

If in these comments I have not answered the questions of where the NSF will be during its second quarter century, I hope I have at least indicated some of the directions in which it may go. The Foundation was born to serve the nation through advancing the progress of science. I believe it has done this during its youthful 25 years of existence. But that period has also been a learning period for the Foundation and for many of us who have grown and learned with it. Now it is time to move ahead to even more productive days. For, as Oliver Wendell Holmes said, "The greater thing in this world is not where we stand but in what direction we are going."

References

1. D. W. Bronk, *Science* **188**, 409 (1975); W. A. Fowler, *ibid.*, p. 414.
2. Meeting of the House Subcommittee on Public Health and Environment on 11 December 1974, as reported in the article "Ozone shield is shrinking" (Washington Post, 12 December 1974). After this meeting, no less than seven bills entitled "Ozone Protection Act of 1975" were introduced in the House of Representatives between 10 February and 17 April 1975; a Senate bill was also introduced on 26 March 1975.
3. R. L. Heilbroner, *The Future as History* [Grove Press (Harper & Row), New York, 1961], p. 13.
4. D. N. Ross, *Food and Population—The Next Crisis* (Conference Board, New York, 1974); "Population and Food—The Crucial Issues" (background paper prepared by the National Academy of Sciences and the National Science Foundation, Washington, D.C., November 1974).
5. Report of the National Science Board, "Science and the challenges ahead" (National Science Board—National Science Foundation, Washington, D.C., 1974).

6. E. Stakman, in an address at the University of Minnesota, speaking as president of the AAAS (reported in *Life*, 9 January 1950).
7. T. Alexander, *Fortune* **91**, 146 (April 1975).
8. "Asilomar decision: Unprecedented guidelines for gene-transplant research," *Sci. News* **107**, 148 (1975); P. Berg, D. Baltimore, S. Brenner, R. O. Roblin III, M. F. Singer, *Science* **188**, 991 (1975).
9. The interest of the NSF in the relation of ethics and science has led to the formal establishment of the Ethical and Human Values in Science and Technology (EHVIST) Program at NSF, a program that is now receiving research proposals. Some investigators working under EHVIST grants do so under grants cosponsored by NSF and the National Endowment for the Humanities.
10. V. Bush, director of the Office of Scientific Research and Development, "Science—The endless frontier," a report to the President on a program for postwar scientific research, July 1945 (reprinted in 1960 by the National Science Foundation, Washington, D.C., on the occasion of its 10th anniversary).
11. H. G. Stever, *Daedalus* **104** (No. 1), 251 (1975).

NEWS AND COMMENT

Nuclear Exports: A U.S. Firm's Troublesome Flirtation with Brazil

The American failure to stop West Germany from selling sensitive nuclear technology to Brazil may have been inevitable even under the best of circumstances. For Washington to suggest that Bonn withdraw its unprecedented offer of uranium enrichment and plutonium processing technology to Brazil was, from the German point of view, a bit like General Motors asking Volkswagen to steer clear of South America. The predictable German response was that the Americans were suffering from sour grapes, and the deal was signed on 27 June.

The State Department's difficult task of convincing Bonn that the paramount U.S. concern was nuclear proliferation—not the protection of American commercial interests—was complicated, moreover, by an odd episode in Brazil last March involving an American corporation in the uranium enrichment business. The episode, repercussions of which continued into mid-April, seems to have resulted from poor communications between government and industry, as well as within the government, in the sensitive area of nuclear export policy.

The company in question is the Bechtel Power Corporation, a subsidiary of the huge Bechtel engineering and construction firm and a major builder of nuclear power plants. The parent firm is also one of about 20 U.S. companies to which the Energy Research and Development Administra-

tion (ERDA) has granted access to classified enrichment technology in the hope of bringing private enterprise into the enrichment business.

According to State Department sources, a sales representative of Bechtel Power held discussions last March with Brazilian government officials that left the clear impression the United States might allow construction of an enrichment plant in Brazil, one that Bechtel Power could build. In fact, the advisability of building enrichment plants in foreign countries—even without actually sharing classified details of the technology—is still under debate in the Ford Administration.

