations on the possibilities and problems of considering climate intervention as part of the policy mix
- Friday morning: Discussion of the draft Conference statement

The breakout groups were organized around five potential objectives to be pursued via climate intervention

- A. Reduce global average temperature (stratospheric aerosols, global cloud or surface brightening, etc.)
- B. Reduce specific (regional) impacts (e.g., cool the Arctic, moderate tropical cyclones, redirect storm tracks, etc.)
- C. Increase ocean uptake of CO₂ and limit pH change
- D. Increase terrestrial uptake and storage of CO₂
- E. Destroy or geologically tie up CO₂ and other GHGs (e.g., scrub CO₂ and inject underground)

One starting point for the guidelines was the input of Steve Rayner et al. to the House of Commons Select Committee

The “Oxford Principles”

1. Geoengineering to be regulated as a public good
2. Public participation in decision making
3. Disclosure of geoengineering research & open publication of results
4. Independent assessment of impacts
5. Governance arrangements to be clear before deployment

The House of Commons Select Committee offered five additional potential principles

6. We conclude that the key principles should not include the precautionary principle as a discrete principle
7. Decisions to be based on the best scientific evidence, including social science
8. Regulatory measures to be able to respond rapidly
9. Regulatory measures to be imbued with a high level of flexibility to be able, for example, to encompass new technologies as they emerge; and
10. Prohibition of geoengineering techniques for military purposes

There were a number of additional inputs and thoughts on possible guidelines

- One key question was to what extent research on climate intervention is different than other research, and thus to what extent one needed to reiterate existing scientific guidelines, and to what extent additional guidelines might be needed.
- Another question was whether there would need to be particular guidelines for each technological approach, or general guidelines could be developed that would cover all categories of intervention research
- Based on consideration of guidelines from other fields, the SOC offered participants a list of the types of possible detailed guidance that might be given regarding (a) the general conduct of research, (b) guideline issues for field experiments, and (c) expectations of issues that seem likely to arise and that governance might be expected to deal with. A pre-Conference survey seemed to agree most of the detailed points likely merited attention.

There was considerable discussion of these ideas in the breakout groups and plenaries— and revisions are under consideration

Some of the ideas suggested included:

- Research on climate alteration should be governed/regulated.
- Research efforts should be coordinated and collaborative.
- Public and governmental decision-making on research should be participative.
- Publication and data release from experiments should be prompt.
- Review and assessment should be independent.
- Both physical and social sciences research is important:
 - Balanced research is needed to evaluate the problems as much as the potential, the advantages and disadvantages, and the benefits and risks.
 - Existing governance procedures provide many safeguards
 - Special governance procedures are merited for climate intervention research

While significant progress was made, pulling it together remains a responsibility of the Scientific Organizing Committee

Outputs of the Conference:

- Conference Statement
- Web site with materials presented, etc.
- Brief report covering suggested guidelines (to be drafted and circulated to participants)
- Publication of results

The Conference Statement was prepared to provide a preliminary sense of the participants

The draft drew more than two dozen insightful comments, which were incorporated in the final version that was finalized as a position statement by the SOC. Since the meeting, individual participants have been given the opportunity to indicate their individual support; to date, about half of the individual participants have signed on.

The statement focuses on several points of agreement:

1. Humility is needed in approaching the issue of potential climate alteration (including just of research on it)
2. The climate situation is becoming increasingly serious
3. Mitigation and adaptation are essential
4. Significant risks will remain despite best efforts
5. Research is necessary on alternatives (i.e., climate intervention and climate or carbon remediation)

1. REGULATION AS A PUBLIC GOOD

- Public goods are non-excludable – cannot opt in or out
- Examples include clean air & water, public health, public order, defence, etc
- Does not mean that private sector is excluded
- Does mean that (democratic) government controls the terms of supply – including funding
- Challenges of international coordination – but these are not insurmountable

- **Principle 1: Geoengineering to be regulated as a public good.** While the involvement of the private sector in the delivery of a geoengineering technique should not be prohibited, and may indeed be encouraged to ensure that deployment of a suitable technique can be effected in a timely and efficient manner, regulation of such techniques should be undertaken in the public interest by the appropriate bodies at the state and/or international levels.

2. PUBLIC PARTICIPATION

- Affected public to be notified, consulted, and give consent
- Mechanisms for consent may vary
- Affected public may be local or national
- Explicit international agreement will be required for some technologies
- **Principle 2: Public participation in geoengineering decision-making**
Wherever possible, those conducting geoengineering research should be required to notify, consult, and ideally obtain the prior informed consent of, those affected by the research activities. The identity of affected parties will be dependent on the specific technique which is being researched - for example, a technique which captures carbon dioxide from the air and geologically sequesters it within the territory of a single state will likely require consultation and agreement only at the national or local level, while a technique which involves changing the albedo of the planet by injecting aerosols into the stratosphere will likely require global agreement.

3. DISCLOSURE & PUBLICATION

- Prompt and timely
- To include modeling as well as empirical research
- Both research plans (prior notification) & results
- To include publication of “negative” results
- No “national security” exceptions

- **Principle 3: Disclosure of geoengineering research and open publication of results** There should be complete disclosure of research plans and open publication of results in order to facilitate better understanding of the risks and to reassure the public as to the integrity of the process. It is essential that the results of all research, including negative results, be made publicly available.

4. INDEPENDENT IMPACT ASSESSMENT

- Possible red-team and blue-team approaches
- To include socioeconomic and cultural impacts
- Potential to include risk mitigation requirements
- Possible basis for establishing liability ex ante
- Required at national & international levels

- **Principle 4: Independent assessment of impacts** An assessment of the impacts of geoengineering research should be conducted by a body independent of those undertaking the research; where techniques are likely to have transboundary impact, such assessment should be carried out through the appropriate regional and/or international bodies. Assessments should address both the environmental and socio-economic impacts of research, including mitigating the risks of lock-in to particular technologies or vested interests.

5. GOVERNANCE BEFORE DEPLOYMENT

- Boundary between research & deployment may be fuzzy
- Credible capacity to enforce rules & terminate activity essential
- Use existing institutions where possible

- **Principle 5: Governance before deployment** Any decisions with respect to deployment should only be taken with robust governance structures already in place, using existing rules and institutions wherever possible.