These discoveries have aided researchers in concluding that west Antarctica is geologically similar to the mineral-rich mountain chains of the Pacific basin, which includes the Andes and the Rocky Mountains. Moreover, if, as is generally supposed, east Antarctica was once joined to South America, Africa, and Australia as part of the supercontinent Gondwanaland, it could be as rich as these in minerals. While none of the above finds has been substantial enough to warrant serious commercial interest, scientists think that it is just a matter of time before such a discovery is made.

The NSF has been redirecting its work in the Antarctic toward "the type of research that would give data that would be useful in finding resources," says Turner. Thus NSF research in McMurdo Sound, along the Ross Sea, has shifted from study of its volcanic history to its marine sediment history. A special study is planned of Seymour island, which is part of the continental shelf, in order to learn more about Antarctica's potentially valuable shelves. Capping this thrust at NSF, which Turner estimates has been going on for several years, was a proposal drawn up last winter during the government-wide crash search for new energy research projects. According to this proposal NSF, which sponsors some $3 million in research grants in the Antarctic per year, would sponsor a special, 5-year, $12 million program to make detailed estimates of the oil potential of the continental shelves.

Pollack and others hasten to point out that the prospects of resource recovery are nil in the immediate future, and that the NSC review is aimed at the long term. The land is 2 to 5 percent exposed; its ports are accessible for only a few months a year; and the industry which has started there, a Danish tourist voyage, is dependent on U.S. logistic support for its safety. Furthermore, Antarctica is a place where an airplane can hardly land safely because of hazardous conditions, and where human flesh can freeze in a matter of seconds if exposed to the elements. Thus any commercial operation there will have to overcome extraordinary hazards.

An economist with Resources for the Future, Inc., Neal Potter, in *Natural Resource Potential of the Antarctic*,‡ has written about the drawbacks. He said that some of the technology developed for oil and mineral exploration in the Arctic is not at the present time applicable in the Antarctic, and that the Antarctic has the additional disadvantage of having no inhabitants to guide prospecting expeditions to likely spots. Potter generally concluded that mineral and fuel recovery in the South Pole region will not be economically feasible in the near future.

But several USGS and NSF scientists are now referring to Potter's estimates as "conservative." His cost estimates, for example, have been dated by the dramatic rise in the price of fuel over the last year. Potter's study assumed that many of the metals found in Antarctica would continue to be in ready supply from other parts of the world; that too has changed as the major industrial nations face possible embargoes from traditional suppliers. As global market conditions change, some of the much-touted disadvantages of Antarctic exploration and exploitation have decreased.

It seems evident that the possibility of Antarctic oil and mineral development could have an impact on the scientific research done there, on the region's environment, and on the historic peace of the continent. It also begs the question of how interested the oil and mining companies really are in such a distant, expensive, and long-term endeavor. But despite the many interests that will be affected, it looks as though a new U.S. policy toward Antarctica will be formulated behind closed doors.—DEBORAH SHAPLEY

‡ N. Potter, *Natural Resource Potential of the Antarctic* (Lane, Burlington, Vt., 1969).

Kissinger on Science: Making the Linkage with Diplomacy

Science and technology may be stepping into a new and more important role in the conduct of American foreign policy. No substantive changes have yet occurred, but the public statements made by Henry Kissinger in the 8 months since he became Secretary of State evince a vigorous interest in using American science and technology as an arm of diplomacy.

Last month, for example, in an address to the United Nations session on development, Kissinger urged that we "now apply science to the problems which science has helped to create," and outlined four specific areas where science could contribute: agricultural technology, birth control, energy, and weather modification (see box for text of proposal).

Kissinger is also aware of the usefulness of American science in bilateral relations. He is said to be very interested at present in the kinds of contributions that technology can provide for Saudi Arabia and Egypt. In reviewing relations with Latin America, his first proposal, says an aide, was a science and technology committee. And access to American technology was of course a major inducement toward détente for the Russians and Chinese. According to Kissinger speechwriter R. Mark Palmer, Kissinger "thinks that Americans' ability to contribute money and run the world in the old-fashioned way of the 1950's and 1960's is now over. What we can contribute—and what the world wants—is our technological capabilities."

The science-related proposals in the Secretary's speech to the United Nations last month do not make many specific commitments, but Kissinger aides stress that the proposals will be implemented. "The Secretary took the speech very seriously and he hopes the scientific community will take it seriously," says Palmer. Before leaving on his latest trip to the Middle East, Kissinger directed Winston Lord, director of the State Department planning and coordination staff, and one of his few close associates, to develop a strategy for following up on the initiatives proposed in the speech, including those related to science and technology.

