Privately, however, there was a general sharing of the view that the rapid growth up to 1965 or so had deposited a fair amount of fat in the system, and that, while hardships might occur here or there as a result of the decelerating and redirection of support, research on the whole could stand—and perhaps might even benefit from—a year or two of relatively lean diets.

This was not the sort of view that an academic in government service could readily offer his panic-prone professional community, and it certainly was not the sort of thing he wanted to have get back to Congress. But, over the past 2 years, in moments of privacy and candor, many of the key scientific figures in Washington would concede that their public rhetoric about a financial crisis in research did not altogether reflect their personal perceptions as to the effects the money situation was having on the quality and development of research.

It was acknowledged that reliable information on the effects of financial changes was often spotty. But at the same time credence was given to the view that a general tightening of money might have a variety of effects that were deemed beneficial. Among those sometimes cited were pressures on long-term postdoctoral researchers to teach or go into industry; greater attention to scientific quality in the support of basic research; and greater reliance on cost-effectiveness techniques in developmental research. [Whether these are reasonable expectations is a separate question. Last spring, for example, H. Bentley Glass, academic vice president of the State University of New York, at Stony Brook, argued that old-time retainers were so well tied into the granting system that in times of tight money they continued to prosper, while unknown but promising young researchers often went unsupported (*Science*, 19 May).]

Whatever the case, the fact is that research money has now been fairly tight for 2 years. It is generally felt that the often-cited fat has now been consumed, and, as details are completed on the budget the President will present to Congress in January, the word at the staff levels is that an unprecedentedly difficult situation is taking form. Thus, one staff man, on the eve of his recent departure from federal service, said, "I was willing to work here while things were standing still, but now we're actually going to go backwards, and I don't want to be a part of it."

Another, viewing the science-government relationship from the perspective of long years of federal service, observed, "We've heard lots of complaints in the past, but I think that when the new budget comes out, there will really be something to complain about." To which he appended, "In the past, scientists could argue that the Russians or some other country were ahead of us in this or that field of research. But now we've run away from everybody, and they can't argue that line any more."

One of the paradoxes of the situation is that, while scientists ruefully anticipate next year's money prospects, the view from Capitol Hill is that R & D is an overstuffed field of federal activity and merits a vigorous trimming. Thus, last week, when Wilbur Mills, chairman of the House Ways and Means Committee, demanded that Johnson substantially reduce federal spending if he wants Congress to go along with the administration's request for a tax surcharge, he cited the $17-billion R & D figure as a good place to begin pruning. In making his point, Mills stated, "Any professor who wants a vacation in the woods can get a grant to make a study of the formation of leaves and then he may write a report or he may not." This being his view of the matter, it might as well be noted that Wilbur Mills, as chairman of the House Committee that writes the tax laws for this nation, is one of the most powerful men in the U.S. government, and, if that's the way he sees the matter, the scientific community has done a deplorable job of conveying how it sees the matter.

Though a thriving conference circuit regularly resounds with boasts and warnings that science is really taking over the control posts of government, the fact is that the men who serve science in Washington are at best peripheral to the decision-making process in government. Now and then, a carefully coordinated effort, accompanied by good luck, enables them to cope effectively with Congress's blunderbuss treatment of research. But, by and large, they remain passive, anguished spectators as political forces crash over their carefully devised and intricate science policy formulations.

—D. S. GREENBERG

Dams and Wild Rivers: Looking Beyond the Pork Barrel

In the 1930's, when the U.S. Army Corps of Engineers began changing a considerable part of the American landscape with its program of dam construction, the Corps' role, as it was then understood, was relatively simple. Its mandate, as the nation's largest water development agency, was to prevent floods, produce power, and open up rivers to navigation and, generally, to support economic development. In the Depression years, few people were thinking about leisure, esthetics, or whether the economic benefits from developing a river should be foregone in the interest of keeping the stream wild and free-flowing.

Now, however, the Corps is having to respond to the demands of a different era, and, despite encouragement from its top leadership, the old ways of thinking and doing are not being abruptly abandoned. Bureaucratic inertia and old habits of mind, especially in the field but also at Corps headquarters, combine to resist sudden change. The Corps holds to its traditional bias in favor of meeting water needs by building dams and other structures which it, as an engineering organization, has been chartered to provide. Moreover, in Congress, the "pork barrel" from which senators and representatives dispense water projects for their constituents is a cherished institution that won't be easily given up. The pork barrel is intimately associated with the old helter-skelter way of building dams and navigation projects one by one, often without priorities or any

A POINT OF VIEW

Edward Wenk, Jr., executive secretary, National Council on Marine Resources and Engineering Development; address on "Oceans and human affairs."

