

Scott Kirsch. *Proving Grounds: Project Plowshare and the Unrealized Dream of Nuclear Earthmoving.* New Brunswick: Rutgers University Press, 2005. xi + 257 pp. \$39.95, cloth, ISBN 978-0-8135-3666-8.



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After 1945, the mushroom cloud was a universal iconic image representing the danger of human overreach. Yet for some, it was also a harbinger of progress. Proper management of nuclear power could become a showcase of successful government-science cooperation in the name of human advancement. Scott Kirsch's history of Project Plowshare, the bold efforts by U.S. nuclear scientists in the 1950s and 1960s to create feasible peaceful uses of nuclear explosions, adds a highly instructive chapter to the political history of science in the United States. The author, a geographer by profession, does so through "a study of the rationalities and discourses through which the enterprise of nuclear earthmoving was pursued" (p. 205). Kirsch's broadest conclusion is that Project Plowshare's story of "hubris and failure" (p. 4) demonstrates the political limits to the modern endeavor of turning nature into a mere resource to be tapped and manipulated indefinitely. Experiment and environment could not be merged. Along the way his story contains many more instructive lessons to be learned.

The first and foremost political problem posed by the bomb was the practice of nuclear science itself. As the recent outflow of literature on J. Robert Oppenheimer has recalled, research on nuclear power was never *not* driven by political considerations. Why else could Oppenheimer's doubts about the scientific feasibility of the H-bomb so easily been presented as political disloyalty?[1] Containment in nuclear science, Kirsch reminds us, meant the creation of what historian Peter Hales called "atomic spaces": laboratories like Los Alamos, Hanford, and Oak Ridge, which facilitated the production of privileged knowledge within by limiting the exchange of information with the outside world. From a purely scientific standpoint these limitations made no sense, yet the Atomic Energy Act of 1946 continued to prioritize weapon development and maintained the established military standards of secrecy, despite the creation of a de jure civilian Atomic Energy Commission (AEC) and an advisory committee made up of scientists and engineers. Atomic spaces, Kirsch contends, hence created "a new hybrid of state-military-scientific authority." As a result the "most important boundary to emerge after Hi-

roshima and Nagasaki was not between the scientists and the generals, but rather between the AEC and the world outside" (p. 19). Even the father of the bomb himself, but also rival government agencies and local scientists could become part of this "outside."

The AEC's first attempts at mapping out atomic spaces outside the laboratories proved easy enough. In 1951, an area of 5,000 square miles northwest of Las Vegas was demarcated as the Nevada Test Site. Subsequently, dozens of nuclear tests took place there without much public controversy. Yet by 1957, when Project Plowshare was inaugurated at the AEC Livermore laboratories in California, the medical ramifications of nuclear fallout had become hotly debated. Anxiety and criticism spread particularly after the frightening and spectacular "Bravo" test at the Bikini Atoll in 1954. From that point on, the practice of nuclear testing itself demanded justifications from the AEC that could trump opponents like Nobel prize-winning geneticist Linus Pauling, who demanded termination of all nuclear tests. Convincing the public that the benefits of nuclear testing outweighed the risks, Kirsch maintains, was hence at the heart of Project Plowshare. AEC scientists began to advertise in the popular press the possibilities of using nuclear explosions to dig canals, create harbors, and other ways "to make the best use of nature's gifts," as Edward Teller put it in his 1962 book *Legacy of Hiroshima*.^[2]

Project Chariot, a proposed harbor at Cape Thompson in northwestern Alaska, serves as the book's most elaborate case study in Plowshare's ambitions and failure. The plan was to blast a 100-300-foot-deep, 400-yard-wide, 2000-foot-long channel through three 150-kiloton and two 1.3-megaton explosions (in comparison, the detonation at Hiroshima had an estimated strength of 13-16 kilotons). Hoping for "an early and obvious demonstration" (p. 52) of the possibilities of nuclear earthmoving, the AEC in 1958 went on a public relations blitz, pushing the economic opportuni-

ties as well as environmental harmlessness of the project to Alaskan boosters and scientists. Yet economic viability, which demanded proximity to human activity, and concerns over radiation hazards, which suggested a remote location, proved irreconcilable goals here as elsewhere. Under pressure from scientists at the University of Alaska at Fairbanks, the AEC's Division of Biology and Medicine agreed to fund over forty "preshot" studies on the potential impact of nuclear blasts on the Arctic ecology. When some of these studies suggested severe disruptions of living patterns of the local human and wildlife population, the AEC's discourse of spatial control was put to the test. The announcement to go ahead despite the objections of local scientists led to a prolonged public controversy over the interpretation of data—many of which were unavailable to outside scientists due to classification—until the AEC gave in and Chariot was cancelled in 1962. This retreat from what Edward Teller had called "the engineering standpoint," an archimedic point of superior scientific knowledge going hand in hand with an entitlement to use that knowledge, indicated the limits of authority government science could yield when confronted by dogged local opposition, scientists with claims of authority of their own, and media willing to publicize the controversy.

