

THE
AERONAUTICAL JOURNAL
VOL.—LXVIII

THE ROYAL AERONAUTICAL SOCIETY

Journal of THE ROYAL AERONAUTICAL SOCIETY

INCORPORATING THE INSTITUTION OF AERONAUTICAL ENGINEERS AND THE HELICOPTER ASSOCIATION OF GREAT BRITAIN

Published Monthly at 4 HAMILTON PLACE, LONDON, W.1
Telephone: Grosvenor 3515-9 Telegrams: Didaskalos, London, W.1

Subscriptions: £10 10s. 0d. per annum, post free Single Copies: 17s. 6d.

Advertisements only: J. W. Williams, D.F.C., Magazine Advertising Ltd., 36-38 Whitefriars St., London, E.C.4. Fleet Street 7539

VOLUME 68

MAY 1964

NUMBER 641

CONTENTS

| | Page |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| The President, 1964-65—Mr. H. H. Gardner | XXXVII |
| Secretary's News Letter | XXXVIII |
| Notices | XXXVIII |
| New Fellows—Honours Awarded to Members—Diary—Other Meetings—United Kingdom Automation Council Lectures—Course on Mechanical Vibrations—Post-Graduate Course in Industrial Engineering and Management—Library Request—Examiners in Aeronautical Subjects for City and Guilds of London Institute—Rotorcraft Section Garden Party—Elections—Salisbury Branch (Southern Africa Divn.) Committee—Documentation Services from the AIAA European Office—News of Members. | |
| The Branches | XLII |
| Graduates' and Students' Section | XLIII |
| Sir Leonard Bairstow—An Appreciation | XLIV |
| European Co-operation in Space Vehicle Development | W. H. Stephens 289 |
| The Development of Blue Steel | R. H. Francis 303 |
| A Method of Measuring Helicopter Landing Loads | M. J. H. Harding 323 |
| Education—A Discussion | 330 |
| Technical Notes | 334 |
| Some Experiments with Vortex Break-down—M. V. Lowson. The Compressible Discharge Coefficient of a Borda Pipe and other Convergent Nozzles—T. H. Frost. Correspondence on The Approximate Distribution of Stress in a Finite Plate having a Stress-Free Circular Cut-out—H. Waters (March 1964 Journal)—S. C. Redshaw. Formation of the South African Air Force—W. E. John and A. E. Woodward-Nutt. | |
| The Library | 351 |
| REVIEWS: From Low Speed Aerodynamics to Astronautics—Plasticity of Metals: The mechanical behaviour and the changes in structure of metals under plastic deformation—Stranger to the Ground—the Zeppelin in Combat. | |
| Additions to the Library | Reports |

All communications for publication in the JOURNAL should be addressed to the Editor, JOAN BRADBROOKE, A.R.Ae.S.; all communications on general matters affecting the Society should be addressed to the Secretary, A. M. BALLANTYNE, T.D., B.Sc., Ph.D., F.R.Ae.S., Hon.F.C.A.S.I., F.A.I.A.A.—at 4 HAMILTON PLACE, LONDON, W.1.

Reproduction in whole or in part of any of the papers and contributions published in this Journal is not permitted without the written consent of the Royal Aeronautical Society.

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

THE ROYAL AERONAUTICAL SOCIETY

OVERSEAS DIVISIONS

AUSTRALIA

President: L. P. COOMBS, F.R.Ae.S.
Hon. Secretary: W. ISBISTER, F.R.Ae.S., Science House, Gloucester & Essex Streets, Sydney, New South Wales.

Branches at: Canberra, Sydney, Melbourne, and Adelaide.

NEW ZEALAND

President: B. CORNTHWAITE, A.F.R.Ae.S.
Hon. Secretary: T. T. N. COLERIDGE, A.F.R.Ae.S., The Shell Company of New Zealand Ltd., Box 2091, Wellington.

Branches at: Auckland, Wellington, Palmerston North, and Christchurch.

SOUTHERN AFRICA

President: E. P. BEDFORD, A.R.Ae.S.
Hon. Secretary: Mrs. C. G. BEDFORD, P.O. Box 4409, Johannesburg.

Branches at: Bulawayo, Johannesburg, Pretoria, and Salisbury.

BRANCHES IN THE UNITED KINGDOM

BELFAST

President: D. KEITH-LUCAS, F.R.Ae.S.
Chairman: E. G. COLLINSON, F.R.Ae.S.
Hon. Secretary: D. SAUNDERS, A.F.R.Ae.S., Short Bros. & Harland Ltd., Castlereagh, Belfast. Tel: Belfast 59271.

BIRMINGHAM AND WOLVERHAMPTON

President: A. RATCLIFFE.
Chairman: Dr. L. W. J. NEWMAN, A.F.R.Ae.S.
Hon. Secretary: G. O. FRAMPTON, A.F.R.Ae.S., H. M. Hobson Ltd., Fordhouses, Wolverhampton, Staffs. Tel: Fordhouses 2381.

