North American Air Defense Command headquarters in Colorado Springs, that cruise missiles would also be deployed in Italy, Belgium, and the Netherlands, in addition to Germany and Britain. The document that summarized all these decisions was drawn up immediately thereafter by members of the U.S. delegation, who went off to a nearby ski area with a secretary in tow. "It worked out very efficiently," one of the participants said. "We would write for a couple of hours and then take a couple of hours off while the secretary typed it up, and go skiing and then come back and revise it." In October 1979, the deployment plan was formally ratified by NATO's defense and foreign ministers.

McGiffert, who led the HLG throughout its deliberations, says that he still thinks they made the right decision. "But one should ask that question 3 or 4 years from now when we are better able to see whether the rift in the German defense policy consensus is a permanent feature which gets in the way of sensible defense decisions. From the point of view of deterrence, there is no question that it was the right thing to do. On the other hand, looked at from the broader point of what has it done to the fabric of the alliance, I think the jury is still out." A high-level British official expands on this point. "The question," he says, "is whether the damage to deterrence that comes from having put the alliance through a severe test of cohesion is now greater that it would have been without any deployment."

In public forums, the United States has portrayed the decision to deploy Pershing and cruise missiles as an extraordinary exercise in political and military diplomacy, brought about by independent European desires for a technological riposte to the SS20. A close review of the decision reveals that it was actually far more routine. Some military officials desired newer, more capable weapons; military contractors desired more business; and conservative U.S. weapons analysts developed the appropriate strategic rationale. Through indirect channels, they played on their allies' natural fears about the depth of the American commitment. And the resultant political pressures steamrollered all opposition. One suspects, without any direct knowledge, that Soviet decision-making on the SS20 took a somewhat similar course. In this manner do the nuclear arsenals on both sides expand in directions that sow alarm among the general public.—**R. Jeffrey Smith**

Part one of four parts.

China, U.S. Positions Closer on Nuclear Deal

Access to American technology was high on the agenda for discussion in the recent visit to Washington of China's Prime Minister Zhao Ziyang, with nuclear technology providing some of the stickiest issues. Zhao said in remarks at a state dinner that progress had been made in negotiations on a nuclear cooperation agreement between the two countries but that problems still remained. Some U.S. officials, however, expressed the view that Zhao's comments on the issue indicated a modification of China's policies that would make it possible to conclude such an agreement, although tough bargaining would be required.

During the prime minister's visit, an accord on the exchange of scientific and technological information originally signed in 1979 was extended. A new bilateral agreement was also signed to promote trade between the two countries and to provide for cooperation in the development of energy resources and of other sectors of the Chinese economy. In addition to these intergovernmental agreements, the U.S. National Academies of Science and Engineering signed an agreement with China's commission on science and technology for a cooperative program in applied research under which scientists and engineers from the two countries will be brought together for seminars and short courses.

China has indicated interest in purchasing U.S. nuclear technology in order to develop its nuclear power industry and the Reagan Administration has been carrying on negotiations with the Chinese with a view to enabling U.S. nuclear industry to export to China.

The main obstacle to an agreement has been the long-standing differences in nuclear nonproliferation policies between the two countries. The United States is bound by requirements of the international Nuclear Nonproliferation Treaty and the U.S. Nuclear Nonproliferation Act (NNPA) that appear to conflict with the Chinese position on nonproliferation.

China, which has possessed nuclear weapons since 1964, has refused to sign the Nuclear Nonproliferation Treaty and declined to join international efforts to prevent the spread of nuclear weapons to countries that do not have them. The Chinese have argued that the treaty gives an unwarranted advantage to the two superpowers, the Soviet Union and the United States.

In recent years, the Chinese have been accused of actions that violate international norms in dealing with nonweapons states. According to press reports, China is alleged to have provided weapons design information and aid in uranium enrichment to Pakistan and is said to have provided heavy water to India and enriched uranium to Argentina and to have supplied reactor grade uranium that ended up in South Africa.

UPI

Prime Minister Zhao in Peking

Recently Chinese statements and actions have indicated a willingness to modify their stance on nonproliferation. For example, the Chinese late last year joined the International Atomic Energy Agency which administers the international safeguards program which is designed to prevent the spread of nuclear weapons.

Observers suggest that China's shift in policy may be prompted by its decision to embark on a program of building nuclear power plants. The Chinese are understood to be interested in making Westinghouse its nuclear supplier. The Chinese have indicated that they plan to make public their choice of a contractor in April. This puts pressure on the Administration to complete negotiations on a nuclear cooperation agreement, which is required by the NNPA if U.S.

companies are to make nuclear exports to China.