Nowhere in the world can science and society be amalgamated under more auspicious circumstances than in the United States. But it will not occur without thought, dedication, and concern by those having responsibilities for research administration.

I realize that these remarks may sound like a plea for a strong, pragmatic application of our research enterprise. Unfortunately this always carries with it the cry of concern that basic research will be harmed. I do not believe this is true. The successful application of scientific discovery adds point to basic research. If we had been more prescient in recognizing this relationship perhaps basic research would not be in such financial trouble in Washington.

broad assessment of national or even regional needs. Even though this narrow-visioned approach is in disrepute, it is still frequently followed on Capitol Hill.

The Corps' dam-building program has been, and is, enormous. Its reservoirs now cover more than 4 million acres and have a shoreline longer than that of the mainland United States. If the Corps achieves its goals for the coming decades, it will flood millions of additional acres and will more than double the storage capacity of its reservoir system. Conflict between water-resource-development objectives and the values involved in keeping some streams in their natural state will, of course, be inevitable.

In political terms, the case for preservation of streams is often likely to be weakly represented, for a major ingredient in traditional pork-barrel politics has been clamorous support for development projects by local economic interests, which usually succeed in getting the politicians behind their cause. However, current trends to have water needs and plans defined by basin-wide and regional planning organizations representing a variety of interests offer at least the possibility that some free-flowing streams will be preserved.

Also, if the basin and regional planning bodies perform their intended function, the Corps and the other water-project agencies (the Bureau of Reclamation and the Soil Conservation Service) will no longer be able to dominate general water-development planning. Whether the planning bodies will, in fact, develop the expertise and self-confidence to prevent such domination is by no means certain, however.

In any case, the files are full of plans for billions of dollars' worth of dams and other water projects for which the feasibility studies or construction was authorized in the old pork-barrel spirit. A number of marginal projects, some destructive of valuable natural areas, are sure to be built unless they are put to increasingly searching review and analysis by federal agencies such as the Department of the Interior's Fish and Wildlife Service and Bureau of Outdoor Recreation, by the Bureau of the Budget, and by the Corps itself.

The Corps, which has been a leader of some of the early efforts in comprehensive basin planning, has itself acknowledged that it will have to do better. Early last year, a special civil works study board made up of two colonels and a civilian official of the Corps said that, while high proficiency in engineering work had been achieved, "too often the [Corps'] planning effort is confined to refining the concept and proving the justification for one or a few promising projects. Too few reports contain evidence that adequate consideration was given to alternatives and to all factors pertinent to producing an optimum solution." As a follow-up to the report of the study board, the Corps has reorganized its division offices in an effort to give planning a status equal to that of engineering.

However, a number of current situations suggest that the concept of giving the public or its representatives a choice among alternative schemes of water-resource use is often honored more in theory than in practice. In a paper presented at the AAAS meeting last December, Francis T. Christy, Jr., a research associate at Resources for the Future, Inc., and the then chairman of the Potomac Valley Conservation and Recreation Council, indicated that thus far public participation in Potomac basin planning had been largely frustrated.

The Potomac basin report issued in 1963 by the Corps' North Atlantic Division recommended construction of 16 major reservoirs in the basin, including one at Seneca, Maryland, which would flood some 30 miles of the Potomac Valley above Washington and a major segment of the historic Chesapeake and Ohio Canal. This development scheme was a modification of one of the four plans presented 2 years earlier—plans which, Christy said, were not real alternatives but "simply variations on the theme of big dams."

As Christy noted, the 1963 report was criticized for its failure to present an analysis, for public consideration, of such possible ways of reducing water-storage requirements for "pollution dilution" purposes as re-aeration of the water in the Potomac estuary at Washington or distillation of effluents. This view, that the Corps has not thoroughly considered new technological solutions to water problems, is widely held among such water-resources specialists as Frank C. DiLuzio, Assistant Secretary of the Interior for water-pollution control. "The Corps and the Bureau of Reclamation have been more interested in promoting their own expertise than in looking at modern technology," DiLuzio said recently, in an interview with *Science*.

