way after 1942. Nonetheless, the raids of 1941 did manage to persuade Hitler to greatly overvalue Norway's importance during the Second World War. A rather significant event that is glossed over is the sinking of HMS *Glorious* by the German battlecruisers *Scharnhorst* and *Gneisenau*. This omission is all the more striking because of recent revelations about the true cause of her rushed exit from Norwegian waters in June 1940. One unintended consequence of the Lofoten raid that could perhaps have been mentioned was its political repercussions within German-occupied Norway. Nevertheless, given the defined mission for volumes in this series, the compilers were perhaps wise to steer away from these issues.

Despite these very minor quibbles, the work stays true to its mission and the series format. Even now, its contents offer a valuable contribution to the growing literature of Norway's role and importance during the Second World War. The dispatches presented provide a more "boots on the ground and on board" perspective on the Norwegian campaign and the sometimes cheeky antics of the British commandos who participated in these actions. This volume is definitely worth reading, or even a second read, by anyone interested in the conduct of the Second World War in this region.

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Aaron S. Hamilton. *Total Undersea War. The Evolutionary Role of the Snorkel in Dönitz's U-Boat Fleet 1944-1945*. Barnsley, S. Yorks: Seaforth Publishing, www.seaforthpublishing.co.uk. 2020. 416 pp., illustrations, appendices, notes, bibliography, index. UK £35.00, US $52.95, cloth; ISBN 978-1-52677-8 8 0-2. (Distributed by Naval Institute Press)

Until recent years, most books relating to the U-boat war in the Battle of the Atlantic suggested that the major threat was pretty well over after May 1943. By then, Admiral Dönitz temporarily withdrew most of his boats after suffering unacceptable losses. More recent, careful research, however, has shown that the battle was by no means over until the last days of May 1945. The continuing threat of submarine attack around Britain has become known as "The Inshore Campaign." U-boats were still very much a threat. They even claimed HMCS *Clayoquot* on 24 December 1944 and HMCS *Esquimalt* on 16 April 1945 off the coast of Canada. These successes, in the *Kriegsmaine's* view, were largely thanks to new equipment that is the subject of this excellent and carefully researched book.

As Royal Navy historian, Captain Stephen Roskill, commented; "We never gained a final mastery over the U-Boats" (*Darkest Before Dawn*: *The Sinking of the* Empire Heritage, 2011). Or, to quote the Duke of Wellington; "It was a near run thing!" Much of the delay in providing new technologies that were being developed for Germany's U-boat arm should, in retrospect, be credited to the RAF and American bombing campaign. To reduce the serious destruction of the shipbuilding yards and technical production facilities located primarily in the northwest, Germany diversified production farther east and south, becoming experts in partial construction, including even U-boat hull sections and engines. But this forced them to depend on rail and river barge shipping, which the Allied air forces then demolished, slowing and too often destroying those critical supply lines—and cargoes.

While the Kriegsmarine did indeed get a few of their much-modified U-boats to sea, they were too little and too late to influence the final outcome.

It was that close. The author's extensive 29-pages of appendix tables will prove valuable reference fodder for determining which U-boats were fitted with new equipment, and thus, assessing the threat.

Hamilton looks essentially at three factors that could have made allied anti-submarine efforts considerably more difficult from mid-1944 to May 1945: the development of a reliable snorkel air-supply system (for simplicity, he uses the American spelling almost throughout); the addition of anaerobic paint or other covering for the snorkel heads and conning towers to reduce radar detection; and most importantly, the development of the Walter engines, more streamlined boats and reliance on the snorkel, to increase underwater speed, an improvement of up to 30 per cent.

After a useful chapter to set the scene facing Admiral Dönitz in 1943, with the introduction of increased air cover as an anti-U-boat threat for convoys and passage routes, the author looks intensely at the development of an improved snorkel, with a number of illustrations and technical drawings. Although the Dutch had been experimenting with similar devices since before the war, as well as various designers as far back as the invention of a practical submarine around 1900, it was not until the Germans largely solved the mechanics of a folding, waterproof and speed-adaptable air intake unit that the snorkel became a practical and necessary addition to most of their U-boats. This was particularly important in the shallower waters around the UK and western Europe (the "Inshore Campaign"). For a more detailed look at that specific 'war,' see John White's *Endgame–The U-boat Inshore Campaign* (2008), or Jak Mallmann Showell's *Hitler's 'Wonder' U-Boats* (2018). Hamilton explains how this reliable working snorkel was a device that could have put Germany in a possible bargaining position at the end of the war. His references to patrol or training exercise reports are interesting in themselves, revealing how rapidly the naval development office was able to modify and change fitting designs. It shows how the pressure of war compares to our current development of the Canadian Surface Combatant (CSC) progress. While the Allied navies' progress toward better anti-submarine weapons, like the ahead-thrown squid, kept them abreast, it did not provide much of a lead over Germany's improved U-boats.

