"The irony, of course, is that no amount of risk review can guarantee that there will not be another Camelot," Hughes said. "The review tends to be a one-shot affair, while the risk potential runs the length of the project and does not end with the project's completion." Hughes said that a group representing all social science disciplines, invited to sit in judgment on the review procedures, recently gave them a "general bill of good health."

Project Simpatico, Army-sponsored research related to the military "civic action" program in Colombia, has survived criticism in the Colombian legislature and is cited as a pleasing contrast to Camelot. This project, which was cleared by the Hughes council, was defended by the Colombian foreign minister. Simpatico was approved by the Colombian government before the research was begun. "The net effect of the furore was a reaffirmation of the value of the research and of the bilateral cooperation between the two governments," Hughes said.

Nonetheless, the new risk review procedures have by no means received a unanimous endorsement from the academic community. "They certainly have eroded confidence in the government's understanding of how science goes about its business," observed Arthur H. Brayfield, executive officer of the American Psychological Association. Brayfield questioned whether the review procedures are necessary. He indicated that they might never have been put into effect had better lines of communication existed between the administration and social scientists.

"It is a real handicap that the President's Office of Science and Technology does not have a high level position for behavioral scientists," he said. The APA secretariat has gotten no reaction as yet from its members about specific actions taken under the review procedures. "You would prefer that your peers look at your work," Brayfield said, however. "This is the way science is advanced, by having your critical colleagues look over your shoulder." Donald R. Young, a visiting professor of sociology at the Rockefeller University and chairman of the NAS-NRC committee on behavioral sciences, expressed concern that the review procedures might lead agencies to consider proposed projects with excessive caution.

On the other hand, Almond gave a qualified and somewhat tentative endorsement to the review procedures. The review council, he said, has tended to be permissive. "I know of only one complaint which has aroused any kind of emotional reaction," he remarked.

Although he favors the review procedures, Senator Harris has observed that they offer no assurance that the research projects undertaken will be of high quality. He feels, moreover, that much research now being conducted under military auspices should be "civilianized." Harris believes that a national social science foundation may be needed to bring the highest levels of professional competence to bear on the government's use of social science research both at home and abroad.

Almond, though not committing himself to the foundation idea, said it should be seriously considered. But Stephen T. Boggs, executive secretary of the American Anthropological Association, thought that, instead of creating a "NSSF," it would be better to expand the social science division of NSF. "We would be faced, if we had a social science foundation, with splitting out a portion of the field of anthropology because we have very close ties with many of the biological and physical sciences," Boggs said.

Young, speaking from his experience as a sociologist at Rockefeller, also saw major disadvantages in separating the social sciences from the "hard" sciences. "We have one man who is studying the problem of gross obesity," he said. "This is obviously both a problem of metabolism and a problem of values, habits, and patterns of life. For cooperation you have got to be there; you have got to work together on it. Now I am quite convinced that integration in the operating of grant-making sources is essential."

At this point, one cannot predict that the work of the Harris subcommittee will lead to concrete legislative achievements. However, Senator Harris, who seems in a fair way to become a serious, well-informed critic of government-science relationships, already may be serving a useful function by stepping up the tempo of discussions within the government and the scientific community about some major issues that are still unresolved. — LUTHER J. CARTER

REPORT FROM EUROPE

East-West Exchanges of Technology Increase Rapidly

London. Trade between Communist and non-Communist countries is expanding rapidly. A good deal of this trade involves the transfer of technology, much of it from West to East but some the other way, and thus it will influence the future standing of nations in international competition.

But the influence may not be exactly that feared by people who oppose any significant sale of technological advances to Communist countries.

The rapidly expanding exchanges of technology, most notable in the field of chemicals, indicate a considerable deficiency in applied technology in the Soviet Union. As a consequence of this deficiency, some targets for economic growth in the Soviet Union cannot be met without massive imports of processes and machines—even entire factories.

This is a further spur to independent behavior by East European countries, which have realized for some years that they could not achieve the economic growth required by their own populations if they kept their economic ties with the Soviet Union as close as their political and military dependence.

Hence, Western countries face large opportunities to earn still more from their industrially useful research and development.

At the same time, the increase in East-West technological trade shows that Eastern industrial managers have acquired both the understanding and

the authority to equip themselves for more rapid internal expansion and more vigorous competition in world markets.

Many Western industrialists, including many members of the Manufacturing Chemists' Association in the United States, fear that expanding technological trade with the East means giving up advanced techniques of both strategic and economic importance.

But others, most notably Sir Paul Chambers, chairman of Imperial Chemical Industries in Britain, disagree. Chambers told a meeting of the Manufacturing Chemists' Association in 1965 that those who feared the consequences of selling the most advanced techniques to Russia and China had less faith than he did "in the vast superiority of a private competitive economy over a totalitarian economy. Plants . . . based on today's technology will almost certainly be obsolescent in a few years. . . .

Between 1960 and 1965, ICI sold three polyester fiber plants and eight polyethylene plants to Communist countries. One of the polyethylene plants went to China.

