

THE AERONAUTICAL JOURNAL

JULY 1969

NOTICES

BRANCHES

GRADUATES' AND STUDENTS' SECTION

Air Cdre. F. R. Banks

PRESIDENTIAL ADDRESS. THIS AVIATION BUSINESS

Lord Kings Norton

THE SEVENTH HANDLEY PAGE MEMORIAL LECTURE.
LOOKING AHEAD IN AERONAUTICS—20: LOOKING FORWARD AGAIN

L. F. Legrand

THE NEXT GENERATION OF FRENCH HELICOPTERS

L. Giusta

EUROPEAN CO-OPERATION IN THE AVIATION INDUSTRY AND ITS FUTURE DEVELOPMENT. INSTANCE OF ITS APPLICATION TO THE ANGLO-FRENCH HELICOPTER PROGRAMME

K. R. Sealy

AIR TRANSPORT FACILITIES AND REGIONAL PLANNING

CORRESPONDENCE

TECHNICAL NOTES

E. H. Mansfield and Carol Hanson An Optimum Fibre Orientation in an Annulus

J. H. Argyris and D. W. Scharpf A Further Sequel to Technical Note 14: The FUGA Family of Elements for Folded Plate Structures

V. C. Patel

On the Use of the Preston Tube in Concentric Annuli

A. Quarmby

Reply

J. Lockwood Taylor

Buckling of Isosceles Triangular Plates

N. Hay

Comparison of Predicted and Measured Wall Temperature in a Turbulent Boundary Layer with Arbitrary Pressure Gradients

A. C. Mills

Experiments on the Buckling of Simply-Supported Rectangular Plates

THE LIBRARY

Reviews.

Additions to the Library.

Reports

SUPPLEMENTARY PAPERS

S. Richmond

MAN POWERED FLIGHT—A NEW APPROACH TO AN OLD DREAM

R. W. Higgins

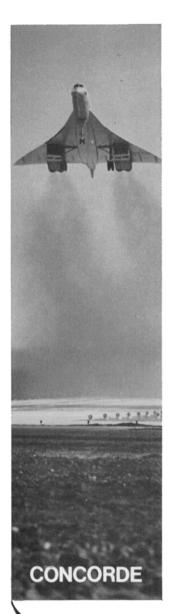
THE CHOICE BETWEEN ONE ENGINE OR TWO FOR TACTICAL STRIKE/CLOSE SUPPORT AIRCRAFT

D. A. Ray HEAD-UP DISPLAY

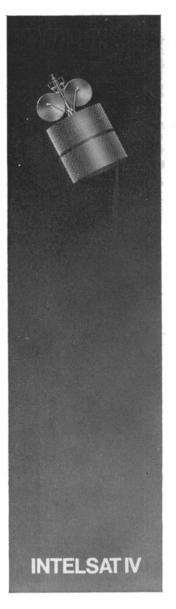
27s 6d

THE ROYAL AERONAUTICAL SOCIETY

4 HAMILTON PLACE LONDON W1









BRITISH AIRCRAFT CORPORATION leaders in European collaboration

Concorde - BAC and Sud-Aviation of France

Jaguar - BAC and Breguet Aviation of France

Intelsat IV—BAC, as the main subcontractor to Hughes Aircraft Corporation of the USA, is working with nine European aerospace firms.

MRCA — BAC and Messerschmitt-Bolkow of Germany, Fiat of Italy, and Fokker of the Netherlands.



THE ROYAL AERONAUTICAL SOCIETY

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

Telephone: 01-499 3515

Telegrams: Didaskalos, London, W1

Published Monthly at 4 HAMILTON PLACE, LONDON W1V 0BQ Subscriptions: £15 15s. 0d. per annum, post free

Single Copies: 27s. 6d.

VOLUME 73 NUMBER 703 **JULY 1969 CONTENTS** Page **NOTICES** LV **BRANCHES** LXIII GRADUATES' AND STUDENTS' SECTION I XIV Air Cdre. F. R. Banks PRESIDENTIAL ADDRESS. THIS AVIATION BUSINESS 553 Lord Kings Norton THE SEVENTH HANDLEY PAGE MEMORIAL LECTURE. LOOKING AHEAD IN AERONAUTICS-20: LOOKING FORWARD AGAIN 558 L. F. Legrand THE NEXT GENERATION OF FRENCH HELICOPTERS 564 EUROPEAN CO-OPERATION IN THE AVIATION INDUSTRY AND ITS FUTURE DEVELOPMENT. INSTANCE OF ITS APPLICATION TO THE ANGLO-FRENCH L. Giusta HELICOPTER PROGRAMME 573 K. R. Sealy AIR TRANSPORT FACILITIES AND REGIONAL PLANNING 581 CORRESPONDENCE 591 TECHNICAL NOTES 593 E. H. Mansfield and An Optimum Fibre Orientation in an Annulus Carol Hanson A Further Sequel to Technical Note 14: The FUGA Family of Elements for J. H. Argyris and D. W. Scharpf Folded Plate Structures V. C. Patel On the Use of the Preston Tube in Concentric Annuli A. Quarmby Reply J. Lockwood Taylor **Buckling of Isosceles Triangular Plates** Comparison of Predicted and Measured Wall Temperature in a Turbulent Boundary Layer with Arbitrary Pressure Gradients N. Hav A. C. Mills Experiments on the Buckling of Simply-Supported Rectangular Plates THE LIBRARY Reviews. Additions to the Library. 609 Reports SUPPLEMENTARY PAPERS MAN POWERED FLIGHT-A NEW APPROACH TO AN OLD DREAM S. Richmond 615 THE CHOICE BETWEEN ONE ENGINE OR TWO FOR TACTICAL STRIKE/CLOSE R. W. Higgins

Editor: JOAN BRUCE, BSc, CEng, AFRAeS.

