



Blind Bombing: How Microwave Radar Brought the Allies to D-Day and Victory in World War II by Norman M. Fine.

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Norman Fine is a retired engineer with a strong interest in the World War II work of the MIT Radiation Laboratory (Rad Lab) in developing airborne microwave radar for sea-surface surveillance and for bombing and navigation without visual reference (i.e., blind bombing). Convinced of the great and underappreciated importance of this work, he investigated and found, to his surprise, that his uncle, Stanley Fine (c. 1920-?) was a bomber navigator with the US 8th Air Force in 1944 and one of the first chosen to lead large bombing raids using radar. During the 1990s, Norman Fine interviewed his uncle and George E. Valley Jr. (1913-99), who, as a young physicist, played a key role at the Rad Lab in 1942-44.

These findings could have been the basis of a substantive article on a key aspect of the Second World War's history. Unfortunately, Fine has elected to pursue a broader, much more ambitious project for which he is ill-prepared. Specifically, he tries to show that the development and use of microwave radar affected the war as a whole, without actually knowing much about the war. He rarely cites current scholarship on the conflict and each chapter rests on only a handful of sources, including *Wikipedia*. His text is liberally seasoned with undocumented, often incorrect judgments apparently drawn from folk history. For example, he writes that "Gen. Adolf Galland" was, in 1940, "the man in charge of the German forces staged to attack from occupied northern France" (37). As he might have learned from *Wikipedia*,¹ Galland gained general officer rank only in late 1941.

Fine reviews the development of radar in the United Kingdom in 1935-41, relying on personal memoirs of limited scope and doubtful objectivity. He briefly notes the simultaneous (actually prior) development of radar in the United States but says nothing of its more or less concurrent development in at least seven other countries.² He describes in triumphal terms the role of Chain Home, the British air defense radar system in the Battle of Britain, with no mention of its serious problems and limitations.³

Fine characterizes J.T. Randall and A.H. Boot's conception of the resonant cavity magnetron in November 1939 (24 ff.) as a still greater triumph. But he does not describe the long multinational trail of development to practical cavity magnetrons, let alone the earlier Japanese development of the nearly identical devices that formed the basis of their microwave radar program.⁴

1. S.v., "Adolf Galland."

2. See S.S. Swords, *Technical History of the Beginnings of RADAR* (London: Peter Peregrinus, 1986).

3. For which, see Phillip E. Judkins, "Making Vision into Power: Britain's Acquisition of the World's First Radar-Based Integrated Air Defence System, 1935-1941" (diss. Cranfield Univ, 2007).

4. See Yves Blanchard et al., "The Cavity Magnetron: Not Just a British Invention [Historical Corner]," *IEEE Antennas and Propagation Magazine* 55.5 (2013) 244-54.

The author again draws mostly on memoirs and biographies in his account of the establishment of the Office of Scientific Research and Development and its Radiation Laboratory at MIT, as well as Britain's Tizard Mission that brought the secret of the cavity magnetron (and other developments) to the United States. An entire chapter concerns financier and scientific polymath Alfred Loomis, a remarkable figure but peripheral to the story.

Fine's discussion of the development of microwave radars—the heart of his book—is flawed by his penchant for Humpty-Dumptyism. He calls a radar operating near 200 MHz “low frequency,” not “very high frequency (VHF)” as international and US standards have it.⁵ All air-to-surface vessel radars operating at wavelengths near 10 cm are known as ASV-10, regardless of official designation, etc. Such errors will mislead non-specialist readers seeking to learn more about the subject.

Development of airborne radars first progressed through a series of 1.5-m wavelength VHF devices for night-fighter airborne intercepts (AIs) and sub-hunting ASVs to 10-cm or “S-band” radars used for similar purposes. Realization that the 10-cm radars could depict features on the ground led to a similar system (viz., H2S) intended to guide bombers on night raids. All this took place in Britain, under the auspices of the Royal Air Force. The Rad Lab picked up the thread and made further advances.

