is a fascinating and worthwhile book, both as a case study of innovation and as a source of clues to the reasons for the later demise of RCA as an independent entity. Graham's work allows one to speculate on the impact that the recent acquisition of RCA by General Electric is likely to have on the process of innovation in general and in the electronics industry.

ERWIN A. BLACKSTONE
Department of Economics, Temple University, Philadelphia, PA 19122

Evaluating Nuclear Strategy

Managing Nuclear Operations. ASHTON B. CARTER, JOHN D. STEINBRUNER, and CHARLES A. ZRAKET, Eds. Brookings Institution, Washington, DC, 1987. xxiv, 752 pp., illus. Paper, $18.95.

Nuclear Crisis Management. A Dangerous Illusion. RICHARD NED LEBOW. Cornell University Press, Ithaca, NY, 1987. 227 pp. $24.95. Cornell Studies in Security Affairs.

For many years the main focus of research concerning nuclear operations was on the weapons systems themselves and the strategic doctrine that was intended to guide their use in the event of war. More recently, attention has centered on the technical and political problems connected with the use or threatened use of weapons systems and with the implementation of strategic doctrine. Both *Managing Nuclear Operations* and *Nuclear Crisis Management* address such problems.

At first glance *Managing Nuclear Operations* is an impressive book. Jointly sponsored by the Brookings Institution and the Harvard University Center for Science and International Affairs, the volume contains 21 essays (many of great length) on various aspects of managing peacetime, crisis, and wartime operations. The contributors include academic and research-institute specialists in addition to government officials and contractors. The chapters focus on the mechanics of nuclear operations as well as on policy questions. Some of the topics addressed are safety and security, communications technologies and vulnerabilities, NATO nuclear operations, assessment of command system vulnerability, the implications of strategic defense, antisatellites, and arms control for nuclear operations.

Among the essays that stand out are those by Bruce Blair and Stephen Meyer. Blair examines the alert system in both crisis and conventional war situations. Alert states are known as Defense Conditions (DEFCONs) and range from DEFCON 5 (normal peacetime) to DEFCON 1 (most serious). Blair examines the disposition of forces, states of readiness, and procedures associated with DEFCONs 1, 2, and 3. Meyer's contribution on Soviet nuclear operations is based on an extensive survey of Soviet writings and treats the Soviet conception of command and control and how it would be implemented in peace, crisis, and war. Of particular interest are the connections Meyer makes between issues such as the predelegation of nuclear release authority to any Politburo member other than the General Secretary and the political succession process, and between the Moscow antiballistic missile (ABM) system and the succession process in the event of a nuclear war. In the first case Meyer suggests that the Soviets may have avoided such predelegation because to do so could be interpreted as designating the General Secretary's peacetime successor. In the second case he argues that the Moscow ABM system may be of such great importance to the Soviets because the succession process will depend on somebody in Moscow surviving a U.S. attack, since "one can be certain that no candidate for the General Secretary's commander-in-chief role is going to wait in Irkutsk on a daily basis just to provide continuity of nuclear control in the unlikely event of a surprise attack."

Perhaps the most striking feature of *Managing Nuclear Operations* is what has been omitted or inadequately covered. There is nothing about the nuclear testing process, a crucial aspect of nuclear operations. The role such testing plays or doesn't play in the maintenance of a reliable arsenal is a key question with implications for the proposed comprehensive test ban. Similarly, no attention is given to the role of intelligence in nuclear operations—either in selecting peacetime targets or in contributing to wartime damage assessment.

Several very important topics are discussed only sketchily. How would nuclear targeting be conducted with respect to the Soviet Union? Instead of an answer, the editors give us Theodore Postol's essay on the targeting of Washington, D.C. Although some general principles can be gleaned from this chapter it hardly represents a serious attempt to explain the complexities of trying to implement U.S. strategic doctrine, which calls for attacks on Soviet military, political, and economic targets with the full range of U.S. strategic forces. Likewise, the discussion of continuity of operations is inadequate. Surviving communications nets are of little value unless the government can continue to operate. No treatment is given to the plans of crucial government agencies for continued operations and the feasibility of those plans. Albert Babbitt's chapter on command centers contains no details on continuity of operations with regard to wartime command centers.

The reason for the omissions is clear: many of the contributors possess security clearances, as is evident from their positions, and as a result feel constrained to avoid detailed discussions of many topics—even topics that have been covered in depth in the open literature. Thus, in his essay on warning and assessment sensors John Toomay ignores the wealth of published material concerning the nature of the Defense Support Program satellites, ground stations, and communications links and instead writes merely of the application of infrared technology to early warning satellites.

