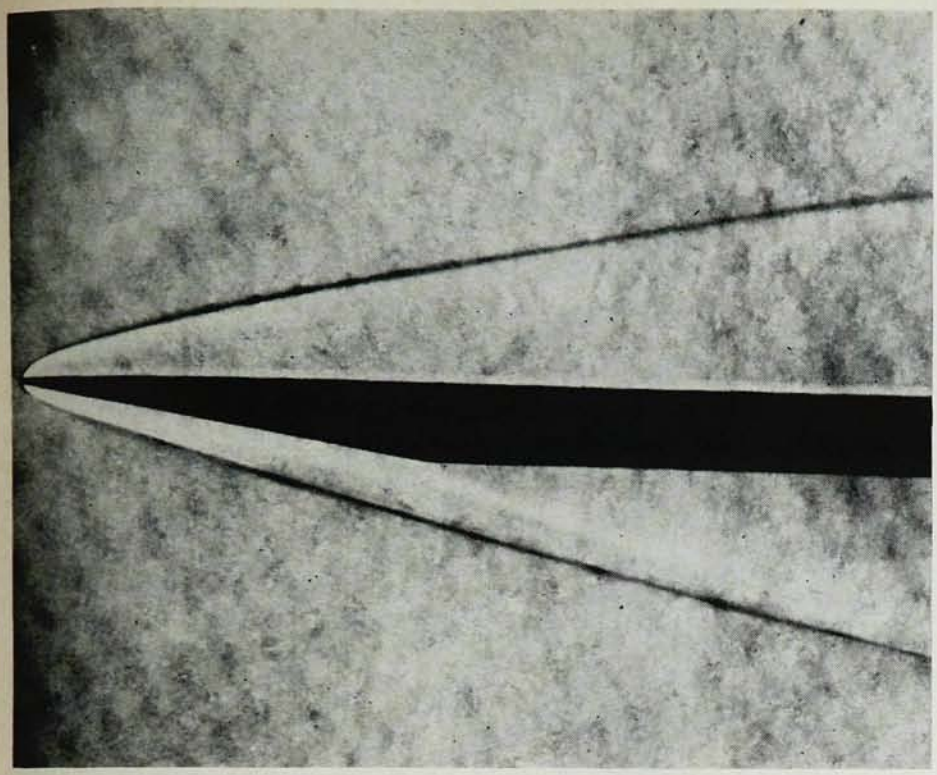

FLOW past a blunted flat plate in air at $M_1 = 13.8$. ($d = 0.0142$ in.) Photo from *Elements of Hypersonic Aerodynamics*. (Crown copyright.)

Solving hypersonic problems

ELEMENTS OF HYPERSONIC AERODYNAMICS. By R. N. Cox and L. F. Crabtree. 243 pp. Academic Press, New York, 1965. $6.50.

by Allen I. Ormsbee

This volume represents a neat compilation of methods for solving problems in hypersonic flow. The first two-thirds of the book is concerned with continuum flow problems in nonviscous, nonconducting perfect gases and includes the expected subjects under this heading, including the blunt-body problem as well as the nature of vortical singularities. The remainder contains a discussion of viscous and low density effects. The writing is lucid, the illustrations are excellent, and the bibliography is thorough.

Establishing a thread of continuity through the rather disparate group of topics necessarily covered in any book on hypersonic flow has been handled in this volume about as well as is possible. It is unfortunate that the book was published too early to include a discussion of some of the numerical problems that are currently being encountered in the various blunt-body solutions. The discussion of entropy layers and vortical singularities could also have benefited by a more lengthy treatment. The material on boundary layers is quite brief but well presented.

On the first pass through the volume, one gets the impression of a completeness which, though an asset to the readability of the work, might lead the casual reader into misunderstanding the complexity of many of the problem areas presented. The authors, R. N. Cox of Britain's Royal Armament Research and Development Establishment, and L. F. Crabtree of the Royal Aircraft Establishment, have, however, provided a very extensive list of references to offset this possibility.

This text should serve rather well as the basis for a first year graduate course, being considerably broader than Chernyi and somewhat more palatable than Hayes and Probstein. It should also constitute a useful reference work for the designer.

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Anything that can happen, will

ERGODIC THEORY IN STATISTICAL MECHANICS. By I. E. Farquhar. 235 pp. Interscience, New York, 1964. $12.00.

by R. B. Lindsay

The principal aim of ergodic theory in physical science has long been known to be the basic justification of the use of statistical mechanics in the description of the macroscopic behavior of dynamical systems. In the vernacular the ergodic hypothesis is often phrased: "Anything that *can* happen, *will* happen, if you wait long enough." In more sophisticated terminology the ergodic theorem states the equivalence between the time average of any dynamical quantity associated with the system and the average over the statistical ensemble representing the system in phase space. It has been customary for most physicists to believe that the theorem follows from the ergodic hypothesis, first introduced by Boltzmann and Maxwell in the seventies and eighties of the last century. They phrased the hypothesis in the form that for a constant energy ensemble (for example, the microcanonical ensemble of Gibbs) the phase path of any dynamical system will in its motion ultimately pass through every phase point on the energy hypersurface in phase space. It was shown, however, in 1913 that the ergodic hypothesis leads to a contradiction. It was replaced by Ehrenfest with the weaker quasi-ergodic hypothesis, according to which the phase path in question passes arbitrarily close to every point on the energy surface. On the whole, physicists have been content with this version and have felt that the validity of statistical mechanics is sufficiently justified by it.

On the other hand, the mathematicians have long been fascinated by the intricacies of the ergodic problem and a relatively large literature concerning it has grown up. It has been the purpose of the author of the book under review, a lecturer in mathematics in London University, to survey the mathematical theory, with, however, primary emphasis on the physical aspects of the problem.