

**Timothy S. Wolters. *Information at Sea: Shipboard Command and Control in the U.S. Navy, From Mobile Bay to Okinawa*. Baltimore, MD: The Johns Hopkins University Press, 2013. Notes. Index. 317pp. ISBN 978-1421410265 (Hardback). Price £35.00.**

The warship constitutes the fundamental building block of naval power and in the machine age it represented the technologically most complex creation the nation-state could muster. Naval warfare might be technology-intensive, but men operate ships and equipment and the quality of training and ability to successfully interact with the machines under their charge are defining features of successful navies. The ability of a warship to fulfil its role is very much dependent on having good situational awareness and the capacity to communicate and coordinate with other units. The improvements in speed, endurance and firepower at the beginning of the twentieth century increased the complexity of naval engagements and the individual command of warships. Despite considerable literature on naval technology, the way warships operated and fought over time remains understudied.

Timothy Wolters examines the issue using the United States Navy (USN) between 1864 and 1945 as a case study and charting out the long-term evolution of what would become the Combat Information Center (CIC), 'an integrated human-machine system' (p. 5), or 'brain' of a warship during the Second World War. While the conflict did see considerable innovation, the foundation of much of this was laid decades earlier. Wolters's work fits into a wider trend over the past decade to understand the dynamics and determinants of innovation, but, rather than focusing on a weapon system, his focus is on a process. Command and Control is often discussed in theoretical or general terms, but this is a study about the practicalities, devices and understanding of command at the platform level and what implications this in turn had on naval operations.

The book is organised into five large, yet not overwhelming chapters, which follow a chronological path covering individual developments as well as broader themes like bureaucratic structures or civil-military interaction. The first two deal with communications, before and after the invention of radio - a crucial development - while chapter three deals with the complexity of fleet operations this brought about during the Great War. Chapter four deals with the emergence of the three-dimensional naval battle as air and subsurface threats needed addressing. While improved communications enabled better coordination, they also represented a vulnerability and potential for compromise. Thus the resultant problem of communications security became an issue and is a feature of the analysis. The role of key individuals in the process receives the necessary attention. Radio direction-finding, active and passive underwater detection systems and the development of radar all provided new sensory inputs for ships' crews to deal with and raised the question of how these different pictures might be superimposed.

In chapter five the transition to war and the integration of various systems into what became the CIC is outlined. What Wolters shows is that rather than a linear development it was the product of different experiences, which shaped the form and functioning of the CIC. Early British wartime experience, the anti-submarine War in the Atlantic and the anti-air and surface actions in the Pacific posed different questions and influenced the final outcome. Better information gathering and

processing created more effective naval units and harnessed firepower more efficiently. The only slight weakness of the book's structure is a somewhat too concise conclusion that might have said more on the evolution of naval command and the implications technology had (and has) on it.

Both author and publisher have made this an appealing book. Illustrations of key personalities and equipment not only bring the subject to life, but are all the more helpful in understanding the core issues. The inclusion of generous notes and an essay on sources further expanding on methodologies – amounting to nearly a third of the volume – completes the analysis and allows readers to probe the subject further in a organised manner. This book is a must for any serious student of naval operations, platform design and in particular of the USN. Despite its specialised subject matter it will be valuable to military historians in general, especially those looking at the development and problems associated with command in the twentieth century. This is not only a study in the transformation of naval power or innovation in a military context, but it is also about the rise of machines in assisting human decision-making more generally. Men remained at the heart of the warship's functioning, but were increasingly dependent on machines to understand the environment in which they were operating and react appropriately.

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