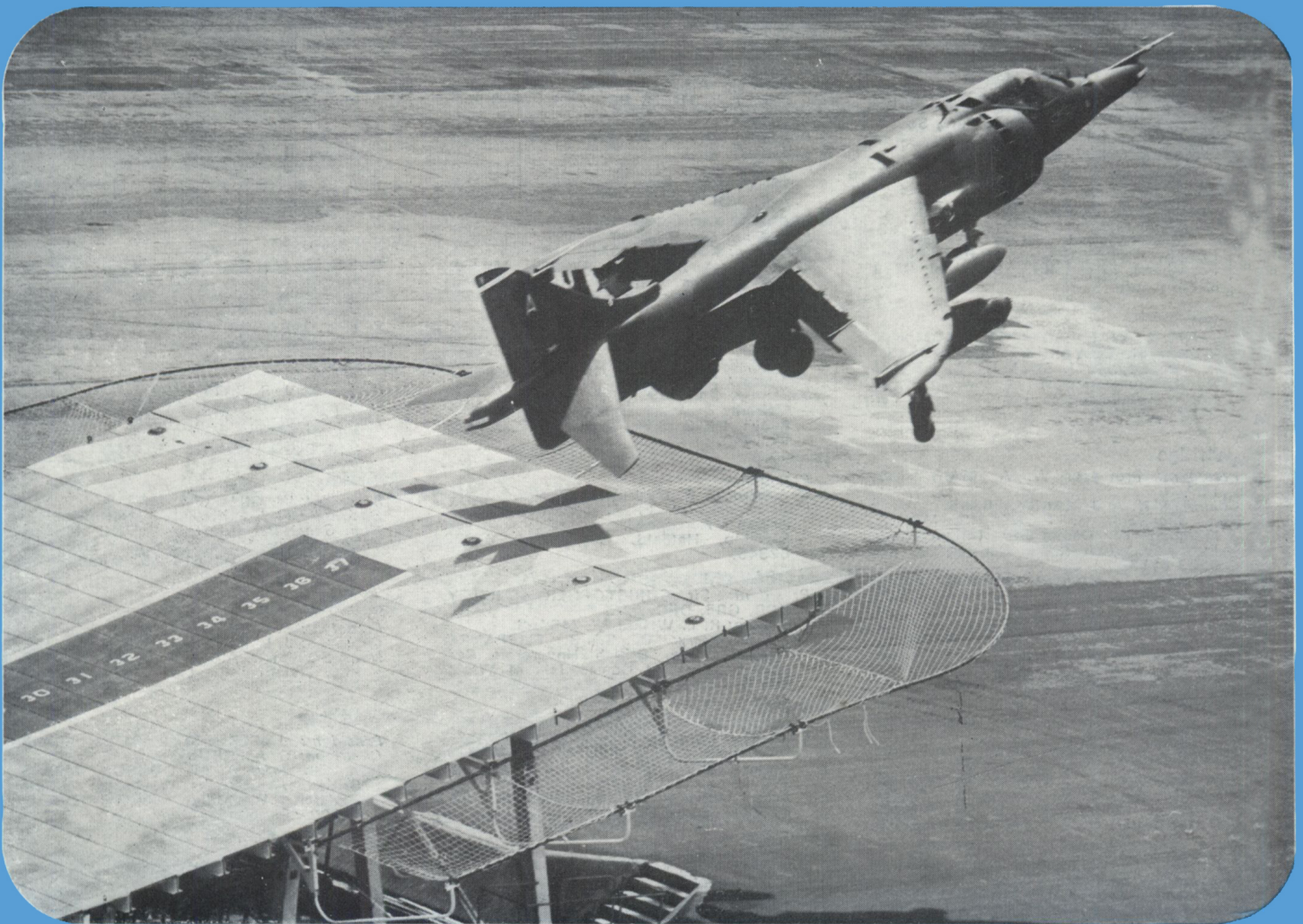




SEPTEMBER 1980

THE  
***aeronautical***  
JOURNAL



VOLUME 84

No. 836

SEPTEMBER 1980

**DIVISIONS AND BRANCHES OF**

# THE ROYAL AERONAUTICAL SOCIETY

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

*President:* FRANK AUSTIN, FRAeS. *Hon. Secretary:* B. A. J. SCOLLES, MRAeS, 191 Royal Parade, Parkville, Victoria 3052.

