FOREWORD

In September of 1956, the first Symposium on Naval Hydrodynamics, sponsored by the Office of Naval Research and the National Academy of Sciences – National Research Council, was held for the specific purpose of presenting authoritative, critical surveys of those areas of Hydrodynamics that are of significance in naval science.* In keeping with the original plans set down for this series, subsequent meetings were to be devoted to one or more themes selected on the basis of importance and need for research stimulation, on the one hand, or of achievement of important "breakthroughs" and hence of interest for wide dissemination, on the other. Thus, the present symposium achieved an example of each criterion: hydro- and aerodynamic noise (of great importance in both warfare and commercial usage of ships and aircraft), and supercavitating and ventilated flows (which promise, for example, possibilities of high-speed marine propulsion at efficiencies hitherto not thought attainable).

Recent declassification of many research results in both subjects made possible the wealth and excellence of contributions presented at the meetings in August of 1958 and now reproduced in this volume. Unlike the first symposium which defined the framework of the field of interest, this meeting was devoted in largest part to original contributions. Again, as for the earlier meeting, each paper was invited from the active research centers without regard to geographic location.

Aside from the military importance of the two theme topics, they are rather remarkable from other standpoints. In each case, the important scientific contributions that stimulated further research occurred within the last seven or eight years. Furthermore, they clearly illustrate a characteristic of the field of Hydrodynamics that the most important practical problems require for their solution research of a nature that is "basic" in the classical sense. In the case of hydrodynamic noise problems, only an understanding of the physical mechanisms of cavitation, turbulence, etc., could lead to the progress that has been made. Of particular interest in recent years has been the question of turbulence noise in both aerodynamic and hydrodynamic application; the clues to the direction of research were provided by Lighthill's treatment of jet noise only eight years ago. In the case of cavitating flows, the difficulties of the nonlinear free stream line theory and of experimental observations made progress very difficult and seemed to lead inevitably to the conclusion that cavitation and cavitating flows were to be avoided at all costs. It was only following the development of a linearized theory of such flows by Tulin in 1953 and his subsequent discoveries of low-drag supercavitating strut and hydrofoil profiles that realization grew of the significent benefits that can be achieved with supercavitating flows and, in fact, that for certain applications, operation under supercavitating conditions is to be sought rather than avoided. In another context, Tulin's accomplishments are an outstanding triumph of theory in providing results that can be used without modification and with confidence in engineering design. The basic achievement itself will certainly rank with linearized airfoil theory and thin ship theory in importance and practical consequence.

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*"Symposium on Naval Hydrodynamics," National Academy of Sciences – National Research Council, Publication 515, 1957, Washington, D. C.

White papers were included on noise in multiphase and multicomponent flows in that part of the program devoted to noise, the major emphasis was given to shear flow noise, and in particular, turbulence noise, in recognition of the growing importance of this source in both aerodynamic and hydrodynamic applications. Because of their close relationship, both scientifically and technologically, both supercavitating and ventilated flows were included in the second part of the program. In addition, to bring out the relationships between cavity flows of these types and separated flows, at least insofar as the usefulness and applicability of modern methods of analysis are concerned, a paper was also included on "aerodynamic cavities." In this way, it was hoped to illustrate and bring about a unification of the various viewpoints of research in the divers disciplines of fluid dynamics.

It is my privilege to extend our thanks to the authors for their willingness to participate in the program. The responsibility for the organization of the technical sessions was assumed by the Mechanics Branch of the Office of Naval Research. It is indeed a pleasure to acknowledge the assistance of the following, who individually or collectively made a number of suggestions of papers and authors from which the final program was selected:

J. S. Coleman, Excutive Secretary, Physical Sciences Division, National Academy of Sciences

S. Corrsin, The Johns Hopkins University (Representing the National Research Council Committee on Undersea Warfare)

J. B. Parkinson, Chief, Hydrodynamics Division, National Aeronautics and Space Administration

M. Strasberg, David Taylor Model Basin

A. J. Tachmindji, David Taylor Model Basin

M. P. Tulin, Office of Naval Research Branch Office, London

The administrative arrangements were very kindly undertaken by the National Research Council and special thanks are due Messrs. George Wood, John Cooper, and Mrs. Helen Ray of that organization. Yoeman work in connection with the technical details of the meeting was performed by CRD H. B. Keller, USN, of ONR's Mechanics Branch, and A. G. Fabula and R. J. Mindak of the Office of Naval Research Branch Offices in Pasadena and Chicago, respectively. Though it is never possible adequately to thank the Editor of symposium proceedings such as these, particular recognition is due Mr. Ralph D. Cooper for his courage in accepting this assignment and for the professionally excellent way in which he accomplished his task. Not only must he live with the meeting long after it is over, but he must, unfairly to be sure, bear the brunt of the clamor that invariably arises when delays in publication occur.

Finally, I should like to express our gratitude to the Commanding Officers of the David Taylor Model Basin and the Naval Ordnance Laboratory, and to their scientific staffs, for their kindness and efforts in providing the technically stimulating tours through these laboratories on the third day of the meeting.

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