Experts Ponder Icebergs as Relief for World Water Dilemma

When in the 1940's John Isaacs of Scripps Institute of Oceanography advanced the idea of fetching icebergs from artic wastes to supply fresh water to arid lands, few paid much attention.

But thanks to a conference held at Iowa State University early this month, icebergs have attained charisma almost overnight. The conference, billed as the First International Conference on Iceberg Utilization, brought together some 200 scientists, consultants, and representatives of private firms from 18 nations to discuss the technical economic, environmental, and legal problems of locating, transporting, and exploiting Antarctic icebergs.

The meeting was made possible by the largesse of Saudi Arabia's Prince Mohammed Al-Faisal, until lately the man in charge of his country's water desalination program, who chipped in $50,000 (the National Science Foundation supplied another $25,000). It was held at Iowa because Faisal's friend Abdo Husseiny, an Egyptian nuclear engineer and optimist about iceberg possibilities, teaches there.

The idea of toting icebergs to civilization has been one with limited but durable appeal—for example, every few years there is a flurry of public interest in response to periodic California water shortages. But there has been little in the way of a systematic effort to assess the feasibility of such an undertaking.

Prince Faisal may now have provided the impetus for a more serious look at the matter. According to several people who attended the conference, a lot of simplistic ideas were floating around, along with wildly varying assessments of what could and could not be done—all of which showed how little certain information there is to go on. Still, it was the first time technical people got together to look at all the angles.

The Antarctic, it seems, is where the most desirable icebergs are. They are much bigger than those in the Arctic; they are also more stable, slower moving, and more accessible. Eyes are trained on the icebergs that break off from the Ross Ice Shelf, which is approximately the size of Spain and which accounts for one-third of the whole Antarctic ice shelf.

Iceberg ice is extremely attractive because it is so pure. There may be traces of rock fragments, but there is virtually no trapped organic matter because nothing much lives in that climate; there is no pollution. Husseiny said contamination in icebergs was about one part per billion, which makes ordinary drinking water look like sludge.

Alluring as is the vision of a resident iceberg on the shore of a thirsty land, there are many possible slips twixt the cup and the lip.

Some of the topics discussed were:

- the use of earth resources satellites and remote sensing devices to locate icebergs suitable for travel;
- varying modes of transportation, including tugs for pulling, semi-submersibles and submarines for pushing, and propellors mounted on icebergs to make them self-propelling;
- ways to keep icebergs together and minimize melting, including wrapping them in plastic sheets or spraying them with urethane foam;
- international and legal problems relating to ownership of Antarctic ice (seven nations claim sovereignty over parts of it, claims which are not recognized by most of the rest of the world);
- problems posed by towing icebergs through foreign waters. (Husseiny claims that Lloyds of London has offered to insure the icebergs against piracy);
- effects of icebergs on marine life and on the weather (they would create considerable fog and possibly rain; they

Saudi Arabian Prince Mohammed Al-Faisal presides over a punch bowl with a 10,000 year-old piece of glacier in it. This is a chip off a 4785 pound iceberg from Portage Glacier Field in Alaska which was transported at great expense to Iowa via helicopter, plane and refrigerated truck to form the glamorous centerpiece for the iceberg convention. In addition to being used to cool drinks, pieces were analyzed for their purity, conductivity, and stress resistance. [AP Wirephoto]

would also have a calming effect on hurricanes);

• possible uses of icebergs as energy sources, through harnessing of thermal and salinity gradients.

Some imaginative notions surfaced at the conference. One paper proposed iceberg propulsion by osmosis, using the salinity gradient. Faisal himself presented a paper proposing that paddlewheels be mounted to the sides of icebergs. This suggestion occasioned some mirth—one participant is reported to have observed, "I'm surprised the prince didn't suggest oarsmen, like the Roman triremes." Husseiny told *Science* that during the long journey, it might be possible to raise populations of fish and oysters in the algae-populated lakes that would naturally occur as the ice melted. Recreation and food storage have been mentioned among secondary uses for icebergs once they reach their destinations.

According to Charles Swithinbank of the British Antarctic Survey, there were enormous divergences of opinion about every aspect of the problem. Everyone had his own ideas, although Swithinbank estimated that fewer than 20 of the people there had ever seen an iceberg. The thorniest questions appear to have centered around rates of melting and the likelihood of icebergs breaking up and "calving" en route. Although Husseiny had a vision of a 10-mile by 5-mile iceberg arriving in Saudi Arabia virtually intact if a strong enough plastic bag could be found to hold its melt, glaciologist Wilford Weeks of the U.S. Army Cold Regions Research Laboratory said that if you tried to drag an unprotected iceberg to Arabia or southern California "you would end up with nothing but a towline." Weeks, along with Isaacs, believes that it may be feasible to tow icebergs to Australia or the west coast of South America, but that getting anything into the Northern Hemisphere is a dubious proposition.

