



# A New British event for engineering designers!

**EXHIBITION &  
CONFERENCE**

# **ENGINEERING DESIGN SHOW 1977**

For the first time in the United Kingdom engineers in research and development as well as project engineers, consultants, design personnel and others in all sectors of British industry will have the opportunity of attending a single major exhibition and conference where their particular specialised interests are met. With the sponsorship and support of Professional Institutions, together with the impact of the Engineering Design Conference, Part I having already proved its value as a technical platform, the success of this event is assured.

**NATIONAL HALL, OLYMPIA, LONDON W14.**  
**29th November – 2nd December 1977**

**10.00 hrs – 18.00 hrs daily. – Admission £1.00**

*Sponsored by* **THE INSTITUTION OF ENGINEERING DESIGNERS**

*Supported by*

**ENGINEERING INDUSTRIES ASSOCIATION  
INSTITUTION OF MECHANICAL ENGINEERS  
INSTITUTION OF ELECTRICAL ENGINEERS**

**INSTITUTION OF PRODUCTION ENGINEERS  
DESIGN ENGINEERING  
ORIGINAL EQUIPMENT MANUFACTURE DESIGN**

**Organised by FAIRS & EXHIBITIONS LTD.**

*A Member of the Kern Organisation Limited*

**21 Park Square East, London NW1 4LH**

**Tel : 01-935 8200 Telex : 21879 Attention Efanee London**

VOLUME 81  
NUMBER 802  
OCTOBER 1977

# THE **aeronautical** JOURNAL

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

*Published Monthly*

## contents

*Editor: G. R. Wrixon, AMRAeS.  
Assistant Editors:  
Jay Wolff, David Scallan.*

*Secretary of the Society:  
E. M. J. Schaffter, MA, CEng,  
MRAeS.  
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:  
J. G. Heller,  
Cheiron Press Ltd,  
8/10 Parkway,  
London NW1 7AD.  
Tel: 01-267 1285*

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

*Subscriptions: £36.00 per annum,  
post free.*

*Single copies, including back  
numbers: £3.00.*

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

*ISSN: 0001-9240*

- |                                                                                                                                      |     |
|--------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Dr. A. Jean Ross</b><br>FLYING AEROPLANES IN BUFFET                                                                               | 427 |
| <b>L. E. Frisbee and R. H. Hopps</b><br>THE CHANGING HORIZONS FOR TECHNICAL PROGRESS                                                 | 437 |
| <b>Prof. J. Lukasiewicz and Dr. K. W. Studnicki-Gizbert</b><br>AVIATION ACTIVITIES IN GLOBAL PERSPECTIVE                             | 451 |
| <b>TECHNICAL NOTE</b><br><b>H. Portnoy</b><br>Thick, two-dimensional wake roll-up behind a wing of finite span—extended calculations | 460 |
| <b>Library, Reviews, Additions and Reports</b>                                                                                       | 464 |

### Cover picture:

A look at the future of air transport in the next decade is made by Messrs. Frisbee and Hopps of Lockheed-California in this issue. Inflation, high fuel costs, product liability of manufacturers, low profit margins for airlines and a heightened sensitivity to environmental problems have all combined to inhibit the introduction of advances in technology. Current wide body aircraft are expected to remain viable to the turn of the century, and will form the base for derivative aeroplanes. The British Airways 747 seen being refuelled at LAP Heathrow has improved performance due to being fitted

# THE ROYAL AERONAUTICAL SOCIETY

**Australia** Branches at: Canberra, Sydney, Melbourne and Adelaide.  
*President:* R. J. YATES, FRAeS. *Hon. Secretary:* B. A. J. SCOLES, MRAeS, 191 Royal Parade, Parkville, Victoria 3052.

