

# BOOK REVIEWS

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



## SORRY ABOUT THAT

*Title* One of Our H-Bombs Is Missing

*Author* Flora Lewis

*Publisher* McGraw-Hill Book Company, 1967

*Pages* 270

*Price* \$5.95

*Reviewer* Robert M. Jefferson

At 10:22 AM on January 17, 1966, high above southern Spain, an episode in the unceasing history of man triggered a series of events that affected the lives of almost everyone in the world. This book is an attempt to review that tragedy and its consequences through the eyes of the hundreds of Spanish and American citizens involved. The story begins with 11 airmen, their backgrounds and personalities, and ends with a description of some of the changes wrought in the lives of the villagers of the Palomares region. Between these end points the author reports experiences of the individuals who participated in these events. Unfortunately, the tendency for some individuals to color and enlarge upon their experiences, and the need for others to observe security regulations, have led to some distortion. Within these recognizable difficulties of personal recollection and official secrecy, Miss Lewis amassed a broad collection of information on the events surrounding the tragedy of the accident and the adventure of the search, finding, and recovery of the missing weapons. The entire episode, from beginning to end, is a story more engrossing than any fiction, and Miss Lewis has written an

engaging account which should find a wide and interested audience. In most cases, the errors contained in the narrative are of minor importance, but in some instances the misinterpretations are condemning.

The narrative skillfully reveals the nature of the intimate, almost inseparable, marriage between ignorance and fear. The secretive attitude of both the Spanish and American governments and the fear that it generated are developed with the same degree of subtlety as the incident itself developed. This observation, coupled with the fact that, like it or not, everyone the world over is a part of the complex political-military machinations of mankind, appears to be the most pertinent point of the book. This being the case, it seems to this reviewer that Miss Lewis had an obligation to counter ignorance with fact, thus effectively overcoming unreasoning fear. Instead, the author counters many factual explanations by introducing a nagging shadow of doubt in an attempt to dramatize an already dramatic situation.

In a technical sense, the book offers only the barest of information. For example, the specific techniques of ocean recovery are overshadowed by the dramatic incidents encountered in the "inner space" of the Mediterranean. From this standpoint, the reader who expects to find useful information will be disappointed even though entertained.

Miss Lewis' book should be of interest to a great number of people, for it gives a personal glimpse of an event of our time. On the other hand, this reviewer thinks the technically educated reader will find some aspects of the book either amusing or irritating, depending upon his viewpoint. From the standpoint that it will represent an

authoritative review of the Palomares incident and thus serve in some ways to introduce new doubts into the minds of uninformed readers, it is recommended that the book be reviewed by those in informed positions, so they might eventually counteract some of the questions it will generate.

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## A HIGHLY PERSONALIZED ACCOUNT

*Title* Thermal Stress and Low Cycle Fatigue

*Author* S. S. Manson

*Publisher* McGraw-Hill Book Company, 1966

*Pages* xi + 404

*Price* \$16.50

*Reviewer* L. F. Coffin, Jr.

To this reviewer's knowledge, this is the first book by a single author to appear on the important subject of thermal stress and low cycle fatigue. This area of inquiry

now occupies an important position in the general study of the fatigue phenomenon in materials and structures. The book is timely and serves a definite need for the student and for the practicing engineer. On the other hand, the subject is a rapidly growing one, and our understanding of the phenomenon and its application to design of structures is still limited. In this light, the volume must be viewed as a "state-of-the-art" rather than a time-tested reference manual.

The book is an outgrowth of several compilations in two major fields of current engineering interest: thermal stress and low cycle fatigue. While primarily a review of several investigations personally conducted by the author the book also incorporates a review of the works of others in the field selected to complement his viewpoints. The reader will find this book aimed toward design, with discussions of material behavior, directed less towards the phenomenology itself than to application in structures. Those looking for a general treatment of low cycle fatigue may not be entirely satisfied by the content and approach, while those seeking design information will find the book highly worthwhile.