Chapter 7 evaluates the considerable benefits to crew habitability and thus, operating efficiencies, derived when snorkels could introduce fresh air more frequently. This is something rarely considered—perhaps because the author was never a submariner, accustomed to just accepting the fetid air in long-dived boats.

Germany also developed special paint and rubber-like coverings for the head of the snorkel protruding above the surface, which coincided with improved anti-radar detection for the conning towers, but both came too late to change the course of the war. Close-up photographs illustrate its use and the developing models required to close the intake when seas washed over the head.

The other main theme is the introduction of the higher speed 'electro-boats', Types XXI, XXIII and XXVI. Although few went operational, those that did proved their worth. In a final chapter, Hamilton assesses their problems, never fully resolved, how they were dealt with and advantages. Post-war, the RN also adapted the HPE (explosive hydrogen-peroxide) boats, and like their Kriegsmarine counterparts, did not find them advantageous enough to

pursue. They weren't called "the Exploders" for nothing.

Hamilton's table listing every boat that had snorkel fitted, from U-92 to U-1308, including those with anti-radar covering and hull modification, provides a useful reference. HMCS *New Glasgow* paid the price in March 1945, at night off Londonderry, when their bridge watch sweeping the area before her group went out on escort duty, heard a thrumming noise. They presumed it was a patrolling aircraft, when in fact it was U-1003's new snorkel close alongside! Her commanding officer had misjudged his closing angle, and in fact hit *New Glasgow*, damaging both of them, to the extent the U-boat broke his snort and periscopes and had to be abandoned the next morning! Count it a dubious success for the RCN, since the ship had to return for major repairs, and a lesson too late for the *Kriegsmarine*.

Offering both detailed description of the trials, successes and engineering amendments, in text and illustrations, this is an important and well referenced book on Germany's late war efforts to regain an advantage. Meanwhile, as Roskill noted, the Allies were just "keeping up."

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Thomas Heinrich. *Warship Builders: An Industrial History of U.S. Naval Shipbuilders 1922-1945*. Annapolis, MD: Naval Institute Press, www.usni.org, 2020. xii+346 pp., illustrations, tables, charts, notes, bibliography, index. US $ 39.95, cloth; ISBN 978-1-68247-537-9. (E-book available.)

Most of the US armada assembled in Tokyo Bay to accept the Japanese surrender in September 1945 had been commissioned since Pearl Harbor. Author Thomas Heinrich uses this diverse fleet of vessels, ranging from aircraft carriers to landing craft, as a vivid symbol of American wartime shipbuilding. This book is a comprehensive look at shipyards including their management and labour, the roles of the US Navy and government support programs, the impact of new technologies, and details of how certain building programs were achieved. The narrative shows how warship building differed from merchant ship construction and from the fabrication of other types of military equipment. Warships were, in fact, built in batches by skilled labour. Writers who have depicted US warship-building as analogous to the mass production of aircraft, tanks, or artillery or liberty ships, by recently-trained workers are incorrect. The book offers welcome comparisons in each chapter with practices in Britain, Germany, and Japan.

Thomas Heinrich is a German-American professor of business and naval history. His *Ships for the Seven Seas: Philadelphia Shipbuilding in the Age of Industrial Capitalism* (1997) examined the nexus of factors that produced a major shipbuilding conglomerate on the Delaware River. *Warship Builders* is the result of ten years of further research and thinking. The writing style is clear; the writer's painstaking efforts to explain (and illustrate with drawings) points like the nature of arc and electric welding, propulsion rotors and the construction of turbine rotors perhaps reflect his teaching background. Extensive endnotes comprise one fifth of the book; they are followed by a 35-page bibliography.

When Congress approved a 70 percent expansion of naval tonnage under the *Two-Ocean Navy Act* in July 1940, America already had one of the world's largest warship-building indus-