**Zimbabwe** Branches at: Bulawayo, Gwelo and Salisbury.

*Hon. President:* Sir HUMPHREY GIBBS, KCMG. *President:* COLMAN MYERS, MRAeS. *Hon. Secretary:* Mrs. MARGARET HEAP, Assoc RAeS PO Box 3759, Salisbury.

**New Zealand** Branches at: Auckland, Wellington, Palmerston North, Christchurch, Hamilton and Blenheim.

*President:* F. A. BRITAIN, AMRAeS. *Hon. Secretary:* All correspondence to: B. D. NEW, Commercial Division, Air New Zealand Ltd, Private Bag, Auckland.

**Southern Africa**

*President:* R. J. FRITZ, CEng, MRAeS. *Hon. Secretary:* Wg. Cdr. N. F. HARRISON, MRAeS, PO Box 27335, Sunnyside 0132, RSA.

**Bedford**

*President:* G. P. DOLLIMORE, FRAeS.  
*Chairman:* G. I. PAULEY, MRAeS.  
*Hon. Secretary:* A. McVITIE, College of Aeronautics, Cranfield Institute of Technology, Bedford. Tel: 0234 750111. Ex. 277.

**Belfast**

*President:* Dr. P. F. FOREMAN, CBE, FRAeS.  
*Chairman:* Prof. P. P. BENHAM, 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:* K. HOMFRAY, AMRAeS, 58 Chartwell Drive, Bushbury, Wolverhampton, West Midlands WV10 8JQ. Tel: Work—0902 26866; Home—0902 787631.

**Boscombe Down**

*President:* Air Cdr. R. G. SPIERS, OBE, FRAeS.  
*Chairman:* J. B. LAMBIE, CEng, MRAeS.  
*Hon. Secretary:* Wg. Cdr. C. T. B. PEILE, MRAeS, RAF, O/C RAF Handling Squadron, Boscombe Down, Salisbury SP4 0JF. Tel: 09802 3331. Ex. 2513.

**Bristol**

*President:* E. B. TRUBSHAW, FRAeS.  
*Chairman:* J. M. HAHN, CEng, MRAeS.  
*Hon. Secretary:* J. F. BORTKIEWICZ, FRAeS, Tudor Cottage, Battery Lane, Portishead, Bristol BS20 9JD. Tel: 0272 842364.

**Brough**

*President:* L. W. MILSOM, CEng, MIMechE.  
*Chairman:* M. EDWARDS, CEng, MRAeS.  
*Hon. Secretary:* E. J. SOLMAN, c/o British Aerospace, Aircraft Group, Brough, North Humberside, HU15 1EQ. Tel: 0482 667121.

**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:* R. GRIFFITHS, FRAeS.  
*Chairman:* V. W. CLARKSON, MRAeS.  
*Hon. Secretary:* J. R. YOUNG, AMRAeS, British Aerospace, Hatfield Chester Division, Broughton, Chester. Tel: 0244 535333.

**Christchurch**

*President:* H. COBHAM, FRAeS.  
*Chairman:* R. C. GODWIN, MRAeS.  
*Hon. Secretary:* R. J. STANDING, MRAeS, British Aerospace, Weybridge Bristol Division, Bournemouth (Hurn) Airport, Christchurch, Dorset. Tel: 020-16 3201.

**Coventry**

*President:* A. H. POPE, FRAeS.  
*Chairman:* A. J. WEBBER, MRAeS.  
*Hon. Secretary:* A. J. EAGLES, 30 Lupton Ave, Coventry, CV3 5BQ. Tel: 0203 415412.

