

Redmond, Kent C. and Thomas M. Smith. *From Whirlwind to MITRE: The R & D Story of the SAGE Air Defense Computer.* Cambridge, MA: The MIT Press, 1997.

The years between 1950 and 1958 saw several definitive steps taken toward the establishment of the "electronic highway." This occurred, not in the commercial world of the booming post-war economy, but within the confines of what President Eisenhower was to define as the "military industrial complex," which had emerged from World War II and which was granted a new lease on life by the ensuing "Cold War." The interaction between the needs of the armed forces, in this case the US Air Force; the research resources of academic institutions such as MIT; and the productive capacity of industrial giants like IBM and other related industries was necessarily complex. The capabilities of the latter two components of the triangle were given focus by the needs of the first and the sense of urgency driven by the US-USSR rivalry furnished the necessary context for adequate financing and willingness to lubricate various frictions in the national interest.

The new vulnerability of the United States to long-range bombers moved the need for an early warning and interception mechanism to near the top of Air Force priorities. As a preliminary system at Bedford Airport near Boston was expanded into a regional Cape Cod system, the development became centered in the Northeast and furnished the experiential setting for the technological breakthroughs which were to follow, including a method to efficiently transmit data via telephone lines. Most particularly, it became necessary to speed up and to improve the reliability and accuracy of the experimental "Whirlwind I" computer so that the collected data could be adequately processed. All through the decade of the 1950s progress was made. The program was often behind schedule and over budget and went through a multitude of restructurings reflected in a plethora of acronyms, but in the end SAGE (Semi-Automatic Ground Environment), as the electronic spotting system came to be called, was a success.

Kent Redmond and Thomas Smith have traced the process by which SAGE became a reality. It is a highly complicated and finely nuanced train of events. The book is meticulously documented and reflects the commitment of the authors to reconstruct the story as it happened. There are moments of crisis, such as the early rivalry of MIT with the University of Michigan as primary research base, that of IBM with Remington Rand for the development contracts and various and sundry bureaucratic contretemps as the Air Force attempted to get the researchers to conform to its budgetary format. The scramble for adequate personnel to carry out the various testing needs (a problem not only of finances, but also one of the scarcity of appropriately trained and committed persons) was a constant concern. Finally, the ambiguity of who would be in charge of weapons development and deployment in the new age of ballistic missiles eventually led to a spin-off of the MITRE Corporation from the more closely MIT-connected Lincoln Lab. All of these issues are carefully analyzed and fully developed.

This volume could well serve as a handbook on the care and feeding of tripartite R and D Management concerns and styles often emerge as primary to the success of the program. The abilities and attitudes of men like Jay Forrester and George E. Valley, Jr. are central to the story and they must be counted, along with several others, among the "fathers" of

the "electronic highway." In addition, it is made clear that the program not only resulted in the improvement of the computers involved but a training ground for a great number of participants in the ways of computers and the transmission of tremendous amounts of information adaptable to general commercial use. IBM in particular profited from its contacts with and work done for the project.

The book should be of great interest to those involved with the history of computers, with defense procurement, with management techniques and with the sociology of bureaucracy as well as to the average curious reader.

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