Negotiations have been proceeding for some time and there were rumors that an agreement might be announced during Zhao's visit. The most substantial development, however, was the comment by Zhao during a formal toast at the state dinner that China "will not engage in nuclear proliferation. We will not help other nations develop nuclear weapons." The NNPA requires that U.S. nuclear technology can be sold only to countries that agree not to export nuclear weapons technology or information. Zhao's remark appeared to remove that issue from contention. Nonproliferation advocates, however, have been pressing the Administration to conclude an agreement only if the Chinese will also insist on the placing of safeguards on any nuclear technology they export.

U.S. sources expect the Administration to push to complete negotiations to make it possible for the agreement to be signed on President Reagan's scheduled trip to Peking in April.

—JOHN WALSH

Europe Eyes U.S. Model on Joint Research Rules

The ten member states of the European Economic Community (EEC), taking a cue from the Reagan Administration's effort to boost technological innovation, are considering a proposal that joint research efforts between high-technology companies in Europe be exempted from the stiff antimonopoly rules contained in the Treaty of Rome, the agreement setting out the code of economic behavior on which the community is based.

In the past, such exemptions have been permitted in individual cases. Last month, for example, the Brussels-based commission of the EEC agreed to allow three West German companies to collaborate in a joint program of research and development on coal gasification. Similar exemptions have also been negotiated for microelectronics research projects carried out under the umbrella of the European Strategic Program for Research and Information Technology (*Science*, 6 Jan., p. 28).

The commission of the EEC, in a draft regulation which is currently being circulated for discussion and is expected to be adopted by the council of ministers within the next few months, is now proposing a blanket exemption for similar research efforts in these and other fields, ranging from textiles to pharmaceuticals.

Some conditions would remain. An exemption would not be allowed, for example, for research projects involving more than one of the three largest European companies in any particular field. Nor would it be permitted when the combined turnover of the companies sponsoring the research exceeded $400 million, an attempt to ensure that the major beneficiaries of the new competition rules are medium-sized companies.

As in the United States, commission officials hope that the main effect of the proposed regulation will be to provide psychological reassurance to research managers that joint research projects will not be subject to a legal challenge from Brussels. At the same time, however, the commission is going further than the Reagan Administration in proposing that the exemption be extended to cover the joint production of new technological products arising from the research.

—DAVID DICKSON

Battelle Predicts Rise in R & D Spending in 1984

Thanks chiefly to a surge in spending by private industry, expenditures on research and development in the United States will climb to $94.2 billion in 1984, according to a forecast by the Battelle Memorial Institute. That would be an 8.9 percent increase over 1983 levels, or a 3.7 percent rise after inflation is taken into account.

According to the usually reliable Battelle figures, industry will spend $48.8 billion, a 10.3 percent increase, and the federal government will spend $42.7 billion, a 7.8 percent rise. The increased federal outlays largely reflect the continuing defense buildup. The Department of Defense is expected to account for 64.5 percent of government R & D expenditures in 1984, up from 58.9 percent in 1983.

—COLIN NORMAN

Guidelines for Artificial Heart Implants Revised

The University of Utah's review committee for research on human subjects has approved a revised and expanded protocol for implanting artificial hearts into patients. Pending review by the Food and Drug Administration, the approval opens the way for introducing an improved version of the artificial heart into patients who are healthier than was the first recipient of an artificial heart, Barney Clark. Clark died in March 1983 112 days after being implanted with such a device.

The revised procedure will allow University of Utah surgeons, directed by William C. DeVries, to select patients who are in less advanced stages of heart failure. Previously, the protocol called for waiting until the eighth week after a patient reaches what the American Heart Association designates as the fourth category of cardiomyopathy. One major difficulty in Clark's case was that his heart disease had caused considerable deterioration in other organ systems. Those complications were his immediate cause of death.

The revised protocol also has expanded the patient's informed consent form so that it now includes information gained from Clark's experiences. The new protocol removes any upper age limit for patients who undergo the experimental procedure, and it specifies that various nutritional and exercise regimes may be studied following the operation. In future implants, the synthetic heart valves will be made of solid titanium without the welds that caused problems in the model Clark received. Also, use of a portable support system during the postoperative period has been approved, potentially allowing future recipients to feel somewhat less encumbered during the recovery period than was Clark.

Two members of the review committee voted against the revised protocol, arguing that the next artificial heart recipients ought to be patients whose hearts have stopped suddenly and thus are not suffering from the multiple and potentially confounding complications seen in patients in the advanced stages of heart failure.

—JEFFREY L. FOX