AIRCRAFT WAKE TURBULENCE AND ITS DETECTION

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Proceedings of a Symposium on Aircraft Wake Turbulence held in Seattle, Washington, September 1-3, 1970. Sponsored jointly by the Flight Sciences Laboratory, Boeing Scientific Research Laboratories and the Air Force Office of Scientific Research

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PLENUM PRESS • NEW YORK–LONDON • 1971

Library of Congress Catalog Card Number 70-159027
ISBN 978-1-4684-8348-2 ISBN 978-1-4684-8346-8 (eBook)
DOI 10.1007/978-1-4684-8346-8

A Division of Plenum Press Publishing Corporation
227 West 17th Street, New York, N.Y. 10011

United Kingdom edition published by Plenum Press, London
A Division of Plenum Publishing Company, Ltd.
Davis House (4th Floor), 8 Scrubs Lane, Harlesden, NW10, 6SE, England

FOREWORD

The combination of increasing airport congestion and the advent of large transports has caused increased interest in aircraft wake turbulence. A quantitative understanding of the interaction between an aircraft and the vortex wake of a preceding aircraft is necessary for planning future high density air traffic patterns and control systems. The nature of the interaction depends on both the characteristics of the following aircraft and the characteristics of the wake. Some of the questions to be answered are: What determines the full characteristics of the vortex wake? What properties of the following aircraft are important? What is the role of pilot response? How are the wake characteristics related to the generating aircraft parameters? How does the wake disintegrate and where?

Many of these questions were addressed at this first Aircraft Wake Turbulence Symposium sponsored by the Air Force Office of Scientific Research and The Boeing Company. Workers engaged in aerodynamic research, airport operations, and instrument development came from several countries to present their results and exchange information. The new results from the meeting provide a current picture of the state of the knowledge on vortex wakes and their interactions with other aircraft.

Phenomena previously regarded as mere curiosities have emerged as important tools for understanding or controlling vortex wakes. The new types of instability occurring within the wake may one day be used for promoting early disintegration of the hazardous twin vortex structure.

The influence of the atmospheric variables of stability and turbulence level on the wake behavior has been examined, but is not yet fully understood. High turbulence levels are thought to accelerate wake disintegration by both increasing dissipation and exciting the natural wake instabilities. High atmospheric stability causes variations in the descent path of the wake, in some cases the effect is similar to the spreading in ground effect.

Determining the interaction between the organized vortex wake of one aircraft and the flight of another is the most important practical problem of the symposium. The interaction depends, of course, on the parameters of the generating aircraft as related to the wake structure and on the parameters of the following aircraft. Analytical models have shown that the two most important parameters are the circulation of the vortex and the span of the following aircraft. A suitable control system can significantly reduce motions of the following aircraft.

The three day symposium to discuss these problems was held in September 1970 in Seattle, Washington. Papers presented were either invited or carefully selected from unsolicited submitted works. Three types of papers were accepted: review papers, descriptions of finished research, and descriptions of ongoing research.

The symposium proceedings are arranged according to subject. The main categories are: I. Fundamental Problems; II. Experimental Methods; III. Wake Formation and Character; IV. Stability and Decay of Trailing Vortices; V. Interactions with Vortex Wakes; and finally VI. the Proceedings of the Panel Discussion.

The editors wish to express their appreciation to Colonel W. L. Shields, Jr. (then at AFOSR), Headquarters, United States Air Force, for his constant encouragement and support which brought the Symposium to its successful culmination as a venture jointly sponsored by the Air Force Office of Scientific Research and the Boeing Scientific Research Laboratories. The editors also want to acknowledge the help and counsel of their colleague, Dr. S. C. Crow, in organizing the Program.

The editors wish to thank Mr. Robert Ubell and the staff at Plenum Press for their aid and cooperation in publishing these proceedings as a companion volume to Clear Air Turbulence and Its Detection.

Finally, the editors wish to thank the Symposium Secretary, Mrs. Edna R. Gaston who took care of all correspondence and typing of papers, to Mr. George H. Tweney, the Symposium Arrangements Chairman, and to Mr. Disman W. Peecher, Symposium Arrangements Coordinator.

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January 1971

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