

The Boeing Symposium on Turbulence

This and the subsequent part of the *Journal of Fluid Mechanics* will be devoted to the publication of papers on turbulence. Each of these papers was the subject of an oral report at a Symposium on Turbulence sponsored by the Boeing Company and organized by the Flight Sciences Laboratory of the Boeing Scientific Research Laboratories, at Seattle, Washington, U.S.A., from 23 to 27 June 1969. The Organizing Committee consisted of Dr A. Goldburg, Prof. L. S. G. Kovasznay (Chairman), and Dr Y.-H. Pao (Secretary). At this Symposium invited participants listened both to review lectures and to contributed papers, and tried by discussion to assess the present position in the study of turbulence.

With the approval of the Editors, participants in the Symposium were told that, if they cared to submit the written record of their symposium lectures to the *Journal* to be considered for publication in the usual way, the papers accepted would be published together in a special Symposium part (or parts). It was also made clear that, since many of the papers might be expected to have a definitive character, describing extensive investigations of some aspect of turbulence, authors should prepare a paper to be read in depth rather than simply a verbatim record of their talk. The Editors believe that the outcome is an interesting collection of papers, many with long-term value, on a subject which is important both in technology and in fundamental theory and which still is poorly understood. Research on the problem of turbulence, which has always presented a major obstacle to rational aircraft design, has been well served by the Boeing Company's initiative in organizing the Symposium.

Readers may find it convenient to see the complete list of the speakers and the lectures given at the Symposium. A dagger to a title indicates that the corresponding paper is being published in this or the next part of the *Journal*.

Symposium Programme

INTRODUCTORY ADDRESS

Some early ideas about turbulence.† *By G. I. Taylor*

SESSION 1. Structure of turbulence in shear flow

Entrainment and the structure of turbulence flow.† *By A. A. Townsend*

Toward a turbulent constitutive relation.† *By J. L. Lumley*

SESSION 2. Turbulent shear flow

Transport equations for turbulent shear stress. *By P. Bradshaw*

The mechanics of an organized wave in turbulent shear flows.† *By A. K. M. F. Hussain and W. C. Reynolds*

A model for turbulent shear flow. *By P. G. Saffman*

The turbulent boundary layer over a wall with progressive surface waves.† *By J. M. Kendall*

Wall pressure fluctuations beneath turbulent boundary layers on a flat plate and a cylinder.† *By W. W. Willmarth and C.-S. Yang*

SESSION 3. Turbulent and non-turbulent interfaces and entrainment

Large-scale motion in the intermittent region of a turbulent boundary layer.† *By L. S. G. Kovasznay, V. Kibens and R. F. Blackwelder*

Further measurements in the intermittent region of a turbulent boundary layer. *By R. E. Kaplan and J. Laufer*

The two-dimensional mixing region.† *By I. Wygnanski and H. E. Fiedler*

On the structure of the turbulent interface. *By T. S. Lundgren*

SESSION 4. Structure of homogeneous turbulence

Experiments on nearly homogeneous turbulent shear flow.† *By F. H. Champagne, V. G. Harris and S. Corrsin*

Some statistical properties of small-scale turbulence in an atmospheric boundary layer.† *By R. W. Stewart, J. R. Wilson and R. W. Burling*

Statistical properties of velocity derivatives in a decaying turbulent field. *By F. N. Frenkiel and P. S. Klebanoff*

Statistics of the fine structure of turbulent velocity and temperature fields measured at high Reynolds number.† *By C. H. Gibson, G. R. Stegen and R. B. Williams*

Some measurements of multi-point time correlations in grid turbulence.† *By C. W. Van Atta and T. T. Yeh*

Development of grid flow turbulence. *By E. A. Portfors and J. F. Keffer*

SESSION 5. Analytical theories of turbulence

Analytical theories of turbulence.† *By S. A. Orszag*

Turbulence from the distribution function point of view. *By J. R. Herring*

Equilibrium characteristics of nearly-normal turbulence.† *By W. C. Meecham*

Relationship between a Wiener-Hermite expansion and an energy cascade.† *By S. C. Crow and G. H. Canavan*

Some properties of a Lagrangian Wiener-Hermite expansion.† *By G. H. Canavan*

Convergents to turbulence functions.† *By R. H. Kraichnan*

Space-time representation of turbulence. *By J. Bass*

Bounds for turbulent shear flow.† *By F. H. Busse*

SESSION 6. Special topics

Some comments on turbulence in compressible fluids. *By A. Favre, J. Gaviglio and H. Burnage*

Spectra of turbulence in stratified fluids. *By Y.-H. Pao*

Turbulence in non-Newtonian media. *By J. L. Lumley*

The problem of density effect on free turbulent mixing. *By A. Roshko*

Turbulence in helium II. *By H. W. Liepmann*

Turbulent dynamo action at low magnetic Reynolds number.† *By H. K. Moffatt*

A numerical study of three-dimensional turbulent channel flow at large Reynolds numbers.† *By J. W. Deardorff*

Numerical results in the statistical theory of thermal turbulence. *By J. R. Herring*

Jets, wakes and isotropic turbulence of two-dimensional numerical fluids. *By N. J. Zabusky and G. S. Deem*