



DECEMBER 1979

THE  
***aeronautical***  
JOURNAL

VOLUME 83

No. 828

DECEMBER 1979



COMBAT AIRCRAFT DESIGN

BRITISH AIRSHIPS

# 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.

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

Hon. President: Sir HUMPHREY GIBBS, KCMG. President: K. A. BOLT, 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: W. R. HEALD, FRAeS. Hon. Secretary: M. E. MURRAY, MRAeS, Shell Oil New Zealand Ltd, PO Box 2091, Wellington.

**Southern Africa**

President: J. W. DULY, 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.

**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 22321; Home—0902 787631.

**Boscombe Down**

President: Air Cdre. R. BROWNLOW, OBE, AFC, AMRAeS, RAF.  
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: K. CHEVERTON, FRAeS.  
Hon. Secretary: J. F. BORTKIEWICZ, FRAeS, Tudor Cottage, Battery Lane, Portishead, Bristol BS20 9JD. Tel: 0272 842364.

**Brough**

President: L. W. MILSOM.  
Chairman: R. MELLING, MRAeS.  
Hon. Secretary: M. EDWARDS, MRAeS, c/o British Aerospace, Aircraft Group, Brough, North Humberside, HU15 1EQ. Tel: 0482 667121. Ex. 383.

**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: R. CRONIN, MRAeS.  
Chairman: D. E. CAILES, MRAeS.  
Hon. Secretary: R. WELLS, AMRAeS, 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 D. HARCOURT-SMITH.  
Chairman: Wg. Cdr. D. M. F. BRIGHT, CEng, MRAeS, RAF.  
Hon. Secretary: Sqn. Ldr. R. C. HOLLIDAY CEng, MRAeS, RAF, Dept of Specialist Ground Training, RAF College, Cranwell, Sleaford, Lincs NG34 8HB. Tel: 0400 61201. Ex. Trenchard 254.

**Derby**

President: D. A. HEAD, MRAeS.  
Chairman: J. BUSH, FRAeS.  
Hon. Secretary: J. M. ROBERTSON, MRAeS, Rolls-Royce (1971) 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, Dublin 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: Capt. E. A. STARLING, MRAeS.  
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. J. P. DOWNES.  
Chairman: Wg. Cdr. P. SWINDLEHURST, MRAeS.  
Hon. Secretary: Sqn. Ldr. D. JOHNSON, OC Propulsion Training Squadron, RAF Halton, Bucks HP22 5PG. Tel: 0296 623535. Ex. 263.

**Hatfield**

President: D. R. NEWMAN, FRAeS.  
Chairman: G. B. EVANS, FRAeS, Drawing Office, 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, FRAeS.  
Chairman: D. W. FEARON, MRAeS.  
Hon. Secretary: G. TYCHOWSKI, CEng, MRAeS, H2 TBA, British Airways Engineering Base, London (Heathrow) Airport, Hounslow, Middx TW6 2JR. Tel: 01-759 5511. Ex. 5820.

**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: A. J. TROUGHTON, FRAeS.  
Hon. Secretary: M. J. TAYLOR, CEng, MRAeS, Flight Development Dept, British Aerospace, Woodford, Stockport, Cheshire. Tel: 061-439-5050. Ex. 556.

**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: D. K. KEMPSTON, MRAeS, British Aerospace, Warton Division, Warton Aerodrome, Preston. Tel: Preston 633333. Ex. 301.

**Prestwick**

President: R. McINTYRE, FRAeS.  
Chairman: V. McLEONARD, AMRAeS.  
Hon. Secretary: P. BERRY, MRAeS, 9 Carluia Crescent, Ayr KA7 4SP. Tel: 0292 42747.

**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: 062-882 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, Westland Helicopters Ltd, Yeovil, Somerset. Tel: 0935 5222. Ex. 160.

VOLUME 83  
NUMBER 828  
DECEMBER 1979

# THE **aeronautical** JOURNAL

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

Editor: Jay Wolff, Assoc. Member  
RAeS.

Assistant to 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.

