



INCLUDING SUPPLEMENTARY PAPERS

MARCH 1973

# THE *aeronautical* JOURNAL



THE ROYAL AERONAUTICAL SOCIETY

UNIVERSITY OF CAMBRIDGE  
DEPARTMENT OF ENGINEERING

## Research on Aerodynamics of Trains

A Research Assistant is required for experimental work on the aerodynamics of yawed long slender bodies in ground effect, with particular reference to high-speed trains.

The Research Assistant may be *either* (i) a post-doctoral research worker with research experience in a relevant field *or* (ii) a research student with little or no research experience.

For (i) the salary would be in the range £1598 to £2397, depending on age and experience, and the post would be tenable initially for a period of 2 years. For (ii) the salary would be equivalent to current Science Research Council rates for research students, with all University and College fees paid by the Department, and the post would be tenable for 3 years.

Further particulars may be obtained from the Secretary of the Degree Committee, University Engineering Department, Trumpington Street, Cambridge CB2 1PZ. The closing date for applications is 30th April 1973.

IMPERIAL COLLEGE OF  
SCIENCE AND TECHNOLOGY

## Postgraduate Bursaries in Engineering

Bursaries are available for the Session 1973/4 to students normally resident in the United Kingdom for courses of postgraduate study (not research) in Aeronautical, Chemical, Civil, Electrical and Mechanical Engineering, Computing and Control, Industrial Sociology, Management Science, and Materials Science and Technology.

The courses are normally of one year's duration, leading to the Diploma of Membership of the Imperial College (DIC) and, for suitably qualified candidates, the MSc Degree of the University of London. Applicants must be graduates who have spent at least one year away from University since graduation, preferably in industry.

The value of the bursaries will range from £675 according to circumstances, plus College (but not University) fees.

Further information, and forms of application, which must be returned by 18th May 1973, may be obtained from the Registrar, Imperial College, London SW7 2AZ.



## HAWKER SIDDELEY

We prefer not to shout about our achievements in the fast growing field of quiet aviation, but further expansion of our research and development programmes is taking place.

This presents an opportunity to join an enthusiastic design team in one of Britain's largest and most progressive engineering and aviation companies as an

## ACOUSTICS ENGINEER

Although we are seeking experienced Acoustic Engineers we believe that the working environment to be equally attractive to those well qualified but with only limited experience.

You would be responsible for implementing theoretical and experimental work on aircraft noise and vibration and should be capable of working independently on individual projects with minimum supervision.

Applications please to:

The Employment Officer  
**HAWKER SIDDELEY AVIATION LTD**

Hatfield Herts.

Tel: Hatfield (07072) 62345 Ext. 372

VOLUME 77  
NUMBER 747  
MARCH 1973

# THE **aeronautical**

*Incorporating The Institution of Aeronautical Engineers and  
The Helicopter Association of Great Britain*

JOURNAL

*Published Monthly*

## contents

*Editor: G. R. Wrixon, ARAeS,  
TEng(CEI)*

*Assistant Editors:  
Jay Wolff, David Scallan.*

*Secretary of the Society:  
A. M. Ballantyne, OBE, TD, BSc,  
PhD, CEng, HonFCASI,  
FAIAA, FRAeS  
4 Hamilton Place, London,  
W1V 0BQ. Tel: 01-499 3515.  
Telegrams: Didaskalos, London, W1*

*Reproduction of any of the papers  
published in this journal is not  
permitted without the written  
consent of the Editor.*

*None of the papers or paragraphs  
must be taken as expressing the  
opinion of the Council unless  
otherwise stated.*

*Advertisements only:  
H. E. Southon  
Magazine Advertising Ltd,  
184 Fleet Street, London, EC4.  
Tel: 01-405 6279 & 01-405 3363.*

*Printed by  
Lewes Press Ltd.,  
Lewes, Sussex, England.*

*Subscriptions: £20 per annum,  
post free.*

*Single copies, including back  
numbers: £1.75.*

*Published by  
The Royal Aeronautical Society,  
4 Hamilton Place,  
London, W1V 0BQ, England.*

### **Cover picture:**

Adam Thomson, chairman of British Caledonian Airways, examined the changing shape of air transport in the 1970s when he gave the 28th British Commonwealth Lecture to the Society last autumn. He mentioned, amongst his conclusions, that it would be necessary to carry different classes of passenger on scheduled service aircraft to enable airlines to achieve a reasonable return on their services. Equipment was another problem, with a long lead time needed when ordering new aircraft. The mainstay of BCAL's short-haul fleet is the BAC One-Eleven 500 Series, one of which is seen here on the apron at LAP Gatwick.

**Diary and Branch Meetings** iii

**Notices and Lecture Summaries** iv

**Obituary—A. N. Tupolev** vi

**Adam Thomson**  
THE CHANGING SHAPE OF AIR TRANSPORT IN THE 1970s 121

**W. Stewart**  
THE MANAGEMENT OF THE MRCA 130

## TECHNICAL NOTES

**J. S. Claridge**  
Design and simulation of an aircraft brake using a digital computer 136

**R. D. Small and R. H. Page**  
Turbulent boundary layer shape after a corner expansion 146

**H. W. Parsons and D. W. Beard**  
The optimum distribution of diagonal stiffeners reinforcing a clamped infinitely long plate buckling under shear 148

**Library, Reviews, Additions and Reports** 151

**Branches** 156

## SUPPLEMENTARY PAPER

**D. J. Farrar**  
Space shuttle and post Apollo 157

# **Royal Aeronautical Society**

## **Symposium on Flight Simulation**

**16th - 17th May 1973**

RAeS Members £10.50; Non-Members £16; including a cocktail party on 16th May and a complete set of papers

Registration forms available from the Secretary :  
4 Hamilton Place, London W1V 0BQ

---

## **Thirteenth Anglo-American Aeronautical Conference**

**4th - 8th June 1973**

The theme of the Conference is  
"The Changing Environment of Aerospace"

Social events will include a cocktail party and the Conference Dinner. A ladies programme is being arranged

Further details and registration forms are available from  
the Secretary : 4 Hamilton Place, London W1V 0BQ