

Requiem for the Skillful

Saunders Mac Lane

Recently I chanced to examine a National Research Council (NRC) report (1992) on the subject “Educating Mathematical Scientists: Doctoral Study and Postdoctoral Experience in the United States”. On page 11, I found the following

World War II provided new opportunities for mathematicians including the newly immigrated mathematicians... (the war) brought technology to weapons. However, very few mathematicians—American or foreign born—had the applied skills needed for the tasks at hand.

The NRC was established to present documented advice to the U.S. government, but in this case and for this last NRC assertion there was no documentation. However, I do not now need to answer this egregious piece of arrant nonsense (“...had the applied skills”), because I have already written and published an answer in my article “The Applied Mathematics Group at Columbia (AMG-C) in World War II”, which appears on pages 495–512 in Part III of the volume *A Century of Mathematics in America*, Amer. Math. Soc., Providence, RI, 1989. This AMG-C group was one of the largest wartime groups in WWII involved in mathematical war research. I was a

member from 1943, and I was its “technical representative” (i.e., its director) in 1994–95.

Since the publication of my 1989 article, the *Notices* of the Society has adopted an active practice of publishing articles which describe and celebrate the various achievements of recently deceased mathematicians. Some of my valued coworkers at the then AMG-C are no longer with us; their number is perhaps too large to allow for individual “in memoriam” articles. I thus wish to record briefly here some of their names with a quick summary of their work.

My task as director was to assemble able mathematicians and to deploy their varied talents to the urgent but confusing problems arising in wartime. I can report to the present NRC that each and every one of them “had the applied skills needed for the tasks at hand.” And I am no longer required to classify this document “Top Secret. Eyes only. Burn before reading!”

For AMG-C the “tasks at hand” revolved around fire control devices for machine guns mounted on bombers.

Hassler Whitney, then at Harvard, was the leading American algebraic topologist of his generation. His work at AMG-C was also deep, involving the understanding of skid (of fighter planes) and the adaptation of rocket sights for fighters. In later years Whitney moved to the Institute for Advanced Study and after retirement developed a passionate interest in the education of young children.

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Leon W. Cohen, trained as a point-set topologist, applied his skills to calculation of the “pursuit curves” followed by fighters attacking bombers. His insights were used in later years in his work as program director for mathematics at the NSF.

Magnus Hestenes (Ph.D. Chicago; Bliss) had the solidity and the skills to apply basic ballistic theory to inaccurate ballistic tables. He was later a wise chairman at UCLA; his wartime research informed his later book on optimal control.

Leon Brillouin brought knowledge of classical theoretical physics to the group; he knew how to refudge a faulty fudge factor in physicists’ formulas. After the war he wrote on information theory.

Walter Leighton, expert in continued fractions and on differential equations, was quickly able to arrange methods for calibrating gun-sights. He subsequently administered a new AMG-N at Northwestern University and after the war was a decisive department chairman.

Adrian Albert, the ambidexterous algebraist, became involved in fire control at AMG-N, to return after the war to his beloved University of Chicago and the advance of algebra and of division algebras on all fronts.

Edgar Lorch, like many of us, found at AMG-C dandy and necessary uses of trigonometry—and even spherical trig. We did not previously know it, but it was easy to learn. After the war Lorch returned to the mathematics department at Columbia.

Paul Smith, then and later professor at Columbia, provided our “fixed point” connection to the University, which was our nominal employer at AMG-C. After the war he brought Eilenberg, one of our members, to the permanent Columbia faculty.

Arthur Sard came to AMG-C fresh from his proof of Sard’s theorem about critical points of maps. His judicious judgments kept AMG-C on a straight course, as in his later work at Queens College, New York City.

Harry Pollard, as with many of us, knew how to use the calculus—nothing beyond the second derivative was needed for our work! He later landed at Purdue, where he worked, *inter alia*, on algebraic numbers.

Warren Weaver, our wise upstairs boss (head of the Applied Mathematics Panel), gave us a good start on the analysis of lead computing sights, as used for those machine guns on bombers. He had left applied math at Wisconsin to become vice-president of the Rockefeller Foundation. Several years later he became well known because he had so wisely distributed Rockefeller funds to the rising sciences of biochemistry.

Mina Rees, technical aide to Weaver and our supervisor, had written her Ph.D. in 1931 on linear algebra with Dickson at Chicago. Thereafter she was subjected to the then fixed fate for female math Ph.D.s: to teach at a women’s college—in her case, Hunter College, NYC. The war work opened new opportunities. She became the first program director for mathematics (at the Office of Naval Research), then member of the National Sciences Board, then president of the City University (NYC). At last report she was in execrable health.

Betty Amitin, my devoted secretary at AMG-C, was later killed with her husband in an auto crash. Her son, Thomas Heppenheimer, is a science writer and now and then tackles mathematics.

By comparison, there were very few mathematicians at Los Alamos: Jack Calkin, C. J. Everett, Paul Olum, Stan Ulam, and John von Neuman. Their decisive contributions there are generally known.

To these and many others who in 1943–45 excelled in vigorous uses of the skills needed in wartime, hail and fond farewell.