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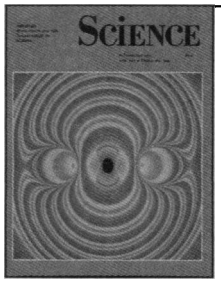

COVER Graphical representation of the motion of satellite orbits in phase space (the space whose dimensions are position and momentum). Each point fixes the orbital eccentricity and argument of perigee; color bands correspond to constant energy levels. Rendered by contour "painting" on a massively parallel processor, the plot reveals a startling configuration of equilibria spawned by pitchfork and saddle node bifurcations. See page 833. [Computer graphics generated on a Thinking Machines Corporation CM-2 by Etienne Deprit and Liam Healy, Naval Research Laboratory, Washington, DC; photographic image by Mark Stucky]

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Priority One: Rescue the Environment

President Bush has recommended that the Environmental Protection Agency be elevated to cabinet status and Congress is likely to approve. As a symbolic move to increase the visibility of our environmental crisis, the change is most welcome. However, unless a slipshod and emotional approach to environmental policy is replaced by a well-planned and scientific one, the EPA hero galloping to rescue the environmental damsel in distress is likely to fall off his horse.

In fact, EPA's change in status should be approved only on condition that improvements in its procedures be made. A major hurdle in protecting the environment is the cost of even partial solutions. Implementing provisions of the Clean Air Act will cost billions, as will disposal of toxic wastes and protection of the water supply. Our environmental dilemma calls for extraordinary thoughtfulness, good research, and careful choices based on cost-effectiveness. At present, priorities often seem to reflect random publicity, and research analysis is an unwanted guest hustled out the back door.

How can we change to a more rational policy? We can start by ensuring that the cost of each object includes the cost of an environmentally protective disposal. Like in mining, manufacturing of a beer bottle or a plastic toy should be subject to laws relating to incineration or recycling which would be supported by the cost of the object. In such circumstances, the manufacturers would have an incentive to devise more environmentally appropriate products, and consumers would have a voice in the cost-effective solutions.

The need to think through the entire cost of a product requires an element of overall planning currently lacking in environmental policy. If, for example, car emissions are reduced by 50 percent to obtain the minimal acceptable level for health, urban communities cannot allow more cars to enter their cities, thus nullifying the effect of the required technological changes. A farmer in Iowa might rightly say, "I shouldn't have to spend more for my car until the urban centers have a plan that makes my sacrifice worthwhile."

Part of a more rational approach to confronting environmental problems is to rely more on facts and be willing to modify policies as new facts are uncovered. Asbestos provides one good example. When asbestos was discovered it was hailed as a marvelous insulator and building material. As the industry grew, disturbing signs of adverse health effects on asbestos workers were swept under the rug, with tragic effects on health and life. The banning of asbestos then seemed logical, but recently, evidence has appeared to indicate that different forms of asbestos may have different pathological effects—one form is dangerous, the other relatively harmless at usual concentrations (see B. T. Mossman *et al.*, *Science*, 19 Jan., p. 294). If this is so, we may be spending between $50 billion and $150 billion needlessly. The dollars might be better spent to improve our water supplies and to provide prenatal care to underprivileged mothers.

Is there a way to institutionalize rational and informed environmental decisions? There is, and the time is now. A large and effective research arm should be put in place in the EPA at the same time that the organization is raised to cabinet level. EPA now does some research (approximately $424 million worth annually), and to give credit where it is due, some EPA officials are already aware that they need more long-range planning. But present research by the agency is almost always directed toward immediate remedies, such as cleaning a specific dump site; as a result we are wasting billions on poorly devised general policy. To provide an effective recycling policy, for example, research in the chemistry of glasses is needed. To develop a policy for effective clean air requires transportation research among other things. Before many plastics can be recycled safely, polymer and combustion research are needed.

A basic research budget for environmental problems at least four times bigger than the present one could provide the kind of information needed to set priorities, stimulate novel ideas, and ensure mutually consistent overall policies. This plan would engage such diverse disciplines as engineering, geophysics, biology, epidemiology, and economics, and would include both Washington-based and university-based research, with the National Institutes of Health as a model. A cabinet-level EPA could then base environmental policy on facts and rational goals, rather than on sloganeering and lobbying. Such a comprehensive approach could provide for environmental research the same kind of stature and competence that we now have in our work in biomedicine and might make giant strides toward the rescue and rehabilitation of our beleaguered planet.—DANIEL E. KOSHLAND, JR.