"enables CEES to develop and recommend a U.S. Global Change Research Program that identifies the highest priority program elements required to support the most critical U.S. global change policy interests."

Aristides Patrinos, Director of DOE's Carbon Dioxide Research, noted seven levels of review in the CO_2 program, with the same criteria for evaluation as the CEES Working Group. Patrinos told the committee that "we are making significant advances in reducing uncertainties in global change."

When asked by Scheuer if they would be willing to work with the Subcommittee on legislation to require peer review, both Correll and David Reichle, Oak Ridge National Laboratory, responded positively, saying they would be delighted to help in any way possible.—*Susan Bush*

Rainfall Mission Approved in U.S. and Japan

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The Tropical Rainfall Measuring Mission (TRMM), the joint U.S./Japan space mission to measure rainfall over the global tropics, has been formally approved in both nations, with launch scheduled for late 1996 or 1997.

As described in the *Bulletin of the American Meteorological Society* (vol. 69, pp. 278–295), TRMM, in its early planning stages, will be the first space mission to fly a rain radar. The "rain package" also includes a multichannel passive microwave radiometer and a high-resolution visible and infrared instrument, similar to the AVHRR (advanced very high-resolution radiometer). Orbiting at 350-km elevation for high resolution, TRMM is inclined at 35° in order to overfly tropical locations at a different local time each day, and to document the diurnal variability in precipitation. An important TRMM measurement will monitor monthly rainfall over 5° by 5° boxes over oceans to an accuracy of approximately 10–15%, with the largest error arising from sampling by the selected orbit. Rainfall over individual swaths will also be valuable and can become useful data sets, particularly when combined with products from other satellites.

TRMM is a member of the low-to-moderate cost Earth Probe series of satellites, which are part of NASA's Mission to Planet Earth. The Goddard Space Flight Center is conducting the project and building the spacecraft in house. To measure Earth and cloud radiation, CERES (clouds and the Earth's radiant energy system) was added in late 1990; additional instruments are being considered.

In July 1990, NASA issued a research announcement and received more than 100 proposals. Principal investigators of the successful proposals, selected in February 1991, comprise the Science Team. Under the leadership of Taroh Matsuno of Tokyo University, a Japan-based science team was also selected, which will collaborate closely with the NASA-selected team.

For further information on TRMM, contact Joanne Simpson, TRMM Project Scientist, Mail Code 912, Goddard Space Flight Center, NASA, Greenbelt, MD 20771.

FORUM

What Is AGU's Proper Role in Society?

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"We do not inherit the Earth from our parents. We borrow it from our children".—Indian proverb

A series of articles that appeared in *Eos* ("Planet Earth Report," December 11–25, 1990) concerning our terrestrial environment, ranging from the Earth's interior to the magnetosphere were generated by a concern that a more comprehensive understanding of our Earth is needed, requiring a "Mission to Planet Earth" that includes substantial efforts in surface and sub-oceanic measurements, as well as spaceborne. Our question is whether AGU should undertake further action on public issues raised by these educative articles, since almost any action involves judgments based on more than geophysical expertise.

Guidelines on public issues were stated by the AGU Council in May 1982: "As a scientific society, AGU should not take or advocate public positions on judgmental issues that extend beyond the range of available geophysical data or recognized norms of legitimate scientific debate."

But certainly AGU members, acting as individuals, have given their opinions to policy makers about what should be done concerning environmental and resource problems that extrapolated from purely geophysical expertise. There are also more comprehensive scientific institutions through which concerned scientists can act, such as the American Association for the Advancement of Science or the National Academy of Sciences, and other organizations more focussed on political issues, such as the Union of Concerned Scientists.

Scientists are also free to publish and distribute their opinions as individuals. In the spring of 1990 three scientists—none renowned as a climatologist and only one an AGU member—distributed a glossy pamphlet on the greenhouse problem to leading policy makers in Washington [*Seitz*, 1989]. It is said to have had appreciable influence on the decision to postpone federal action on the problem beyond enhanced research. Is it all right that these three individuals have more influence than the 25,000-member AGU, which presumably has more of the relevant expertise?

