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Book Reviews

The Space Environment—Implications for Spacecraft Design

Alan C. Tribble, Princeton University Press, Princeton, NJ, 1995, 203 pp., $49.95

Princeton Guide to Advanced Physics

Alan C. Tribble, Princeton University Press, Princeton, NJ, 1996, 397 pp., $59.50 cloth, $19.95 paper

Since the beginning of flight, engineers and scientists have encountered the challenge of designing for the flight vehicle environment. For flight in the Earth's atmosphere, continued research and development over this century have addressed the fundamental issues. But in the relatively short time that space vehicles have flown, new and often unexpected environmental issues have arisen. For flight in Earth orbit and beyond, design for the hostile and unforgiving environment of space remains a significant challenge.

The Space Environment—Implications for Spacecraft Design by Alan Tribble consists of seven chapters and four appendices. After an introductory chapter, the heart of the book considers basic space environmental effects organized into five chapters for vacuum, neutral, plasma, radiation, and micrometeoroid/orbital debris environments. The appendices tabulate nomenclature and acronyms, give physical constants, and describe NASA's Long Duration Exposure Facility.

The author sets himself an ambitious goal. He tries to bridge the gap between space physics and astronautical engineering by emphasizing facets of the environment that may degrade spacecraft subsystems. He is only partially successful in achieving this goal. There are two basic difficulties. The level of scientific background required to understand space physics is high. Subjects touched on in the book include chemistry, magnetic field theory, atmospheric physics, plasma physics, nuclear physics, and radiation. This list of advanced scientific topics is likely to be beyond the working knowledge of many aerospace engineers. The second difficulty is that the book is too short at 200 pages to develop the subject with comprehension and clarity. Readers with strong scientific backgrounds are likely to find it a concise summary of key points. Readers with limited scientific knowledge will find the book tough going and will need supplemental references.

Positive features of the book are the good expository sections in many chapters where the nature of the environmental problem and potential spacecraft degradation problems are explained clearly. In Chapters 2–6 the role of the space environment in spacecraft design is discussed and design guidelines are given. The design guideline sections are usually very brief, typically about one page in length including a summary table, and they are sketchy on details. For example, in the design guidelines for vacuum environment regarding material selection, Table 2.12 states, "Choose space stable materials and coatings." The problem is that stable materials and coatings are not identified, nor is a suitable reference for material data given.

The conclusions chapter was a good idea, but it is too brief to be effective. It consists of a 14-line overview section and two tables that summarize space environment effects and synergistic space environment effects. There are not enough conclusions to justify the chapter title.

In his other new book, *Princeton Guide to Advanced Physics*, Alan Tribble develops a review guide to various subjects encountered in advanced physics. Twelve chapters cover mathematical methods, classical mechanics, electrodynamics, optics, fluid dynamics, plasma physics, relativity, quantum mechanics, atomic physics, nuclear physics, statistical physics, and solid-state physics. The book is intended to serve as a reference manual for graduate students studying for comprehensive examinations or to provide practicing physicists with a refresher of fundamental topics studied in the past. It, therefore, does not claim to be a supplemental reference for *The Space Environment*, although there are some common topics. The *Princeton Guide to Advanced Physics* probably would not be helpful to most spacecraft engineers since it is heavy on the mathematics of advanced physics and has only minimal explanatory material relevant to understanding physics of the space environment. For the intended readers among graduate students and science professionals it may be a good reference.

Alternatives to *The Space Environment* are spacecraft design texts. Several spacecraft system design books consider issues relevant to design for the space environment. Examples include *Space Mission Analysis and Design* by Wertz and Larson, *Fundamentals of Space Systems* by Pisacane and Moore, and *Space Vehicle Design* by Griffin and French.

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