lime content. Processing with $(NH_4)_2CO_3$ has never been used on a plant scale. Another misleading comment suggests that vanadium is recovered in the United States by ion exchange resin processes.

(2) To the extent that the book serves as an annotated bibliography, a larger number of references would be desirable.

(3) The discussion of comparative economics of ion-exchange versus solvent-extraction processing is in qualitative agreement with information available to this reviewer. However, in a more quantitative sense, the assumption of solvent losses at 0.07% of the aqueous flow may be questionable since operating plants have reported losses that are lower by a factor of 2 or more. Solvent losses comprise an appreciable portion of the total solvent-extraction costs, and assumption of lower losses would further increase the indicated economic advantage of solvent extraction even on low grade (0.2 g U_3O_8/liter) liquors. It might also be noted that the concentration of uranium in the liquor is not the only controlling factor in choosing between ion-exchange and solvent-extraction processing. For example, process development work on certain uraniferous shales showed a preference for solvent-extraction processing of liquors containing only 10-20 ppm uranium. This was due to the presence of relatively large amounts of molybdenum, phosphate and other contaminants which caused considerable interference with the ion exchange process.

(4) Appendix 1, on the general economics of uranium processing, is an interesting and valuable addition to the book. As a word of warning rather than criticism, the reader should be encouraged to use this information only within the limitations that are already carefully set forth by the authors. Quotation of these costs out of context would be of disservice to the authors and to the painstaking efforts that were obviously expended in accumulating the information.

Several other possible errors of commission, omission or implication might be commented upon, but it is believed that these, as well as those mentioned, do not detract in any large way from the value of the book. It is apparent that the authors are well informed in the field and have, with excellent organization, condensed a prodigious amount of material into a limited space. It should prove to be a worthwhile contribution to the published literature.

Tratamiento de Minerales de Uranio. By L. G. Jodra and J. M. Josa; published by the International Atomic Energy Agency, Vienna, 1962; distributed by National Agency for International Publications, Inc., New York; 54 pages; $1.00. (This book is bound with the one reviewed above).

This is also a small book which touches upon nearly all aspects of the field of uranium ore processing. Consequently, there is considerable overlap with the book by Pinkney, Lurie, and van Zyl. On the other hand, there are some notable differences. For example, in the book by Jodra and Josa, somewhat greater attention is given to such items as physical concentration methods, roasting, ore reception and sampling at the mill and preparation and packaging of the final product. Still more important is the difference in emphasis given to treatment of similar subject matter in the two books. Jodra and Josa devote a relatively large amount of attention to effects of important chemical and physical variables in the several unit operations in ore processing, along with reasons for these effects. Minimal attention is given to specific plant practices or process economics. As a result, they have produced a useful companion piece to the book by Pinkney *et al.*

Since the book by Jodra and Josa has not been translated from the original Spanish, any detailed comments by this reviewer suffer from an extremely low proficiency in that language. It does seem that some questions might be raised concerning:

(1) the suggestion that weak-base anion exchange resins are not useful, whereas it is probably possible to design suitable resins of this type;

(2) the suggestion that $UO_2(SO_4)_3^{-4}$ rather than $UO_2(SO_4)_2^{=}$ is the ion which transfers in the ion-exchange process;

(3) the statement that the structure of the uranyl di(2-ethylhexyl)phosphate complex is not defined, whereas the structure is now well understood;

(4) the quotation of soluble amine losses at 20 to 30 ppm in the aqueous phase, whereas the amines used in practice have much lower soluble losses.

The long reference list is a credit to the book. However, it is noted in several cases that the reference points could have been better positioned for leading the reader more directly to the best source of original detailed information.

However, these criticisms are minor in relation to the total work. It is simply not possible to give complete coverage to so large a field in such limited space, and the authors make no pretense at such an attempt. Little objection can be raised to the authors' particular choice of emphasis. It is evident that they are highly familiar with nearly all of the available literature and that they have succeeded in packing a surprisingly large and well organized amount of information into a small volume. It should prove useful to both the novice and expert in the field.

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About the Reviewer: K. B. Brown has been in the nuclear materials field for more than 19 years and is currently a Section Chief in the Chemical Technology Division at Oak Ridge National Laboratory. From the late 1940's to late 1950's, he directed an intensive development program on the processing of uranium and thorium ores. One important outcome of the program was the development of the Amex and Dapex solvent-extraction processes which are widely used in the United States and some foreign countries. He received the Mining World Technical Achievement Award for 1956. In recent years he and his co-workers have turned their attention to radiochemical separations and have developed new solvent-extraction processes for the recovery and separation of fission products, transplutoniums, neptunium, plutonium and other elements.

Handbook of Astronautical Engineering. Edited by H. H. Koelle; McGraw Hill, New York; 1805 pp; $27.50.

McGraw Hill and Mr. Koelle have brought about a handbook aimed at the engineer or scientist at work in the expanding fields of aerospace technology. Typical of a handbook, it will not be particularly useful to an individual in his working field, but instead will augment his background in all relating areas. It is quite complete and should serve as a continuing reference for many years. This is augmented by the fact that the essence of most chapters is an understanding of the problems and how to attack them both as to philosophy and theoretical approach. The book must surely be augmented in many areas as far as design data are concerned, but this is a requirement which comes with age in any case.

The handbook, composed of twenty-eight chapters, has been formulated into six major areas: fundamentals of astronautical engineering, astrodynamics, astrionics, propulsion systems, space vehicles, and space flight operations. The scope of coverage is tremendous and yet in each area consideration is given to the most recent advances, particularly in advanced vehicle design concepts, space flight economy, components, and systems integration. Information of a historical nature is presented which indicates early interests in space flight and the rapid growth in activity today. The nature and operational characteristics of missiles, probes, and space vehicles currently existing or under development will provide an important reference to design engineers.

The content of chapters concerning technological and design problems will be of particular aid in preliminary design application. A basic presentation is given of design problem areas and their method of attack. Much of the design data presented are in graphical form and are only suitable to preliminary design application. Likewise, a probing into the refinement of engineering problem areas is left to external treatment in specialized sources. Technology of more general application, such as nuclear technology and reactor design considerations are treated most lightly. Very little is included on general properties of materials except those particularly oriented to space applications. It must be presumed that the user would refer to other handbooks.

An instrumental fact leading to the high quality of material presented and the clarity of the philosophy is that a very high-quality editorial board, chaired by Dr. Wernher von Braun and including such names as Dixon, Herrick, Lange, Stuhlinger, and Sutton assisted Mr. Koelle. Over and above this, 150 specialists from government agencies, industry, and universities contributed their expertise to this major undertaking.

Certainly the *Handbook of Astronautical Engineering* does not provide everything needed to build and fly a space vehicle, but there is collected in this one volume a composite of information which covers the technological scope in adequate detail to give an understanding of all major technical problems and the approaches to their solution. Design, development, and operational considerations are covered completing a handbook that should be useful to any space systems engineer.

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About the Reviewer: Robert F. Trapp is currently Chief of Man-System Integration Division in the Office of Advanced Research and Technology, National Aeronautics and Space Administration, Washington, D. C. In this capacity he is involved with all aspects of incorporating man into future space systems.

Mr. Trapp's previous experience includes six years with Douglas Aircraft Company, Missiles and Space Division, in charge of their nuclear space system activities.

Mr. Trapp has been active for some years in