The Corps' basic assumptions about water-supply needs in the Potomac basin also were challenged, Christy pointed out. "There is no evidence that the per capita estimates were derived in any but the most casual fashion," he said, noting that the Corps' report made no reference to the effect that change of price could have on per capita use of water, even though it is clear that by fixing appropriate price schedules and using water-saving devices consumption can be reduced.

In Christy's judgment, the special interagency task force on the Potomac which issued its interim report last year repeated the Corps' mistake. It did so, he indicated, by not outlining alternatives to its plan for building—as an initial step in an unrevealed scheme

for ultimate basin development—three reservoirs, and by failing to provide the cost estimates and other data required by citizens groups in order to evaluate its proposals.

Federal water-storage projects often appear especially attractive to states and localities because most of the advantages they confer represent an outright gift from the federal taxpayers. For example, the projected Oakley Reservoir on the Sangamon River in Illinois will, by maintaining stream flows during dry periods and diluting municipal effluents, provide a free service for Decatur and other downstream communities. But a reservoir large enough to provide this service will inundate part of the University of Illinois' Allerton Park, perhaps ending this forested bottomland's usefulness for research in biology and ecology.

The flood-control capacity built into a reservoir project usually represents another gift to communities downstream. This, too, is a factor contributing to the clamor for storage projects for which other measures, such as flood-plain zoning, might be more than an adequate substitute. In fact, a federal task force chaired by Gilbert F. White, geographer at the University of Chicago, last year reported that, despite the billions invested in flood-control dams, levees, and other works, flood losses had been steadily mounting. Such projects cannot protect against floods that exceed their design capacity, yet the Corps counts as project benefits the protection of *future* as well as existing property development in the flood plain.

The Water Resources Council, a cabinet-level coordinating body established under the Water Resources Planning Act of 1965, now has under study the possibility of requiring contributions from "nonfederal interests" toward the cost of storage capacity provided for flood- and water-quality-control purposes. In June, Secretary of the Interior Stewart L. Udall, chairman of the council, took a major step when his own department, which includes the Water Pollution Control Administration, proposed that such interests pay half of project costs associated with water quality control.

Nothing so stimulates scrutiny of water-project plans and the search for alternatives as knowledge on the part of the officials concerned that they have a major controversy on their hands. A case in point is the proposal for the $2-billion Ramparts Dam hydropower project in Alaska, which would destroy one of the most important waterfowl nesting grounds in North America by flooding the Yukon flats and creating a reservoir larger than Lake Erie. This proposed project, which would be built by the Corps, now appears dead. A special Interior Department study concluded recently that Alaska would have no foreseeable market for the project's huge power output, and that the wildlife losses, as assessed both by Interior and by a National Academy of Sciences committee, would be irreplaceable. Any electricity needs which Alaska could reasonably foresee could be met through the development of other available dam sites, the study found.

Projects threatening natural areas which are valuable but not of recognized national significance may, however, advance rapidly toward authorization without anyone in official Washington taking a properly critical look. Indeed, special bureaucratic and private interests are often pushing their hardest to get at the pork barrel when nobody is watching. For a prime example, some conservationists point to the current push by the Corps, the Interior Department's Bureau of Outdoor Recreation, the rural electric cooperatives, and politicians and business interests in the Fredericksburg, Virginia, area to build a high dam on the Rappahannock River.