The result is a book that is far less than it could be. Rather than provide the reader with a solid set of essays on the mechanics of nuclear operations followed by discussion and recommendations concerning policy options, the editors have assembled a jumble of essays, leaving the reader to fill in the gaps and sort the wheat from the chaff.

Nuclear Crisis Management is a valuable companion volume to *Managing Nuclear Operations* or any works written under the assumption that nuclear crises can be managed. The author says that such an assumption is dangerous under present circumstances. In further contrast to the viewpoint of *Managing Nuclear Operations*, Lebow sees good crisis management as requiring "fundamental changes in the force structures, doctrines and the target sets that define contemporary nuclear strategy."

Lebow suggests that there were three fundamental reasons for the outbreak of World War I: preemption, loss of control, and miscalculated escalation, possibilities that still exist in the nuclear world of today. Preemption could be a problem because, according to Lebow, the United States and the Soviet Union share many of the flawed assumptions that were responsible for German preemption; both give evidence of believing that striking the first blow can make a significant difference to the outcome of the war. Factors that could lead to loss of control over the crisis include the information overload produced by a massive technical intelligence network and the enormous Defense Department communications system, institutional compartmentalization, the compression of decision time due to the speed at which intercontinental ballistic missiles and submarine-launched ballistic missiles can reach their targets, and informal decision and implementation procedures that undermine safeguards.

Lebow believes miscalculated escalation to be a risk because of a variety of factors—including the complexity of nuclear war.

Because of this complexity civilian leaders, with the exception of Jimmy Carter, have had little interest in the details of U.S. fighting plans and capabilities. This lack of interest has been encouraged by a military bureaucracy (specifically, the Strategic Air Command) that has been most reluctant to reveal details of U.S. nuclear war plans to civilian officials. The result is a civilian leadership ill-prepared to make the appropriate decisions in a nuclear crisis.

In his final chapter Lebow offers several suggestions, beyond those implicit in earlier chapters, for improving crisis management. Among them are improvement of early warning, arms control, preservation of the ABM Treaty, and alternatives to quick-launch strategies. I found this the weakest chapter in the book, particularly because of the absence of recommendations relating to force structure and targeting, matters the author had earlier identified as important to making nuclear crisis management possible. But even with this failing *Nuclear Crisis Management* is a valuable contribution.

JEFFREY RICHELSON
School of Government and Public Administration, American University, Washington, DC 20016

Pioneer Ecologist

Fraser Darling's Islands. J. MORTON BOYD. Edinburgh University Press, Edinburgh, 1986 (U.S. distributor, Columbia University Press, New York). xiv, 252 pp., illus. $25.

Scientists are inclined to snub colleagues who indulge in popular scientific exposition, especially if they are successful at it. Many contemporaries of Sir Frank Fraser Darling, who died in his beloved Scotland in 1979 at the age of 76, were less than appreciative of his contributions to vertebrate natural history and to the international conservation movement. This affectionate portrait by J. Morton Boyd goes a long way toward setting the record straight.

Fraser Darling was a naturalist writer whose book *A Herd of Red Deer* broke new ground in field research on animal behavior. As a result of it, the red deer was to become a testing ground for modern theories of vertebrate social evolution. By Fraser Darling's own assessment, the most important outcome of the red deer project was to gain credence for extended study of groups of wild animals as a source of new insights in behavioral biology and to establish social behavior as a significant ecological factor. Another work, *Bird Flocks and the Breeding Cycle*, concerned with social influences on breeding synchrony in gulls, was equally influential, though scientifically it proved to be on less secure ground. Another favored subject for island projects was the behavior of the gray seal. Then, as now, funding for long-term field studies of behavioral ecology was exceedingly difficult to obtain. Fraser Darling did get support from a Leverhulme Fellowship (the other recipient that year was Charles Elton), but mostly he paid his way by income from popular books about the delights and hardships of life with his family on uninhabited islands in northwestern Scotland, in pursuit of his animal subjects. Books like *A Naturalist on Rona* and *Island Years*, romantic in their sense of adventure and isolation and immensely evocative in their appreciation of nature at close quarters, played their part in drawing budding scientists, including Boyd and this reviewer, into field biology.