Chambers was arguing against an attitude prevalent among American chemical firms—that trade should be limited to "nonstrategic" commodities, with up-to-date information on production and machinery excluded. This is the sort of attitude which appeared to lie behind the decisions of Goodyear in 1964 and Firestone in 1965 not to sell a synthetic rubber plant to Rumania.

Nonetheless, opinion in the White House and State Department has long favored liberalization of trade with Eastern Europe. President Johnson's action this year in asking for the right to give "most-favored-nation" treatment to East European countries other than Poland and Yugoslavia followed years of quiet evolution of policy.

As long ago as 1960, Thomas C. Mann, then assistant secretary of State for economic affairs, showed in a published comment that high officials understood the pressures behind the already rapidly mounting purchases of Western technology and equipment by the Soviet Union. Mann said, "There is a tremendous job of engineering which must be done before laboratory processes can be adapted to the industrial production of plastics, synthetic fibers and such things," and so the Soviet Union was gaining time by purchasing Western technology.

Such thinking was stimulated by many studies of the Soviet chemical industry that were becoming available at the time. In the fall of 1960 the Office of Technical Services of the U.S. Department of Commerce issued a detailed study of the use of the important compound acetylene in the Soviet organic chemicals industry. This study, presumably by the Central Intelligence Agency, noted that while the United States used 80 percent of its production of acetylene in the organic chemical industry (including synthetic rubber) and only 20 percent for such other work as metal cutting and welding, the Soviet Union divided its acetylene output about evenly between these two uses.

The study pointed out that the use of acetylene is crucial for the chemical industry. The lag in its use in the Soviet Union was held to be one important sign that chemical engineers there lacked originality and were backward in applying modern theories of chemical structure and reactions (New York *Times*, 17 November 1960).

In response to this situation the managers of Russia's chemical industry began massive purchases of chemical plant and equipment in the West. They began these purchases, indeed, at the very time when the United States was passing through a period of acute self-criticism in all areas of science and technology in response to the Soviet Union's dramatic first steps in space. Soviet chemical engineers, faced with the developing shortages of fertilizers, man-made fibers, and other important chemical products, cannot have been too impressed with the propaganda victories the Soviet Union was winning.

Indeed, by 1960, P. A. Timberlake, secretary to a group of British firms seeking more trade with Russia, could comment: "Russia has taken a deliberate decision to rely on foreign trade with the west to obtain the technology for those industries within the U.S.S.R., such as plastics, chemicals, man-made fibers and others, which lag in development" (*Wall Street Journal*, 8 June 1960).

Sales of chemical plant and equipment to the Soviet Union by non-Communist countries totaled $25 million in 1957 and rose in the next 3 years to $51 million, $115 million, and $187 million. After 2 years of moderate decline, the total reached $223 million in 1963.

In the single year 1959, overall Soviet imports rose by no less than 16.7 percent, chiefly because of the dramatic increase in imports of Western techniques and machinery. At that time, about a third of all Soviet foreign trade was with non-Communist countries, mostly those of western Europe. The trade with non-Communist countries rose by 30 percent in 1959—about twice the increase for all trade. For trade with certain countries, the increase was even higher: Italy, 70 percent; West Germany, 52 percent.

In 1960 the Soviet Union already was importing from West Germany a $42-million British tire factory, a polyethylene factory, and equipment for petroleum refining, and from France such items as a caustic soda plant (capacity, 100,000 tons a year), a cellulose acetate plant (50 tons a day), a phosphoric acid plant (166 tons a day), an acetic anhydride plant (20,000 tons a year), and an aluminum sheet rolling mill (10,000 tons a year).

American firms, although few of them were selling machines directly to the Soviet Union at that time, had received permission to sell some know-how on the production of fertilizers, pulp, paper, and plastics. European subsidiaries of U.S. firms were, like their continental competitors, selling directly to Russia.

In recent years the development has been rapid and has moved to the point where the Soviet Union can award the Italian firm Fiat an $800-million contract to build a factory that will be able to turn out 500,000 cars a year. The deal, which was announced in May, must have had the approval of the United States and the other 14 Western members of a little-known committee called COCOM (short for Coordinating Committee), which has been sitting in Paris since the fall of 1965. COCOM reviews East-West trade proposals in the light of their significance to Western defense. There are also persistent rumors that Fiat was enabled to bid on the contract beccause of a large investment in Fiat by the American firm General Motors.

One of COCOM's early decisions last fall was important: the committee chose to permit sales of power reactors to Communist countries that will give an undertaking to use them only for peaceful purposes and to submit to the safeguards of the International Atomic Energy Agency. The decision was requested by Britain, with U.S. backing. Britain is interested in selling reactors to East European countries like Rumania, and so are the United States, France, and perhaps also Canada.

COCOM has also been working on

one of the knottiest problems of East-West technological trade: computers. There is a big market for Western computers in Communist countries.

Continuous processes like those of the chemical industry, to which the Communist bloc has committed so much of its recent investment, lend themselves readily to computer control. Furthermore, East European nations lag behind in the installation of computers for accounting and economic planning.

