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Louis Brown. *A Radar History of World War II: Technical and Military Imperatives.* Bristol and Philadelphia: Institute of Physics Publishing, 2000. 584 p $38.00, cloth, ISBN 978-0-7503-0659-1.

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By the fall of 1944, American submarines had sunk a large share of Japan's merchant marine, and their skippers were having trouble finding targets. In a typical mission, submarines would be sent to meet a convoy, locate the ships and escorts, and then conduct a night surface attack. Meanwhile, German U-boats, once the scourge of the Atlantic, had stopped attacking convoys and were merely trying to survive Allied air and sea attacks.

Two technological innovations were critical in creating these situations: codebreaking and radar. The story of the first --cracking the Enigma ciphers than Doenitz used to communicate with his ships, and the American mastery of Japanese codes that provided sub commanders with precise coordinates for their attacks--has been well told many times. But the military history of radar--how it was developed and used by armed forces during the war--has not, until now. Louis Brown's excellent *Radar History* fills this gap, and should be a necessary reference work for historians of World War II.

Brown is well qualified to write this history, for he is both a physicist-emeritus at the Carnegie Institute and knowledgeable about the war. He begins with a brief chronicle of the development of radar in the 1920s and 30s in a surprisingly signicant number of countries. Engineers and scientists noticed that radio signals were suddenly blocked when ships or airplanes passed between transmitter and receiver. The possibilities of using this for remote detection did not pass unnoticed. By 1939, all of the countries that would fight the war had research programs or had even installed primitive radar sets on warships or coasts.

In spite of this progress, though, Great Britain was the only nation which started the war with both a radar system and a doctrine for its employment. Brown explains why Britain trumped every other power in radar, in spite of cuts to its interwar defense budget which resulted in armed forces poorly equipped to fight the war. The technology behind the Chain Home warning network may have been obsolete, but the stations gave complete coverage of England, and were backed by emergency replacement sets and a filter room

system that allowed Fighter Command to take full advantage of the data Chain Home provided. It would be years before Germany, the United States or Japan possessed anything like it.

Brown provides detailed histories of radar in each of those four countries, with a fair amount of information about the Soviet Union and Australia, but almost nothing about the work done in France, Italy and Holland. This makes *Radar History* a far more international work than another recent history, Robert Buderi's *The Invention that Changed the World*. Where Buderi devotes three pages to Japan's radar efforts, Brown furnishes a complete description of each important set used by the Imperial Army and Navy, including wavelength and power. More important, he gives descriptions of the actual use and effectuveness of radar by both sides in the Pacific, from Pearl Harbor to the final aerial assault on Japan.

A postwar appraisal by American experts placed Japan "four or five years behind" the United States in the development of radar, but the situation in Europe was a much closer-run race. The longest sections in Brown's book are devoted to the Battle of the Atlantic and the bomber war over Europe. The former was a clear triumph for Allied electronics. While British, American and Canadian escort vessels and planes got better and better radar and moved from metric wavelengths to centimetric radar, Doenitz's doomed submarines only hoped for radar detectors that would reliably give warning of air attacks. Only a handful of U-boats ever carried radar, and they made little use of it. The contrast with the Pacific, where every fleet sub was equipped with SJ radar, is overwhelming. *Radar History* also shows how superior British radar, and especially superior use of radar, helped doom both the *Bismarck* and the *Scharnhorst*.

Brown is at peak form when he moves to the air battles over Europe, where both sides were able to devote massive resources to ground radar, airborne interception radar, and bombing radar, not to mention jamming. Unlike the Japanese or the Soviets, whose electronics industries were never able to produce enough good radar equipment, the Germans were able to cover Europe, from Norway to the Black Sea, with air warning sets, while the British equipped their bombers with radar able to find German cities through darkness and clouds. Brown has read the official histories and the memoir literature in both German and English, and is able to describe the seesaw battles that cost so many lives in the skies over the Reich. Thanks to his physics background, Brown is able to explain exactly why certain sets could give altitude information as well as bearing, and why others could not. Similarly, he analyzes the jamming war, showing why Window (chaff, in today's terminology) and electronic jammers worked against some sets, but not others.

Radar History also covers two areas which are not, strictly speaking, radar: the "beam wars," and proximity fuses. The Luftwaffe pioneered the use of navigational aids for bombing. Its Knickebein and X-geraet systems were both used by bombers which needed to locate blacked-out cites at night. The British jammed both, and later created their own, more extensive, systems of radio beams to help RAF bombers. Proximity fuses for anti-aircraft shells were almost entirely an American success story. Each fuse amounted to a tiny radar set which detected a bomber tens of meters away, then detonated the shell. Brown describes how the combination of American fire-control radar, ninety mm guns, and proximity fuses made Japanese night air raids on our Pacific bases suicidal affairs even before the Kamikazes.

Brown and the Institute of Physics are to be especially commended for their choice of photographs. Absent are the tired images of D-Day and Tarawa that decorate so many works of military history. Instead we have almost seventy sharp black and white photos of American, British, German and Japanese radar, real sets, in place. And each one is accurately identified. *Radar History* is

also made more useful as a reference work by the many diagrams, maps and charts it contains, and particularly because Brown has detailed endnotes keyed to an extensive bibliography.

One of the few things I would change is the appendix he calls "A Radar Primer." This brief science lesson explains terms such as "lobe-switching" for lay readers -- and it would have been much more valuable placed at the beginning of the book.

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