**Rhodesia** Branches at: Bulawayo, Gwelo and Salisbury.  
*Hon. President:* Sir HUMPHREY GIBBS, KCMG. *President:* M. MADDERS, FRAeS. *Hon. Secretary:* Mrs. MARGARET HEAP, Assoc RAeS, P.O. Box 3759, Salisbury.

**New Zealand** Branches at: Auckland, Wellington, Palmerston North, Christchurch, Hamilton and Blenheim.  
*President:* F. W. FAHY, FRAeS. *Hon. Secretary:* R. L. WILLIAMS, New Zealand National Airways Corp'n, P.O. Box 96, Wellington.

**Southern Africa** Branches at: Johannesburg, Pretoria, Cape Western and Durban.  
*President:* Dr. B. W. SKEWS, MRAeS. *Hon. Secretary:* N. A. H. BARRAUD, CEng, MRAeS, P.O. Box 27335, Sunnyside 0132, RSA.

**Bedford**  
*President:* Air Cdre. A. H. WHEELER, CBE, FRAeS.  
*Chairman:* D. CLAYSON.  
*Hon. Secretary:* K. PALLISTER, MRAeS, 16 Lilac Walk, Kempston, Bedford MK42 7PE. *Tel:* Bedford 851284.

**Belfast**  
*President:* P. F. FOREMAN, CBE, FRAeS.  
*Chairman:* M. I. WILD, MRAeS.  
*Hon. Secretary:* T. E. MORRISON, MRAeS, Dept. of Mech. Eng., College of Technology, College Square East, Belfast BT1 6DJ. *Tel:* Work—Belfast 27244. Home—Dundonald 3403.

**Birmingham and Wolverhampton**  
*President:* J. H. GOODIER, MRAeS.  
*Chairman:* D. E. HAMMOND, MRAeS.  
*Hon. Secretary:* E. V. G. ALBRECHT, MRAeS, 2 Stonehouse Avenue, The Dingle, Willenhall, West Midlands, WV13 1AP. *Tel:* 0902 67755.

**Boscombe Down**  
*President:* Air Cdre. H. A. MERRIMAN, CBE, AFC, MRAeS, RAF.  
*Chairman:* C. REDMAYNE, CEng, MRAeS.  
*Hon. Secretary:* R. J. HOWARD, MBE, CEng, MRAeS, A & AEE, Boscombe Down, Amesbury, Salisbury, Wilts. *Tel:* 098 02 3331. Ex. 2483.

**Bristol**  
*President:* P. H. CALDER, MRAeS.  
*Chairman:* B. RAYBOULD, MRAeS.  
*Hon. Secretary:* Dr. R. K. NANGIA, MRAeS, Dept of Aero Engng, University of Bristol, Queens Bldg, Bristol BS8 1TL. *Tel:* 0272 24161. Ex. 459.

**Brough**  
*President:* R. D. BOOT, FRAeS.  
*Chairman:* R. J. CHANDLER, AMRAeS.  
*Hon. Secretary:* R. MELLING, CEng, MRAeS, c/o Hawker Siddeley Aviation Ltd, Brough, HU15 1EQ. *Tel:* 0482 667121. Ex. 311.

**Cambridge**  
*President:* Professor W. A. MAIR, CBE, FRAeS.  
*Chairman:* N. A. J. HARRY, FRAeS.  
*Hon. Secretary:* G. T. ATKINS, MRAeS, Marshall of Cambridge (Engineering) Ltd, Newmarket Road, Cambridge. *Tel:* 0223 61133.

**Chester**  
*President:* J. GARSTON, FRAeS.  
*Chairman:* V. W. CLARKSON, MRAeS.  
*Hon. Secretary:* J. R. YOUNG, AMRAeS, Hawker Siddeley Aviation Ltd, Broughton, Chester. *Tel:* 0244 24646.

**Christchurch**  
*President:* P. S. MACGREGOR, MBE, FRAeS.  
*Chairman:* D. E. CAILES, MRAeS.  
*Hon. Secretary:* R. WELLS, AMRAeS, BAC Ltd, Bournemouth (Hurn) Airport, Christchurch, Dorset. *Tel:* 020-16 3201.

