Guided Missile Design

Handbook of Satellites and Space Vehicles. Robert P. Haviland and C. M. House. Van Nostrand, Princeton, N.J., 1965. xvi + 457 pp. Illus. $15.75.

This handbook, a volume in the series entitled Principles of Guided Missile Design, is reasonably successful in its aim to provide sufficient information to permit preliminary creative design of satellites and space systems, but partially incomplete through being out of date. For example, in chapter 8, on space environment, the most recent reference cited was published in February 1960, 5 years before the preface was written. Chapter 17, on engineering design for man in space, cites no references published after 1961, the first year of man's venture into space! If a handbook is to be very useful in such a rapidly changing endeavor as space engineering, editors and publishers must shrink publication time to 1 year, not 4.

However, the handbook is very useful in those domains where it is concerned with such topics as fundamental relationships and properties of materials. Useful data are given in 100 graphs, more than 300 figures, and numerous tables. Basic factors with dominant effects on preliminary design of space hardware are emphasized. Equations and references are generally included. The editors maintain a helpful approach, and include several systems of units in the scales on many figures—for example, atmospheric density has units of slugs/ft^3, lb/ft^3, and kg/m^3.

The first seven chapters, which treat satellite and rocket orbits and trajectories, start with Kepler's laws and orbit fundamentals, including nomographs and graphical information for orbits about all the planetary bodies. Perturbations and lifetimes for near-earth orbits are included, as well as takeoff and trajectories that reach the surface, or escape, or transfer between orbits. It is shown how earth-bound or space-borne observers may determine position in an orbit or in space. Vehicle stabilization and orientation only by solid and liquid flywheels are discussed, but propulsive, magnetic, and gravity-gradient orientation devices are not.

An extremely useful group of technical compilations, by several specialists, deals with materials in space and their susceptibility to vacuum, to sputtering and meteoritic erosion, and to charged-particle and gamma-ray bombardment.

Fundamentals of thermal control in space are discussed, with useful graphical evaluation of equilibrium temperatures of bodies with different shapes and different (α, ϵ) values.

Communications in space are treated to "provide a first estimate of the communication system required." Requisite bandwidths, noise in receivers and antennae and from nonterrestrial sources, as well as the attenuation of radio waves by rainfall, the ionosphere, and the atmosphere are discussed, as are Doppler shifts and refraction by the atmosphere and by the solar corona. There is no inclusion of many fundamental points in preliminary design, such as existing networks of tracking and telemetry stations, uses of tape recorders or command receivers, designs of satellite antennae, or PCM systems.

The chapter on power systems is comprehensive, but only two pages are used to treat common solar-cell sources, while nine pages are used to discuss unusual solar concentrators such as mirrors. No guide for preliminary design is given on some important aspects—for example, coatings to improve the thermal characteristics of solar cells or plates to give radiation protection.

Despite such detailed criticisms, this is a very useful handbook in a field of endeavor where rate of change and range of topics make a perfect handbook unfeasible. Perhaps my approval is influenced by the discerning (and human) comments in the preface—"design is still an inexact science. . . . Perhaps the best reason for the separation—into preliminary and detail design—is the fact that it increases the level of analytical effort, thereby preventing poor design. Unfortunately, *there is indication that it also tends to prevent outstanding design*" (my italics). This preface should be mandatory reading for personnel who are concerned with reliability and quality assurance.

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Museums: A History and a Guide

Museums, U.S.A. A History and Guide. Herbert Katz and Marjorie Katz. Doubleday, Garden City, N.Y., 1965. xii + 395 pp. Illus. $6.50.

In this single volume, Herbert Katz and Marjorie Katz have attempted to provide both a complete history, covering more than two centuries, and a comprehensive and informative current guide to all museums in the United States. Considering the vast compass of this undertaking, they have done remarkably well.

The work is divided into six major parts. The first is a summary of the museum movement in the American colonies, a movement which had its beginning with individual collections assembled for private scholarly research or public edification. This is followed by consideration of the major museum fields, which include art, science, history, children's, and miscellaneous collections. The exposition of the formative element leading to the establishment and development of each is particularly interesting. The chapter on science museums presents the impulses that brought them into being—the scientific interest starting in the late 18th century, coupled with their development from early cabinets of curios into the major institutes of learning they are today. In addition to the prominent "name" museums, known to the entire scholarly world, there is coverage of the unusual such as Ward's Natural Science Establishment, which started from the private collection of a 19th-century stone collector (a "rock-hound") to become during the past century an important supplier of scientific school equipment. There are stimulating and interesting descriptions of 64 museums that range from trailside installations and natural preserves to the modern formal structures which have become so familiar that we tend to take them for granted.

Included among the 150 museums of history are those of local, state, and national societies, and the house museums, as well as the large complexes like the Ford Museum and Greenfield Village, Cooperstown, Colonial Williamsburg, Deerfield Village, and Old Sturbridge. The authors make a careful and useful distinction between these establishments, which is