

The Dark Night Sky crystallizes all the innocence of science. There is no admission of a mawkish sense of guilt, foisted on physicists by a society that enjoys the cornucopia but has gone sick because of gluttony. The issues of nuclear weaponry, hazards of nuclear power and threats of pollution and overpopulation do not muddy Clayton's clear waters. The message is fresh—even brash—and is written by an active scientist for the layman. We need more books of this kind, which present science from a personal point of view.

To a native of Cumberland, the sky above Grassmoor is as wide and bemusing as the sky above Texas. But where each handful of soil contains ancestral ash the air is filled with whispering voices. The difference between the old and new worlds is that Grassmoor is haunted by the past, whereas the Texan silence holds promise for the future.

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Laboratory On-Line Computing

J. E. Brignell, G. M. Rhodes

297 pp. Halsted, New York, 1975. \$24.50

On-line computing is a laboratory technique which could be added to the repertoire of many scientists. As mini- and microcomputers decrease in price, they will become common pieces of laboratory equipment. The obvious uses for such computers include experiment control, data processing and recording, decision making, digital processing of analog signals, filtering and noise reduction techniques. In fact, the applications usually are limited only by the operator's imagination and ingenuity.

Essentially, on-line computing involves the use of a computer as a data-processing device with real live data instead of the prerecorded species. Now, before everyone runs out to purchase his own personal computer, I would suggest a reading of John Brignell's and Godfrey Rhodes's new book *Laboratory On-Line Computing*. This is an introductory book written for a limited audience consisting of individuals with advanced degrees and some background in mathematics and electronics. It is these people who possess the capability for the most efficient computer usage; however, anyone contemplating the use of a computer in his lab can benefit from the book. Because the computer field is rapidly evolving, Brignell and

Rhodes have kept their presentation general, with the intention that the interested reader will use their bibliography for a more extensive treatment.

The topics covered include computer hardware and software and their interactions, accompanied by a discussion of specific matters such as interrupts and input-output. A mathematical section discusses sampling processes, Z-transform theory and other techniques used in sampled-data theory and digital filtering. The last section deals extensively with so-called "peripherals." In general, a computer with the correct software may be used in the operation and control of expensive scientific instruments by treating the instruments as peripherals. The added sophistication of this method has tremendous potential. For example, a computer-controlled high-voltage source could gradually increase or decrease the potential while making other measurements by outputting a number to a digital-to-analog converter to produce a control voltage. This looks foolproof as long as the software works. However, consider the output of the number negative one: this is all ones or full scale. The point made by the authors is that sophistication works two ways. It can provide an elegant approach to a difficult problem or just add another example to the catalog of "garbage in—garbage out" experiences.

It is difficult to break into this area of research productively. The authors have outlined the basic background necessary for a newcomer to make the transition as painlessly as possible. Let me add one further warning: always remember that with a new sophisticated high-speed digital computer it's possible to make mistakes millions of times faster than with just a pencil and paper.

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Independence and Deterrence—Britain and Atomic Energy, 1945–1952: Vol. 1, Policy Making and Vol. 2, Policy Execution

M. Gowing.

1062 pp. St. Martin's Press, New York, 1974. \$25.00 each volume

Margaret Gowing's earlier book entitled *Britain and Atomic Energy 1939–1945* (published in 1964) presents the history of the British nuclear program from its beginning until the successful completion of the American program—to which the British made crucial contributions—in August 1945. That volume

describes in detail the origins and early results of the effort, its transfer to North America, and The British hopes, plans and proposals for continuation of the very close wartime cooperation in the post-war era. The two volumes under review are, in effect, despite their somewhat confusing titles, the second and third volumes in Gowing's series on the history of the British nuclear program. They cover the period beginning with the dramatic technical success of the Manhattan Project and its contribution to ending the war in the Pacific in 1945 and ending with the test of the first British-made A-bomb in Australia in 1952.

These two volumes, plus the earlier book, by their very nature will constitute an essential element in the library of any person or institution concerned with either the history of nuclear energy or the history of the modern technological arms race in particular, or with the history of the cold war in general. Happily the volumes are also well written and easy to understand and use. They, like their predecessor are official history based on what the author describes as free access to still classified documents and the subsequent circulation of early drafts among the principals in the story.

Following the discovery of fission in Germany on the eve of World War II, scientists in many countries carried out experiments and calculations intended to elucidate this most interesting new nuclear process. In at least six countries—France, Germany, Japan, the Soviet Union, the United Kingdom, and the United States—scientists with the active interest and support of their governments undertook work designed to explore and exploit two practical applications of the new process, namely the production of useful energy and the creation of an unprecedentedly powerful new weapon, the atomic bomb. For various reasons, the work on the bomb in England soon outpaced that in the other five countries. In the fall of 1941, American knowledge of this British work was, as much as any factor, the immediate stimulus behind the decision to set in motion the US A-bomb program and to establish the Manhattan Project to carry it out. The exigencies of the war made necessary, and the generally very close scientific and political relations made possible, the eventual melding of the British and American programs and the transfer of most of the scientists in the British program (including by then many refugees from the continent) to various laboratories in North America.