To these pressures from the East can be added one from the West: the introduction of large new computers using diodes and integrated circuits, or integrated circuits only. Among these are the IBM System 360, the Imperial Computers and Tabulators 1900 series, and the English Electric Leo Marconi System 4. The installation of the systems can be expected to release, over the next few years, a very large number of older computers, like the IBM 1400's.

But the East Europeans are not interested only in the cheap older computers; they would like the newer ones for some applications.

Are the newer computers too new? Are they "strategic" in the sense that a Control Data Corporation 6600— requested by the French Government for calculations related to its nuclear weapons program, and denied by decision of the U.S. Government—is strategic? Is anything newer than a card-punch device too good for the East Europeans? These are the questions being faced by COCOM.

The questions are given special urgency by the computer exhibition recently held in Prague, from 12 May through 11 June—an exhibition visited by the prime ministers of Bulgaria and Czechoslovakia. A considerable number of Western computers of various types were exhibited, and presumably COCOM will decide to permit export of such computers to Communist countries.

But within the limits of Western coordination of exports to the East, the British Government is considerably more liberal than the American.

This was illustrated at Prague by the fact that Imperial Computers and Tabulators could show its large new 1905, while IBM could only exhibit a 1410. It is likely, however, that IBM, which operates its already considerable East European scouting effort from a special office in Vienna, will also receive permission to sell its 7040 to Communist countries.

Thus, in the immediate future, under the aegis of a probable COCOM decision to defer exports of computers like the System 360 and the System 4, it is likely that English firms like ICT will pick off orders for more advanced computers. The market for these may be limited, however, until East European managers get more experience in using computers. Hence, IBM is likely to compete strongly with these firms with its older machines.

In the growing Communist-bloc purchases of technology and machinery, China is now beginning to figure strongly. At one time in 1965, firm Chinese orders for chemical plant and equipment from Western suppliers totaled $100 million, and contracts for another $100 million were being negotiated. Among the plants now being built are three from the United Kingdom: a $12.6-million low-density polyethylene unit (Simon Carves), a $7-million ammonia plant (Humphreys and Glasgow), and an $8.4-million acrylic fiber plant (Courtaulds). But financing can be a limitation on such sales to China.

A major factor in the Soviet Union's purchases of processes and plant from the West has been the rapidly increasing supply of Soviet petroleum, for which a massive pipeline system has been built. The petroleum comes from three major basins, around Baku in the Caucasus, around Kuibyshev near the Urals, and around Tyumen in Siberia. In 1964 most of the system of pipelines for carrying petroleum westward to Czechoslovakia, Hungary, and East Germany and eastward to Irkutsk on Lake Baikal was completed. The scheme was delayed at least a year by Western refusal to supply 1-meter pipe for a 1350-kilometer section of the line between Tambov, near the Volga, to Mozyr in Byelorussia. Presumably the Western refusal, based on "strategic" considerations, was reinforced by Western oil companies' desire to postpone the full impact of the Soviet Union's entry into the world oil market. This impact is already beginning to make itself felt. In 1963, even before pipeline system had been completed, Soviet crude oil production totaled 206 million tons, of which 51 million were exported, 21 million went to Communist eastern Europe, and 23 million went to western and southern Europe.

The price of the oil has been held quite low, partly because gas has often been found in the same fields and some investments, such as those for exploration or for factories to build pipe, can be charged off against both oil and gas.

The low price of Soviet petroleum has made it especially attractive to Japan, which is forced by her great distance from energy supplies to experiment boldly with the use of larger and larger tankers. Under consideration is a plan whereby the oil pipeline would be extended eastward from Irkutsk to Nakhodka on the Sea of Japan. Japan, which now buys about 4 million tons of crude oil from the Soviet Union annually, would agree to take perhaps 100 million tons over 3 years and would supply the Soviet Union with steel pipe of equivalent value. With such a large supply of Soviet oil, the Japanese would be in a strong position to bargain for reductions in the price of oil it receives from other countries. Thus, the ramifications of East-West trade in technology spread into much broader economic fields.

Although, in this trade, the West is doing most of the selling and the East most of the buying, it is not all one way. Indeed, the Soviet Union expects in the future to sell much more equipment and earn much more from patent-license fees than it now does.

An important sign of this hope was the Soviet Union's decision in 1965 to adhere to the 1883 world agreement on patents. All countries who sign this agreement grant inventors of other countries the same patent rights as their own citizens.

The Soviet decision will increase the willingness of Westerners to license the use of their patents in the Soviet Union. Heretofore Westerners have been deterred by the fear that the patented process would be copied in the Soviet Union and that they would get little remuneration. With the ever-growing chemical investment in Russia, which, according to current planning, is to total over $8 billion in the period 1966–71 and to include many more foreign contracts, it became necessary to the Soviet Union to end Western inhibitions about licensing.

At the same time, the activity of Litsenzintorg, the Soviet agency for selling patent rights abroad, is expanding. This agency, set up 4 years ago, also handles the licensing of foreign patents inside the Soviet Union. Litsenzintorg has negotiated agreements to license Soviet patents in 12 countries, including Britain.—VICTOR K. MCELHENY