As it turned out, Plowshare from now on was on the defensive and never recovered, despite ample funding well into the late 1960s. Even the apparently successful Sedan test of July 1962 on AEC home turf in Nevada, which created a massive crater to be awed at by the press, sparked controversy. Radioactive fallout was well beyond predictions, and biologists in Utah discovered high concentrations of the radioiodine I-131 in local dairy products. Entry of this short-lived isotope into the food chain had only recently become a concern for public health scientists. Even the AEC's own Division of Biology and Medicine was kept at bay. It was not until May 1963 that its head Harold Knapp received permission to publish a

report using fallout data kept classified until then. Although Sedan itself did not turn out to be the main culprit (rather the many military tests in the area), the danger of nuclear fallout loomed even larger from that point on.

Paradoxically, it appears that the more resistance Plowshare encountered from the outside, the more ambitious the scientists became. A five-year plan was crafted in 1962 to acquire mastery of all aspects of nuclear excavation, in combination with new institutional partnerships instead of public advertising. The success of the program depended now on the highly ambitious plan to blast a sea-level canal through the Central American isthmus, a project that gained President Johnson's attention in 1964 more because of current political tensions with Panama than because of the scientific progress the Livermore scientists had made so far. Quite the opposite: a subsequent experiment designed to test techniques of trapping nuclear gases underground failed quite miserably. Even from the engineering standpoint, the prospects of nuclear earthmoving dimmed.

In its late stages, Project Plowshare's search for spectacular demonstrations led it to focus even more on the developmental aspects of nuclear engineering. The AEC took interest in participating in the development of domestic infrastructure projects like the proposed canal connecting the Tennessee and Tombigbee rivers or a road construction project through a mountain in Southern California. In both cases it was the hazard of nuclear fallout again that proved beyond the "discourse of control" designed to determine the environmental consequences of nuclear explosions with "an acceptable level of certainty" (p. 179). Yet even more boldly, the AEC still commissioned extensive feasibility studies for the Panamanian canal project. The presence of uncooperative indigenous people however, as well as the humid climate--rain enhances the hazards of fallout considerably--led to the termination of the scheme in its planning stages, as was the case

with a proposed harbor in Australia. By the late 1960s, any practical hope for an impressive blast capable of silencing doubters was gone, and Plowshare largely confined itself to paper projects henceforth.

Proving Grounds can be taken on its own merits as a useful case study of the ambitions, ideology, and limits of science as a tool of government. The author's approach (influenced by Michel Foucault) to examine the exertion of power *through*, rather than simply the ideas *behind* the projects, makes this study more satisfying than a more traditional intellectual history. Even though the author seems to be unaware of it, the book is also part of a larger historiography of U.S. cold war discussions of nuclear power. As historians of American postwar domestic culture have amply demonstrated, nuclear power--whose scientific principles were hard to understand even for educated Americans, while its impacts on the other hand could be imagined vividly--colored a variety of attitudes toward other areas of domestic life. Hence, it was often the search for a proper emotional response to looming danger that expressed itself in assertions, for example, of the value of traditional gender roles in the 1950s, or in popular culture like music, television, or film. [3] Rhetorical containment of the shadowy presence of the atom, and demonstrations of its blessings, could hence be important elements of authority. One of the many fascinating side issues this book covers is the heroic, recklessly optimistic image nuclear science received in popular magazines like *Time* and *Life*. We might hence conclude that vivid optimism as well as a willingness to trust government assertions was as much part of American cold war culture as was anxiety, at least until the early 1960s. Kirsch produces convincing evidence of the prominence of public relations in the planning of Plowshare projects; nuclear explosions may thus be seen as spectacular performances for an audience eager for reassurance.