As it happened, Bechtel's gambit came just as Brazil and West Germany were moving into final negotiations on the sale of some \$5 billion to \$8 billion worth of nuclear reactors and fuel facilities—a deal that the Westinghouse Corporation had sought and lost. The timing of Bechtel's gambit, State Department officials say, lent itself to the interpretation that the U.S. government spoke with forked tongue—encouraging American industry in a last resort effort to recapture the Brazilian nuclear market with its own fuel facilities as "sweeteners" while, at the same time, urging Bonn to stop the sale of fuel technology in the interest of international security.

To make matters worse, German officials may have had an inkling of the

Bechtel approach (though how accurate an inkling is hard to tell) weeks before such key elements of the State Department as the Arms Control and Disarmament Agency (ACDA) learned of it. Moreover, a four-man delegation the State Department sent to Bonn on 8 April to convey official American concern is said to have heard about the flap only after returning; the last of several clarifying cables sent to U.S. embassies in Bonn and Brasilia did not go out until 17 April.

Not surprisingly, some arms control officials were deeply angered at what appeared to be an American company's blunder into a foreign policy issue of extreme sensitivity. One official, still smoldering, described Bechtel's Brazilian maneuver as "totally unauthorized" and "way out of line." Asked whether it contributed to German intransigence in the matter, he replied brusquely: "Draw your own conclusions."

Another State Department official familiar with the affair said, however, that no one seriously regarded the Bechtel matter as "decisive" in influencing the Germans to conclude their deal with Brazil. Rather, he said, it played into German hands as a piece of "hard evidence" to support a predictable claim that U.S. criticism of the deal stemmed from commercial interests. By this view, the episode was more embarrassing than damaging.

Progressive Misunderstanding?

The prevailing view among State Department officials familiar with the Bechtel episode is that it arose from a gradual misunderstanding of U.S. enrichment policy as that policy trickled down the corporate chain of command, ending with an overzealous salesman in Brazil. This explanation, however, is not entirely consistent with others.

The misunderstanding may have begun

with a 28 January briefing ERDA held for companies with access to enrichment technology; the companies were told they could hold general discussions with potential foreign investment partners as long as they divulged no classified information. According to an official of the State Department's bureau of oceans, environment, and scientific affairs—the office formerly headed by Dixy Lee Ray—a Bechtel salesman “apparently got wind of this second- or third-hand, and seeing the nuclear deal slipping away to the Germans, pulled things out of context and essentially offered Brazil an enrichment plant.”

This official added that no restricted information was disclosed and that he believed Bechtel headquarters, in San Francisco, was “honest” in saying that it had no prior knowledge of the salesman's offer: “They probably would have had the political sensitivity to check with us before proceeding.”

The View from Bechtel

This explanation, however, conflicts with that of a Bechtel corporation official in California who watched the controversy develop. The official, who asked not to be named, said the company's “offer” consisted of a proposal to study the feasibility of building a uranium enrichment plant in the northern Amazon basin, where enormous hydroelectric power potential exists far from Brazil's major industrial area of São Paulo. To avoid having to string transmission lines 2500 miles across the trackless Amazonian forest, Bechtel proposed to study the possibility of using the power on the spot in an enrichment plant and shipping the uranium fuel to nuclear power plants near the populous coastal cities.

“That's a little different from saying we're going to come in next week or next year and build a plant,” the Bechtel man said, although he conceded that the proposal could have been interpreted as a first step in that direction.

He also dismissed as implausible the idea that one of the company's salesmen acted without the knowledge of the San Francisco headquarters. “These guys aren't selling used cars, you know. They're very, very cautious.” In this case, he said, Bechtel headquarters was kept fully informed. He added that “I'm sure the State Department knew what we were doing every step of the way. . . . My impression is that Dixy Lee Ray was kept apprised, totally.”

