NUCLEAR WARFARE

Measuring the Unthinkable

Janne E. Nolan

Whole World on Fire is a whole book about how the U.S. government uses flawed methodology and inaccurate data to plan for nuclear war. For over half a century, the United States has severely underestimated the level of destruction that would result from the use of nuclear weapons. Relying on long-standing orthodoxies and established routines within the organizations charged with preparing for nuclear war, planners predict and measure only the damage caused by the blast of nuclear weapons; they do not consider damage caused by the massive fires that would inevitably follow. The actual level of lethality, according to Lynn Eden's analysis, could be two to five times greater than predicted in the detailed models of damage expectancies found in American targeting plans. If this is true, successive American presidents, who believed that they were in command of forces that allowed for a range of options tailored to specific crisis scenarios, have been systematically misinformed. Similarly, overly conservative estimates of the destructive capacity of nuclear forces have created requirements for nuclear weapons well beyond a reasonable calculus of "how much deterrence is enough."

Whole World on Fire
Organizations, Knowledge, and Nuclear Weapons Devastation
by Lynn Eden
Cornell University Press, Ithaca, NY, 2004. 381 pp. $32.50, £19.50. ISBN 0-8014-3578-1.

How could this happen? The fact that destruction by fire can occur after nuclear detonation is not in dispute. That was illustrated all too vividly by the firestorms which consumed Hiroshima and Nagasaki. The argument, which dates back to the first studies (in 1947 and 1948) of the effects of atomic weapons, is over whether planners can count on the effects of fire to achieve the objectives of targeting. For a variety of reasons—ranging from the limited utility of fire to destroy the "counterforce" targets (like missile silos) that the U.S. Air Force always favored, through moral qualms about including the indiscriminate effects of nuclear fires in actual war planning, to the comparatively low status of "fire engineers" who studied firestorms relative to the civil engineers who measure blast effects—the nuclear weapons establishment remains convinced that fire effects are too variable and too complex to be included in the science of targeting. Many believe that fire damage cannot be predicted with the same degree of precision as blast effects, because it is so susceptible to environmental factors: temperature, time of year, visibility, and wind conditions. The author argues that this conclusion is not the product of scientific research but of institutional inertia.

Witness to atomic fire. Blackened trees are among the few still-standing objects in this section of Hiroshima, photographed one month after it had been devastated by the explosion of a 15-kiloton atomic bomb.

CREDIT: BETTMANN/CORBIS

Potential readers, including some experts, might reasonably ask: Who cares? The prevalent public assumption is that a nuclear war would be a fatal catastrophe, leading inexorably to Armageddon, and that limited nuclear war is an oxymoron. During the Cold War, the ability of the United States and the Soviet Union to launch thousands of weapons and to destroy each other several times over certainly put into question the significance of accurately predicting exactly how "the rubble would bounce," as Winston Churchill phrased it.

But American nuclear strategy has long relied on detailed plans for limited and "winnable" nuclear war. The policy of flexible response, which originated in the l960s, envisioned the controlled use of nuclear weapons on the battlefield to defend European allies against Soviet aggression. Nuclear strikes were to escalate gradually, allowing for "negotiating pauses" to try to end hostilities. The current administration's policy of preemptive and preventive war relies on precision nuclear strikes against rogue state military installations, assuming that "collateral damage" could be contained. But if the estimates of likely destruction are wrong, what happens then? The disjuncture between political beliefs and military plans is a prescription for disaster in wartime.

The analysis of the nuclear war planning sector in *Whole World on Fire* is interesting, controversial, and likely to provoke debate, but the book is about much more than the minutiae of nuclear targeting. Eden, a research scholar at Stanford University's Center for International Security and Cooperation, transforms the arcane world of planning for nuclear war into a nuanced case study for understanding organizational behavior. Drawing on technology studies as well as organizational theory and science, she presents a meticulously researched narrative about how insulated bureaucracies charged with complex, technical missions can become trapped by their own biases ("organizational frames"). This is especially true when the work being conducted is specialized and highly valued (environments that Eden describes as knowledge-laden), and the result is likely to be even more pronounced in a climate of secrecy.

Without systematic oversight by outside authorities—in the case of planning for nuclear war, a duty long abdicated by political leaders—bureaucracies cannot be expected to assimilate information that challenges the way people are used to doing business. Organizations, in other words, solve the problems they have identified and discount the importance of problems that they do not understand.

A key aspect of this analysis is the author's account of an attempt to correct the perception that fire effects cannot be predicted, an effort undertaken in the 1980s by a group of re-

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searchers working on government contracts. Led by Harold Brode, a highly respected physicist at the Pacific-Sierra Research Corporation, the scientists adapted the physics of fire effects into a predictive damage assessment model. They eventually demonstrated that fire effects could be reliably incorporated into existing methods for calculating target vulnerability. Their work yielded persuasive results and won over an "insider" constituency. However, in the end—for reasons that are prosaic rather than scientific—the effort failed to bring about changes in targeting criteria. If nothing else, this episode reveals that even those charged with "the fate of the Earth" are not immune from the tyranny of competing interests and bureaucratic politics.

The one weakness of Eden's analysis is her inattention to the importance of top-level leadership in achieving significant innovations in national security policy. As she herself demonstrates, politics matter. But presidents and senior officials traditionally have abdicated their responsibility for the stewardship of the nuclear arsenal and resist learning more than the most perfunctory details about nuclear operations. No amount of scientific inquiry, however compelling, is likely to achieve desired change until a president opts to take charge.

Whole World on Fire is a significant contribution and should be read by anyone who is concerned about the accountability and effectiveness of powerful American organizations. The consequences of institutional myopia can be catastrophic. Eden's analysis is potentially as applicable to the Challenger disaster and recent intelligence failures in Iraq as to the less familiar world of planning for nuclear war.

BROWSINGS

100 Suns. *Michael Light*. Knopf, New York, 2003. 208 pp. $45, C$68. ISBN 1-4000-4113-9. Jonathan Cape, London. £30. ISBN 0-224-06451-7.

Between July 1945 and November 1962, the United States conducted some 216 tests of nuclear weapons in the atmosphere and underwater. Blasts at the Nevada Test Site and the Pacific Proving Grounds were photographed and filmed by a U.S. Air Force unit based in Hollywood. Light, a photographer and artist, presents 100 images of these tests selected from publicly accessible collections of the U.S. National Archives and the Los Alamos National Laboratory. The brief text that follows the plates comprises detailed captions, a chronology of the development of nuclear weapons, and a short bibliography. Truckee (above), a 210-kiloton aerial blast near Christmas Island detonated 9 June 1962, was a prototype test of a warhead for Polaris submarine-based ballistic missiles.

Face to Face with the Bomb. Nuclear Reality after the Cold War. *Paul Shambroom*. Johns Hopkins University Press, Baltimore, MD, 2003. 141 pp. $34.95, £24. ISBN 0-8018-7202-2. Creating the North American Landscape.

Between 1992 and 2001, Shambroom visited U.S. military bases to photograph components of America's post–Cold War nuclear arsenal. His color prints show us the warheads, missiles (such as this Minuteman III, right, being lowered into its silo in Colorado), bombers, submarines, and command centers along with the people who maintain them. The author summarizes his involvement with the nuclear weapons debate and his sometimes humorous experiences gaining access to installations. A short essay by historian Richard Rhodes helps place the images in context.

CREDIT: (TOP) U.S. AIR FORCE 1352ND PHOTOGRAPHIC GROUP, LOOKOUT MOUNTAIN STATION; (BOTTOM) PAUL SHAMBROOM