Book Review

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The Neutron's Long Shadow

Martin Miller

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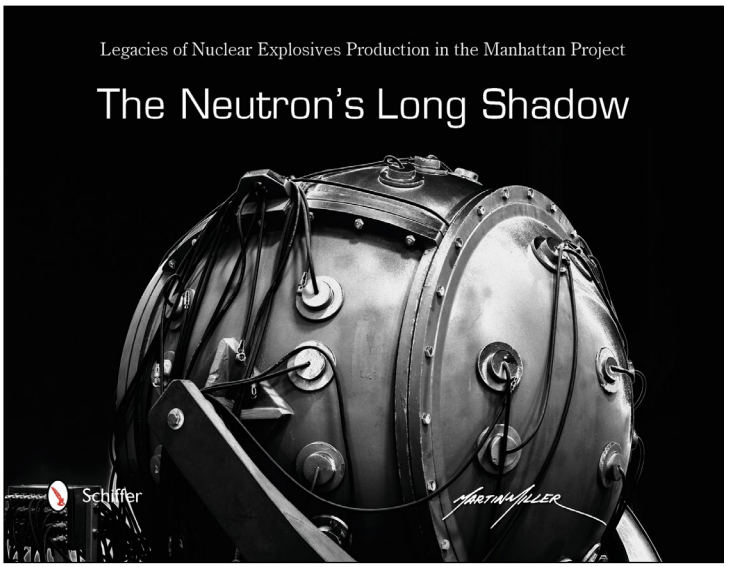

I have always admired books that support the technical material that is learned in the classroom. These are the biographies of the scientists and engineers in our fields, the histories of their great scientific discoveries, and now becoming more numerous are the histories of the technical advances made in the 20th century. Among them, perhaps leading the way in some respects, are the histories of the atomic bomb-making apparatus of the United States. Some have even been reviewed in this column—*Longing for the Bomb: Oak Ridge and Atomic Nostalgia* (University of North Carolina Press, 2015) being one of the better known of this type.

In *The Neutron's Long Shadow*, whose title references the eternal legacy of bomb-making materials granted us by virtue of the efforts at Hanford, Washington, and Oak Ridge, Tennessee, Martin Miller takes readers on a photographic journey of both facilities using U.S. Department of Energy (DoE) archival photos and his own photographic expertise. The result is impressive if not beautiful, striking if not glorious—for how can bolts, steel, and concrete designed to be functional be anything but raw engineering? Ah, but that is not the point.

Industrial photography may be viewed as the poor stepsister of artistic (or all other) photography. But, beauty can indeed be said to be in the eye of the beholder. Photos of factories, laboratories, and otherwise arcane buildings of little architectural value will be admired by those with a special interest in them. And there, quite simply, is the worth of Miller's long, hard work. For those of us who still wonder at the achievements of atomic physics that resulted in the bomb, we can now wander through *The Neutron's Long Shadow* in the comfort of our armchairs without breaking a sweat in the hot Nevada or Tennessee sun, traversing the many miles needed to see the facilities in which humankind isolated the fissile materials that brought a world war to its end.

Having been employed at the DOE for several years back in the late 1980s, I came onto the scene far too late to have fully appreciated this undertaking. My classroom training in health physics and the rather superfluous reading I had done about the building of the bombs left the Nevada test site, Hanford, Oak Ridge, Savannah River, and other historical sites as unfelt, unseen mysteries—unfathomable in their scope of effort, output, and enormity of engineering. Their descriptions only hinted at the greatness of the achievements and the heroism and dedication of the men and women who labored at them. But most importantly, unless one put in some effort to correct their invisibility and mystery, these sites were just names, void of mass, size, or volume. Miller has changed that—at least for two of these temples to the bomb.

While in government service in those days, I could not help notice that the architecture, office furnishings, and laboratory equipment—even the font on the facility signs and letterheads—spoke to the decades that predated my entry on the scene. The place had a tacit sense of heritage. Government scientists protect their equipment: their legacies often remain on daily display, if not still in operation. The wooden chairs that you worked in or the glass-topped conference room tables that you debated at also remained from previous times, subtly reminding you that you are but one link in a long chain of predecessors. You could sense the antiquity of the place by the enameled green paint on the equipment

controls, the exposed nuts and bolts that held a test chamber together, or just the oddly colored linoleum floor that was periodically waxed to a polish that betrayed its age by its imperfect sheen. The place had a feel to it. Miller's photographs—as stark and unbeautiful as they may appear—evoke such memories. He achieved a goal beyond mere visual recording of historic facts.