Volume 1, as its title indicates, deals with policy making during 1945–52. It relates the essentially sad story of repeated attempts on the part of the British first to continue and then later to

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reestablish the close wartime Anglo-American cooperation, and the repeated rebuffs of these efforts by the American government. These rebuffs apparently had multiple origins: just plain chauvinism; the peculiar kind of isolationism, aimed especially at foreign intellectuals, that was engendered by the Cold War; the revelations about spies; McCarthyism and its formative attitudes, and concern over potential commercial advantages in a world which apparently would eventually have to turn to nuclear power to meet its growing energy demands.

Volume 1 does not, however, claim that these rebuffs had very much to do with the British decision to build their own A-bomb and thus achieve an independent deterrent. Rather, the British A-bomb program seems to have had—in words used two decades later in connection with another related matter—a “mad momentum of its own.”

It seems to have been tacitly assumed from the beginning that there would be a British A-bomb, and every time a decision point was reached in the technological program, the decision appears always to have been made in the way that such an implicit assumption demanded. The immediate postwar decision to build the “Windscale” reactors was made because it was believed that any respectable nuclear program must include the construction and operation of large reactors, but the type and size were from the beginning matched to the American reactors at Hanford and hence were capable of producing weapon-grade plutonium in amounts such that the output of one pile would be sufficient to make 15 bombs per year. The immediate Ministerial-level decision (December 1945) was to build one reactor and prepare the basis for an eventual second, but on New Year's Day in 1946, the British Chiefs of Staff issued a report saying “clearly two piles are better than one, and in the number of bombs we have will lie our strength.”

It was not until January 1947 that it finally became necessary to decide whether or not to actually design and build bombs. A very small group, surrounded by a wall of secrecy apparently substantially higher than what we are accustomed to in America in peacetime, made the decision on very general and fundamental grounds, including simply “a feeling that Britain as a great power must acquire all major new weapons.” Among those few persons in on making these decisions, and among the larger circle of those in a position to discuss the question even though they were not directly involved in making the decisions, there seems to have been very little opposition. Gowing names only Patrick M. S. Blackett as being firmly opposed, and only Sir Henry Tizard as expressing any doubts.

Later in 1947, William Penney was placed in charge of the bomb-development program. He had spent the war years at Los Alamos and had participated in the American tests at Bikini in 1946. Immediately after the war he had been named director of the Ministry of Supply's Armament Research Establishment in Kent. This organization was not then engaged in developing nuclear weapons, but Penney's being appointed to this post must have been in anticipation of its later expansion into this field. All of these decisions led directly and, in the main, smoothly to the 1952 test of the first British A-bomb. The only major surprise seems to have been the prior explosion of the first Soviet A-bomb in August 1949; the British had definitely expected to be number two and were quite surprised to find they weren't.

Volume 2 recounts mainly the stories of three men and the institutions they headed—John Cockcroft and the Atomic Energy Research Establishment at Harwell; William Penney and the Atomic Weapons Laboratory at Alder-

maston; and Christopher Hinton and all of the production facilities including the Windscale reactors. The stories include many personal matters as well as strictly professional and technological events, and these will be of interest to anyone who either has or is importantly involved in the development and management of nuclear energy.

Three other interesting persons also appear in this volume: The spies Klaus Fuchs and Alan Nunn May and the defector Bruno Pontecorvo. The information presented in this volume on these three men is by comparison quite brief, but even so there is more here than will be found in any other equally well informed source.

Finally, I must note that Canadian scientists especially will be interested in the full and detailed account of the very important Canadian-British atomic relationship, which began during the war and has continued ever since.

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All in Our Time: The Reminiscences of Twelve Nuclear Pioneers

J. Wilson, ed.

236 pp. Bulletin of the Atomic Scientists,
Chicago, 1975. \$3.45

This collection of personal reminiscences, *All in Our Time*, describes the discoveries and events that culminated in the Trinity test at Alamogordo, New Mexico. It comes at a time when the spread of nuclear-energy production poses, in many people's minds, a threat to humanity.

Almost anyone reading this little volume—and it is very readable—has to be impressed with the inevitability of the successive discoveries leading up to the Bomb and to nuclear power. In the same vein, one may find cause to wonder if there really is any way to turn the clock back or to prevent the imaginative use of this available source of energy.

Jane Wilson has very ably edited the contributions of twelve nuclear scientists into a story that spans the decade that saw the birth of the “atomic age,” and her own introductory contribution successfully ties together the separate essays that follow. While the authors are all highly



Metal quonset huts and wooden boardwalks made a crude backdrop for the physicists who ushered in the atomic age at Los Alamos. Photo from Fermi Documentary Film Collection, AIP Library.