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Timothy S. Wolters, *Information at Sea: Shipboard Command and Control in the U.S. Navy, from Mobile Bay to Okinawa*. Baltimore: Johns Hopkins Univ. Press, 2013. Pp. xii, 317. ISBN 978–1–4214–1026–5.

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Timothy Wolters (Iowa State Univ.), a captain in the US Naval Reserve, has crafted an outstanding history of the US Navy from the Civil War through the Second World War, highlighting the ingenuity of the officer corps. *Information at Sea* has four particular strengths. First, it reveals the connective tissues and nervous system of shipboard command and control across an eighty-year period through extensive and pioneering archival research. Second, its well written chronicle of technological investigation, adaptation, innovation, and combat applications will appeal to experts and general readers alike. Third, it seamlessly interweaves bureaucratic decision-making with matters of laboratory research and development, field experimentation, adjustments in training and education, and the new command and control systems; Wolters explains how, why, and to what effect the Navy made changes to improve its combat efficiency. Fourth, the book challenges the longstanding notion that entrenched naval conservatism time and again retarded innovation. Wolters makes abundantly clear that, on the contrary, the Navy regularly listened, learned, and made intelligent decisions about integrating new communications and detection systems.

In recent years, many historians of the US Navy have shifted their attention from writing battle narratives and biographies of naval heroes to what have been dubbed "revolutions in military affairs."[1] Stimulating this change were the Pentagon sponsored investigations by military historians Allan R. Millett and Williamson Murray in the 1980s and 90s.[2] While Millett and Murray focused on the interwar period (1918–39), Wolters applies their findings over a longer time frame. Though his book will not have the popular appeal of Paul Kennedy's more broadly conceived *Engineers of Victory*,[3] Wolters echoes many of its themes, unveils new dimensions of the Pacific War, and discerns the longer trends of innovation during that epochal war.

The author begins by showing how the *Virginius* Incident (1873) exposed the inability of a weak US Navy to protect American lives, in this case, during a crisis over Spanish Cuba. Once the emergency abated, the Navy took advantage of the rare concentration of its warships along the eastern seaboard to conduct genuine fleet-scale exercises designed to ensure readiness for potential future conflicts with European powers. The *Virginius* crisis underscored old problems in ship-to-ship communication. Adm. David Glasgow Farragut had notably experienced these at the Battle of Mobile Bay (1864). After the Civil War, Farragut and his peers were keenly eager to improve signaling between warships amid the din of battle. New procedures appeared in 1867, and the Navy created a Signal Office in 1869. Wolters credits the US Army with providing instruction early on for naval personnel at its signal school and expediting procurement of cipher discs and other essential materials. This fine example of interservice collaboration allowed the Navy to rapidly expand its signal service and, thereby, the efficiency of its fleet.

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1. See, e.g., John T. Kuehn, *Agents of Innovation: The General Board and the Design of the Fleet That Defeated the Japanese Navy* (Annapolis: Naval Inst Pr, 2008); Thomas C. Hone and Trent Hone, *Battle Line: The U.S. Navy, 1919–1939* (Annapolis: Naval Inst Pr, 2006); Craig C. Felker, *Testing American Sea Power: U.S. Navy Strategic Exercises, 1923–1940* (College Station: Texas A&M U Pr, 2007); and Thomas G. Mahnken, *Uncovering Ways of War: U.S. Intelligence and Foreign Military Innovation, 1918–1941* (Ithaca: Cornell U Pr, 2002).

2. They co-authored *Military Innovation in the Interwar Period* (NY: Cambridge U Pr, 1996) and *A War to Be Won: Fighting the Second World War* (Cambridge: Harvard U Pr, 2000), and co-edited *Military Effectiveness*, 3 vols. (NY: Cambridge U Pr, 1988; 2nd ed. 2010).

3. Subtitle: *The Problem Solvers Who Turned the Tide in the Second World War* (NY: Random House, 2013).

The confrontations with Spain in the 1870s and 1890s (not considered are tensions between the United States, Britain, and Germany over Samoa in 1889, and with Chile in 1891–92) spurred peacetime innovations in the Navy. The frequency of crises in the late nineteenth century led American naval officers to constantly increase the war readiness of the fleet. The Navy lacked modern warships at a time when industrial development was making possible rapid improvements in firepower, armor, and propulsion; it also suffered from tactical and technical deficiencies. In particular, revamped communication systems were badly needed to facilitate squadron maneuvers and concentrate the fighting power of the fleet.

Some readers will be surprised that Wolters entirely omits to discuss the influence of strategist Alfred Thayer Mahan, who gets only a passing mention in his conclusion. This refreshing and quite defensible exclusion permits the author to avoid the mistake (made in many general accounts) of over-reliance on the thought of a single theorist, however brilliant.[4]

The growth of the US fleet in the New Steel and Dreadnought eras (1880s–1920s), Wolters asserts, required new means to coordinate its increasingly complex operations. Drawing astutely on archival sources, he identifies which organizations and officers concerned themselves with research, development, and experimentation in laboratories and at sea to improve command and control. Naval officers also conducted experiments privately, wrote scholarly studies, sought greater institutional support, and worked with civilian inventors like Martha J. Coston, an entrepreneurial designer of signal flares.

In a fascinating analysis of the pistol-flare signaling proposal of Lt. Edward W. Very in 1874, Wolters argues that the Navy's unwillingness to implement at once this seemingly superior method of shipboard communication was the result not of the mindless conservatism of ossified bureaucracies, but rather of a calculated gamble that funding additional research in an as yet immature but promising technology would pay greater dividends in the future. Six years later, the Navy adopted a much improved version of Very's design.