**Cranwell**

*President:* Air Vice Marshal B. BROWN-LOW, AMRAeS.  
*Chairman:* Wg. Cdr. D. M. F. BRIGHT, CEng, MRAeS, RAF.  
*Hon. Secretary:* Sqn. Ldr. A. W. DEBUSE, CEng, MRAeS, RAF, Dept of Specialist Ground Training, RAF College, Cranwell, Sleaford, Lincs NG34 8HB. Tel: 0400 61201. Ex. Trenchard 205.

**Derby**

*President:* D. A. HEAD, MRAeS.  
*Chairman:* J. BUSH, FRAeS.  
*Hon. Secretary:* J. M. ROBERTSON, MRAeS, Rolls-Royce Ltd, Derby, DE2 8BJ. Tel: 0332 42424. Ex. 158.

**Dublin**

*President:* Capt. J. C. KELLY-ROGERS, OBE, FRAeS.  
*Chairman:* Capt. G. McCABE, CEng, MRAeS.  
*Hon. Secretary:* T. J. MORRISSEY, MRAeS, 109 Foxfield Grove, Raheny, Dunlin 5. Tel: Dublin 370011. Ex. 2814.

**Gatwick**

*President:* A. T. PUGH, FRAeS.  
*Chairman:* R. R. ATWOOD, MRAeS.  
*Hon. Secretary:* B. R. DAY, AMRAeS, Sales Div, British Caledonian Airways, Gatwick Airport, Horley, Surrey, RH6 0LT. Tel: 01-668 9311. Ex. 2950.

**Glasgow**

*President:* Dr. A. W. BABISTER, MRAeS.  
*Chairman:* T. J. GOODWIN.  
*Hon. Secretary:* C. SNOWDON, AMRAeS, 18 Torwood Brae, Hamilton ML3 9XB. Tel: East Kilbride 20200. Ex. 395.

**Gloucester and Cheltenham**

*President:* Sir ROBERT 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. Ex. 2423.

**Halton**

*President:* Gp. Capt. O. J. TRUELOVE, MBE, CEng, MRAeS, RAF.  
*Chairman:* P. R. SAMPSON, AMRAeS.  
*Secretary:* Sqn. Ldr. P. G. HISCOCK, RAF, Airframe Training Squadron, RAF Halton, Bucks HP22 5PG. Tel: 0296 623535. Ex. 440.

**Hatfield**

*President:* D. R. NEWMAN, FRAeS.  
*Chairman:* D. R. NEWMAN, FRAeS.  
*Hon. Secretary:* F. W. VANN, FRAeS, British Aerospace, Hatfield, Chester Division, Hatfield, Herts. Tel: 07072 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: 098-29 4121.

**London Airport**

*President:* K. G. WILKINSON, CBE, FRAeS.  
*Chairman:* Capt. T. A. FULTON, MRAeS.  
*Hon. Secretary:* D. S. FORSYTH, AMRAeS, Room 200A, TBK 5477, British Airways, P.O. Box 10, London (Heathrow) Airport, Hounslow, Middx TW6 2JR. Tel: 01-759 5511. Ex. 3525.

**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:* T. G. KENT, MRAeS.  
*Chairman:* C. H. MARTIN, CEng, FRAeS.  
*Hon. Secretary:* M. F. RICKETT, AMRAeS, British Aerospace, Dynamics Group, Gunnels Wood Rd, Stevenage, Herts SG1 2AS. Tel: 0438 3456. Ex. 325.

**Manchester**

*President:* C. E. FIELDING, OBE, FRAeS.  
*Chairman:* D. L. RAFFLE, CEng, MRAeS.  
*Hon. Secretary:* J. H. MANGAN, AMRAeS, Assist. Sec., W. JAMES, Aerodynamics Dept, British Aerospace, Manchester Division, Woodford, Stockport, Cheshire. Tel: 061-439 5050. Ex. 170.

**Medway**

*President:* P. A. HEARNE, FRAeS.  
*Chairman:* M. MOULTON, MRAeS.  
*Hon. Secretary:* F. H. WOOD, MRAeS, c/o Marconi Avionics Ltd, Airport Works, Rochester, Kent. Tel: 0634 44400.

