

2022

## Innovating Victory: Naval Technology in Three Wars

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### Recommended Citation

Demy, Timothy J.; O'Hara, Vincent P.; and Heinz, Leonard R. (2022) "Innovating Victory: Naval Technology in Three Wars," *Naval War College Review*: Vol. 75: No. 3, Article 10.

Available at: <https://digital-commons.usnwc.edu/nwc-review/vol75/iss3/10>

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*Innovating Victory: Naval Technology in Three Wars*, by Vincent P. O'Hara and Leonard R. Heinz. Annapolis, MD: Naval Institute Press, 2022. 336 pages. \$36.95.

Many aspects of warfare may remain the same through the centuries, but the weapons of war do not. Weapons developed, tested, and used in one conflict become standard arms in subsequent wars. Today's experimental weapon may become tomorrow's weapon of choice. For navies, new technologies become part of doctrine, practices, and platforms.

The authors of *Innovating Victory* study six emerging technologies in naval conflict during three wars of the twentieth century: the Russo-Japanese War, World War I, and World War II. They provide a macroperspective on mines, torpedoes, radio, radar, submarines, and aircraft; after an introduction and an opening chapter titled "Use, Doctrine, Innovation," one chapter is devoted to each of these technologies. Each such chapter is structured similarly, presenting to readers information on and discussion of the discovery, evolution, and exploitation of the technology. In the course of doing so, the authors tell how these "six technologies facilitated and frustrated navies in their pursuit of victory" (p. 5).

In the introduction, readers are reminded that in the twentieth century there were four waves of technological change for navies, three of them climaxing in one war—World War II. The first wave began in the mid-nineteenth century with the shift from sail to coal-fired steam engines, and included the development of armor, the improvement of guns and mines, the rise of torpedoes, and the introduction of radio. The second wave, from 1905

to 1918, brought to naval warfare submarines and aircraft. The third wave was made up of radar and sonar, which "revolutionized the collection and use of information, and saw the introduction of practical guided weapons" (p. 2). The fourth and final wave is still ongoing. It began with the splitting of the atom and includes satellites, drones, computers and data networks, artificial intelligence, and weapons that employ magnetic and directed energy. (This fourth wave is worthy of its own volume.)

The first chapter reminds readers how quickly naval technologies changed during the twentieth century. Some of the ships of the British and German navies that fought at the Battle of Jutland in 1916 were twice as large as the battleships that had fought ten years earlier at the Battle of Tsushima, and they fired shells that were twice as heavy at twice the range. Within three decades, junior officers who had fought at Jutland, now senior officers, might have used radar and guided weapons in World War II. Not only is technological development fast moving, but it does not follow a specific trajectory that permits rapid establishment of doctrine regarding its use. Further, technological advantages in warfare rarely endure, and not all naval technologies developed are successful when employed.

Mines are the subject of the second chapter. Mines as a naval weapon came to maturity during the Russo-Japanese War, and by the war's end all major navies had begun to study the conflict for lessons about this and other new technologies with an eye to future wars. Properly used, mines can be highly effective, yet the authors contend that even though mine warfare is a core naval capability, navies do not prioritize

it, in part because it is not a compelling technology with an emotional component that will “command the imagination like aircraft carriers and nuclear submarines do” (p. 50). This lack hinders advocacy of the technology.

The third chapter’s study of torpedoes shows that the maturation of torpedo warfare was slow and sporadic. After the Russo-Japanese War there was debate regarding the future role of torpedoes, because of their negligible effects in that war, but by the eve of World War I the range, speed, and warhead weight of torpedoes had increased—with deadly consequences. The British, Germans, and Americans all faced difficulties with sea-launched torpedoes, and early in the war the Americans’ air-dropped torpedoes had a staggering failure rate. For U.S. torpedoes, a reliable magnetic exploder did not appear until 1943, but after that the results were impressive. The authors contend that, more than for any other technology, torpedo development “shows that the combination of the right platform and the right target transforms a technology of marginal application into one with war-winning potential” (pp. 77–78). They continue this argument in the sixth and seventh chapters, dealing respectively with the development of submarines and aircraft.

Chapters 4 and 5 (radio and radar, respectively) provide summaries that for this reviewer were the most informative and show the exponential effects of combining technologies in warfare. Both technologies are constructed to use the electromagnetic spectrum, but with different core purposes. For radio, it is communication; for radar, detection. The Italian navy began testing shore-to-ship radio in 1897, and the British navy did so in 1899. Radio systems that competed

with Marconi’s invention soon arose, with other navies favoring them. By the time of the Russo-Japanese War, radio’s naval utility had been proved, and the technology continued to improve. The interwar years saw the initial development of radar and its varied use by belligerent nations, and World War II saw its maturation as an effective naval weapon.

The final two chapters, dealing with submarines and airplanes, likely will cover ground more familiar to most readers, and the authors present very good overviews of these technologies as naval weapons. The concluding chapter provides a synthesis of the lessons learned from the six weapons studies.

The volume has numerous photographs and charts that enhance the study, as well as an extensive bibliography. Equally weighted chapters provide balance to the book and ensure it is readable to generalists yet informative and thought provoking for all; it is filled with historical examples, well written, and engaging.

TIMOTHY J. DEMY



*Military Virtues*, ed. Michael Skerker, David Whetham, and Don Carrick. Havant, U.K.: Howgate, 2019. 410 pages. \$39.99.

The opening line of *Military Virtues* captures the attention of the reader with the provocative teaser: “What does Aristotle have to teach a fighter pilot?” (p. xxv). In response to the question, editors Michael Skerker, David Whetham, and Don Carrick integrate articles by thirty-eight warfighters, professors, and chaplains into one book, combining both theory and practice into a cohesive exploration of moral virtues for the profession of arms. Each of the fourteen segments on