Despite these alternatives, we are told that opinions expressed as AGU consensuses may have appreciable influence; that politicians tend to give greater weight to collective opinions of well-established institutions than to opinions of individuals, even though the latter may be more acute.

The articles published in *Eos* were originally intended, at a meeting of the AGU Planet Earth Committee in May 1989, to appear, with recommendations for action in a brochure of about 25 pages addressed primarily to policy makers and their staffs. A draft of this brochure, entitled "A Complete Mission to Planet Earth," was presented to a meeting of the AGU Planning Committee in September 1989. At that time, it was decided that the brochure was too long for policy makers and that emphasis should be placed on a letter of two pages addressed primarily to Allan Bromley, the president's scientific advisor. The main parts of the resulting draft were four recommendations concerning program implementation and two concerning public policy implied by geophysical findings. The former four have largely been incorporated in AGU policy statements. The two on public policy follow.

"We urge implementation of measures to maintain, at least, environmental quality and conserve resources, even though the full implications of certain geophysical trends are not yet understood. Certain trends are unmistakable: e.g., CO_2 increase, topsoil erosion, and petroleum depletion. In face thereof, a rational society takes action, such as participating in ministerial-level coordination because of the long lead times for orderly implementation of preventive measures."

"The public in the industrialized nations, particularly the United States, must be made more aware of the pervasive trends in environmental degradation and resource depletion, and of the need to modify patterns of life to cope with these trends. There needs to be a greater spirit of cooperation and care about the future. A significant part of the burden of environmental protection measures, such as halting rain forest destruction, falls on the developing countries. We cannot hope for them to cooperate without evidence of belt-tightening in the developed countries."

The majority of the AGU Council at its meeting of December 1989, decided that these recommendations were too political and went beyond the 1982 guidelines.

In a meeting with the AGU council in December 1990, the opinions expressed by members associated with the National Science Foundation and the President's Council of Advisers on Science and Technology were that recommendations based on specialized expertise and backed by scientific analyses were desireable as inputs to policy making. Even though the leading policy makers may not have time to study the backup analyses, they are reassured by their presence and delegate their reading to their staffs. But a question remains: What are the bounds on "recommendations based on specialized expertise?"

A major difficulty of geophysics in these matters of public concern is the large uncertainties associated with predictions. We feel that it is not going outside our specialized expertise to say that these uncertainties should not be used as reasons to postpone action on unmistakable trends that, in the long run, will be detrimental, or that the public needs to be made more aware of these trends, as stated in the two recommendations above. A recent article by *White* [1990] enumerates several developments that could be undertaken that would yield benefits entirely aside from climate amelioration: solar energy, safe nuclear power, reforestation, and stress- and disease-resistant crops. But he also warns that the public must not be misled into thinking that these steps alone will solve the global warming problem.

However, there are differences of opinion within AGU. These differences are largely differing definitions of caution: to some, caution is preserving options for the future, as expressed by *White* [1990]; for others, it is being slow to change economic patterns, because any significant action will entail costs and dislocations that may prove unnecessary when the relevant circumstances are known more accurately, which seems to be the attitude of *Seitz* [1989].

In our opinion, there has been a failure to articulate just what is the proper definition of caution in the face of uncertainty. This is an issue on which debate within AGU would be valuable. Too often the press gives the impression that scientists are more concerned about who's right and who's wrong among themselves, rather than what should be their common recommendation to policy makers.

Relevant to the definition of caution in the face of uncertainty, natural scientists seem to require a much higher degree of assuredness before speaking out on matters of public policy, relative to other communities. In contrast, some economists boldly advocated the cuts in taxes and deregulation of the savings & loan industry in the early 1980s—to as yet somewhat debated benefit, to put it mildly. Is it right that there should be a higher level of confidence in geophysical predictions than in economic predictions?