**Coventry**  
*President:* A. J. WEBBER, MRAeS.  
*Chairman:* A. J. EAGLES, 30 Lupton Ave, Coventry, CV3 5BQ. *Tel:* Work—0203 452152, Ex. 3336. Home—0203 415412.

**Cranwell**  
*President:* Air Vice Marshal W. E. COLAHAN, CBE, DFC, RAF.  
*Chairman:* Air Cdre. H. F. GLOVER, CEng, MRAeS.  
*Hon. Secretary:* Sqn. Ldr. G. ROSCILLI, MRAeS, RAF, Dept of Specialist Ground Training, RAF College, Cranwell, Sleaford, Lincs NG34 8HB. *Tel:* 0400 61201. Ex. Trenchard 300.

**Derby**  
*President:* D. A. HEAD, MRAeS.  
*Chairman:* A. D. JACKSON, FRAeS.  
*Hon. Secretary:* C. HORNBLLOWER, AMRAeS, Rolls-Royce (1971) Ltd, Derby, DE2 8BJ. *Tel:* 0332 42424. Ex. 1476.

**Dublin**  
*President:* Capt. J. C. KELLY-ROGERS, OBE, FRAeS.  
*Chairman:* M. C. MCGOVERN, CEng, MRAeS.  
*Hon. Secretary:* BRIAN KEOGH, AMRAeS, 14 Stockton, Castleknock, Co. Dublin. *Tel:* Dublin 370011, Ex. 2800.

**Glasgow**  
*President:* Dr. A. W. BABISTER, MRAeS.  
*Chairman:* F. FRENCH, MRAeS.  
*Hon. Secretary:* T. K. BLACK, 43 Partickhill Road, Glasgow, G11 5BY. *Tel:* 041 221 9600. Ex. 2410; 041 334 7193 (Home).

**Gloucester and Cheltenham**  
*President:* R. F. HUNT, FRAeS.  
*Chairman:* K. BEST, MRAeS.  
*Hon. Secretary:* R. W. WHITE, MRAeS, c/o Smiths Industries Ltd, Bishops Cleeve, Cheltenham, Glos. *Tel:* 024-267 3333.

**Halton**  
*President:* Air Cdre. M. P. STANTON, CBE.  
*Chairman:* Gp. Capt. E. E. LAKE, MRAeS.  
*Hon. Secretary:* Sqn. Ldr. B. NOBLE, Student Wing, RAF Halton, Bucks HP22 5PG. *Tel:* 0296 623535.

**Hatfield**  
*President:* Sir HARRY BROADHURST.  
*Chairman:* D. R. NEWMAN, FRAeS.  
*Hon. Secretary:* G. B. EVANS, FRAeS, Drawing Office, Hawker Siddeley Aviation Ltd, Hatfield, Herts. *Tel:* 30 62345.

**Isle of Wight**  
*President:* Sir CHRISTOPHER HARTLEY, KCB, GBE, DFC, AFC.  
*Chairman:* R. L. WHEELER, MRAeS.  
*Hon. Secretary:* D. S. B. FLIPPANCE, Design Office, British Hovercraft Corporation Ltd, East Cowes, Isle of Wight. *Tel:* 098-382 4121.

**London Airport**  
*President:* E. R. MAJOR, FRAeS.  
*Chairman:* H. G. ROSSITER, FRAeS.  
*Hon. Secretary:* D. S. FORSYTH, AMRAeS, 3 Mole Abbey Gdns, West Molesey, Surrey. *Tel:* Office 759 3131, Ex. 4755. Home 979 7588.

