nationally. Although $2.8 billion in R & D contracts have been awarded in the ABM program since it began 10 years ago, fewer than a dozen localities have felt a major impact. Some 15,000 persons are now participating in the R & D effort.

Of course, once a decision to deploy Nike X was made, political pressures arising from the program's economic impact would increase. According to qualified Army sources, spending for production and deployment probably would reach a peak of about $1 or $2 billion a year, depending on the nature of the deployment. Roughly estimated, the peak manpower requirement for achieving a "thin" deployment might be about 80,000 persons, 20 percent of them scientists and engineers. A deployment providing some point defense for 25 cities might require 160,000 people. Manpower for producing and deploying a system providing comparatively intensive defenses for 50 cities—the largest program the Army now contemplates—would require still more personnel, but the outer limit would be about 200,000, or half the civil servants that were working for NASA at the peak of the Apollo program.

Douglas Aircraft and the Martin Company would do the missile airframe work, but work on the radar and other electronics equipment would be widely dispersed through invitation of competitive bids and proposals. Without a doubt, the economic impact of the Nike X program would be significant for a sizable number of firms and localities.

Nevertheless, suggestions that the ABM program can be put over on the strength of its economic appeal stand up poorly. Among the 14 senators who voted against the appropriation of $168 million in unrequested ABM "pre-production" funds last year were four from states where major Nike X work is in progress—Joseph Clark of Pennsylvania, Harrison Williams of New Jersey, Robert F. Kennedy of New York, and Edward M. Kennedy of Massachusetts. The majority supporting the extra apropriation probably was deceptively large, for voting on defense spending bills has tended to become *pro forma*, with most members of Congress accepting what the Armed Services and the appropriations committees recommend.

Congressman Alphonzo Bell, a Republican moderate who represents the Santa Monica area, recently polled his constituents on the ABM question and found that, of the more than 10,000 respondents, a majority opposed deployment. Though Bell's district embraces the Douglas facilities where the air frame for an ABM interceptor missile is being developed, it takes in much besides, including part of the U.C.L.A. campus. Statewide, the diversity of political influences at play is still greater. Kuchel of California was the first senator to publicly propose the negotiations with the Soviets. In short, the politics of a major industrial state such as California, with its welter of economic interests, educational institutions, and enormously varied groups championing everything from world peace to abolishment of the income tax, is too complex for any simplistic military-industrial-complex, or merchants-of-death, theory to hold true.

The national constituency appears to be the one that really counts on the ABM issue, and it is to this constituency that President Johnson will have to look in the months ahead as the question comes to a point of decision. Regardless of the outcome of the negotiations with the Soviets, Johnson should be able to deal with the issue on its merits, without being unduly bothered by political pressures.

—LUTHER J. CARTER

Their Decision-Making Process Bothers Some of the British

London. The British have their hands full with the wage freeze, the technology gap, and the brain drain, but they are engaged also in a serious search for longer-term solutions to these immediate problems through finding better ways to employ science and technology in the national interest.

A minor sign of the times is the January–March *Political Quarterly*, which is a special issue on "The Politics of Science." Science-policy questions have been getting increasing attention in both scholarly and popular publications here and, as the *Quarterly*'s editors say in their introduction, the "special issue forms part of a widespread effort to reconcile the interests of science with the needs of society."

The Political Quarterly, a London-based journal, has no direct American equivalent. It is not published under the sheltering wing of a professional society or university, as are almost all American journals. While the academic credentials of its editors are impeccable, the *Quarterly* has on its board such nonprofessorial types as Kingsley Martin, former editor of the *New Statesman*, and Leonard Woolf, both of whom represent the radical, reformist, humane Left in Britain.

Articles in the special issue cover a range of subjects and are soundly informative without saying anything startlingly new. For an American reader the surprising thing is that, in an issue devoted to the politics of science, hardly an allusion is made to politics in the functional sense of who gets what and how.

The explanation may well be that, in Britain, political scientists and others interested in how science policy is made and carried out have limited acquaintance with the workings of policy-making machinery. The American preoccupation with the "decision-making process" seems only now to be infecting the British.

In part, this may be due to differing academic tendencies in Britain and the United States. Political scientists in the United States have expended greater energy in trying to make political science more scientific, and this has led to the prominence, if not the ascend-

ancy, of the quantifiers with their reliance on the questionnaire and, recently, the computer. New techniques, particularly the "depth interview," have given political scientists much more intimate knowledge of the institutions they study and have enabled them to describe these institutions, so to speak, warts and all.

In British universities, where *political science* is still an alien term, emphasis in the field of politics has been on the study of political history, political institutions, and political theory. The good historian's ability to write clearly, even elegantly, and to make fresh and valid interpretations of established facts has been highly valued.