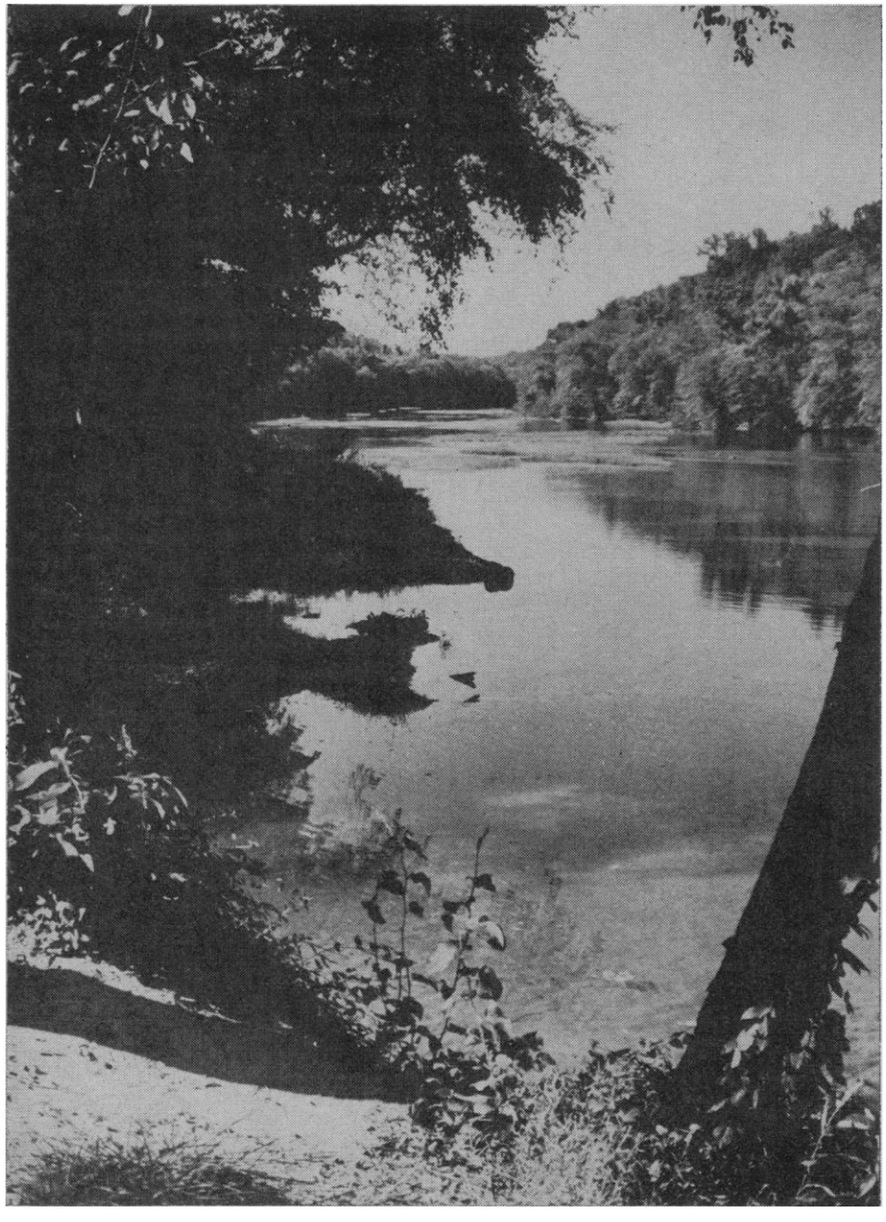
This $79.5-million project, which would be built at the Salem Church

This 1965 cartoon in the North Little Rock (Arkansas) *Times* was inspired by a Corps of Engineers proposal to build another dam in the Ozarks, this one to be on the Buffalo River. However, Orval Faubus, then governor of Arkansas, opposed the project and advocated preservation of the Buffalo as a wild river. The Corps withdrew its proposal for the dam, but felt the dam and wild river were compatible.

site 5 miles above Fredericksburg, would create a 21,300-acre reservoir and would flood long stretches of two rivers, the Rappahannock and its major tributary, the Rapidan. These rivers, passing through semiwilderness areas and crossed by few highways, are unpolluted and a delight to canoeists and bass fishermen; moreover, their bottomlands are rich in wildlife, including such big woods species as the ruffed grouse and the wild turkey.

The Salem Church project has been approved by the Corps' Board of Engineers for Rivers and Harbors, the governor of Virginia, the Chief of Engineers, and the Secretary of the Army, and has been cleared by the Bureau of the Budget for submission to Congress for authorization. Yet it is what Howard L. Cook, head of the Corps' policy and legislative branch, frankly calls "one of the vestigial remnants" of the project-by-project approach to water project planning.

In effect, what Cook is saying is that the project did not grow out of the kind of basin-wide and regional planning which, at least in principle, is now the vogue. As an official of the Water Resources Council recently said, the logical sequence for water-development planning to follow is development of (i) regional framework plans—now being prepared for each of 17 regions across the country, including the North Atlantic region, which takes in the Rappahannock basin—in order to assess water needs and priorities on a regional and national basis; (ii) plans for individual river basins and subbasins; and (iii) plans for individual projects (such as the Salem Church dam).



