The method, an inquiry submission form, and scenarios describing open-ended problem situations are available on our website, http://onlineethics.org/helpline. Although many advantages of the method can be realized only by having the discussions within departments, the Online Ethics Center could use the given scenarios, or others that users submit, to discuss a problem-of-the-month in an open, moderated Web forum.

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Book Review on Fire

Peter Zimmerman's review of Lynn Eden's book *Whole World on Fire: Organizations, Knowledge, and Nuclear Weapons Devastation* (PHYSICS TODAY, April 2005, page 62) strikes me as throwing the baby out with the bath water. Zimmerman appears to condemn the book's real message about organizational dysfunction because he dislikes "her and [Theodore] Postol's diatribe against the atomic establishment," which he has labeled "her conspiracy theory." My reading says that Eden provided useful and verifiable history about portions of the development of US strategic targeting procedures.

If there had been a conspiracy within the Department of Defense (DOD) to exclude fire damage from the development of US targeting plans and procedures, I would have had a role in it. There was no conspiracy. What are my credentials for making that declaration? My career in nuclear weapons effects research testing and analysis began in 1951, when I was present at Operation Buster/Jangle at the Nevada Test Site, and continues to the present. Until 1974 I was responsible for planning several DOD nuclear tests. I still consult for the Defense Threat Reduction Agency on matters related to the nuclear effects database compiled by that agency during the entire nuclear testing period that ended in 1992.

My recent review of the 1946 reports of the US Strategic Bombing Survey and my personal involvement with nuclear weapons effects are consistent with what Eden has described. In fact, the survey team's extensive documentation in 1946 was soon put on the back burner by DOD scientists and engineers. The researchers at first used analyses of Japanese building responses to infer the weapon yields. Their analyses also suggested a simplified model for calculating a critical building-element response—a model that is still used in target damage assessment. However, when the Atomic Energy Commission (AEC) began atmospheric nuclear testing in 1948, DOD engineers quickly attached themselves to those tests.

Although we had experiments on thermal ignition and so forth, they were separated to avoid unwanted synergy in systems response. In addition, most structure-response test items were theoretical analysis models, not models of Japanese buildings. Consequently, as the Japanese structural-response database was replaced for US test planners by the sterile-structures tests at the Nevada and Pacific Proving Ground test sites, a unique feature of the Japanese data—the fire damage—faded in importance.

In reading Eden's book and recalling my own experience during those years, I can visualize how our nuclear weapons effects community lapsed into a sort of "group-think" programmatic decision-making process. We could not demand that the AEC test at a rate that would satisfy requirements for good scientific method for instrumentation development, for preliminary scale-model tests, and for thorough analysis of test data before conducting the next test. The DOD engineers were not in sufficient control of their test beds and the timing of events, nor did they have enough time between tests to understand the data.

Conspiracy? Absolutely not. A historically relevant story from which to learn and move on? Yes! And, move on we did.

The real value of Eden's book is in her thesis that entrenched organizational thinking can lead to unwanted results or ignore important factors, and in her suggestions about change. Zimmerman seems intent on finding inconsistencies in engineering and scientific details about the fire damage in Japan and in targeting in general. Certainly, fire damage was devastating in Japan. I started reading Eden's book because I wanted to know what she had written about that, since I was actively reviewing the data. I soon found that her real message was more important and wasn't just a criticism of military

planners for not incorporating fires in target damage predictions.

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Because Peter Zimmerman has an impressive record of publications and achievements, his words carry considerable weight, and so his characterization of Lynn Eden's work and objectives will not be ignored.

I cannot pose as a disinterested bystander, since Eden makes liberal use of my work, but I do wish to establish my support for what I view as a thoroughly documented and carefully researched book.

Many academics suspect that science done under military sponsorship is less than pure, and I encountered that thinking in my early dealings with Eden. But to her credit, she listened to my explanations, studied my work with care, and went on to research her subject extensively over many years. Her characterization of the government's efforts to deal—or not deal—with fire from nuclear weapons is more complete than any other source I am aware of. For that alone her book deserves careful reading and a place on library shelves.

