BOOK REVIEWS

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Prospects for Fusion Power

Editor	Stephen O. Dean
Publisher	Pergamon Press, Inc., Elmsford, New York (1981)
Pages	90
Price	$19.50
Reviewer	John G. Gilligan

Prospects for Fusion Power is an extremely broad title for a book, and therefore could deal with any one of many topics. However, this particular monograph is a collection of short papers from two important public symposia on "The Status of Fusion Research and Development" and "The Role of Industry in Fusion Development" conducted by Fusion Power Associates (President and Chairman, Dr. Stephen O. Dean) in November 1980. Fusion Power Associates was formed in late 1979 as a nonprofit tax-exempt public benefit corporation with its primary aim: "to ensure a smooth, timely transition from scientific research on fusion to engineering development and practical application."

Stephen Dean was director of the Magnetic Confinement Systems Division of the Department of Energy (DOE) from 1972 to 1979, and is well qualified to edit a summary of this type. Previously he had been a researcher at the Naval Research Laboratory. The 15 papers in the monograph are contributed from a variety of knowledgeable "fusionites" including elected government officials, directors of DOE and national laboratory programs, and industrial managers.

The book gives an overview of magnetic and inertial fusion in November 1980, complete with progress reports on individual programs and summaries of critical issues. These cover both physics and engineering areas, but engineering is highlighted since, presumably, industrial participation will be focused in that area.

Perhaps the driving force behind the choice of theme in this book was the Magnetic Fusion Energy Engineering (MFEE) Act of 1980, that establishes as a national goal the operation of a magnetic fusion demonstration plant at the turn of the century. It calls for emphasis on engineering development during the 1980s and, to this end, directs the secretary of DOE to "develop a plan for the creation of a national magnetic fusion engineering center." It further calls for the operation of a fusion engineering device (FED) by 1990 and recognized the importance of maintaining research on a variety of concepts while "promoting the broad participation of domestic industry."

The Preface of *Prospects for Fusion Power* is written by former congressman Mike McCormack, who conveys much optimism for fusion and sees numerous opportunities for cooperation between government and industry. As father of the MFEE Act, he explains the urgency for building the FED, but, alas, it is noted that while congress *authorized* $20 billion for magnetic fusion (over 20 years), the money must still be *appropriated* from adequate government budgets. That is the rub. In the Introduction to the book, former congressman Craig Hosmer colorfully expands on the fusion process, and notes that the Japanese government has recently taken up much slack in attacking the engineering problems of commercial fusion.

From here the book is divided into two parts: Chaps. 1 through 7 on magnetic fusion, the remaining six on inertial fusion. In Chap. 1, Stephen O. Dean (Fusion Power Associates) gives an overview of magnetic fusion and discusses basic principles. He also describes device progress in an interesting series of figures that shows plasma temperature, average beta, size, and the density-confinement-time product increasing over the years. N. Anne Davies (DOE) discusses major research issues confronting the tokamak program in Chap. 2 and describes FED as a focal point in years to come. The mirror program, which includes the tandem mirror, the Elmo Bumpy Torus, and the field reversed mirror, is explained in Chap. 3 by William R. Ellis (DOE). James F. Decker (DOE) defines in Chap. 4 the many programs under the Applied Plasma Physics Division of DOE that include plasma theory, alternate concepts, and alternate fuels. The reversed field pinch, compact toroids, and stellarators all appear to offer attractive fusion reactor systems, he concludes.

An enlightening paper on the FED concept is provided in Chap. 5 by John F. Clarke (DOE), deputy director for magnetic fusion. Some insight is given into what type of organization will be required to construct and operate an FED, as well as some of the advanced features of the device. Murray W. Rosenthal [Oak Ridge National Laboratory (ORNL)] notes in Chap. 6 that ~20% of the ORNL budget is let to subcontractors in industry and universities, and that this fraction should continue to grow. In Chap. 7, the history of the fusion program at General Atomic Company is told by Tihiro Ohkawa. He goes on to discuss fusion as a commercial product from industry, and the transition from plasma physics to engineering. Ohkawa suggests that

government, national laboratories, utilities, and industry can cooperate and combine their strengths to conquer fusion.

Chapter 8 is an overview of the inertial fusion program by Gregory H. Canavan (DOE), who describes the basic physical processes, and discusses the program to choose an optimum driver (i.e. laser, light ions, etc.). Sheldon L. Kahalas (DOE) goes on in Chap. 9 to give more detail on the progress and research issues for laser drivers, as does Terry F. Godlove (DOE) for particle beam drivers in Chap. 10. Both conclude that large experiments in the next several years should give energy deposition close to that required for fusion reactors. Industrial participation in inertial fusion is the theme of Chap. 11 by Lawrence E. Killion (DOE), who describes potential areas of involvement and examples of current cooperation. However, near-term interest by industry is noted to be primarily military related, with energy-producing technology somewhat long term. Industry-related programs at Lawrence Livermore National Laboratory (LLNL) are discussed by Alexander Glass (LLNL, now at KMS Inc.) who explains that ~80% of the Shiva Laser budget was subcontracted to industry. Glass also suggests that an FED program for inertial fusion is needed. Finally, in Chap. 13, Patrick B. Long (KMS Inc.) gives a businessman's point of view of fusion and shares some thoughts on the private company's role under the Reagan administration.

Prospects for Fusion Power is *not* a book for learning the basics of fusion. Rather, it describes how government and industry are going about the slow and arduous process of developing a safe and economical energy source. The papers dealing with program progress read like a dissertation to Congress, but are generally well written and surprisingly consistent. The perspectives from industry are refreshing and probably are the most valuable asset of the book. Lacking was a frank discussion of the inherent minuses of fusion; namely, tritium and induced radioactivity, magnetic and chemically stored energy, comparative cost, and public acceptance. Input on these issues could have been provided from the Electric Power Research Institute or the like, but were not to be found.

The monograph is highly recommended to managers in government, universities, industry, and elected officials (and their staffs). However, researchers would not find the book particularly useful, unless they were interested in the "big" picture. Likewise, a lay person might be dumbfounded by the plethora of programmatics. All in all, *Prospects for Fusion Power* is an excellent "snapshot" of the status of fusion in 1980. It is also a fitting testimony to that glorious point in time when the MFEE Act was made the law of the land.

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