RAPPAHANNOCK RIVER: Much of this small Virginia river, popular with canoeists and fishermen, would be flooded by a proposed Corps of Engineers dam. Opponents of the project point out that in most years a drawdown of the reservoir in the fall would create, in many places, unsightly conditions similar to those shown in the photograph on page 241. [*Washington Post* photo by Douglas Chevalier]

Not only does no plan exist for the Rappahannock basin, but residents of the basin are sharply divided over the kind of water projects needed. Two of the upper-basin counties strongly oppose the Salem Church project. Nearly half of the land required would be taken from their tax rolls. They point out, moreover, that, in the late summer and fall, thousands of acres of mud flats often would be exposed at the upper end of the reservoir as the water level is drawn down in order for power-generation and water-quality-control commitments to be met.

Construction of a dam at Salem Church was first authorized by Congress in 1946 in response to demands from the Fredericksburg area, which had suffered damages in a 1942 flood. But the benefit-cost ratio was marginal, and this dam, smaller than the one now proposed, was not built. In 1955, however, a restudy of the project was authorized, and this year the Corps recommended building the larger dam, citing a variety of potential benefits. But now the benefits claimed for flood control represent only 2 percent of the total annual benefits, while recreation, together with hydropower, represent 64 percent.

The project's average annual "dependable capacity" of 71,000 kilowatts would be equivalent to less than 2 percent of the peaking capacity the Virginia Electric Power Company expects to have by 1970. Though many of his colleagues in the Corps disagree with him, Cook believes, as do a number of economists, that, except for large rivers such as the Columbia, the Corps is seldom justified in installing hydropower facilities. Thermal generation of power has become increasingly efficient, he observes. Nevertheless, he says, there is always pressure on the Corps to include power in its projects from the rural electric cooperatives, which are priority customers for low-priced federal power.

Critics of the Salem Church project have noted that the Bureau of Outdoor

Recreation (BOR) touts the project's potential for offering "flat-water" recreation opportunities, despite the fact that such large bodies of water as the Potomac and Rappahannock estuaries and Chesapeake Bay are close by. Cook says that, without the claimed recreation benefits, the Corps could never have recommended the high dam. BOR, which prepared the recreation plan at the Corps' invitation and expense, was "pushing for maximum development," he says. According to Stanley Cain, Interior's assistant secretary for fish, wildlife, and parks, who is concerned about possible overuse of the natural areas his bureaus administer, BOR has "gone slaphappy over the number of customers."

In making the Salem Church study BOR could have insisted on investigating the Rappahannock's potential recreation value as a wild river as well as its potential as a reservoir recreation area. However, it did not do so. "The Rappahannock had to go because there was, and is, a lot of steam behind the Salem Church project," Roy Wood, BOR's chief of water resources studies, told *Science*. Wood said that, while BOR wants to preserve some wild rivers, "you can't save them all."

But if BOR is trying to guess which rivers Congress will be ready to preserve, it is playing a difficult game. Two rivers in West Virginia, the Cacapon and the Shenandoah, both of which BOR had recommended for preservation, recently were stricken from the wild and scenic rivers bill now before Congress, at the urging of West Virginia's senators. A bill protecting seven streams (among them the Rogue River in Oregon and the Wolf River in Wisconsin) and calling for study of 27 other potential wild rivers has now passed the Senate. But while such a measure may be enacted next year, a large wild rivers system, with some streams in all parts of the nation included, may never be established unless it emerges from a regional and basin planning process in which the needs for development and those for preservation are brought into balance.

It seems evident that, to enhance the quality of planning and decision making in the water-resources field, the review process will have to be strengthened at those points where independent judgment is most easily exercised. Whether the Water Resources Council, which will review basin and regional plans as they are completed, will be able to exercise such judgment is a matter of pure speculation. However, the tendency to indulge in mutual back scratching is endemic to such interagency bodies. Furthermore, the council has no say in regard to individual projects such as Salem Church, which is only one of many "vestigial remnants" still around.

The Corps of Engineers itself has a review body which has weeded out many dubious water projects in the past and which could do still better in the future. This, of course, is the Board

Acres of mud flats have been exposed by the lowering of the Youghiogheny Reservoir, a Corps of Engineers project in southwestern Pennsylvania. Such autumn "drawdowns" are often inevitable in the operation of multipurpose reservoirs. This *National Parks Magazine* photograph was taken in early November 1963.

of Engineers for Rivers and Harbors, made up of the Deputy Chief of Engineers, five of the 11 generals who head Corps division offices, and a resident colonel. The Corps' civil works study board recommended that, in the interests of obtaining a "broader and more detached viewpoint," the board's membership be widened to include some people from outside the Army. This recommendation is still under study.