Things have been changing. Survey methods were certainly suspect in Britain a decade ago, and the impression that some Americans use questionnaires promiscuously still lingers. But the British are now employing the numerative techniques. As one Oxford don with experience on a big Midwestern campus pointed out, sheer economics has been an impediment. Less use has been made of survey techniques because less money has been available. In addition, emphasis on the tutorial system—which means making students write essays—puts heavy demands on teachers' time, particularly in the new universities, many of which are understaffed.

Information Problems

The more rapid development of science-policy studies in the United States cannot, however, be attributed simply to a difference in academic atmosphere; information on the making of policy is harder to get in Britain. Law, custom, the character of institutions, and perhaps national temperament contribute.

For the academician interested in science-policy questions, difficulties in Britain were suggested in a paper presented by Lewis A. Gunn of Glasgow University at a science-studies seminar in Edinburgh in November (*Science*, 2 December 1966). In his discussion "Organizing for Science in Britain," Gunn noted a lack of hard information about existing organizations and said, "often we simply do not know how this machinery works."

On the financing of research in universities by the government, Gunn had this to say:

> The total budgets made available to [the five research councils] reflect the priorities of "someone up there" regarding the broad relative merits of agriculture, medical, social, and much basic research. Who that someone is we do not know: no doubt it is an impersonal and highly pluralistic mechanism involving at least the various elements of the [Department of Education and Science], the Council for Scientific Policy, the Research Councils themselves, perhaps the Royal Society, and, of course, the Treasury. But we do not know how these decisions are made, nor what criteria are employed, nor what qualifications some of the people involved have for taking such decisions. We only know that decisions emerge. I do not mean to attack these bodies: rather it is a criticism of British social scientists that we have shown so little curiosity about the decision-making process in science policy.

Lack of information does not affect science policy alone. This winter there have been letters to the *Times* complaining of inadequate public airing of issues before official decisions are taken. The primary target for criticism has been the British civil servant—that stainless, but also faceless, paragon of public service. A government-appointed committee is now considering proposals for the reform of the civil service, and this, of course, has encouraged the critics.

Some of the sharpest barbs were contained in a memorandum from the Parliamentary Labour Party. The memo was produced by the party's research department, which has a particular ax to grind, but it was approved by the national executive, which now numbers among its members the top government office holders.

The memorandum charges that civil servants sometimes conceal planning work going on in their departments from the minister responsible. A point hit hard is that the legislature is limited in its ability to influence policy by lack of information in the critical formative stages. Sometimes, says the memo, "it almost seems that the whole structure of British government is designed to protect the policy making function from public scrutiny."

High marks are given the civil service for ability, conscientiousness, and nonpartisanship, but a number of reforms, including two drastic ones, are recommended. The first would leaven the civil service dough by making it possible for a minister to bring in a limited number of personal assistants when he takes office and also to appoint experts from outside the ranks of the civil service to government posts high enough to have an effect on policy. Perhaps more traumatic to the system, if followed, would be the recommendation to abolish the stratified "class" structure of the civil service. If this were done, scientists and engineers in the present so-called "professional classes" could be brought directly into the policy-making process.

The civil servants themselves favor change. The Association of First Division Civil Servants, which represents the top administrative class, has told the committee that more open discussions of policy matters would be beneficial. It notes incidentally that, if the civil servant's tacit vow of silence were modified, this could help with recruiting. The association, however, stops short of wishing to see its members "participating in the more artificial confrontations of television journalism, or in any exchange where objectivity is at a discount."

Role of Press

Mistrust of the motives and methods of the press runs much deeper in the British than in the American government. The journalist in Washington will be confided in, and perhaps used by, the politician or government official much more often than his counterpart in London. British officials are inhibited by an Official Secrets Act, which operates as a general commandment for those in government service against saying anything which may be contrary to the national interest. To the civil servant, for whom discretion is a way of life, the act can serve as an official excuse for declining comment. Last and not least, the British civil service is dominated by an administrative class selected by competitive examination from among the brightest university graduates. Since Victorian times the mandarins, as their critics call them, have remained, as Tory, Liberal, Labor, and coalition governments came and went. To this small group of clubbable men, the less said in public about the decision-making process the better.

An indirect comment on the situation came last month in an address to the House of Commons Parliamentary and Scientific Committee by P. M. S. Blackett, president of the Royal Society and chief adviser to the Ministry of Technology. His remarks centered on the structure of British industry and on government policy in the encouragement of technological advance. But the press gave prominence to his comments on the effects of government

policy in dividing R&D work between government establishments and industry. "I have slowly come to the conclusion," said Blackett, "that Britain after the war inadvertently took a wrong turning when it continued to rely so much for defence and atomic energy R&D on its own government stations rather than on industry. I believe that in the U.S.A. a bigger fraction of government funds for defence and atomic energy went to industry and less to government stations. Few would now doubt that the United States has gained greatly from the resulting strengthening of industry and the building up of very strong firms and that Britain has lost relatively."

