"Somehow the R & D explosion spearheaded by the military has permitted the scientific community to live with something near to a personality split; to be a principal agent of change in our society during the work hours in the laboratory and yet not feel committed to the consequences of such change as it enters our daily life," the report says. "The state of 'pureness' of intentions and 'non-involvement' in consequences will no longer be possible in a society fully permeated by science."

Despite its comprehensiveness, this massive volume, standing a foot tall and 2 inches thick, remains annoyingly incomplete. The treatment of industrial science is sketchy. The lack of an index, coupled with a rambling organization, means that a reader in search of particular information may have to plow through mountains of half-digested material to find what he wants. And despite all the documentation (the volume contains more than 150 tables, graphs, charts and figures), the report often lacks supporting evidence just where the reader wants it most. The four experts are forever tossing out generalizations without explaining in any detail how they reached their conclusions. Lefèvre, for example, suggests: "Is it not American industry and science which lay down science policies under the cover of the specialized agencies of the President's Executive Office and control and modify them under cover of the Science Policy Division of the Library of Congress?" An interesting speculation, but one which surely requires a bit more documentation than a one-sentence reference to President Eisenhower's famous warning against the "military-industrial complex" and a one-paragraph observation that scientific advisers are "in evidence at every level of the administration."

The heart of this report—the analyses by the four experts—rests, in the final analysis, on a surprisingly shaky foundation. The four examiners visited this country for a total of 15 days and whizzed through a series of interviews in Washington, New York, Cape Kennedy, Los Angeles, San Francisco, Stanford, Santa Monica, Boston, and Cambridge that would daunt even the hardiest information-seeker. In their 6 days in Washington, the four talked (usually as a unit but occasionally in groups of two) with representatives of the State Department, NSF, OST, PSAC, Council of Economic Advisers, Bureau of the Budget, AEC, Commerce Department, HEW, NIH, NAS, Department of Defense, NASA, Brookings Institution, AAAS, National Council on Marine Research, four congressional committees, ACS, the Dupont Company, General Electric, Union Carbide, Merck Sharp and Dohme, Ford Motor, and U.S. Steel. Granted that the examiners seem to have backgrounded themselves thoroughly, one could reasonably ask if 2 weeks of on-site investigation was enough for the job at hand.

This is a question that troubled the examiners themselves. Acknowledging that their reports may be "superficial" and "cannot . . . claim to make any revelations," the examiners nevertheless hope that a fresh look "from the outside" may shed "new light" on U.S. science-policy problems. They also hope that a discussion of fundamental issues confronting U.S. science, though old hat in this country, will prove useful to other OECD nations. On both counts the report, despite its imperfections, may well prove valuable.

—PHILIP M. BOFFEY

Budgeting for Research: British Study the Cost of "Sophistication"

London. One of the conventions of budget-making for science is that an automatic annual increase is needed to pay the costs of the growing complexity of science. Five percent a year for "sophistication" is widely regarded as fair. A study made recently for the British government, "The Sophistication Factor in Science Expenditure,"* indicates that 5 percent is probably a little high for an average figure. But in demonstrating that different laboratories have very different sophistication factors, the study calls into question the whole custom of giving a flat 5 percent.

The study, made by the science secretariat of the Council for Scientific Policy, is based on a survey of 13 government and three university departmental laboratories for which budget data over a 10-year period were available. In the study, the sophistication factor for each laboratory was obtained through an analysis of rising costs per scientist in a budget separated into items for salaries, buildings, and equipment.

Very costly purchases of major equipment, such as computers and a ship, were omitted when inclusion, for several reasons, would have had a distorting effect. Even so, equipment was by a big margin the fastest rising of the three items. Increases in expenditure on equipment hit 10 to 20 percent a year and even more, but since the item accounted for only about 18 percent of total expenditures, the effect on overall budgets was small.

For nine Ministry of Technology stations included in the study, the major elements—salaries and buildings—grew at roughly the same rate of 5 to 6 percent a year, so that the annual growth rate in overall costs per scientist was about 6 percent.

Salaries, which include the pay of supporting staff as well as of researchers, is the item which was perhaps most difficult to analyze in terms of pure sophistication. After wage inflation in the general economy is allowed for, the incremental raises on the civil-service pattern, which go to scientists in both government laboratories and universities, and salary increases attributable to a rising standard of living for scientists have to be taken into account. And it is very difficult to separate these elements from the rises or falls in costs which are actually the result of sophistication.