A more broadly constituted board might be better able to interpret sympathetically Army regulation ER1165-2-2, which Lieutenant General William F. Cassidy, Chief of Engineers, issued on 6 March. This regulation, taking note of the growing national concern for the preservation of natural areas, says that, if a project's "potential net economic benefits do not clearly outweigh the intangible aesthetic values that would be lost, serious consideration should be given to deferring development until doubts are resolved."

Scientists and conservationists in Indiana who have been protesting the Corps' plans for a reservoir which would flood a part of Big Walnut Valley that is described as Indiana's most remarkable natural area are disappointed in the board. For, in May, the board recommended construction of the project without so much as a mention of the natural areas to be lost. The Chief of Engineers has since appointed a special panel to study the Big Walnut problem.

The final review a water project receives before going to Congress, often to become just another piece of pork in the barrel, is that made by the Bureau of the Budget. To judge from the Bureau's superficial analysis of the Salem Church project (wherein, for example, the adequacy of the BOR recreation study was accepted on faith), much improvement could be made here.

"We must content ourselves with sampling and spot-checking," says a Budget Bureau official, who points out that the Bureau has a relatively small staff (four examiners are now assigned to the Corps' annual billion-dollar-plus civil works program). More aggressive reviews by a larger staff seem indicated. In any case, it is clear that, with the Corps of Engineers and the other water-project construction agencies scouting every river and creek bottom for dam sites, sharp eyes had best be watching. —LUTHER J. CARTER

ESRO: Space Sciences Research in Europe Suffers Growing Pains

Paris. Fragmentation is a salient feature of Western Europe's space effort. In addition to national programs of varying size there are separate intergovernmental organizations for space sciences, launcher development, and satellite communications. Urgings toward unification, or a least rationalization, have been heard for some time, and at a ministerial meeting in Rome in July a committee was formed which appears to have the best chance yet of framing and winning approval of a comprehensive plan.

The main intergovernmenal agencies are the European Space Research Organization (ESRO), the European Launcher Development Organization (ELDO), and the European Conference on Satellite Communications (CETS). A new consultative body at the ministerial level, the European Space Conference, has also recently been given permanent status.

The satellite communications organization is still mainly a sentiment in search of a program, but ESRO and ELDO are solidly established enterprises with a recent history of closer cooperation, in part encouraged by a crisis which nearly shook ELDO apart about a year ago.

ESRO is in its fourth year of full operation and entering a more expensive and ambitious phase as it begins to launch satellites as well as the sounding rockets which have been its mainstay until now. As its cost of living has risen, ESRO has encountered difficulties, some stemming from its own handling of its program, others political and of the sort that an intergovernmental organization competing for national funds is likely to encounter.*

British participation, for example, has recently been the subject of critical examination by a parliamentary financial watchdog committee. The essence of the British committee's advice was that Britain should unify its own national space program under a central authority and apply stricter limits to participation in international programs.

One of the committee's complaints was that British industry has not done well in gaining contracts from international space organizations of which Britain is a member. Britain, which contributes nearly 25 percent of the ESRO budget, for example, has won contracts worth only about $11 million, while France, which makes a contribution of 20 percent of the budget, has cornered ESRO contracts worth about $25 million.

Besides this sensitivity to what national aerospace industries get back in relation to national contributions, there are also differences among ESRO member nations over what they would like to see ESRO doing. Smaller countries with minor space programs of their own in general are enthusiasitc about ESRO's program of launching sounding rockets. France, on the other hand, with the biggest national space program in Europe, would like to see ESRO engaged in larger projects, particularly those which complement French activities. To insure something satisfactory for everybody, ESRO works within the framework of an 8-year program which lays out rough details of both budget and scientific program.

ESRO was established by a convention signed in 1962, which, however, did not go into force until 1964. Under the 1962 agreement the 8-year budget was to be the equivalent of 1509 million French francs (about

*Member states of ESRO and their percentage contributions are as follows: Belgium, 3.72 percent; Denmark, 2.15; France, 20.17; Germany, 24.31; Italy, 11.72; Netherlands, 4.04; Spain, 3.29; Sweden, 4.23; Switzerland, 3.24; United Kingdom, 23.13.