Unlike influential accounts that depend chiefly on memoirs or stress contentious relationships between innovators and naval authorities,[5] Wolters uses extensive research in Navy archival records to prove that naval officials methodically assessed and embraced new technologies (e.g., the wireless radio) and accurately anticipated their effects on warfare at sea. The Signal Office, Bureau of Navigation, and Bureau of Equipment prioritized experimentation and were averse to acquiring emerging systems, especially when existing equipment worked adequately or could be upgraded with minimal effort. The Navy preferred, moreover, that private industry fund research and development for many command and control technologies, in order to channel its own financial resources into select areas. Accordingly, the Navy obtained many new commercially available technologies on a trial basis to test them for reliability and functionality before contemplating fleet-wide adoption. It also established new research and advisory organizations such as the Naval Radio Telegraphic Laboratory and Naval Consulting Board. It encouraged the education, training, promotion, and retention of specialists in communications and allied fields, and evaluated the potential of new technologies to help decentralize decision-making at sea.

In the face of troubling international conditions like the Sino-Japanese War of the late 1930s, or in fear of being outdone by other nations based on information gleaned by naval attachés and wireless specialists in foreign markets, the Navy moved quickly to develop and field its own designs. It also acted to overcome export restrictions or other barriers and repeatedly followed the recommendations of expert officers assigned to laboratories, research programs, investigative boards, and special missions.[6] Evidence of a progressive Navy was clear in regular procedural changes like the adoption of Capt. Foxhall A. Parker's

4. For good surveys of naval history that elucidate the sway of Mahan's theories, see Kenneth J. Hagan, *This People's Navy: The Making of American Sea Power* (NY: Free Press, 1991), and George Baer, *One Hundred Years of Sea Power: The U.S. Navy, 1890–1990* (Stanford: Stanford U Pr, 1993).

5. Wolters specifies Susan J. Douglas, "Technological Innovation and Organizational Change: The Navy's Adoption of Radio, 1899–1910," in *Military Enterprise and Technological Change: New Perspectives on the American Experience*, ed. Merritt Roe Smith (Cambridge: MIT Pr, 1985) 117–73, and Jerry Strahan, *Andrew Jackson Higgins and the Boats That Won World War II* (Baton Rouge: LSU Pr, 1998).

6. E.g., the European mission of Stanford C. Hooper, sometimes called the "Father of Naval Radio," in 1914–15.

improved signals book for steam-era tactics. Wolters's investigation of the budgetary, legal, and technical aspects of the Navy's acquisition of wireless technologies illustrates the complex reasoning behind the adoption of wireless. All this proves that the Navy, far from being wedded to sail-era technology in the era of steam, often acted boldly and with keen foresight, unfettered by "individual and institutional conservatism" (44).

Information at Sea clarifies the new, multifaceted relations between the military and industry, but exaggerates the Navy's fear of predatory private-sector recruitment from its ranks. The Navy certainly did implement special measures to retain its newly trained radiomen, but also itself tapped the expertise of private industry and former sailors. Thus, in 1939, the Naval Research Laboratory fielded a 200-MHz radar of its own design that outperformed the model produced by Navy contractor RCA (180). This despite any "loss" of naval personnel to civilian firms.

The other service branches had similarly beneficial interactions with civilian entrepreneurs and industry. For example, the US Army Air Corps in World War II profited from the time James H. "Jimmy" Doolittle had earlier spent studying aeronautics at the Massachusetts Institute of Technology, participating in high performance air racing, and working with the Shell Oil Corporation. The Navy and its service counterparts of the early twentieth century were as dependent on defense contractors as today's military, especially in wartime. Wolters notes, for example, that "In 1940 the Naval Research Laboratory was still the nation's leader in radar development, but it was not a manufacturer and could never bring to bear the resources available in private industry. As such, the bureau sought to establish a highly collaborative relationship with RCA and Western Electric, the two firms that had bid on the initial XAF [radar] contract. It also persuaded General Electric to enter the field" (183).

The book culminates with the naval battles in the Pacific during World War II. Wolters describes how the Combat Information Center (CIC) strengthened the Navy's ability to counter Japanese air attacks on its vessels. After solving the nettlesome problem of ensuring "accurate, timely, and secure" transmission of information between ships and shore establishments (134), the Navy concentrated on using radar to coordinate fleet actions. The new position of Fighter Director was designed to manage the fleet's aerial defenses and the CIC rapidly became its "brain" (188). Fighter Director officers regularly vectored aircraft to intercept Japanese airplanes. Their situational awareness and authority to launch aircraft made them as vitally important as the ship's captain. Wolters's discussion of increasing CIC autonomy reveals how the Navy actually fought its enemy at such battles as the Coral Sea, Midway, the Philippine Sea, and Okinawa. There are only passing allusions to the CIC's critical role in amphibious and antisubmarine operations in this primarily naval aviation-centered study of the war (221).

In this superbly written and researched book—each chapter features hundreds of endnotes, many of them citing unpublished or neglected sources—Wolters's judicious appraisal of the Navy's actions and decisions persuasively replaces the myth of a tradition-bound officer corps with a well documented picture of an adaptable and innovative naval service working intelligently to wage war more effectively. Though the book is chiefly concerned with command and control initiatives, its arguments could also be applied in future studies to other arenas (ordnance, amphibious warfare, etc.), likely with very similar results. For all these reasons, *Information at Sea* should stand as a landmark work of military history.