Scientia Canadensis
Canadian Journal of the History of Science, Technology and Medicine
Revue canadienne d'histoire des sciences, des techniques et de la médecine

The Science of Bombing: Operational Research in RAF Bomber Command. By Randall T.Wakelam. (Toronto: University of Toronto Press, 2009. ix + 347p., ill., notes, bibl., index, app. ISBN 0-8020-9629-8 $55.00)

Tami Davis Biddle

Volume 35, numéro 1-2, 2012

URI : https://id.erudit.org/iderudit/1013994ar
DOI : https://doi.org/10.7202/1013994ar

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Éditeur(s)

CSTHA/AHSTC

ISSN

0829-2507 (imprimé)
1918-7750 (numérique)

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Citer ce compte rendu

Biddle, T. D. (2012). Compte rendu de [*The Science of Bombing: Operational Research in RAF Bomber Command*. By Randall T.Wakelam. (Toronto: University of Toronto Press, 2009. ix + 347p., ill., notes, bibl., index, app. ISBN 0-8020-9629-8 $55.00)]. *Scientia Canadensis*, *35*(1-2), 176–179. https://doi.org/10.7202/1013994ar

confortable majorité parlementaire dont il bénéficiait, il lui aurait été facile de formuler et de faire adopter ses politiques, à condition bien sûr d'en avoir la volonté et le courage politiques qui, au final, lui ont fait défaut. En somme, si Diefenbaker a fait preuve d'indécision, ce serait essentiellement dans la mesure où le débat sur l'armement nucléaire représentait une menace électorale, et non pour des raisons morales ou de stratégie militaire. Pour Patricia I. McMahon, en définitive, « l'essence de l'indécision » de Diefenbaker dans toute cette saga est une affaire de calcul politique, et non de sécurité nationale.

Les lecteurs de *Scientia Canadensis* l'auront également compris, *Essence of Indecision* n'est pas une histoire du développement scientifique et technologique du nucléaire. Néanmoins, l'ouvrage éclaire de manière pertinente le contexte de production nord-américain de l'arsenal nucléaire, qui sera finalement implanté au Canada sous le gouvernement libéral de Lester B. Pearson en 1963. Et s'il est peut-être un peu cliché de considérer le très honorable Diefenbaker comme un grand mal-aimé, il est également vrai que les méandres de ses deux mandats – et particulièrement l'annulation du projet de production de l'Avro Arrow et les aléas entourant l'éventualité de nucléariser les Bomarc et les intercepteurs F-101 Voodoo – contribuent aujourd'hui encore à nous voiler le legs de cette période. Cette « indécision », qui n'en était peut-être pas tout à fait une, nous masque des apports importants qui mériteraient certainement notre attention. Pensons seulement à cette vision qu'avait Diefenbaker d'une identité canadienne transcendant, avant son heure, les deux solitudes pour englober les autres cultures. Une meilleure compréhension de la politique nucléaire canadienne permettra sans doute, nous l'espérons, à une nouvelle génération de chercheurs de se pencher sur une compréhension renouvelée de l'histoire canadienne sous Diefenbaker.

LISA T. GOODYER
Bibliothèque et Archives Canada

***The Science of Bombing: Operational Research in RAF Bomber Command*. By Randall T.Wakelam.** (Toronto: University of Toronto Press, 2009. ix + 347p., ill., notes, bibl., index, app. ISBN 0-8020-9629-8 $55.00)

At 10:15 pm on the night of 13 February 1945, "blind illuminator" aircraft of Britain's Bomber Command, equipped with H2S radar, dropped flares to mark the contours of the city of Dresden and prepare it for the swarms of "visual marker" Mosquito aircraft that would soon follow. The incoming Mosquitoes swept low over the city, dropping bright red "target indicators" fused to explode at low altitude. On that particular night, the marking was so tight and concentrated that it formed a clear, blazing bull's eye in the heart of the old city. The red beacon was the unmistakable aiming point for the 244 Lancaster bombers that then flew over the city, plastering it with high explosive and incendiary bombs, and creating what would become a catastrophic "firestorm" of high winds and uncontrolled flames. That storm was only intensified later in the night when a second wave of Bomber Command aircraft arrived to further exploit the chaos and devastation of the first raid. The elaborate orchestration of the twin raid—which included carefully planned electronic jamming, feints, and simultaneous sister raids to confuse and overwhelm German defenders—was punctuated by the presence of a "master bomber" who flew in slow loops over the city, constantly communicating with and adjusting the incoming bombers to make sure that their bomb fall would be as accurate as possible. Very few of those who have heard of the infamous Dresden raid realise that it was so destructive *because it was so accurate*. But there is much that is still misunderstood about Bomber Command, despite all that has been written about it since the end of World War II.

