Book Reviews

Bureaucracy and Technology

The Polaris System Development. Bureaucratic and Programmatic Success in Government. HARVEY M. SAPOLSKY. Harvard University Press, Cambridge, Mass., 1972. xx, 262 pp., illus. $9.95.

In providing a serious scholarly account of the development of Polaris, Harvey Sapolsky offers more than an interesting and generally edifying piece of history. Polaris, as Sapolsky notes, is the most plausible case for government success in the development of modern weapons systems. It was developed and deployed (i) ahead of schedule, for (ii) about the planned cost. It is (iii) the most effective embodiment of the nation's established strategic doctrine—deterrence through an invulnerable retaliatory force. In a decade of use, it has compiled (iv) an outstanding record of operational reliability. Since these virtues involve what we have sadly come to recognize as major dimensions of failure in other weapons acquisition projects, one inevitably looks to the Polaris experience for inspiration of acutely needed reform.

Recognizing the significance of the case, Sapolsky performs very well indeed the necessary but unglamorous duty of the scholar—refining plausible, popular, but overly simplistic accounts of its success. The program did benefit from high-quality technical management, he finds, and that was important. The process of technical management, however, did not depend on (or even seriously use) the Program Evaluation Review Technique (PERT) or other innovative management devices widely touted as the critical element of success. The Polaris program initiated PERT and other managerial devices but used them only as political cover.

Similarly Sapolsky argues that Polaris was not simply the result of a compellingly superior technology's having its way. The technical coherence of the initial Polaris proposals depended upon projecting substantial, simultaneous advances in a number of critical component technologies—solid fuel missile propulsion, underwater navigation, warhead design, and others. In other weapons projects (the B-70, the F-111, the Skybolt missile) this has been a formula for failure if not disaster, but in Polaris the projections were realized. Moreover, there were some serious organizational obstacles which combined with technical difficulties could easily have scuttled the Polaris program. Polaris had to gain independence from the Army's Jupiter program, for example, in order to effect a switch to a solid fuel configuration. It also had to overcome serious resistance within the established Navy, among both the fleet admirals and the submariners. The history of the F-111B provides ample testimony that such resistance can be fatal when there are technical hurdles to leap.

Finally Sapolsky argues that the creation of the Special Projects Office was not a simple key to success. That agency's role in managing Polaris was indeed critical. It focused the Navy's effort and outflanked the cumbersome traditional bureaus. It provided a suspension of normal personnel rules, a concentration of talent, special accounting and budgeting arrangements, and a degree of integration which could not have been achieved through the established Navy bureaucracy. But precisely because the special projects office arrangement does cut across normal organizational patterns, it is subject to a number of elemental forces capable of undermining a complex effort such as Polaris was. The inertial hostility of organizational routine had its effects on the Polaris program, and as a general matter the special projects office form of organization is not by itself proof against the entrenched bureaucracy.

The major theme which Sapolsky develops through this series of arguments is that modern weapons systems development (and by implication other technical enterprises) is essentially political business. Polaris was successful, Sapolsky insists, because the project was consciously and effectively managed politically as well as technically. Skillful politics, often seen as the refuge for technical failures, is here announced as a necessary condition for technical success. The implications of this point need to be taken seriously, and that is perhaps the most important message of the book.

Especially because of the importance of this general theme, it is to be regretted that Sapolsky does not develop his analysis of the political management of Polaris in satisfying depth. The actions of the project managers, he argues, reflect four implicit strategies designed to develop and maintain the necessary political support: differentiation; co-optation; moderation; and managerial innovation. The first two respectively established a unique identity for the project (and thus a claim to resources) and engaged potential rivals in its development (for example, Admiral Hyman Rickover as the czar of nuclear reactors). These are occurrences, however, which do not distinguish Polaris from other projects and do not necessarily reflect conscious design. There is little in the book about the specific calculations that project managers actually made. The third strategy, moderation, is exemplified in the fact that the enormous power developed by the Special Projects Office by the early 1960's was used judiciously so as to control the natural envy of less-favored Naval programs. It does not explain how such power developed in the first place. The fourth strategy pertains to the development of PERT, a management center with elaborate charts and graphics, the Reliability Management Index, and other devices, to convey the impression of competence to political superiors and established bureaucrats who otherwise might have meddled in the project and disrupted its business. This analysis of strategies, at the level of generality at which they are presented, provides useful insights into the Polaris program; but hardly a full accounting of its success, hardly a penetrating understanding of the political management of technology.

To some extent the analysis could have been better developed by providing more detail. That is a fair demand, for the study was unusually favored with access to government records and personnel. The Navy initiated it, sponsored it, and provided broad access. It is very significant and commendable that the Navy allowed Sapolsky, as a serious scholar whose analysis it could not directly control, to do the work

and publish the results. This is an unusual arrangement which ought to have yielded an unusually detailed account of the critical and irreducible politics of weapons development. But the book depends a great deal upon material already published and on general assertions illustrated by a few specific examples briefly presented. It is not in fact an unusually fine-grained analysis.