This book has three main components. The first is a text of some 78 pages written by Miller, explaining the overall atomic bomb effort and in particular the contributions made at Hanford and Oak Ridge. The second component is intertwined with the first. These are the DOE archival photographs that support the text. All of them are high-quality black-and-white images that put reality to the history. Some are quite impressive, particularly the panoramic images of Hanford that show its immense expanse. The final component is a gallery of Miller's more recent photographs—92 high-resolution images comprising about 110 pages of the book. Here, Miller captures the facilities that have been, are being, or will soon be demolished as remediation work progresses at both sites: history literally disappearing before our eyes. His photographs are also black and white, and much like a cinematic experience from before the late 1960s, this choice is deliberate, adding a patina of age to the images and damping the distraction color might bring to them. One can speculate, for example, that the big blue sky out at Hanford might dominate a panoramic of the site and detract from photographer's true aim: to impress upon the viewer the size and emptiness of the reservation.

And indeed, expansiveness is conveyed. The Hanford and Oak Ridge complexes are sprawling. From the perspective of the 21st century, this is all the more impressive. Without being there to witness it, it is simply incredible to contemplate how buildings such as the K-25 gaseous diffusion plant (Oak Ridge) were conceived and executed. The labor alone, we are told, involved nearly 20,000 workers. Even that number seems to be not enough to construct such a massive building. Miller was not shy in obtaining his photographs. Where he was allowed to shoot (permissions were de rigueur), he did so with pleasure—getting in close or, by stepping back, framing a facility with its associated landscape, thus putting the viewer at the front door or in the neighborhood as was his whim.

Perhaps equally striking, but in terms of the history of technology, are the interior photos (both from the DOE archives and by Miller) of the many buildings, reactors, and support facilities at both complexes. In the close-ups, one can recognize many familiar components that have survived into the digital age, and much more that hasn't. It was totally an analog environment populated by strip charts and galvanometer-type readouts. One can feel the grittiness of the technology: screws and bolts hold together towering metal control panels crowded with mechanical switches and rheostat-like knobs. The government-issued wooden chairs, so out of context with all the metal, toggles, and push-buttons, are common foreground accoutrements.

The book is constructed beautifully—a tribute to both author and publisher. Layout, headers, fonts, and paper weight were well considered, resulting in a look that is befitting of both its industrial subject matter and its historical intent. The text is concise and informative. Facts prevail, with the occasional musing by the author on controversial issues. Miller explains the bomb-making process in four chapters that cover enriched uranium production, plutonium production, overcoming production difficulties, and postwar turmoil over use of the bomb. There are helpful process diagrams, Hanford and Oak Ridge site maps, and photographs of notables such as Lieutenant General Leslie Groves and Robert Oppenheimer, among others. Even the captions convey interesting information—no space was wasted in this telling of atomic bomb history. Endnotes and a chronology of atomic bomb-making events are appended. In perhaps his most poignant statement, Miller reminds us that the creation of the bomb may never be surpassed as an example of humankind's boundless creativity and the terrors that accompany such ingenuity.

In a final assessment of the Manhattan Project, Miller notes that the neutron, the soul of the fission process, does indeed cast a long shadow. In 16,000 years, assuming it is not used, nearly 99.90 percent of the U-235 and about 66 percent of the plutonium produced will still exist. After several hundred years more, there will still be enough plutonium to make another Fat Man bomb. The enriched uranium needed to build a Little Boy bomb will be present for 10 billion years—longer than the estimated habitability of planet Earth. And here we see that atomic-technological history has a bidirectional reach. As we look back in time through Miller's photographs, we must always remember that what they portray—no matter how anachronistic—reaches deeply and ominously into humankind's immeasurable future.

This book review ends a productive association with Patricia Sullivan, managing editor of the Journal of Nuclear Materials Management, who is moving on to other challenging prospects. As every published writer knows, a good editor who works with you is essential. Patricia has indeed been indispensable and is likely to succeed anywhere she goes. This writer wishes her well.