The Dresden raid of 13-14 February was perhaps the most effective (and therefore devastating) execution, to that point in time, of variants of the complex "Newhaven" bombing method that had been carefully worked out by Bomber Command's planners, scientists, and analysts. It was a breathtakingly sophisticated method of technical warfare developed by an organization that, only short years earlier, had found itself painfully under-equipped to perform the mission it was designed for: the long range bombing of Germany. Between 1939 and 1945, Bomber Command went from being a weak, flailing force that could barely find its way in the dark, to the most highly-trained, skilled, and powerful aerial bombing force the world has ever seen. And, by 1944, Bomber Command was—much of the time—a more accurate force than the US Eighth and Fifteenth Air Forces. Randall Wakelam's book, *The Science of Bombing: Operational Research in RAF Bomber Command*, sets out to explain how this dramatic transformation was made possible, and how it evolved.

It is an important effort not only because it adds to our knowledge of how operations research emerged and developed during the Second World War, but also because it goes far to upend the widespread stereotype of Bomber Command as an unsophisticated (indeed Luddite) organization that never attempted to be more than a bludgeon in the hands of its rigid, unthinking commander, Sir Arthur Harris. Bomber Command was, as early as mid-1943, a powerful, brutal force capable of inflicting almost unfathomable pain on its enemy. But it was surely *not* technologically unsophisticated, and Harris was surely *not* unthinking in his approach to his work. Wakelam, while well aware of the large, argumentative literature on the ethical and moral dilemmas raised by strategic bombing, does not wade much into that difficult territory. While the book might have benefited from a more developed treatment of the interwar years (which left Bomber Command crews in such an impossible position in 1939), and by a more frequent threading together of science and its moral ramifications, the author unapologetically defines the parameters of his task at the outset. His work focuses on the analysis and the science behind aerial bombardment; he has plenty to do and he covers plenty of ground, much of it heretofore under-explored. Significantly, he wrestles with two issues that should be of interest to all those who study the use of science in the realm of war and defence:

1) How, organizationally, do scientists and analysts integrate themselves into war-fighting institutions?

   and

2) How do they maintain their objectivity—and control their agendas—when they are integrated into such institutions?

The organization of the book is sensible and effective; the author provides the fundamentals that enable the reader to follow the story as it progresses. Harris emerges, naturally enough, as a central figure in the drama. But the portrait of him developed here is quite different from the standard interpretation. He is a man thrown into an unfathomably difficult situation who scrambles to come to grips with the immense challenges facing his command. He finds assistance from the young field of operations research (OR), which provides explanations for and solutions to the dire dilemmas faced by his crews. Technically proficient and driven (rather like the famous American commander of the day, Maj. Gen. Curtis LeMay), Harris is an instinctive problem solver who is prepared to listen to those who can prove their worth by providing intelligent analyses of problems and intelligent solutions to them.

Wakelam's research into the application of OR to air warfare is detailed and revealing. And the resulting book adds texture and insight to our understanding of the interplay of science, analysis, and war-fighting in World War II. The work is timely since other literature—most notably Adam Tooze's careful analysis of the German war economy, *The Wages of Destruction*—has begun to re-interpret the impact of the strategic bombing campaign on Germany and to reveal the significant ways in which Bomber Command hindered and, at times, crippled the Third

Reich's war effort at critical moments, including the spring of 1943. Wakelam's book will be of interest and benefit to students of air warfare and to students of the science and technology of the Second World War.

TAMI DAVIS BIDDLE
US Army War College

Environment / Environnement

What is Water? The History of a Modern Abstraction. **By Jamie Linton.** (Vancouver: UBC Press, 2010. xviii + 333 p., ill., maps. ISBN 9780774817028 $34.95).

I leaped at the opportunity to review Jamie Linton's *What is Water?* Working in the earth sciences and surrounded by university colleagues studying various forms, attributes and meanings of water (hydrology, climatology, permafrost, wetlands, coastal erosion, sea-level rise, water transport, geopolitical conflict, and differing cultural concepts—just to name a few), it was difficult not to profit from the opportunity to enquire more deeply into such a hot topic. Given this multiplicity of interests and understandings, it is not surprising that, as Linton notes, water has an unlimited ability to convey metaphors. Despite the repetition *ad nauseam* of those metaphors in current media, Linton's confident critique of many of them results in an informative historical analysis that will leave most readers conscious of their previously limited understanding of one of earth's most important resources.

For most readers, that limited understanding stems not from any intellectual failing but rather from the nature of the water literature itself. Over the last sixty years, as Linton explains, most water research was written by hydrological engineers, natural scientists and resource managers who were concerned with water primarily as a quantifiable resource and as an economic commodity. Given that state of the literature, Linton is led to ask probing questions about how to expand the understanding of water—that is to say, how to find other ways of knowing water. Ultimately, he ponders how the recognition of water as a quantifiable object and economic good can be reconciled with its essential function of sustaining life. This contradiction, he argues, brings about a fundamental impasse in present society. The understanding of water, he believes, must be complexified. It must be viewed not solely as a quantifiable and commodifiable thing—for hydroelectric projects, farm irrigation, and drinking water—but also as a historical process wherein water becomes