This is fairly strong stuff, but what Blackett said was perhaps less remarkable than the fact that he said it at all. Some idea of local reaction is indicated by a line in an editorial in *Nature* (25 February), which said, "If Professor Blackett goes on like this, he may easily persuade others who give advice to governments without becoming civil servants that they do not have ever afterwards to bite off their tongues, which would help enormously to improve the quality of public life."

It would be misleading to suggest that development of science policy is a back-room operation in Whitehall. University scientists do participate as advisors in decisions, and a scientists' grapevine—similar to the one in the United States—does operate, at least for those near the top of the vine. Alumni of the wartime scientific mobilization in Britain have continued to be particularly influential. And it is worth noting, for example, that an outsider, a German scientist working at a British government research station, expressed surprise at the extent of discussion within the scientific community before decisions on scientific matters are taken.

Nevertheless, it appears that science policy formulation is a more open process in the United States than in Britain. Congressional committees dealing with science programs and budgets have operated as increasingly effective monitors as their expertise has advanced. The science advisory structure which undergirds the President's Science Advisory Committee, NSF, NIH, and the science programs of NASA, AEC, and the Defense Department involves civilian scientists on a massive scale and not only provides advice to the government but constitutes a major information feedback system to the scientific community. The National Academy of Sciences committee on science and public policy (COSPUP) and the interuniversity consortium formed to administer the projected 200-Bev accelerator are prime examples of *sui generis* organizations formed to influence government science policy.

Americans can avoid *hubris* over their science-policy-making system, however, by examining its actual workings. For example, the officials of the Bureau of the Budget, who figure prominently in decisions on science projects, are, in their professional lives, as fully incommunicado as any British civil servant. On the biggest scientific-technical decision of the last decade—the moon-landing program—the scientists were, in effect, consulted after the fact. Project Mohole had a history that many people would prefer to forget. Now the machinery is being tested by a situation in which more men and projects are competing for proportionally fewer dollars, but by and large the system has worked relatively well.

Policy Machinery

Britain seems to be developing parallel institutions. Richard Crossman, leader of the majority in the House of Commons and a proponent of reform of the House, has argued that, while the modern governmental trends have deprived the House of real control over expenditure, the legislature should at least exercise its responsibility to investigate. He has been rebuffed on proposals for radical reform but has succeeded in having two select investigating committees created, one on agriculture and the other on science and technology. Because of the current interest in science and technology in Britain, the scientific committee is regarded as the more interesting test case. Its authority is not limited to one ministry, it can make its own rules, it can hold public sessions and investigate and report on whatever subject it chooses. Its opportunities are therefore ample, but it is still too early to judge or even predict its performance.

While members of the Royal Society have been among the most important scientific advisers to the British government, the role of the Society itself has been an anomalous one. This too could be changing. It is known that a delegation from the National Academy of Sciences familiar with COSPUP operations visited the Royal Society at the end of February. The visit was characteristically described as being for the purpose of "private discussions," but it is not too difficult to imagine the point of the conversations.

The reorganization of British government science apparatus culminated recently in absorption of the Ministry of Aviation by the new Ministry of Technology. Because of the disparity in size, this was a little like Jonah swallowing the whale. The Ministry of Technology, however, has shown considerable ingenuity and flexibility in its main task of encouraging the technical and managerial modernization of British industry, and it is regarded as likely to maintain its momentum.

In Britain's present economic situation, the Ministry of Technology and the government in general must persuade people to do things and to endure things for their own good and the country's good. In this dimension of policy the old habits of presenting the *fait accompli* don't serve very well. But the habits seem hard to break. This has been illustrated recently by incidents affecting money and education. A report on decimal reform of the British coinage and currency was issued, and simultaneously the government announced its choice of the centpound system. Opposition to the system has been stiff, and the opponents have been particularly irked because the government, in effect, said it would not listen to reasons. The way news of a raise in university fees for overseas students was released a few weeks ago set off a series of student protests in Britain which may prove to be only a first round. The government even found chief university administrators lined up against the increase, which added to the embarrassment and indicated that the consultation process short-circuited somewhere. The hint for Whitehall may well be that a little trouble early is better than a lot of trouble later.

—JOHN WALSH

Erratum: In the report "Selection of social partners as a function of peer contact during rearing" by C. L. Pratt and G. P. Sackett (3 Mar., p. 1133), the third sentence of the first paragraph should read as follows: "Monkeys reared in isolation tend to withdraw from other animals and huddle by themselves in social situations. If such animals prefer each other over more normal monkeys, they may not be effectively exposed to the stimuli which lead to some degree of social adjustment."

Erratum: On the contents page of the 24 March issue, the title of the first article should read "Planetary Contamination I: The Problem and the Agreements: *N. H. Horowitz, R. P. Sharp, R. W. Davies.*"

Erratum: In the report "Amino acid transport: evidence for genetic control of two types in human kidney" by C. R. Scriver and O. H. Wilson (17 Mar., p. 1428), the first sentence in the abstract should read "A mutation affecting renal transport of proline, hydroxyproline, and *glycine* occurs in man."