The Story of Radar

The Invention That Changed the World. How a Small Group of Radar Pioneers Won the Second World War and Launched a Technological Revolution. ROBERT BUDERI. Simon and Schuster, New York, 1996. 575 pp. illus. $30 or C$40. Sloan Technology Series.

It has often been said that while the atomic bomb ended World War II, radar won it. Radar was decisive in defending Britain against the superior air forces of the Germans, in securing shipping channels in the Atlantic against German submarines, and generally in winning the later sea and air battles in the Pacific. Though numerous articles and books of technical history have been written, mainly by radar practitioners, the subject has lacked a general overview accessible to a wide audience. This book, commissioned for the Sloan Foundation Series on Technology and written by an able science writer, serves this purpose—much in the same way Richard Rhodes's widely acclaimed books tell the stories of the atomic and hydrogen bombs.

The central focus of Buderi's book is the Radiation Laboratory, operated on the campus of the Massachusetts Institute of Technology from 1940 through 1945 to develop radar technologies that could be transferred to industry for rapid manufacturing and delivery to the Allied forces. Starting as a handful of scientists organized hastily under the authority of the National Defense Research Committee, the Radiation Laboratory mushroomed into a community of almost 4000 workers by war's end. Although located in the nation's most hallowed bastion of engineering education and devoted primarily to development rather than research, the Rad Lab, as it was called, was populated mainly by scientists from other institutions rather than by engineers from MIT. It rivaled in many ways the distinguished group of physicists brought together in Los Alamos during the war. With spartan working conditions, great camaraderie, a common sense of urgency, an almost total absence of red tape and bureaucratic structure, and the highest levels of national-security procurement priority, it provided an experience that profoundly touched the lives of all who worked there and a working environment that many tried later to reproduce.

MIT was not the only place developing radar during the war. Columbia and Harvard universities had important development facilities, critical work on both development and manufacturing occurred in the industrial sector, and various military organizations were also involved. But with the focus on the Rad Lab, these other contributions are not well captured.

The United States was not alone in developing radar. The first important developments, including the cavity magnetron, took place in Britain and were shared with the United States government. Germany and Japan both had their own indigenous wartime radar R&D efforts, and Australia was an important user of radar technology after the war. Buderi does a good job of describing these efforts succinctly and explaining how their national contexts affected development and implementation. The account of Japanese radar is mostly new material and hence particularly welcome.

The most compelling section of the book is that covering the war years, telling of the race against time to develop a technology to defeat the Axis forces. Buderi does an able job in describing how the technology moved out of the laboratory, how it was received in the military culture, and what significance it had in various theaters of war.

The discussion of the postwar years is interesting, but the literary devices the author employs obstruct his analysis. The greatest influence of the Rad Lab occurred through the postwar redeployment of the large professional staff; the many small and large contributions to microwave and radar theory, practice, and applications that spread into industry; and the fundamental understanding of the general theory and practice of electronics that emerged. Buderi mentions these things but does not dwell on them, because an analytical rather than a narrative approach would be needed to do them justice. Instead, he focuses on a few scientific and technological breakthroughs connected in one way or another to Rad Lab developments or personnel: radio astronomy, nuclear magnetic resonance, the maser, the transistor, and the computer. These examples are enlightening and important, but they do not give an accurate rendering of the Rad Lab's influence. Also, Buderi sometimes overplays that influence, for example in his excessive claims about the importance of radar to the development of computing.

I am not sure whether it is fair to indict Buderi for successfully following the formula used in contemporary popular science writing, but this style certainly has its drawbacks for the scientific reader and the professional historian. He relies on his writing skill and deft use of analogies from everyday life and does not employ any quantification or assume any knowledge of basic science and engineering. This makes for a clear but shallow account of the science and technology. It is difficult to determine from Buderi's account which technical problems are challenging and which routine; and when he does inform the reader in this regard one has little basis for knowing why. His analysis of the relationships between science and technology is murky, which is a pity in a case where top-quality scientists devoted great attention to technological problems. Buderi believes in "genius," and his repeated references to Nobel prizes won by Rad Lab alumni wear thin. His is a book fundamentally about people, and thus even minor figures receive some biographical treatment, which is sometimes useful but often irrelevant and even distracting.

Buderi researched his subject thoroughly. He cites hundreds of books and articles among his sources and conducted dozens of interviews. The book is free of factual error to a remarkable degree. Buderi is also to be praised for taking a very complex story involving many different players and many different technologies, employed in many different military and scientific settings, and rendering it into a cohesive narrative. His account of radar may not be as definitive as Rhodes's account of the atomic bomb, but because of the greater complexity of his task Buderi may well have made an equally important contribution.

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Vignettes: Catching Errors

A scientist is a mimosa when he himself has made a mistake, and a roaring lion when he discovers a mistake of others.

—*Albert Einstein*, as quoted in *The Quotable Einstein* (Alice Calaprice, Ed.; Princeton University Press)

There are those who notice mistakes in passing and those who buy books for the sole purpose of finding them.

—*A. K. Dewdney*, in *200% of Nothing: An Eye-Opening Tour Through the Twists and Turns of Math Abuse and Innumeracy* (Wiley)