We disagree. To emphasize that recent and future global temperature changes due to natural causes may be larger than the anthropogenic greenhouse warming (as does Seitz) is equivalent to saying "No need to be careful in crossing the street, because meanwhile you may be killed in some other way than by being hit by car." Public policy should be based on a balancing of risks and should not impose differing standards on different sectors of its bases of expertise. This also is a matter on which debate within AGU could be helpful to both the geophysical community and society.

Another difficulty is the over-simplification of problems. It is irksome to see global mean temperature repeatedly emphasized, while there are other predictions of the models that may have much greater economic impacts, such as poleward shifts of rain. It is not entirely implausible that a moderate increase in atmospheric carbon dioxide could lead to a lowering of global mean temperature through increased cloud cover. But the most unlikely scenario of all is "no significant change at all in geographic distribution of insolation and rainfall." Analogously, the earthquake problem in California is much more ramified than the next big jerk on the San Andreas. Again, AGU could play a role by making the definition of such problems more meaningful.

The opinions of the members on the societal role of AGU are sought, by letters to *Eos* or phone calls to the authors.—*William M. Kaula, University of California, Los Angeles (213-825-4363); and Don L. Anderson, California Institute of Technology (818-356-6901)*

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Editor's Note: The stated goals of AGU in regard to public affairs and developing public positions include furthering "the public welfare by assuring that geophysics makes appropriate inputs to public policy decisions" and "assisting members of the geophysics community in their efforts to assure a political, social, and economic environment conducive to increasing excellence in geophysical research." It is the responsibility of the Committee on Public Affairs to formulate the AGU program that works toward these goals and to provide continuing guidance and review.

In May 1982, the AGU Council approved the following policy on the Union's role in advocacy on public issues:

"The American Geophysical Union is an association of scientists, scholars, and interested lay public for the purpose of advancing geophysical science. The Union shares a collateral sense of responsibility to assure that the results of geophysical research are made available to benefit all mankind. The Union encourages its members to exercise their individual sense of responsibility in addressing political and social issues. Should they choose to act collectively on such issues, other organizations exist for such purposes. The American Geophysical Union, as a society, should preserve its unique position as an objective source of analysis and commentary for the full spectrum of geophysical science. Accordingly, the following policies should guide the AGU's role as an advocate."

A Call for Rotators

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"Needed: highly motivated geoscientists willing to slow the pace of their research for 1–2 years while managing federal government support of their discipline. Assured: change of perspective; no change in pay. Contact your National Science Foundation Program Director for details."

No, this isn't an NSF job announcement; this is an open letter to members of the Earth science community from a recently "retired" NSF rotator concerned by the small number of researchers interested in a Washington tour. I learned firsthand the extent to which an individual in this position is entrusted with decision-making powers, and as a result, I believe that each of us in the research community should feel responsible for ensuring that highly qualified people serve as rotators.

My 18-month rotation ended last October, and it was an extraordinarily rewarding experience. I was one of three (the other two were permanent) program officers (POs) in the Marine Geology and Geophysics program, located in the Ocean Sciences division of the Geosciences directorate. (The rotator's job has been discussed by Kohn, 1988, *Ecolog. Soc. America Bull. 69*: 149–51; Batiza, Rea, and Rumble, 1988, *Eos 69*: 801; Packard, 1989, *Eos 70*: 709; and D'Elia, 1989, *Ecolog. Soc. America Bull. 70*:180–184.) I thoroughly agree with others' descriptions of what the rotator gains personally: broader familiarity with the topics and people outside of one's specialty; sharper awareness of where the scientific "cutting edge" is; and substantially enlarged skills for successful grantsmanship.

It has been said that "National Science Foundations" would be a more accurate agency title, owing to the diverse ways in which the NSF promotes scientific progress. From its beginning in 1950, the agency has regarded operational flexibility as essential to its own health and to that of the research community. Indeed, the reason for including temporary rotators alongside permanent POs is to ensure that organizational structure and onboard expertise can adapt to changes in federal support and in the direction of basic research. Rotators also provide a two-way exchange of information and attitudes: as they enter, they bring fresh community concerns; as they leave, they take back an enhanced understanding of NSF issues and policies. In line with this latter function, I want to describe a few ways that an individ-