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Terrors and Marvels: How Science and Technology Changed the Character and Outcome of World War II

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The epilogue also examines disappointments, including the observation that “the Pentagon still lacks a vision of its needs for Joint officers and how to prepare and reward them.”

Locher is a graduate of West Point and the Harvard Business School. He was a leading Goldwater-Nichols strategist on the staff of the Senate Committee on Armed Services. He is the authority on the detailed political pulls and tugs that brought Goldwater-Nichols into existence. While Locher strives for a balanced analysis, his commitment to the Joint Chiefs of Staff reform and his own key role in that process result in a more detailed examination of the proponents’ view while giving less detail to the arguments of the opponents. Some of the opponents he classifies as excessively parochial, while others are characterized as ignoring obvious system flaws.

Goldwater-Nichols has had an unquestioned major effect on the Joint Staff process and on officer education. It is and will be for many years, the subject of intensive debate and analysis.

Locher’s book will be an important reference in this debate (and in turn, his article “Has It Worked? The Goldwater-Nichols Reorganization Act,” in the Autumn 2001 issue of this journal, is a good introduction to it). I strongly recommend that anyone interested or involved in the national security process read this book. It describes democracy at work and just how hard that process can be.

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Shachtman, Tom. *Terrors and Marvels: How Science and Technology Changed the Character and Outcome of World War II*. New York: William Morrow, 2002. 360pp. \$26.95

Tom Schachtman’s brief history of the influence of science and technology on World War II needs less “gee whiz” and more John McPhee. As in the war itself, the author’s strategic decisions are critical to the book’s successes and failures.

The successes can be quickly acknowledged. The book is well written.

Shachtman shows a good familiarity with the oral histories and memoirs of the most prominent scientists. He is interesting when identifying personalities and providing biographical material to enliven the narrative. He also correctly treats most of the significant scientific-technical developments of the war: the exploitation of the electromagnetic spectrum for command and control, navigation, and target acquisition; guidance systems for such ordnance as acoustic torpedoes and proximity-fused shells; nuclear weapons; signals intelligence; jet propulsion; and chemical and biological warfare.

Now I’ll drop the other cyclotron. *Terrors and Marvels* does too little with too much, and it suffers from Shachtman’s attempt to be international and chronological. Except for the fact that somehow the Allies “did better science” than the Axis (all those refugees from Nazism certainly helped), the author offers little explanation of how all these Allied wonder weapons, crypto dominance, and radar-sonar devices came about. If Shachtman had written separate chapters on his prize weapons, one would be far the wiser about the scientific and

political dimensions of technological innovation. He is blissfully ignorant of a decade of writing about the process of military-technical innovation in the twentieth century. The book has no compelling theme or interpretive core. Although this reviewer usually grimaces when graduate students invoke such deities as Thomas S. Kuhn and Michel Foucault, this book would have benefited from more theoretical structure.

Terrors and Marvels might also have profited from more attention to innovations that did not involve the gallant struggles of Nobel laureates in physics and chemistry to convince knowing politicians and generals to adopt their latest schemes to win the war. Storytelling conquers all. From the perspective of military logisticians and commanders, innovations in food processing, materials research, automotive engineering, computer technology, synthetics, and chemical explosives were war winners too. Schachtman gives them all short shrift. His discussion on preventive medicine and the treatment of combat trauma wounds is particularly limited, given the rich multi-volume official histories of the U.S. armed forces medical establishments in World War II.

Part of Schachtman's difficulty is that he really does not know much about World War II, apparently alternating carelessly between the books of Martin Gilbert and Richard Overy—who, of course, are blameless for his series of gaffes. A few samples should suffice: Ishii Shiro's final rank was lieutenant general, not major (p. 318); Iwo Jima was prized as a fighter base and emergency landing site, not a B-29 base (p. 298); Japanese troops did not land on Bataan in December 1941, and they did

not seize "American garrisons at Shanghai and Tientsin," since the 4th Marines and 15th Infantry had already departed (p. 166); the 17 August 1943 Eighth Air Force raid on "Schweinefurt" [*sic*] was made by 230 B-17s, not 376, and German flak accounted for only six bombers from the 1st Bombardment Wing, which lost thirty B-17s to German fighters. In fact, the entire first paragraph of chapter 7 is riddled with fiction. The sparse account of Allied military medicine ignores a central fact and accomplishment—wounded survival rates were important but not as important as the number of American wounded who returned to a duty status of some sort. The number of wounded combatants who lived to fight another day is dramatized in the story of Company E, 506th Parachute Infantry Regiment, immortalized in word and videotape by historian Stephen Ambrose. Another slip is Shachtman's sketchy account of the role of operations research and analysis mathematics; it ignores a massive literature on operations research in air warfare, logistics, and antisubmarine warfare—a literature that Shachtman apparently does not know.

In sum, a single volume on the influence of scientific and technological innovation on World War II would be welcome. *Terrors and Marvels* is not that book.

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Norris, Robert S. *Racing for the Bomb: General Leslie Groves, the Manhattan Project's Indispensable Man*. South Royalton, Vt.: Steerforth Press, 2002. 722pp. \$40