No one is sure what the optimal size and configuration of a traveling iceberg should be. A Rand Corporation study in 1973 envisaged a long 300-meter-wide train of icebergs as optimal, but the thinking now is that there would be too much friction between them.

There seems to be little doubt that one day icebergs will be put to use, at least in the Southern Hemisphere. Whether they become a major source of fresh water to arid lands farther north will depend on economics. The 1973 report, written by J. L. Holt and N. C. Ostrander, estimated optimistically that total costs per acre-foot for transport, conversion to water, and delivery would amount to $30

Point of View

McGill Warns vs. Adversary Method

In a recent address to the Guild of Catholic Lawyers of the Archdiocese of New York, Columbia University president William J. McGill spoke about the "increasingly adversary character of American public life as it affects the administration of science," and argued that science should be primarily responsible for keeping its own house. He said in part:

The emerging social order in America may well be one in which policy at all levels is forged from the clash of narrowly based constituency interests, each one at war for its own special advantage without regard for the others or for the larger public interest. . . . A deepening cynicism and almost paranoid mistrust of established institutions appear to have gripped the American people in the aftermath of the Vietnam War and the Watergate scandals. Fortunately, the courts have emerged from this troubled period with enhanced respect. But the burden of conflict resolution which the legal profession and our courts are now expected to bear has also increased geometrically. It raises serious doubts about the capacity of our legal system to deal effectively with public discord on the scale projected by the recent growth of adversary conflict in the United States. . . . I do not accept the view of many lawyers and judges . . . that they are more or less passive observers of society's disputes. . . . It appears to me . . . that courts and legislatures should not deceive themselves about the consequences of their activism. They are shapers of society, not passive arbiters.

. . . We are weakening America's scientific leadership by unwittingly establishing the principle that the conflicting advocacy of the legislature or the courtroom is the best way to develop sound public policy in science and technology. . . . The adversary method for arriving at truth on which our legal procedures are based is, in simple language, not appropriate for arriving at sound public policy on scientific matters. Scientific questions simply cannot be settled by persuasive argument. The only effective method for resolving safety questions in nuclear or biological research is the objective analysis of experimental results by our best scientific minds. . . . What I am saying, in unvarnished simplicity, is that the use of the adversary legal process to control scientific research is likely to lead to serious scientific errors and to badly thought-out policy. . . .

The problems of universities, as they attempt to protect their scientific research from adversary attacks generated by well-organized community groups playing on the fears of the general public, are a rather faithful reflection of the problems of the nation as a whole addressing major public questions which turn on subtle scientific or technical judgments.

The idea that the adversary legal and political struggle characterizing the environmental protection movement in America during the last decade may be doing great damage to our scientific and technology capability is bound to be a very unpopular one but I fear that it is uncomfortably close to the mark. And the basic question persists. How are we to find more responsible ways to make sound public judgments on critical national issues such as the control of energy, science, and technology?

First, I believe that we must be extremely careful to avoid legislating American science out of existence under the guise of environmental protection. . . .

Second, local authorities should be extremely reluctant to intervene in the administration of research at universities when legal actions are brought by community advocates claiming public safety violations or environmental damage. The necessary controls can and indeed must be established at the national level under the guidance of scientifically competent agencies such as the National Academy of Sciences or the National Institutes of Health.

Finally, the government and the bench should turn more frequently to special commissions constituted from the best and most responsible members of the scientific community in an effort to formulate wise public policy on the protection of the environment, public health, and on all major public safety questions.

per acre-foot, compared with $108 per acre-foot for desalinization. But at the conference someone estimated it would cost $30 million to take a plastic-covered iceberg on a 9-month trip to California, and Faisal announced that probably $100 million worth of research and engineering would have to precede the first successful iceberg move. That would include basic investigations of life cycles and melting rates of icebergs as well as a technology, as Miami consultant Henri Bader said to move "immense, fragile, shrinking masses on the order of 100 to 1000 million tons . . . global distances in rough seas."

