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BOOK REVIEWS

Space applications at the crossroads edited by John. H. McElroy and E. Larry Heacock. American Astronautical Society Publication, 1983, pp 296 $ 35. Orders to: Univelt, Inc., P O Box 28130, San Diego, Calif, 92128, USA.

This volume represents part of the proceedings of the 21st AAS Goddard Memorial Symposium, held in March 1983. The Symposium consisted of seven sessions, respectively on:

1. Twenty-five years of NASA - Reflections and projections
2. A new look at planet earth
3. Fifty years of space astronomy
4. Applications of satellites' observations to climatic research
5. Large scale integration in space: A macro view
6. Value-added user services
7. Applications and the space station concept

Unfortunately, many papers presented at the Symposium are *not* part of this volume; in particular, Sessions 4 and 5 — both important — have no contributions to the volume at all. Also, unfortunately, there is no clear statement in any of the papers, or in the preface, why space applications are at the cross-roads today: the reader is left to find that out for himself after ploughing through the papers.

The first section has three papers on the first 25 years of NASA. Even a mere listing of NASA projects in this period, of the kind provided by Mr. Yardley, is enough to show how breath-taking NASA's achievements have been: from Mercury through Apollo to the Shuttle has been a long series of technological triumphs. Mr. Yardley correctly says, 'Without the Russian challenge and the resulting national goal, it might have taken 50-75 years to accomplish what we have done in 25 years'. To cite only one specific outcome of these achievements, it is now commonplace to view TV programmes broadcast through satellites; as late as 1961 the combined bandwidth of *all* circuits between North America and overseas points was far short of the requirement for carrying a *single* TV signal!

But now space technology enters a phase where the glamour of technological achievement has worn off, and the US is seeking to find a return on its investments by promoting commercial and military applications - there is some discussion of the former in the volume,

but none of the latter, which as every newspaper reader knows now looms large in Mr. Reagan's mind. It is an indication of the maturity achieved by space technology that, the dreamers having succeeded, the bankers and generals are taking over.

Among the commercial applications reviewed in some depth are the possibilities of LANDSAT 4 in land-use surveys, agriculture and private industry. Papers in Section 2 on this theme are followed by related papers in Section 6, discussing how a strong value-adding industry can commercialize space, by providing agriculture information systems, image services, etc. Mr. Hussey's review of possible economic benefits from operational environment satellites is probably particularly relevant to India. Section 7 argues for the space station concept, and its uses for earth observation and communication. In between, Section 3 reviews achievements in space astronomy. But the virtual blank in Section 4 - devoted to climate research (there is only an half-page abstract) - is a serious loss to the reader.

The most interesting and well-written article in the volume however comes from Prof. Bisplinghoff, and is (rather ironically) on *aeronautics* at NASA. He brings to his study a keen sense of history and of the key role played by ideas and people. He points out how NACA —NASA's predecessor—was given, in 1915, 'the simple but far seeing directive to *supervise and direct the scientific study of the problems of flight with a view to their practical solution*'. Any one who is familiar with the complex and detailed 'charters' that some Indian organizations have cannot fail to admire the concise appropriateness of the directive to NACA (shades of the US constitution!). Prof. Bisplinghoff points out how its dominant role in making the US a leader in aeronautical technology was primarily through its research reports - on which he himself relied entirely when he was an young designer at Cincinnati, as did the Japanese engineers working at war-time Mitsubishi (one of whom photographically copied all NACA reports when he was a graduate student at MIT before the War). With the advent of the space effort, the R & D budget on aeronautics plunged steeply to a low of less than a million dollars in 1961 (it recovered to $589 million in 1984). Prof. Bisplinghoff also points out how the success of NACA owed much to a highly effective 'technology delivery system', namely, military aviation. His account of these and other similar factors in US aeronautics is fascinating, although it sometimes tends to over-advertise NASA achievements; *e.g.*, reading his brief account of developments in supercritical aerofoil technology (p. 36), one may get the impression that it was all done at NASA - whereas in actual fact the pioneering contributions, both experimental and theoretical, came from Europe.

In summary, this volume is a partial but nevertheless useful record of an American Symposium, good to keep in your institutional library for possible reference.

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Developing the space frontier (Ed. Albert Naumann and Grover Alexander) Vol. 52: Advances in the Astronautical Sciences; American Astronautical Society, San Diego, California, USA, 1983, pp. 419., $ 45. Orders to Univelt, Inc., P.O. Box 28130, San Diego, CA 92128.