After introducing thermal stress fatigue and low cycle fatigue as related phenomena of limited life, the author considers several methods for computing thermal stresses elastically. Emphasis is given to approximate methods which the author describes as generally less cumbersome than exact solutions.

Next the author considers the analyses of structures subjected to plastic flow and creep when the loading is monotonic. After a discussion of the differences between deformation and incremental theories, numerical methods for solving time-independent problems by both theories are given. This is followed by a discussion of creep analysis including means for treating complex loadings from uniaxial creep data by means of time-hardening, strain-hardening, or life-fraction rules. No attempt is made to relate this treatment to the very extensive engineering literature devoted to this subject.

The phenomenological behavior of metals subjected to cyclic strain is considered next. After a discussion of cyclic hardening and soft-

ening during controlled cyclic plastic strain, the author's previously published treatment of the relationship between cyclic strain and life is considered. The procedure involves establishing four equations for determining four constants which permit the general description of a cyclic strain-life curve for a given metal. The four equations are derived in terms of 1) the ultimate stress, the fracture stress, the tensile ductility all obtained from the tensile test, and the elastic modulus; or 2) the fracture stress, the endurance limit, the tensile ductility and the elastic modulus. Comparisons of these relationships with that developed by this reviewer and based on fracture ductility, endurance limit, and elastic modulus are then given for a variety of engineering metals. It is important to note that no consideration is given to the limits of applicability of the methods described. At elevated temperatures where creep deformation can be extremely important, the procedures outlined are not applicable, and predictions of fatigue life can be greatly overestimated.

The subject of cyclic plasticity is treated next. Here three methods for relating cyclic strain data to complex engineering structures are examined. These methods are a necessary adjunct to low cycle and thermal fatigue design, but lack experimental confirmation and the test of time.

Thermal stress fatigue considered next is largely a review of the literature on the subject. Attention is given to the relationship of thermal stress fatigue tests to those involving constant temperature cyclic strain. No mention is made of methods of experimentation, nor of the rather extensive literature on the subject developed abroad, particularly in England, Russia, and Japan.

The subject of thermal shock, largely a consideration of the behavior of brittle materials, is then treated. The approach is one of determining a fracture stress, and cyclic life is not involved. The discussion involves the determination of thermal shock parameters, failure criteria, and experimental results.

Miscellaneous topics covered in the chapter entitled "Choice of Materials" include some physical properties of ceramics and cermets,

anisotropic ratcheting, transition temperature, strain rate effects, metallurgical factors, and the specific performance of a number of materials subjected to a variety of cyclic thermal stress test methods.

Finally, means for investigating severe thermal stresses are reviewed, including constrain reduction, floating construction, flexibility, thermal sleeves, dimensional contouring, temperature control, auxiliary heating, expansion compatibility, and use of favorable residual stress (for brittle materials); mentioned briefly are procedures common to high cycle fatigue.

The text is well organized, and a summary is included at the end of each chapter.

The reader cannot help but form the opinion that this is a highly personalized account of the subject. This is both its strength and weakness. Those whose background and approach to the subject are similar to those of the author will find the book stimulating, thorough, and useful; those whose background or interests are in experimentation or in mechanical metallurgy or metal physics may not find much stimulation from the subjects covered.

*L. F. Coffin, Jr. is a mechanical engineer in the Metallurgy and Ceramics Laboratory of the General Electric Research and Development Center in Schenectady, New York. Prior to taking his present position in 1955, he was a member of the staff of Knolls Atomic Power Laboratory. He has been active in the fields of plasticity, flow and fracture, strain cycling, fatigue, and friction and wear. His ScD in mechanical engineering is from MIT.*

## BOOK ANNOUNCEMENTS

Although the following books will not be reviewed, they may be of interest to some of our readers:

*Photographic Film Dosimetry*, Klaus Becker, Focal Press, 1967, 223, \$21.50

*Pulse Radiolysis of Water and Aqueous Solutions*, A. K. Pikaev, (Edwin J. Hart, ed.), Indiana University Press, 1967 (English tr.), xvi + 295, \$10.00