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Harnessing the Genie: Science and Technology Forecasting for the Air Force 1944-1986

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tion. Also, they became overwhelmed by Allied saturation raids.

Nissen covers the selection and development of the first radar jamming and countermeasures by the British. His description of the delicate choice of technique so as to be effective without revealing enough to allow counter-countermeasures is relevant to today's electronic warfare and ECM problems.

After the Battle of Britain radar continued to be developed for night fighter interception, where it was not particularly successful, and for submarine hunting, where it was very successful. Fisher's account of these later developments is comprehensive. His scientific background is apparent in his good description of the technical problems and how they were solved.

For those interested in the development of technology and its application to warfare, or for those practicing it, both Nissen and Fisher are useful additions. Fisher is the technical historian; Nissen, the technical practitioner.

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Gorn, Michael H. *Harnessing the Genie: Science and Technology Forecasting for the Air Force 1944-1986*. Washington, D.C.: U.S. Government Printing Office, 1988. 209pp. \$9

This survey of scientists and engineers, in and out of uniform, defines their role in forecasting technological futures for the air force. It is important reading for those who would understand the processes that bear on the formation of technology policy in the military departments. As an individual who has been close to navy research and development for most of the period covered by the author (1944-1986), I note that, given changes in the names of some individuals and in the titles of the major study efforts, this could be a history of the decline of scientific advice in the navy also.

Michael Gorn traces the results of a series of major air force-sponsored technology forecasts. He also describes the repeated assaults on the freedom of the civilian and academic scientific community to contribute to or influence the results of these forecasts. This is a history of conflict between civilian and military, scientist and engineer, visionary and pragmatist—an intellectual game of “king of the mountain” with counterproductive results.

Dr. Theodore von Karman, in what became the USAF Scientific Advisory Board, established the model for air force science and technology forecasts. *Toward New Horizons* (1945) was the first such forecast. Others discussed in *Harnessing the Genie* are the *Woods Hole Summer Studies* (1957-1958), *Project Forecast* (1964), *New Horizons II* (1975), and *Project Forecast II* (1986). But after the Woods Hole studies failed to deal in a prescriptive way

with the U.S. response to *Sputnik*, the Scientific Advisory Board lost influence in the air force, influence that it has yet to regain.

General Bernard Schriever conceived the idea of an across-the-board examination of future air force missions and the technologies to support them. This examination, *Project Forecast*, also came about because of perceptions among senior officials that the USAF lacked the vision and vitality that it ought to have. The core of the study was the technology panels, each led by scientists or engineers of great distinction. But the genius was in organizing the study in such a way as to make the air force top command part owners of the product. The navy could learn a few useful lessons in "selling a study project" from the USAF.

Unlike most major navy studies, the air force since *Project Forecast* has accompanied the scientific report with a financial plan for implementation. This can be both good and bad. Inclusion of budgetary realities too early in the process of "socializing findings" can result in prematurely truncating the viability of the approach under consideration. Military budgets represent a conservative system; enhancement in one area is at the expense of another.

Michael Gorn notes the diminished opportunities for civilian and academic scientists to contribute as heavily in the more recent study efforts as they did at first. Part of this has occurred because of the increasingly adversarial atmo-

sphere between government and industry stemming from procurement disputes and embarrassments. There is much similarity between the USAF and the naval aviation community; indeed, the latter is practically a microcosm of the former. To the navy's peril, there have not been the kind of technological appraisals that the air force has sponsored. Two that have been done by the Naval Studies Board of the National Academy of Sciences dealt respectively with technology and naval aviation (1983), and an across-the-board study of the future navy called *Navy XXI* (1988). Although both studies sparked interest and enjoyed some implementation, the navy regards such activities as advisory only. This may be tantamount to saying that the scientific community enjoys even less influence with the navy than it has with the air force.

There is another perspective that is somehow lacking in *Harnessing the Genie*. One really has to look at scientific advice and its reduction to practice in fielded weapons systems as the very "front end" of the defense systems acquisition process. While the air force attempts to market the results of its major technological forecasts to the ultimate military user (and keeper of the budget claimancies), there is little or no interaction with the major entities in the systems acquisition processes: the program offices. Considerations of technology base issues receive short shrift throughout the military departments in their approach to acquisition. I can testify

personally to the almost complete disconnect between the technologists in the DOD laboratories and the acquisition program managers. What kind of efforts are made by any of the services to "market" study results to all of the tiers of the defense industrial base? All too often the results of far-reaching studies are given "eyes only" treatment. One can only hope for reform in systems acquisition education, at places like the Defense Systems Management College, so that fewer technology base opportunities will be missed.

I repeat: This is a worthwhile book. I hope someone will commission a navy companion piece, and, for that matter, one for the army as well. But if such activities are undertaken, they should be related to the tribal rites that each of the military departments follows in its acquisition and force development processes.

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Collins, Michael. *Liftoff: The Story of America's Adventure in Space*. New York: Grove Press, 1988. 288pp. \$25

Well, he's done it again! Michael Collins, fighter pilot, experimental test pilot, astronaut, State Department official, museum director, and author, has produced another superb book. His previous effort, *Carrying the Fire*, is a highly personal account of his own development and adventures in aviation and astronautics.

This fascinating, occasionally hair-raising memoir is an ideal introduction to the current effort.

Liftoff is more ambitious. In seven exceptionally well organized chapters, the author traces the engineering and technical development of capabilities for space travel in language which will capture the general reader and yet still satisfy all but the most specialized practitioners in space endeavors.

The range of description and analysis is unusually broad. The Apollo XI mission to the moon, during which Collins traveled with the first moonwalkers but did not descend himself, reads like an adventure novel. The description of the Challenger disaster is an exquisite balancing act among technical precision, compassion, and perspective on failure in what has been a remarkably successful program overall.

The final chapter, "Ad Inexplorata," could stand alone as a first-class piece of thinking and writing. It begins with a remarkably clear exposition on our solar system. Then, Collins argues persuasively that a commitment to explore Mars could be the keystone to renewal in the United States, not only of the space effort but of national purpose in general. Collins shows himself simultaneously visionary and practical, culturally sensitive and politically savvy.

The book is very well put together. Its page format is somewhat larger than normal, a great asset when presenting the