This volume contains the proceedings of the 29th AAS Annual Conference held in October 1982 in Houston. The meeting was addressed by many persons holding responsible positions in aerospace-related institutions in US, as the biographical sketches in the appendix make clear. Looking at the list of contents, one gets a feeling that the success of the US space programme could well be due to the fact that there are so many competitive and complementary organizations which make concentrated efforts to maintain the US supremacy in space.

The main body of the volume has five interrelated sections: Governing policies, Roles in space development, Implementing the development of space, Preparing the base for space development and Space transportation system in addition to a rather lengthy introduction. There are about forty-three papers in the volume not counting the brief lectures and introductions. Quite a few are recorded lectures transcribed and reviewed. Sometimes the rhetorics of speech cloud the contents and make one think that the written version should have been prepared separately, especially while bringing out a special volume like this one from AAS. But it cannot be denied that occasional anectedotes and short stories must have made the speeches interesting.

In the introduction part where all papers discuss the same themes like strengthening of the security of US, commercial exploitation of space, etc., though from different angles, the keynote address on 'Tactics for survival' is refreshingly interesting with a balanced opinion and a keen scientific attitude. Both in this and in the following sections on Governing policies and Roles of government and private sector in space development, the articles are full of generalities on well-known themes, and a discerning reader has to sift through a lot of material to discover a few new ideas — fortunately, there are some indeed. Of particular interest will be the examples on private sector ventures in space.

Similar feeling continues even through the next section on Implementing the development of space. The analogy between space and aviation appearing in two different papers deserves a careful reading. An article which strikes a different tune is the one on adjustments needed in today's business curriculum in higher education as a consequence of the rapid progress in space-related activities. The need for regular updating of knowledge is well brought out and it is more urgent now than ever before.

'Preparing the base for space development' will certainly find wide readership. Here the articles are more technical in content and are quite informative too. Each paper deals with a different aspect of space development and addresses the problem—technical, legal, educational or psychological—in a direct way. Although some parts can be termed as emotional, this section is definitely the best part of this volume.

In the latter sections, the tone returns to that in the earlier part with pages and pages to be glossed over before discovering a couple of nice ideas.

The volume essentially addresses a US reader who finds some emotional identity with the policy makers there (and is familiar with the innumerable acronyms too!). The volume projects a very impressive space programme of United States to counter the Soviet military activities in space, to keep ahead of the probable European and Japanese commerical

ventures in space, as well as with a deep commitment to the pursuit of science. But a non-American reader cannot, at times, escape the feeling that many speakers sound as though US is a self-appointed guardian of peace, security and progress of the world.

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Space manufacturing 1983 edited by J.D. Burke and A.S. Whitt. American Astronautical Society, 1983, pp. 496, HC $ 60/SC $ 50. Orders to Univelt Inc., P.O. Box 28130, San Diego, CA 92128, USA.

The volume is a collection of thirty-seven papers presented at the Sixth Princeton Space Studies Institute Conference on Space Manufacturing held during May 9-12, 1983. It essentially presents new research and study results since 1981 in the area of commercial exploitation of space. A comparison with the earlier volumes of the series during the mid-1970's shows a clear shift away from broad and sketchy goal of space exploitation towards a closer consideration of specifics regarding manufacturing processes and facilities.

A very wide range of topics are covered in the volume, including disciplines with indirect bearing on the manufacturing process itself. Space manufacturing requires, first and foremost, a platform in space, and quite often the involvement of human operators and supervisors. Habitation aspects - physical, biomedical and social - get about as much coverage in the volume as material processing and resource collection aspects themselves, which form the central theme of the volume. This is not surprising since experience on manned spacecraft is far more than space manufacturing.

Some very interesting collateral aspects are presented, notably the international and legal aspect of space manufacturing, including some exotic and somewhat futuristic topics such as mining asteroids. These serve to provide thematic completeness and continuity with future. One paper advocates a 'popular spectacular', such as a solar sail race to the moon as a means of generating public support for space programmes by creating a sense of participation among lay public. Although its connection with the main theme of the volume is somewhat far-fetched, it is a good idea in itself. A question 'Should people, robots, or hybrids operate a space station?', which appears as the title of a paper, would be very relevant to economic exploitation of space; but, unfortunately, only an abstract appears under the title. However, the reader is directed to an article published elsewhere on this subject.

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Luminescence and light emitting diodes by E.W. Williams and R. Hall. Pergamon Press, 1978.

This book is a comprehensive presentation of an exciting new field dealing with electroluminiscent devices which have already become part of our daily lives through the pocket calculators and digital watches. These devices convert electrical energy into optical radiation. The phenomenon, first discovered in 1907, became commercially viable only in the late sixties when light emitting diodes (LED) came into the market. This was the result of tremendous research and development efforts particularly in the area of III-V semiconductor materials. The authors of this book have worked extensively with these materials and their treatment shows full understanding of the subject.