Reached by telephone at her home on Fox Island in Puget Sound, Ray said her bureau had been generally aware of Bechtel's uranium enrichment activities but that

she recalled nothing about the company's proposed feasibility study in Brazil. She added, however, that it didn't seem like the sort of thing a company would necessarily feel obliged to tell the government about.

Ray also had some harsh words for the basic approach to nuclear technology export policy taken by the arms control agency and by Secretary Kissinger's policy planning group, and she said this philosophical disagreement—which intensified with the debate over the West German–Brazilian deal—was one of the “last straws” that led to her resignation in June. Her position was that it ought to be possible for U.S. companies to build an enrichment plant in Brazil while preserving the secrecy of essential technology. She denied, however, encouraging Bechtel to propose such an arrangement: “They don't need to be told how to run their business.”

Ray also contended that ACDA simply doesn't belong in the field of nuclear export policy. “They're meddling in areas where they don't belong, and they've made a real mess of things. They're trying to cover up their ineffectiveness in controlling conventional arms. It's conventional arms that are killing people, not nuclear exports.”

Basically, the State Department has been trying quietly for the past year—ever since India's first nuclear explosion—to persuade other exporter nations to place more stringent conditions on the uses of all nuclear exports and to prevent the unilateral export of such sensitive technology as uranium enrichment and plutonium processing. In effect, the State Department seeks to establish a cartel-like arrangement, not to control price but to ensure the peaceful application of nuclear know-how.

Some progress has been made. According to William O. Doub and Joseph M. Dukert, writing in the July issue of *Foreign Affairs*, the United States, the Soviet Union, and 8 other supplier nations filed letters with the International Atomic Energy Agency last August agreeing to tighten controls on nuclear exports to nations that are not parties to the Non-Proliferation Treaty (NPT). The suppliers agreed to require that receiving countries accept IAEA safeguards, provide assurances that fuel and equipment provided will not be used to make nuclear explosives, and agree not to re-export such items so as to evade the NPT. West German officials say that such assurances were obtained from Brazil. While the State Department considers this an “important step,” arms control analysts still believe that enrichment and plutonium technology should under no circumstances be exported unilaterally, although they do favor multinational nu-

clear fuel centers under international control and serving an entire region such as South America. In the meantime, in the hope of setting an example, the State Department has discouraged companies from exporting fuel facilities and technology, whereas the United States' chief competitors in the world nuclear market, West Germany and France, have not.

Ray, like many in the nuclear industry, regards this policy as “simplistic” and self-defeating. “They're trying to bottle up nuclear technology and make every new nuclear program out to be the beginning of a military operation.” The United States has turned aside entreaties, for example, from Zaire, which is looking for enrichment technology. As for Brazil, Ray noted that last summer, when she was still chairman of the Atomic Energy Commission, the AEC had received clear indications that Brazil was looking for a supplier of enrichment technology and was growing impatient with U.S. reluctance to provide it. Far from preventing the West German deal, Ray said, “we drove the Brazilians into it. I blame ACDA.”

Necessary Sacrifice

State Department officials say her point of view is legitimate but short-sighted. “We may have to sacrifice a sale or two along the way,” one official said. “But what we're trying to do is create a climate of responsibility.” Another official compared the nuclear export problem to that of the conventional arms trade: “You get the same arguments, but there the industry has largely prevailed. And there are essentially no controls.”

The practical effect of this debate last spring seems to have been poor communication between Ray's bureau and arms control officials concerned with the impending West German–Brazilian deal. As Ray puts it, “They knew my position and they made every effort to keep me and my bureau out of it.”

Perhaps the fairest assessment would be to say that it pointed up poor coordination within government, and between government and industry, in a critical area of foreign policy. Seemingly with this in mind, Fred C. Iklé, the director of ACDA and still a dominant voice in the setting of nuclear export policy, has spoken recently with officials of U.S. supplier companies and with ERDA administrator Robert C. Seamans, Jr., in an effort to clarify the government's position and improve communications. “More will be done,” Iklé said in a brief interview. “U.S. companies are entitled to be kept fully informed of the constraints on nuclear technology exports.”—ROBERT GILLETTE