**Loughborough**  
*President:* Professor D. J. JOHNS, FRAeS.  
*Chairman:* F. G. MACCABEE, MRAeS.  
*Hon. Secretary:* L. E. WOODFIELD, AMRAeS, Transport Technology Dept, Loughborough University of Technology, Loughborough, Leics LE11 3TU. *Tel:* Loughborough 63171, Ex. 470.

**Luton and Stevenage**  
*President:* G. D. PEACOCK, FRAeS.  
*Chairman:* C. H. MARTIN, CEng, FRAeS.  
*Hon. Secretary:* M. F. RICKETT, Hawker Siddeley Dynamics Ltd, Gunnels Wood Rd, Stevenage, Herts. SG1 2AS. *Tel:* 0438 3456. Ex. 325.

**Manchester**  
*President:* C. E. FIELDING, OBE, FRAeS.  
*Chairman:* J. B. SCOTT-WILSON, MRAeS.  
*Hon. Secretary:* M. J. TAYLOR, CEng, MRAeS, Flight Development Dept, Hawker Siddeley Aviation Ltd, Woodford, Stockport, Cheshire. *Tel:* 061-439-5050. Ex. 558.

**Medway**  
*Chairman:* P. A. HEARNE, FRAeS.  
*Hon. Secretary:* M. MOULTON, MRAeS, c/o Marconi Elliott Avionic Systems Ltd, Airport Works, Rochester, Kent. *Tel:* 0634 44400.

**Preston**  
*President:* F. E. ROE, FRAeS.  
*Chairman:* H. C. CHANNON, MRAeS.  
*Hon. Secretary:* D. K. KEMPSTON, MRAeS, British Aircraft Corp'n Ltd, Warton Aerodrome, Preston. *Tel:* Preston 633333. Ex. 183.

**Prestwick**  
*President:* R. McINTYRE, FRAeS.  
*Chairman:* T. C. OVEREND, DFM, AMRAeS.  
*Hon. Secretary:* P. BERRY, MRAeS, 9 Carcluie Crescent, Ayr KA7 4SP. *Tel:* 0292 42747.

**Southampton**  
*President:* Professor G. M. LILLEY, FRAeS.  
*Chairman:* A. G. J. SMITH, MRAeS.  
*Hon. Secretary:* Dr. P. TAYLOR, AMRAeS, Dept of Aeronautics and Astronautics, The University, Southampton SO9 5NH. *Tel:* 0703 559122, Ex. 2303.

**Southend**  
*President:* J. R. BATT, MRAeS.  
*Chairman:* R. R. ATWOOD, MRAeS.  
*Hon. Secretary:* P. R. GROUT, AMRAeS, 36 Alexandra Road, Rochford, Essex. *Tel:* 0702 546160.

**Swindon**  
*President:* W. GILLESPIE, MRAeS.  
*Chairman:* G. N. GINGELL, MRAeS.  
*Hon. Secretary:* W. H. BUNTING, MRAeS, Vickers Ltd, Design and Procurement Div, PO Box 44, Swindon. *Tel:* Stratton St. Margaret 3241.

**Thames Valley**  
*President:* E. N. MOBBS.  
*Chairman:* J. L. FAREHAM, MRAeS.  
*Hon. Secretary:* A. G. FOSKETT, MRAeS, M.L. Aviation Co Ltd, White Waltham Aerodrome, Berks. *Tel:* 062-882 3361.

**Weybridge**  
*President:* F. W. PAGE, CBE, FRAeS.  
*Chairman:* G. ALESBURY, MRAeS.  
*Hon. Secretary:* A. M. DOBSON, MRAeS, BAC Ltd, Commercial Aircraft Division, Weybridge, Surrey. *Tel:* 97 45522. Ex. 6945.

**Yeovil**  
*President:* B. D. BLACKWELL, FRAeS.  
*Chairman:* Dr. J. P. JONES, FRAeS.  
*Hon. Secretary:* F. N. R. BALLAM, MRAeS, Westland Helicopters Ltd, Yeovil, Somerset. *Tel:* 0935 5222.