Yet, Kirsch also shows the marked shortcomings of discourse management. No matter how much praise newspapers could heap on Plowshare projects and no matter how plausible nuclear cratering could appear on the elaborate maps and graphs produced for AEC studies (the author makes excellent use of these), the discourse of "the engineering standpoint" could never convince enough people for one single plan to be realized. When Kirsch hence states "whatever power was realized in the ability to conduct a planetary search for nuclear excavation sites, or by the force of such analysis, it meant little without the power to actually set the project in place" (p. 46), the government technocrats' ability to abstract from local concerns appears very limited indeed. This held true in a larger sense as well. Confronted with the failure of the containment doctrine in Vietnam, by the late 1960s for many Americans, science—as much as the state sponsoring it—began to look more like the problem than the solution. The gap between what was technically feasible and politically acceptable widened instead of closing. In this environment, Plowshare was left with few allies and evaporated into a mere paper project, to be completely eliminated by the late 1970s. *Proving Grounds* provides another example of how the cold war can be used as the context for social and cultural histories of science and the intersection of research with "outside" agendas, in this case political and military concerns. To mention just one poignant illustration of this intersection: One explicit goal of Plowshare experiments was to reduce the highly toxic fission component of thermonuclear explosives, which set off the fusion explosions of hydrogen bombs. This goal of creating "clean explosions" (and hence reducing fallout) was crucial for the military as well as non-military uses of nuclear explosions. In public, the scientists emphasized the nonmilitary character of Plowshare. Yet due to its military applications, the AEC could never fully disclose all details of Plowshare experiments, which certainly hampered its ability to garner institutional support at

home and abroad. In fact, the AEC's insistence on Plowshare proved to be a serious hurdle to the negotiation and consistent interpretation of the Limited Test Ban Treaty of 1963.

On the down side, Kirsch sheds little light on the individual beliefs and motivations of the government scientists involved. We don't really find out what drove them. Throughout, the book analyzes scientific arguments exclusively in terms of discursive positioning, as bound by the framework of "atomic spaces." At times readers have to plow through convoluted prose like the following sentence: "I argue that the success of the Plowshare program in enlisting allies in its projects, but ultimately, its failure to blast new experimental spaces in landscapes outside of the Nevada Test Site, were both characterized by, and through, the contested politics of feasibility and trust" (p. 160). More significant, on the nuts and bolts of decision-making, Kirsch often has to concede ignorance. For example, the book does not say at which point and for what precise reasoning Chariot was cancelled in 1962. Was it due to the public controversy, or because inter-governmental allies withdrew support? This absence is crucial, because it puts into question Kirsch's insistence on the discursive power of nuclear spaces to convince the general population, institutional allies, or indeed anybody but the government scientists themselves. Or, one would like to know if Plowshare scientists harbored genuine concerns about the environmental impact of their experiments in Alaska or elsewhere. The book does not tell. These gaps, of course, might very well be due to lack of archival evidence. In any case, they contribute to an overall bloodless presentation of the human actors involved.

Kirsch's book does not answer the question whether Plowshare was "real science," wishful thinking, or bluff. It rather suggests that all these elements played into each other. The scientists' and engineers' plans effortlessly crisscrossed the lines between the realistic, the ambitious, and the

utterly fantastic; we hence see science as an endeavor driven by many different motivations, yet not all-powerful and leaving openings for effective challenge. It is this emphasis on constraints that makes Kirsch's study stand out among the many books that emphasize the pervasiveness of nuclear discourse. Even though American scientific globalism developed elaborate visions of control and predictability, it had to accept definite limits to its ambitions.[4] In this case, faith could not move mountains after all.

Notes

[1]. See especially Kai Bird and Martin J. Sherwin, *American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer* (New York: Knopf, 2005); and Priscilla J. McMillan, *The Ruin of J. Robert Oppenheimer and the Birth of the Modern Arms Race* (New York: Viking, 2005).

[2]. Edward Teller and Allen Brown, *The Legacy of Hiroshima* (New York: Doubleday, 1962).

[3]. The seminal study of initial American responses to Hiroshima and Nagasaki is Paul S. Boyer, *By the Bomb's Early Light: American Thought and Culture at the Dawn of the Atomic Age* (New York: Pantheon, 1985). Equally important on attitudes toward family life is Elaine Tyler May, *Homeward Bound: American Families in the Cold War Era* (New York: Basic Books, 1988). Among the many studies that emphasize, often overemphasize, the presence of anxieties over nuclear war in popular culture, see Margot A. Henriksen, *Dr. Strangelove's America: Society and Culture in the Atomic Age* (Berkeley: University of California Press, 1997).

[4]. The most elaborate argument for global visions of scientific control sparked by cold war science is Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, Mass.: MIT Press, 1996).

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