A chief variable in the salaries item is what the authors of the study call the "youth factor." A new research organization tends to have a large group of young and relatively low-paid workers. In an expanding organization the intake of young staff and the retirement of elders act to keep salaries in balance. When an organization stops growing its pyramidal age

*Her Majesty's Stationery Office, London; 6 shillings.

structure changes, with the base narrowing and salary costs per scientist rising. Building costs go up, from the necessity to house new equipment, but there is also a demand from staff for more space and better accommodations, which suggests that there might be something like an "amenity factor" to consider.

The study's conclusion is that there is no uniform residual growth or sophistication factor. Patterns of growth in salaries, buildings, and equipment differed substantially in different laboratories over the 10-year period. Where the intake of young scientists was fairly constant, typical average annual growth rates appear to have been about 2 to 5 percent (in terms of "real prices" computed in noninflating currency). About half this annual growth appears to be due to the effect of incremental increases in salaries. In laboratories in which costs per researcher were low at the beginning of the period and in university departments getting new research support, the typical figure was higher.

One interesting finding was that, where investment in instrumentation was heavy, the number of supporting staff per scientist had not declined. The authors say they can only guess at the reasons, but they suggest that the volume of data gained with new instrumentation increased the need for help in processing such data. The march of big science doesn't seem to bring technological unemployment in its train.

The study makes clear that major equipment costs are worth watching—that this is a true sophistication factor and the fastest-growing item in the budget. So far, equipment costs represent a small part of the budget, but if, as seems probable, the increase in the capacity and cost of instruments continues to rise, it won't be long before the demand for increased funds for equipment puts pressure on the proverbial 5 percent.

The authors of the study stress the fact that their sample was limited and their conclusions tentative, but they think their methods can be applied profitably to a larger number of laboratories.

It must be noted that only money inputs were considered, not outputs in terms of volume or quality of work done. And the past is not necessarily a good guide for making future science policy. Policy makers still have to judge the performance of laboratories, but by looking at patterns of development in good and bad labs they may well be able to estimate the inputs which will encourage something like an optimum rate of growth in a particular kind of research organization.

—John Walsh

CERN II: Still Not Past the Starting Line

Geneva. Not enough backers have yet been enlisted to start the project for a European 300-Gev accelerator. There were hopes that when the council of the European Nuclear Research Organization (CERN) met here in mid-December the project would have a quorum which would include CERN's three major contributors—Britain, France, and West Germany. But, at the meeting, letters of intent were on hand only from Austria, Belgium, and France.

British and Italian delegates to the meeting reported attitudes favorable to the project among science advisory groups at home, and there were indications that the British decision had been delayed by devaluation. It was devaluation and the need to assess its implications that made Britain and Spain abstain on a vote on the CERN budget.

The council did pass a budget for 1968, of some $63 million, but, because of the British and Spanish predicament, estimated budgets for the following 3 years were not acted on. This failure was regarded as serious, since forward planning based on such budget estimates has been one of CERN's strong points. A special council meeting is scheduled for March, when, it is hoped, Britain will be able to declare itself on both the 300-Gev project and the 3-year estimates.

The 300-Gev project did get something of a vote of confidence when the council unanimously voted nearly $1 million to carry on preparatory work for the project during the coming year. A revision of the CERN convention, making it possible to set up a laboratory for the 300-Gev machine under the CERN organizational umbrella, was approved by the council and referred to the member states.

CERN's boat was rocked most vigorously during the council meeting by the German scientific delegate's discussion of a resolution, passed in November by the Federal Republic's Atomic Energy Advisory Committee, raising several sharp questions about the 300-Gev project.

Main points of the resolution were that "it would seem appropriate to use as much new technical know-how as possible in construction of the accelerator," and that "an advanced design and close cost calculation may help to cut construction costs on the accelerator." On both counts the resolution referred to the achievements of the design team working on the American 200-Gev accelerator project.

Reservations some European scientists have had about the design of their own 300-Gev machine seem to have been crystallized at the Cambridge accelerator conference in September by a talk R. R. Wilson, director of the National Accelerator Laboratory, gave on the design study for the big American machine.

The view is apparently spreading among European high-energy physicists that the Americans working on the 200-Gev design have been able to pare costs deeply while, at the same time, coming up with promising innovations in accelerator design. Some Europeans are nagged by the possibility of the American project's meeting its deadlines and putting into operation, perhaps in 1973, a 200-Gev machine which for a comparatively small outlay can be boosted to 400 Gev. While no slippage is likely to occur in the CERN project if the go-ahead is given by March or even June, the present timetable calls for the 300-Gev machine to go into experimental use in 1976 and