Zimmerman's description of weapons of different yields as radiation, blast, or thermal weapons is an oversimplification if not misleading. Even subkiloton weapons carry an impressive blast wallop and create an intense but brief thermal pulse. Megaton weapons also generate vast amounts of nuclear radiation and an impressive blast wave as well as a long if less intense thermal pulse.

Eden's example of a burst at 1500 feet over the Pentagon is not so unreasonable as Zimmerman asserts. It would indeed put about 10 atmospheres or 140 psi on the Pentagon, which has multiple levels below ground that house vital functions. That yield and burst height would go a long way toward collapsing and blowing away the entire structure. At the same time, the blast and the thermal radiation across the rest of Washington, DC, would be devastating, even if a higher burst height might cause damage to urban structures and civil facilities over a larger area.

Zimmerman gives the impression that blast does not lead to fires, that only thermal ignitions do. Of course that is not the case. There is ample evidence that disruption fires, which are caused by blast interference with flammable or ignitable systems, are inevitable in any city bombing. The British learned this the hard way in early World War II, when the Germans bombed their cities and the damage was spread by fires; damage from spreading fires could be far greater than the direct damage from high-explosive bombs.

A recent review of the damage done at Hiroshima and Nagasaki confirmed the prevalence of fire damage. In several instances the authors of the US Strategic Bombing Survey reports on the atomic bombings expressed annoyance that fire damage hindered their assessment of blast damage to structures. It is clear that the survey instructions were to correlate and quantify the blast damage from the bombs. The reports, however, did document in detail the damage done by fire, and that damage is in agreement with the modern predictions Eden frequently mentions.

The early analysts who planned the use of atom bombs faced many difficulties and uncertainties. Largely because of the emphasis on physical or blast damage, I spent the first few decades of my professional life defining and refining our understanding of the blast from nuclear explosions.

I believe Eden is correct in pointing out that, had the same effort to understand blast damage been applied earlier to fire damage, the initial attempts to plan targeting for atom bombs might have been different.

In her book, Eden seems to have grasped many of the factors that influenced or guided the evolution of the US planning doctrine and the computational tools that dictated the use of what grew to be a vastly expensive and potentially devastating nuclear force. She alludes to the fact that civil engineers with experience in structural dynamics played important roles in the early development of the targeting methodology, but that no comparable experts in fire damage were included. Intentional? The result of a conspiracy? I doubt it. I would like to think that I was too much a part of the process to have missed a conspiracy.

Eden has acknowledged the progression toward more comprehensive planning for the use of nuclear weapons, and in the process has highlighted several important aspects of the functioning and potentials for failure in organizations, bureaucracies, and large-scale systems. Her account contains many useful lessons, even if one discounts the importance of fire damage in nuclear planning.

I reviewed with care Eden's use of my material, so I feel qualified to assert that she has produced a carefully and fully researched and referenced work whose findings, although arguable, are difficult to refute.

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In his review of my book, Peter Zimmerman has made some egregious errors. He says that I discuss the detonation of a 100-kiloton bomb at ground level at the Pentagon and criticizes me for choosing a ground burst. In fact I discuss the detonation of a 300-kiloton bomb 1500 feet above the Pentagon. He then says I compare the resulting damage with a 10-kiloton bomb. I do not. Despite Zimmerman's claims to the contrary, I carefully discuss the relative damage done by blast and fire at Hiroshima (15 kilotons) and Nagasaki (21 kilotons), and in chapter four I present a table showing in detail blast damage by distance to various structures for both cities.

I do not argue, as Zimmerman says, that fire damage has not been incorporated into US nuclear targeting calculations because of "some conspiracy to deny the truth." On the contrary, I argue vigorously against a notion that organizational interests—which, full-blown, could be understood as conspiracy—explain why fire damage has been ignored.

Zimmerman compliments me when I depart from what he has divined as my "conspiracy theory" to ask how a new mode of thinking gradually replaced entrenched patterns of thought. He laments that it's too bad I did not expand on that question. But the entire book is about entrenched organizational ways of thinking and doing and the possibilities for organizational change. I wrote a careful scholarly book. He has written a polemic.

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Zimmerman replies: Let me first apologize to Lynn Eden for misstating the yields and burst heights of the nuclear weapons she compares in her first chapter. I had computed