**Preston**

*President:* F. E. ROE, FRAeS.  
*Chairman:* H. C. CHANNON, MRAeS.  
*Hon. Secretary:* J. R. HUNTINGTON, MRAeS, British Aerospace, Warton Division, Warton Aerodrome, Preston. Tel: (0772) 633333. Ex. 60.

**Prestwick**

*President:* R. McINTYRE, FRAeS.  
*Chairman:* J. M. JANKE, MRAeS.  
*Hon. Secretary:* V. B. M. McLEONARD, AMRAeS, 21 Hillhouse Gdns, Troon, Ayrshire KA10 6SZ. Tel: 0292 311351.

**Southampton**

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

**Southend**

*President:* J. R. BATT, MRAeS.  
*Chairman:* E. B. DOVE, FRAeS.  
*Hon. Secretary:* P. R. GROUT, AMRAeS, 36 Alexandra Road, Ashingdon, Rochford, Essex. Tel: 0702 546160.

**Swindon**

*President:* W. GILLESPIE, MRAeS.  
*Chairman:* F. J. PURNELL, AMRAeS.  
*Hon. Secretary:* W. H. BUNTING, MRAeS, 29 Chedworth Gate, Swindon SN3 1NE. Tel: Work—0703 614655. Home—0793 32327.

**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: 012-882 3361.

**Weybridge**

*President:* J. FERGUSON SMITH, FRAeS.  
*Chairman:* G. ALESBURY, MRAeS.  
*Hon. Secretary:* A. M. DOBSON, MRAeS, British Aerospace, Weybridge Bristol Division, Weybridge, Surrey. Tel: 97 45522. Ex. 6945.

**Yeovil**

*President:* B. D. BLACKWELL, FRAeS.  
*Chairman:* Dr. J. P. JONES, FRAeS.  
*Hon. Secretary:* S. J. LOVE, MRAeS, Development Instrumentation, Wistland Helicopters Ltd, Yeovil, Somerset. Tel: 0935 5222. Ex. 160.

VOLUME 84  
NUMBER 836  
SEPTEMBER 1980

THE  
**aeronautical**  
JOURNAL  
*Incorporating The Institution of Aeronautical Engineers and  
The Helicopter Association of Great Britain*  
Published Monthly

**contents**

Editor: Jay Wolff, Assoc. Member  
RAeS.

Assistant Editor:  
Carol Evans.

Secretary of the Society:  
E. M. J. Schaffter, MA, CEng,  
FRAeS,  
4 Hamilton Place, London  
W1V 0BQ. Tel: 01 499 3515.  
Telegrams: Didaskalos, London, W1.

Advertisements:  
J. G. Heller,  
Cheiron Media Ltd,  
43a Dulwich Village,  
London SE21 7BN.  
Tel: 01-299 1711/2.

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.

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

Subscriptions: £48.00 per annum,  
post free.

Single copies, including back  
numbers: £4.00.

US subscription: \$100 per annum.  
Single copies, including back  
numbers: \$8.25.

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

Second class postage paid at  
New York, NY.

US Mailing Agent: Expeditors of  
the Printed Word Ltd,  
527 Madison Ave, Suite 1217,  
New York, NY 10022.  
ISSN: 0001-9240

**Sir Frederick Page**

TOWARDS A NEW INDUSTRIAL REVOLUTION 261

**G. H. Wright and J. G. Russell**

THE M.45SD-02 VARIABLE PITCH GEARED FAN ENGINE  
DEMONSTRATOR TEST AND EVALUATION EXPERIENCE 268

**W. H. Ekin and D. McCloy**

AN OBJECTIVE METHOD OF ASSESSING THE REALISM OF A  
SIMULATION OF A SIMPLE CONTROL SYSTEM 278

**Professor Clive Hart**

SWEDENBORG'S FLYING SAUCER 282

**TECHNICAL NOTES**

**B. L. Hunt**

Calculation of two-dimensional and three-dimensional regular  
shock intersections 285

**E. G. Tulapurkara and V. Ramjee**

Effect of contraction on screen-generated turbulence 290

**Library, Additions and Reports**

296

Cover picture:

In his lecture to the CEI, published in this issue, Sir Frederick Page mentions some of the innovative ideas that are earning export revenue for Britain. One of these is the ski jump, and pictured on the cover is Harrier GR3 XZ 136 making the 500th take-off from the ramp at RAE, Bedford.