Fine maintains that the cavity magnetron and the microwave radars it powered played the dominant role in countering the U-boat threat to Allied merchant shipping. But his confused narrative of antisubmarine warfare (ASW) is rife with errors of fact and based on outdated secondary sources and unreliable memoirs.⁶ We read, for instance, that “With the introduction of the Leigh Lights together with ten-centimeter radar early in 1942, about 110 Axis submarines were sunk that year even despite Germany's deployment of radar detectors” (108). But the first 10-cm ASV radars were not deployed operationally until December 1942, and no U-boat kills were achieved until March.⁷ The 1.7-m ASV Mark II, produced in the thousands, did the job throughout 1941–42 and well into 1943. The German Navy had almost no satisfactory detectors for 10-cm signals on their U-boats even in 1943, let alone in 1942.⁸ Allied forces sank ca. 74 U-boats in the Atlantic in 1942, ca. 204 in 1943.⁹

Fine believes the introduction of the British 10-cm Mark III ASV in March 1943 at the climax of the ASW campaign clinched the defeat of the U-boats, which in fact did considerable further damage up to the war's end. (He buttresses this claim with quotations of various “authoritative” figures [110].) Cliometric historians have analyzed World War II data in careful studies, using statistical techniques to identify the factors that drove the campaign results. The most exacting of these show that the impact of the 10-cm radar was significant but (pace Fine) far from decisive.¹⁰

5. *Handbook of Frequency Allocations and Spectrum Protection for Scientific Uses*, 2nd ed. (Washington: Nat'l Academies Pr, 2015).

6. E.g., Fine claims (overstating the case) that *forty-four* U-boats were destroyed in May 1943, but two paragraphs later changes that number to *fifty-six* (107–8).

7. Louis Brown, *A Radar History of World War II: Technical and Military Imperatives* (Bristol: Inst of Physics Publishing, 1999) 340. R.A. Smith et al., “ASV: The Detection of Surface Vessels by Airborne Radar,” *IEE Proceedings A (Physical Science, Measurement and Instrumentation, Management and Education, Reviews)* 132 (1985) 359–84.

8. Brown, *idem*.

9. Calculated on the basis of Axel Niestlé, *German U-Boat Losses during World War II: Details of Destruction*, 2nd ed. (London: Frontline, 2014) 198–99.

10. See Brian McCue, *U-Boats in the Bay of Biscay: An Essay in Operations Analysis* (Washington: Nat'l Defense U Pr, 1990).

The next step in magnetron technology was 3-cm radar (code name "X-band"). It had both advantages and disadvantages with respect to 10-cm radar (both still widely used). On the whole, Rad Lab considered 3-cm superior for bombing radar, though little was done along those lines because the US Army Air Forces command was committed to using visual sighting to increase bombing accuracy. But when it was recognized that Germany's skies are frequently more overcast than, say, Arizona's, bombing radar suddenly became an urgent priority.

George Valley worked on a low-priority 3-cm bombing radar called H2X.¹¹ Now he was called upon to produce twelve sets at once. Philco was making an ASV radar based on the British H2S/ASV-III system for the US services. Valley obtained some examples and converted them to 3-cm and rushed through changes to provide the prototype H2Xs. All this is well described by Fine.

Stanley Fine now enters the story. After volunteering for the air force early in the war, he trained as a navigator for B-17 bombers. He was selected to join the first group to train as radar navigator-bombardiers and flew to England aboard a new B-17. After some innocently picaresque adventures, he became a "pathfinder," leading large groups of bombers to targets concealed by clouds.

Stanley Fine was an everyman, a high-school graduate who often felt lonely and buffeted in the wartime military. But he was also a modern hero of technological war, able to concentrate on his very technical task at hand while the Germans were shooting at him during thirty-two missions through 1944. His nephew does him justice.

The author also does better in telling the story of radar bombing in the second half of the book. He describes quite clearly the development of the H2X radar, its operational use, and effect on the war. That said, he is prone to irrelevant anecdotes and digressions.

Blind Bombing should not be assigned in undergraduate courses. More advanced students and scholars able to fact-check doubtful assertions may, however, welcome Norman Fine's discussions of radar history, the Second World War in Europe, the struggle to protect cargo ships and their escorts, and the conduct of effective bombing campaigns.

11. Designated AN/APS-15 or /APG-13 in various iterations.