There are limits, however, to the improvement that greater detail might bring. Ultimately the defects of the book are reasonably seen as defects in the state of the art of political analysis. Sapolsky does not try to advance the art in any theoretical dimension but rather seeks to use it to good advantage in analyzing the Polaris case. He does a creditable job of this, and makes a good case for the importance of politics. He leaves us wanting to know a great deal more about how politics actually works.

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Australia Antigen

Hepatitis-Associated Antigen and Viruses. A. J. ZUCKERMAN. North-Holland, Amsterdam, and Elsevier, New York, 1972. x, 222 pp., illus. $20.75.

Hepatitis-virus laboratory research appeared to be withering away in a perennially barren and desolate field until Blumberg planted Australia antigen at its periphery in the mid-1960's. Firmly established in its association with human hepatitis by 1968, the antigen suddenly flourished and quickly took over almost the entire field. This surge in hepatitis research spawned numerous meetings, the proceedings of many of which have been published as books or special issues of journals. Some of these publications have proved to be highly useful as collections of current references, particularly for readers already acquainted with the recent developments. With such an abundance at hand one might well ask if Zuckerman's new monograph is really necessary, since it covers much of the same territory. However, it is unique in its organization, breadth, and balance, and particularly in providing the perspective of a single author who has long been an active and regular contributor to many aspects of hepatitis research. This book should serve a much wider audience than any of its predecessors, including Zuckerman's own *Virus Diseases of the Liver*, which was published in 1970 just in time to catch the beginning of the antigen era.

For some potential readers, this new volume will appear to suffer from superficiality and brevity—a few chapters are disappointingly narrow or short—but most of the topics are presented in sufficient detail and with adequate references to satisfy even those well-established workers in one part of the field whose knowledge of the entire field may be limited. Its conciseness, clarity, and style make it specially suitable for the uninitiated reader who wants to gain relatively easy access to almost any of the multifarious activities in current hepatitis research. The author's familiarity with and understanding of the rapidly accumulating literature (published prior to March 1972) are apparent in his thorough coverage of generally accepted information as well as in his clear statements concerning controversial or unconfirmed reports, for example, on the "Milan" and fecal antigens purportedly related to infectious hepatitis (type A). However, the focus is quite properly on serum hepatitis (type B) and the increasingly recognized complexity of the little particles known as Australia (hepatitis-associated) or hepatitis B antigen. In general the illustrations, including numerous electron micrographs, are well chosen, clear, and helpful.

This book is perhaps best considered as a panoramic progress report. Undoubtedly it will call for a sequel within the next few years when, it is to be hoped, the "viruses" part of the title can take top billing.

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Zoonosis

Venezuelan Encephalitis. Proceedings of a workshop-symposium, Washington, D.C., Sept. 1971. Pan American Health Organization, Washington, D.C., 1972. xiv, 416 pp., illus. Paper, $5. PAHO Scientific Publication No. 243.

The designation of the conference on Venezuelan equine encephalitis (VEE) as a workshop-symposium reflects its two objectives: the comprehensive presentation of current knowledge concerning VEE; and an attempt to define future research needs, largely by free discussion among the more than 100 experts participating. Thus, the record of the discussion is a particularly important part of the proceedings, which are notable for their completeness and probable accuracy (typically, at PAHO conferences, transcripts of a discussant's extemporaneous comments are made available to him within 24 hours for verification and minor editing). The table of contents guides the reader to the formal papers and to the related discussion sections but, except for naming the invited discussants, leaves him on his own to unearth the frequent significant contributions made in the discussions.

The coverage is broad but, presumably reflecting the present state of knowledge, uneven; it ranges from ultrastructure and biochemistry of the virus (touched on lightly) through antigenic characteristics (well studied) and aspects of host-parasite interaction, for both vertebrate and invertebrate hosts, to epidemiology and control, which are extensively covered (five of eight sessions and 260 of 410 pages of text are devoted to these topics).

Except to dedicated arbovirologists, VEE virus heretofore has been an unimportant exotic agent. Its status changed sharply with the recent (1970–71) northward progression of epidemic equine disease and related disease in man from Central America through Mexico to Texas. In point of fact, the disease potential of VEE was evident long before its recent northward move. Extensive epidemics involving horses (hundreds of thousands, a mortality of 28 to 30 percent) and man (many thousands of cases and hundreds of deaths) have been recognized since 1935 in northern South America (chiefly Venezuela, Colombia, and Ecuador) and in Central America.

The story of VEE is unusually complex even for an arbovirus. There are several serologically distinct varieties, only certain of which (subtypes 1A, 1B, and 1C) are virulent for equines and associated with epidemics. Extensive enzootic areas are known, each with its characteristic variety of virus, none of which has been associated with epidemics. Indeed, the major unknown part of the story is the source (and reservoir) of the "epidemic" varieties. A range of vertebrate and invertebrate (mosquito) species can be infected, and both con-