BOSCOMBE DOWN

President: Air Cdre. J. F. ROULSTON, C.B.E., D.S.O., D.F.C.
Chairman: G. MACLAREN-HUMPHREYS, M.B.E., A.F.R.Ae.S.
Hon. Secretary: Sqn. Ldr. H. H. HORSHAM, M.B.E., A.R.Ae.S., A. & A.E.E., Boscombe Down, Amesbury, Wilts. Tel: Amesbury 3331, Ext. 2143.

BRISTOL

President: Dr. W. J. STRANG, F.R.Ae.S.
Chairman: K. B. CHAMBERLAIN, F.R.Ae.S.
Hon. Secretary: W. O. LEE, A.R.Ae.S., British Aircraft Corporation (Operating) Ltd., Filton Division, Filton, Bristol 7. Tel: Bristol 693831, Ext.90.

BROUGH

President: Capt. E. D. G. LEWIN, C.B., C.B.E., D.S.O., A.F.R.Ae.S.
Chairman: J. T. STAMPER, A.F.R.Ae.S.
Hon. Secretary: A. D. HOWARTH, A.R.Ae.S., c/o Hawker Siddeley Aviation Ltd., Hawker-Blackburn Div., Brough, Yorkshire. Tel: Brough 67121, Ext. 314.

CAMBRIDGE

President: Professor W. A. MAIR, F.R.Ae.S.
Chairman: R. O. GATES, A.F.R.Ae.S.
Hon. Secretary: E. M. J. SCHAFFTER, A.F.R.Ae.S., Marshall of Cambridge (Engineering) Ltd., Aircraft Division, Airport Works, Cambridge. Tel: Cambridge 56291.

CHESTER

President: C. B. V. NEILSON, A.F.R.Ae.S.
Chairman: J. E. HAINES, A.F.R.Ae.S.
Hon. Secretary: G. W. MONNINGTON, Electro-Hydraulics Ltd., Liverpool Road, Warrington, Lancs. Tel: Warrington 35241.

CHRISTCHURCH

President: E. W. J. GRAY, F.R.Ae.S.
Chairman: H. E. VINCENT, A.F.R.Ae.S.
Hon. Secretary: J. F. BRENNAN, A.R.Ae.S., c/o British Aircraft Corporation (Operating) Ltd., Weybridge Division, Bournemouth (Hurn) Airport, Christchurch, Hants. Tel: Northbourne 3201.

COVENTRY

President: J. WRIGHT, C.B.E., F.R.Ae.S.
Chairman: C. BAYLY, F.R.Ae.S.
Hon. Secretary: J. G. LUM, A.F.R.Ae.S., Wind Tunnel Dept., Hawker Siddeley Dynamics Ltd., Whitley, Coventry, Warwickshire. Tel: Tollbar 3271, Ext. 121.

DERBY

President: Sir DENNING PEARSON, F.R.Ae.S.
Chairman: A. A. RUBBRA, F.R.Ae.S.
Hon. Secretary: J. F. COPLIN, Rolls-Royce Ltd., Dept. 61, Derby. Tel: Derby 42424.

GLASGOW

President: Dr. A. W. BABISTER, A.F.R.Ae.S.
Chairman: Wm. H. G. W. FINLAY, A.R.Ae.S.,
Hon. Secretary: W. N. ALCOCK, Shenstone, Dumbuck Crescent, Dumbarton.

GLOUCESTER AND CHELTENHAM

President: K. FEARNSIDE, F.R.Ae.S.
Chairman: J. G. RUSSELL, A.F.R.Ae.S.
Hon. Secretary: C. E. HUTT, A.R.Ae.S., c/o S. Smith & Sons (England) Ltd., Bishops Cleeve, Cheltenham, Glos. Tel: Bishops Cleeve 3333.

HALTON

President: Air Vice-Marshal J. K. ROTHERHAM, C.B., C.B.E., A.F.R.Ae.S.
Chairman: Gp. Capt. R. C. FORDHAM, C.B.E., A.F.R.Ae.S.
Hon. Secretary: Sqn. Ldr. P. V. AYERST, D.F.C., A.R.Ae.S., Officers' Mess, R.A.F. Halton, Bucks. Tel: Wendover 2242, Ext. 310.

HATFIELD

President: Sir GEOFFREY DE HAVILLAND, O.M., C.B.E., A.F.C., Hon.F.R.Ae.S.
Chairman: A. W. TORRY, A.F.R.Ae.S.
Hon. Secretary: G. B. EVANS, A.F.R.Ae.S., Drawing Office, Hawker Siddeley Aviation Ltd., de Havilland Division, Hatfield, Herts. Tel: Hatfield 2345, Ext. 274.

HENLOW

President: J. HANSON, F.R.Ae.S.
Chairman: Wg.Cdr. W.S.C. WATKINS, A.F.R.Ae.S.
Hon. Secretary: Sqn. Ldr. A. H. CRAVEN, A.F.R.Ae.S., Officers' Mess, R.A.F. Technical College, Henlow, Beds. Tel: Henlow Camp 391, Ext. 261.