The engineering challenge does appear to be stupendous and is matched only by the increasingly desperate search for water in Saudi Arabia and other arid parts of the world. Faisal told an Iowa television audience that his country would spend $15 billion on water desalinization between now and 1981, and that by 1985, the country wouldn't have enough drinking water if new sources were not found. He believes icebergs will ultimately prove a cleaner, cheaper, more abundant, and environmentally safer answer than stepped-up desalinization.

Faisal said the next step will be to set up a body of experts to analyze the findings and decide where to go from here. There was no indication where the money would come from, but the Prince (who is now a private businessman) said if the project could be proved feasible "we will get all the financing we need."

—CONSTANCE HOLDEN

Coal: Invoking "the Rule of Reason" in an Energy-Environment Conflict

Enactment of the strip-mining bill and the Clean Air Act amendments this past summer finally brought some surcease to the battle that had been going on since the early 1970's between environmental lobbyists and lobbyists for the coal and utility industries. But neither side had given any quarter. The major issues, such as those over the requirements for stack gas scrubbers and the elimination of the "highwalls" * left from stripping operations, were decided not through sweet reason or goodwill but on the basis of the votes that the lobbyists could muster in committee and on the House and Senate floors.

Yet, even as this fierce struggle was being waged by the lobbyists on Capitol Hill, some other environmentalists and industry people (mainly from coal-using enterprises such as utilities and steel and chemical companies) were quietly engaged in an ambitious and unusual attempt to reach a consensus on some of the still-unresolved issues associated with the mining and burning of coal. This latter effort was being carried on under the name of the National Coal Policy Project, put together in 1976 by Laurence I. Moss, a former president of the Sierra Club, and Gerald L. Decker, corporate energy manager of the Dow Chemical Company.

The project is now entering its final phase, and although it is clear that on some troublesome issues no agreement will be possible, most of the participants appear convinced that enough progress is being made to make the effort worthwhile. Some of the questions addressed are central to how the strip-mining and clean air legislation will be implemented or to decisions that will have to be made on federal coal leasing and the siting of coal-burning power plants. Therefore, if consensus can be reached on certain of these questions, the project could turn out to have important consequences. Certainly that could be the case if Carter Administration officials perceive recommendations from the project as generally representative of what environmental and industry leaders think.

Although nothing has been finally approved yet, five project task forces—on mining, air pollution, conservation, transportation, and pricing—have prepared preliminary drafts of papers setting forth, at least in a tentative way, areas of agreement and disagreement. For instance, it appears that the air pollution task force is near agreement on a recommendation that new coal-fired power plants should be built in the regions where the power will be consumed—which is to say, the people who get the electricity should also have to live with the environmental effects of generating it.

In light of all the power plants that have been built on or proposed for remote sites in states such as Arizona, Utah, and Wyoming, such a recommendation—prepared by a task force cochaired by an executive of Detroit Edison and an environmental lawyer who has represented the Sierra Club in two major coal suits—would be of no little interest, and it might carry considerable political weight.

Similarly, some of the policy recommendations which appear likely to come from the mining task force—cochaired by John Corcoran, former board chairman of Consolidation Coal Company (the industry's second largest producer), and Michael McCloskey, executive director of the Sierra Club—could have a political impact.

The draft papers on mining in the Midwest and Northern Great Plains regions contain recommendations bearing importantly on possible conflicts between surface mining and farming. According to these drafts, permits for surface mining on highly productive prairie soils in the Midwest or on alluvial valley floors on the Northern Plains should be issued only on an experimental basis until it has been demonstrated that agricultural productivity can be fully restored.

This conclusion follows logically from the consensus among the task force members (who include not only the former head of Consolidation Coal but also officials from two other big coal companies, Peabody and Amax) that the present state of the art for land reclamation involves some major uncertainties. That such a consensus has been reached on so important a point of fact is itself significant because, in the past, controversy has often raged over assessments as to the adequacy of this or that reclamation technique.

The recommendations cited above indicate that the environmentalists are presenting their arguments forcefully and effectively. Yet it seems certain that environmentalists on some of the task forces are being won over by certain industry arguments and points of view, too. As cochairman of the mining task force, John Corcoran has been particularly insistent that regulation of mining and reclamation be flexible enough to take into

*"Highwalls" are the walls created when strippers, either in open pit or "area mining" on gentle terrain, or in "contour mining" along mountainsides, cut into a coal seam and remove the overburden. Highwalls can be eliminated by backfilling the spoil or overburden into the cut and regrading it to the approximate original contour.