Fraser Darling had a deep appreciation for the sturdy qualities of the crofters of the Scottish Highlands and the Hebrides and became deeply concerned about their poverty and dwindling numbers. His *West Highland Survey: An Essay in Human Ecology* was a milestone in British environmental science. Pitted against the deep conservatism of the highlanders and the British civil service, the practical consequences of his ecological evangelism were few. According to Boyd, the words "wilderness" and even "national park" are anathema in the Highlands to this day. Internationally, however, Fraser Darling's work had some of the impact of the writings of Aldo Leopold and Fairfield Osborne, confronting problems of land use planning in a spirit not of exploitation but more of "wooing" of the environment. In fact, Fraser Darling got a better hearing on this side of the Atlantic than at home and quickly moved to the forefront of activities of the Conservation Foundation, in Washington, D.C. He also spent much time in Africa, the subject of another book Boyd plans to write. Fraser Darling was influential, for example, in conservation of the Ngorongoro Crater in Tanzania. Late in life his focus shifted back to Britain, where he gave the prestigious Reith Lectures and received a knighthood. The network of nature reserves throughout Scotland established and administered by the Nature Conservancy, an organization Fraser Darling helped to create, stands as a monument to his foresight.

Yet, these accomplishments notwithstanding, for many the true image of Fraser Darling is a more modest and personal one. As Boyd says, he saw himself "as an explorer in the middle ground between animal behavior and ecology and felt that he possessed something special in the philosophy of science which most of his academically distinguished contemporaries did not have." By felicitous choice of quotations, including unpublished letters and notebooks, warm personal reminiscences, and eloquent accounts of pilgrimages to places where Fraser Darling lived and worked, Boyd has captured the essence of a biologist who fulfilled his own sense of destiny as a leader of contemporary thought on the awareness and care of nature.

PETER MARLER
Rockefeller University, New York, NY 10021

Reprints of Books Previously Reviewed

The Age of Birds. Alan Feduccia. Harvard University Press, Cambridge, MA, 1987. Paper, $12.95. *Reviewed* **211**, 1153 (1981).

The Ecology of Natural Disturbance and Patch Dynamics. S. T. A. Pickett and P. S. White, Eds. Academic Press, Orlando, FL, 1986. Paper, $24.95. *Reviewed* **230**, 434 (1985).

Revolution in Science. I. Bernard Cohen. Belknap (Harvard University Press), Cambridge, MA, 1987. Paper, $9.95. *Reviewed* **229**, 1077 (1985).

Books Received

The A–Z of Nuclear Jargon. Jonathon Green. Routledge and Kegan Paul (Methuen), New York, 1987. viii, 199 pp. $34.95.

Adsorption Processes for Water Treatment. Samuel D. Faust and Osman M. Aly. Butterworths, Stoneham, MA, 1987. xii, 509 pp., illus. $59.95.

Advanced Methods in Protein Microsequence Analysis. Brigitte Wittman-Liebold, Johann Salnikow, and Volker A. Erdmann, Eds. Springer-Verlag, New York, 1986. x, 423 pp., illus. $79. Based on an advanced course and a symposium, Berlin, F.R.G., Sept. 1985.

Advances in Neurology. Vol. 45, Parkinson's Disease. Melvin D. Yahr and Kenneth J. Bergmann, Eds. Raven, New York, 1986. xxiv, 616 pp., illus. $98.50. From a symposium, New York, June 1985.

Advances in Viral Oncology. George Klein, Ed. Vol. 6, Experimental Approaches to Multifactorial Interactions in Tumor Development. xiv, 174 pp., illus. $63. Vol. 7, Analysis of Multistep Scenarios in the Natural History of Human or Animal Cancer. xii, 217 pp., illus. $69. Raven, New York, 1986.

An Adventure in Multidimensional Space. The Art and Geometry of Polygons, Polyhedra, and Polytopes. Koji Miyazaki. Wiley-Interscience, New York, 1986. viii, 112 pp., illus. $49.95. Translated from the Japanese edition (1983). Henry Crapo, Ed.

Cultural Models in Language and Thought. Dorothy Holland and Naomi Quinn, Eds. Cambridge University Press, New York, 1987. xii, 400 pp. $49.50; paper, $15.95.

Current Concepts in Craniofacial Anomalies. A Symposium in Honor of Joseph J. Bonner (Los Angeles, Aug. 1985). Michael Melnick, Ed. Liss, New York, 1986. x, 339 pp., illus. $80. Also published as *Journal of Craniofacial Genetics and Developmental Biology*, Supplement 2, 1986.

Dark Matter in the Universe. J. Kormendy and G. R. Knapp, Eds. Reidel, Dordrecht, 1987 (U.S. distributor, Kluwer, Norwell, MA). xxx, 596 pp., illus. International Astronomical Union symposium no. 117 (Princeton, NJ, June 1985).

Decision Analysis and Behavioral Research. Detlof von Winterfeldt and Ward Edwards. Cambridge University Press, New York, 1986. xvi, 604 pp., illus. $59.50; paper, $19.95.

Decision Making About Decision Making. Meta-

(Continued on page 1362)