# The Royal Aeronautical Society

FOUNDED 1866

INCORPORATED BY ROYAL CHARTER 1949

*Patron: HER MAJESTY THE QUEEN*

## COUNCIL

*President:* P. A. HEARNE, MSc, DLC, CEng, FRAeS

*President-Elect:* J. T. STAMPER, MA(Cantab), FEng, FRAeS

*Vice-Presidents:*

CAPTAIN E. M. BROWN, CBE, DSC, AFC, MA, FRAeS, RN(Ret'd)  
PROFESSOR M. G. FARLEY, CEng, FIMechE, FBIM, FIProdE, FRAeS  
J. W. FOZARD, DCAe, BSc(Hons), CEng, FIMechE, FRAeS

*Past Presidents:*

HANDEL DAVIES, CB, MSc, CEng, FAIAA, FRAeS  
PROFESSOR L. F. CRABTREE, BSc, DIC, PhD, CEng, AFAIAA, FRAeS

*Members:*

C. ABELL, OBE, CEng, HonFSLAET, HonFRAeS  
A. J. ADCOCK, BSc(Eng), AMRAeS  
M. W. ANDERSON, MA(Cantab), CEng, MICE, MSAE, AFAIAA, FRAeS  
F. AUSTIN, FRAeS (*President—Australia Division*)  
R. G. AUSTIN, MSc, CEng, MAIAA, FRAeS (*Chairman, Rotorcraft Section*)  
AIR CDRE F. R. BANKS, CB, OBE, HonCGIA, CEng, HonFAIAA, HonFRAeS,  
RAF (Ret'd)  
A. E. M. BARTON, DFC, CEng, MRAeS  
A. L. BLACKMAN, OBE, MA, FRAeS  
M. J. BRENNAN, BSc, CEng, FIMechE, FRAeS  
F. A. BRITAIN, AMRAeS (*President—New Zealand Division*)  
DR P. H. CALDER, OBE, BSc, ACGI, PhD, CEng, MRAeS  
R. J. FRITZ, CEng, FRAeS (*President—Southern Africa Division*)  
N. FALCONER, MRAeS  
DR W. F. HILTON, PhD, DSc, CEng, AFAIAA, FIERE, FRAeS  
DR G. S. HISLOP, CBE, HonDSc, PhD, BSc, ARCST, FEng, FIMechE, FRSA, FRSE,  
FRAeS  
A. S. HUGHES, CEng, MRAeS (*Chairman—Branches Committee*)  
T. H. KERR, BSc, FRAeS  
D. KNIGHT, BSc(Eng) (*Chairman—Graduates' and Students' Section*)  
B. P. LAIGHT, OBE, MSc, CEng, MIMechE, FRAeS  
F. J. LOW, MRAeS  
COLMAN MYERS, MRAeS (*President—Zimbabwe Division*)  
G. K. C. PARDOE, BSc(Eng), DLC, CEng, FBIS, FRAeS  
AIR MARSHAL SIR CHARLES PRINGLE, KBE, MA, FEng, FRAeS, FBIM,  
RAF(Ret'd)  
D. J. RICHER, MSc, BSc  
A. C. SOUTHGATE, BSc, DCAe, CEng, FRAeS (*Chairman—Astronautics &  
Guided Flight Section*)  
G. T. WANSBROUGH-WHITE, AMRAeS

*Officers:*

Hon. Treasurer: C. F. HUGHESDON, AFC, FRAeS  
Solicitor: C. L. BYWATERS, Associate RAeS  
Secretary: E. M. J. SCHAFFTER, MA, CEng, FRAeS