## contents

- J. Fletcher and B. R. A. Burns**  
SUPERSONIC COMBAT AIRCRAFT DESIGN 459
- Arnold Nayler**  
BRITISH LIGHTER-THAN-AIR ACTIVITY: A REVIEW 467
- E. J. Niedermayer**  
BRITISH CIVIL AIRWORTHINESS REQUIREMENTS FOR  
AIRSHIPS 476
- H. G. Mason**  
THE SHAPE OF THINGS TO COME—AN INTRODUCTION TO  
THE CAPABILITIES OF THE BRITISH AEROSPACE NUMERICAL  
MASTER GEOMETRY SYSTEM 483
- TECHNICAL NOTE**
- A. Rothwell and N. J. Liacos**  
Stiffened shear webs: post-buckling failure of stiffeners of  
less than critical rigidity 490
- Library, Reviews, Additions and Reports** 494

### Cover picture:

The cover shows the attractive  
Cameron balloon D-96 'Sultan'  
made for Solomon Carpets of  
Australia, flying over Adelaide, S.A.  
In this issue we reprint two papers  
given at the AIAA Lighter-than-air  
Systems Technology Conference,  
held in California this year.



# The Royal Aeronautical Society

FOUNDED 1866

INCORPORATED BY ROYAL CHARTER 1949

*Patron: HER MAJESTY THE QUEEN*

## COUNCIL

*President:* R. P. PROBERT, CB, MA, FEng, FRAeS

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

*Vice-Presidents:*

J. T. STAMPER, MA(Cantab), FEng, FRAeS  
CAPTAIN E. M. BROWN, CBE, DSC, AFC, MA, FRAeS, RN(Ret'd)  
G. R. JEFFERSON, CBE, BSc, FEng, MIMechE, FRAeS

*Past Presidents:*

C. ABELL, OBE, HonFSLAET, CEng, HonFRAeS  
HANDEL DAVIES, CB, MSc, CEng, FAIAA, FRAeS  
PROFESSOR L. F. CRABTREE, BSc, DIC, PhD, CEng, AFAIAA, FRAeS

*Members:*

A. J. ADCOCK, BSc(Eng), AMRAeS  
M. W. ANDERSON, MA(Cantab), CEng, FRAeS, MICE, MSAE, AFAIAA  
AIR CDRE F. R. BANKS, CB, OBE, HonCGIA, CEng, HonFAIAA, HonFRAeS  
A. E. M. BARTON, DFC, CEng, MRAeS  
K. A. BOLT, MRAeS (*President—Rhodesia Division*)  
M. J. BRENNAN, BSc, CEng, FIMechE, FRAeS  
DR P. H. CALDER, OBE, BSc, ACGI, PhD, CEng, MRAeS  
PROFESSOR I. C. CHEESEMAN, PhD, BSc, ARCS, CEng, FRAeS, FCIT  
J. W. DULY, CEng, MRAeS (*President—Southern Africa Division*)  
N. FALCONER, MRAeS  
PROFESSOR M. G. FARLEY, CEng, FIMechE, FBIM, FIProdE, FRAeS  
J. W. FOZARD, DCAe, BSc(Hons) CEng, FRAeS, FIMechE  
W. R. HEALD, FRAeS (*President—New Zealand Division*)  
DR W. F. HILTON, PhD, DSc, CEng, AFAIAA, FRAeS, FIERE  
DR G. S. HISLOP, CBE, HonDSc, PhD, BSc, ARCST, FEng, FIMechE, FRAeS,  
FRSA, FRSE  
A. S. HUGHES, CEng, MRAeS (*Chairman—Branches Committee*)  
T. H. KERR, BSc, FRAeS  
B. P. LAIGHT, OBE, MSc, CEng, MIMechE, FRAeS  
D. J. LASCELLES, BSc(Eng), CEng, MIMechE, AMRAeS  
F. J. LOW, MRAeS  
G. K. C. PARDOE, BSc(Eng), DLC, CEng, FBIS, FRAeS  
AIR MARSHAL SIR CHARLES PRINGLE, KBE, MA, FEng, FRAeS, FBIM,  
RAF (Ret'd)  
A. C. SOUTHGATE, BSc, CEng, DCAe, FRAeS (*Chairman—Astronautics &  
Guided Flight Section*)  
M. N. A. WATKINSON, BSc(Eng), (*Chairman—Graduates' and Students'  
Section*)  
G. T. WANSBROUGH-WHITE, AMRAeS  
F. W. AUSTIN, FRAeS (*President—Australia Division*)

*Officers:*

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