Lord declines to say what actions are envisaged, and it is too early to

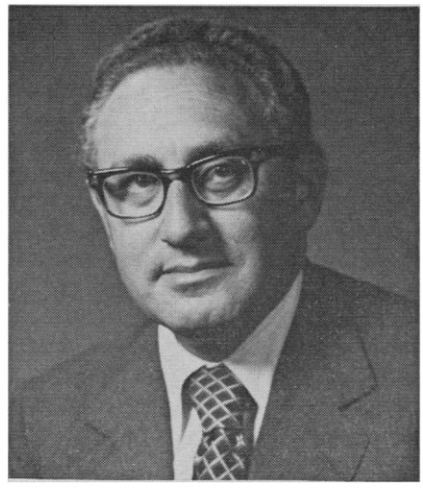
say whether there will be major budget or program changes. Assuming, however, that there is a redirection of resources, it is of interest to trace how Kissinger's initiatives on science policy are generated. His views of bureaucracy as the antagonist of creative action are well known. Kissinger did not ask the State Department's Bureau of International Scientific and Technological Affairs to come up with a formal list of policy options. Instead, his speechwriter gathered ideas from within and outside the State Department. The proposal on climatic change, for example, although a particular concern of Kissinger's because of the Sahelian drought, was inspired in part by a speech given by Philip Handler, president of the National Academy of Sciences.

Having been announced by the Secretary of State, the proposals in the speech become U.S. government policy, and the bureaucracy, even if not consulted beforehand, has to respond appropriately. "Kissinger's overall philosophy," says Palmer, "is to get way out in front of the bureaucracy by challenging people to meet the goals he has set."

Kissinger's interest in science and technology lies chiefly in its effects on diplomacy and is shaped by the study of nuclear weapons problems on which he spent much of his academic career. The not infrequent characterization of Kissinger as a Metternichian is doubly inaccurate: his admiration of Metternich is strictly limited, besides which a major theme of Kissinger's writings is that the international system perfected by Metternich and Castlereagh has been rendered irrelevant by the technology of modern warfare. "The stable technology, the multiplicity of major powers, the limited domestic claims, and the frontiers which permitted adjustments are gone forever. A new concept of international order is essential; without it stability will prove elusive," Kissinger wrote in 1968.

The destabilizing influence of technology, and the difficulty of finding ways to control it, are a recurrent theme of Kissinger's writings on nuclear weapons. A concept stressed in his more recent statements is the role of science and technology in forcing the interdependence of nations. In his first speech as Secretary of State, also to the United Nations, on 24 September 1973, Kissinger said:

> We are in fact, members of a community drawn by modern science, technology and new forms of communication into a proximity for which we are still politically unprepared. Technology daily outstrips the ability of our institutions to cope with its fruits. Our political imagination must catch up with our scientific vision.



Henry Kissinger

He returned to the same theme in an address to Latin American foreign ministers at Tlatelolco, Mexico, on 21 February this year:

> The products of man's technical genius —weapons of incalculable power, a global economic system, instantaneous communications, a technology that consumes finite resources at an ever expanding rate—have compressed this planet and multiplied our mutual dependence. . . . A cooperative world reflects the imperatives of technical and economic necessity. . . .

Since Kissinger's tenure as Secretary of State, the science-spawned Hydra which is the world food/energy/population crisis has developed several new heads—hence the acerbic reference in last month's United Nations address to "the problems which science has helped create." Kissinger clearly has the monster in his sights and intends to put science to use against it, but whether a coherent science policy will emerge is not yet evident.—NICHOLAS WADE

In his address to the United Nations last month, Kissinger emphasized the role of technology in bringing about the present interdependence of nations and outlined a science policy for addressing the problems of global scarcity. This is an excerpt from that speech.

In a global economy of physical scarcity, science and technology are becoming our most precious resource. No human activity is less national in character than the field of science.

No development effort offers more hope than joint technical and scientific cooperation.

Man's technical genius has given us labor-saving technology, healthier populations, and the green revolution. But it has also produced a technology that consumes resources at an ever-expanding rate; a population explosion which presses against the earth's finite living space; and an agriculture increasingly dependent on the products of industry.

Let us now apply science to the problems which science has helped to create.

- To help meet the developing nations' two most fundamental problems—unemployment and hunger—there is an urgent need for farming technologies that are both productive and labor-intensive. The United States is prepared to contribute to international programs to develop and apply this technology.
- The technology of birth control should be improved.
- At current rates of growth, the world's need for energy will more than triple by the end of this century. To meet this challenge, the U.S. government is allocating $12 billion for energy research and development over the next 5 years, and American private industry will spend over $200 billion to increase energy supplies. We are prepared to apply the results of our massive effort to the massive needs of other nations.
- The poorest nations, already beset by man-made disasters, have been threatened by a natural one: the possibility of climatic changes in the monsoon belt and perhaps throughout the world. The implications for global food and population policies are ominous. The United States proposes that the International Council of Scientific Unions and the World Meteorological Organization urgently investigate this problem and offer guidelines for immediate international action.