ISLE OF WIGHT

President: H. KNOWLER, F.R.Ae.S.
Chairman: R. STANTON-JONES, A.F.R.Ae.S.
Hon. Secretary: R. L. WHEELER, A.F.R.Ae.S., Design Office, Westland Aircraft Ltd., Saunders-Roe Division, Osborne, Isle of Wight. Tel: Cowes 2211.

LEICESTER

President: K. L. C. LEGG, F.R.Ae.S.
Chairman: K. B. AYERS, A.F.R.Ae.S.
Hon. Secretary: D. M. WATERS, A.F.R.Ae.S., 24 Roulstone Crescent, East Leake, Loughborough, Leics.

LONDON AIRPORT

President: Rear Admiral Sir MATTHEW S. SLATTERY, K.B.E., C.B., F.R.Ae.S.
Chairman: R. C. MORGAN, O.B.E., F.R.Ae.S.
Hon. Secretary: N. BROWN, A.R.Ae.S., BOAC H.Q., Technical Publications Department, London (Heathrow) Airport, Middlesex. Tel: Skyport 5511, Ext. 2883.

LUTON

President: G. R. JEFFERSON, A.F.R.Ae.S.
Chairman: H. E. CURTIS, A.F.R.Ae.S.
Hon. Secretary: L. A. WILLOTT, A.F.R.Ae.S., British Aircraft Corporation (Operating) Ltd., Luton Division, The Airport, Luton, Beds. Tel: Luton 31151.

MANCHESTER

President: C. E. FIELDING, O.B.E., F.R.Ae.S.
Chairman: M. J. BRENNAN, F.R.Ae.S.
Hon. Secretary: J. A. E. WATERFALL, 56 Manor Avenue, Ashton-on-Mersey, Cheshire. Tel: Failsworth 2020.

MERTHYR AND TREForest

President: E. J. BUSH.
Chairman: J. INGRAM.
Hon. Secretary: Dr. G. O. FORESTER, Chief of Research, Teddington Aircraft Controls Ltd., Cefn Coed, Merthyr Tydfil, South Wales. Tel: Merthyr Tydfil 3261.

PRESTON

President: F. W. PAGE, C.B.E., F.R.Ae.S.
Chairman: F. D. CROWE, A.F.R.Ae.S.
Hon. Secretary: J. T. FROUD, A.F.R.Ae.S., Project Research Office, British Aircraft Corporation (Operating) Ltd., Preston Division, Warton Aerodrome, Preston, Lancs. Tel: Freckleton 531.

PRESTWICK

President: C. D. WALDRON.
Chairman: R. HOSIE, A.R.Ae.S.
Hon. Secretary: G. RAE, Design Office, Scottish Aviation Ltd., Prestwick Airport, Ayrshire. Tel: Prestwick 79888.

READING

President: E. N. MOBBS.
Chairman: J. T. APPLEBY, A.F.R.Ae.S.
Hon. Secretary: E. W. C. ANGELL, A.R.Ae.S., M. L. Aviation Co. Ltd., White Waltham, Maidenhead, Berks. Tel: Littlewick Green 248.

SOUTHAMPTON

President: Professor E. J. RICHARDS, O.B.E., F.R.Ae.S.
Chairman: F. C. KIRKPATRICK, A.R.Ae.S.
Hon. Secretary: Dr. B. L. CLARKSON, A.F.R.Ae.S., The Department of Aeronautics and Astronautics, University of Southampton, Southampton, Tel: Southampton 56331.

SOUTHEND

President: F. A. LAKER, A.R.Ae.S.
Chairman: K. A. COLE, A.F.R.Ae.S.
Hon. Secretary: T. R. C. BERRETT, A.R.Ae.S., Aviation Traders (Eng.) Ltd., Southend Airport, Essex. Tel: Southend 48561.

SWINDON

President: S. R. HUGHES, A.F.R.Ae.S.
Chairman: Prof. D. S. HOUGHTON, A.F.R.Ae.S.
Hon. Secretary: D. E. J. TIPPING, A.F.R.Ae.S., Vickers-Armstrongs (Engineers) Ltd., South Marston, Swindon, Wilts. Tel: Stratton St. Margaret 3241.

WEYBRIDGE

President: Sir GEORGE EDWARDS, C.B.E., Hon.F.R.Ae.S.
Chairman: J. HEAP, A.F.R.Ae.S.
Hon. Secretary: A. M. DOBSON, A.F.R.Ae.S., British Aircraft Corporation (Operating) Ltd., Weybridge Division, Weybridge, Surrey. Tel: Weybridge 45555.

YEovil

President: E. C. WHEELDON, C.B.E.
Chairmen: R. HAFNER, F.R.Ae.S. and Dr. E. W. STILL, F.R.Ae.S.
Hon. Secretary: L. A. LANSDOWN, A.F.R.Ae.S., Westland Aircraft Ltd., Yeovil, Somerset. Tel: Yeovil 5222.