Understanding light-emitting diodes requires detailed understanding of crystal structures, band theory of semiconductors, and other concepts of solid state physics. The book assumes this background. However, post-M.Sc. students and researchers can easily follow it or use it as a reference. Crystal growth techniques relevant to the III-V compounds are briefly described in Chapter 3. Here a more detailed treatment would have been useful; however, references are given which a researcher seeking details can look up. Chapter 4 dealing with device fabrication procedure is quite adequate and well written.

Chapters 5,8 and 9 deal with the basic theory of luminescence and excitation processes and present the physics of commercial LEDs. These are excellent presentations with detailed experimental data in tables and figures. Various radiative transition mechanisms such as donor-acceptor transitions, bound exciton collapse at isoelectronic impurities, etc., have been presented with examples. Frontiers of research and unexplained results have also been pointed out. In this respect, it is to be remembered that the book was written in 1978 and much more has happened in the intervening period. Chapter 6 provides a very brief account of semi-conductor injection lasers. In view of several other books dealing mainly with the lasers, this treatment is adequate since the book emphasizes the LEDs.

Chapter 7 dealing with measurement techniques including photo-luminescence, cathodo-luminescence, electron beam-induced current, deep level transient spectroscopy, and photometry is one of the best treatments of experimental methods I have seen and reveals the authors involvement with the practical aspects of these devices. Chapter 10 shows how LEDs are used.

Even though the book published in 1978 is somewhat outdated now, it will be useful on the table of any researcher dealing with light-emitting diodes and semiconductor materials. It can be a good textbook for a course on optoelectronics and will be found useful by those dealing with optical communications.

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Introduction to TI BASIC by Don Inman, Ramon Zamora and Bob Albrocht. Hyden Book Co., Inc., Rochelle Park, New Jersey, 1980, pp. 305, $ 10.95.

The immense magnitude of development in the field of Computer Science, has segregated the common mass into two groups - one that can use a computer and the other which cannot. It is those who belong to the latter category that often feel it to be too late for a beginning and therefore tend to shy away from a computer.

However, personal computers have started invading the market and slowly more people are coming forward to familiarize themselves with such a machine. This familiarization is therefore much dependent on the machine one possesses. Texas instruments have their series of home computers.

Introduction to TI BASIC by Don Inman, Ramon Zamora, and Bah Albrocht, is more of a user manual to those who possess a TI home computer. It definitely guides the readers and the users of the home computer to the expanding world of personal computing. It is therefore evident that such a text for readers in Indian environment does not attract interest.

The introduction of programming concepts and technical material as persued in this text, is more of a guide towards building the good foundation to effectively exploit all the facilities of such a personal computing system.

It therefore cannot be catagorised as a book for either growing scientists or engineers. It is more of an awareness to the immense capabilities of the TI computer for personal use. In other words, a layman is introduced to the system, to which he/she had considered himself/herself alien.

In summary, the book is a good guide to a TI home computer user.

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Mechanical measurements (2nd Edition) by R.S. Sirohi and H.C. Radha Krishna. Wiley Eastern Ltd., New Delhi 110 002, 1983, pp. xi + 256, Rs. 35.

As per the authors, the material contained in the book is extracted freely from literature in view of the exceptionally good method of presentation in some of these publications. Appearance of a second edition, with useful addition and revision of information, indicates the popularity of the book.

After introducing the significance and necessity for measurement, a general functional description as well as the input-output configuration of measurement systems are presented. Certain methods of correction of spurious inputs, nature of information signals and normal modes of operation of instruments are then brought out.

Performance capabilities and limitations in measurements are covered next. Various static characteristics are clearly explained. Response of zero, first and second order measurement systems are detailed. Experimental determination of system parameters is also indicated.

A clear study of various types of errors and their sources, distinction between accuracy and precision, statistical analysis of errors, least square technique and error propagation would enable the reader to select suitable measurements to realize the required accuracy in a measurement and to specify errors precisely.

Common and established methods of measurement of force, torque, strain, pressure, flow and temperature are covered in detail. A separate chapter is devoted to recent optical measurements involving lasers. Information on the quality of standards as maintained in NPL ought to prove very useful. Problems given at the end of each chapter permit self-assessment.

Bibliography includes some of the good books available. Addition of a list of technical articles and manufacturers' notes on various topics covered in the book would be equally useful for delving deep into various aspects of measurement.

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