Secretary of the Society: A. M. BALLANTYNE, OBE, TD, BSc, PhD, CEng, HonFCASI, FAIAA, FRAES.

D. A. Ray HEAD-UP DISPLAY

SUPPORT AIRCRAFT

4 HAMILTON PLACE, LONDON, W1V 0BQ. Tel: 01-499 3515.

Advertisements Only:

H. E. SOUTHON

Magazine Advertising Ltd, 184 Fleet Street, London, EC4.

Tel: 01-242 0434/5.

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 expressing the opinion of the Council unless otherwise stated.

620

622

PRINTED BY THE LEWES PRESS WIGHTMAN & CO. LTD., LEWES, SUSSEX, ENGLAND, AND PUBLISHED BY THE ROYAL AERONAUTICAL SOCIETY, 4 HAMILTON PLACE, LONDON, W1V 0BQ, ENGLAND.

DIVISIONS AND BRANCHES OF

THE ROYAL AERONAUTICAL SOCIETY

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

President: P. S. LANGFORD, FRAES. Hon. Secretary: R. R. GREEN, AFRAES, Science House, Gloucester and Essex Streets, Sydney 2000.

Branches at: Bulawayo, Gwelo and Salisbury.

Hon. President: Sir HUMPHREY GIBBS, KCMG, OBE. President: G. A. FORD, AFRAeS. Hon. Secretary: S. H. GUY, AFRAeS, 76 Bideford Road, Chadcombe, P.O. Hatfield, Salisbury, Rhodesia.

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

President: T. T. N. COLERIDGE, FRAeS. Hon. Secretary: A. A. HOFFMAN, ARAES, New Zealand National Airways Corpn, P.O. Box 96, Wellington.

Branches at: Johannesburg, Pretoria, Cape Western and Durban.

President: A. O. M. VIALLS, FRAeS. Hon. Secretary: Cmdt. F. W. CARNELL, AFRAES, 11 Staal Road, Valhalla, Pretoria Dist.

President: F. O'HARA, FRAES.
Chairman: D. CLAYSON, AFRAES.
Hon. Secretary: J. B. BERRY, AFRAES,
Aircraft Research Association, Manton
Lane, Bedford. Tel: Bedford 67701.

President: P. F. FOREMAN, FRAES.
Chairman: J. H. McCLEAN, AFRAES.
Hon. Secretary: T. E. MORRISON, AFRAES,
Dept. of Mechanical Engineering College
of Technology, College Square East,
Belfast BT1 6DJ. Tel: Belfast 27244.

Birmingham and Wolverhampton

President: L. W. J. NEWMAN. FRAES.
Chairman: R. F. HOLDNALL, ARAES.
Hon. Secretary: I. B. CRIPPS, AFRAES,
H. M. Hobson Ltd, Fordhouses, Wolverhampton, Staffs. Tel: Fordhouses 2381.

Boscombe Down

President: Air Cdre. C. D. A. BROWNE, DFC. Chairman: G. MACLAREN HUMPHREYS, MBE, FRAeS. Acting Hon. Secretary: Fit. Lt. A. A. CLARK, E. Squadron, A & AEE, Boscombe Down, Amesbury, Salisbury, Wilts. Tel: Amesbury 3331.

Bristol

President: D. ROWLEY, FRAeS. Chairman: T. P. FROST, FRAES. Hon. Secretary: R. HARDING, BAC Ltd, Filton, Bristol. Bristol 693831.

Ough
President: Capt. E. D. G. LEWIN, CB, CBE,
DSO, AFRAeS.
Chairman: K. ESSEX-CROSBY, FRAeS.
Hon. Secretary: A. D. HOWARTH, ARAES,
c/o Hawker Siddeley Aviation Ltd,
Brough, Yorkshire. Tel: Brough 667121.

Cambridge

Ambridge
President: Professor W. A. MAIR, FRAeS.
Chairman: R. O. GATES, FRAeS.
Hon. Secretary: D. J. COLE, Marshall of
Cambridge (Engineering) Ltd, The Airport, Cambridge. Tel: Cambridge 56291.

Chester

President: K. G. HANCOCK, FRAeS.
Chairman: H. STRAWSON, AFRAeS.
Hon. Secretary: V. W. CLARKSON, ARAeS.
Hawker Siddeley Aviation Ltd, Broughton,
Chester. Tel: Chester 24646.

Christchurch

President: E. W. J. GRAY, FRAeS.
Chairman: D. E. CAILES, AFRAeS.
Hon. Secretary: A. L. RUCKLEY, AFRAES.
BAC Ltd, Design Office, Bournemouth
(Hurn) Airport, Christchurch, Hants. Tel:
Northbourne 3201.

Coventry

President: R. W. F. FARTHING, FRAeS. Chairman: R. A. FIELD, ARAeS. Hon. Secretary: J. KIRKLAND, ARAES, Dunlop Aviation Division, Design Dept, Holbrook Lane, Foleshill, Coventry. Tel: Coventry 88733.

Cranwell

President: Air Vice-Marshal T. N. STACK, CB, CVO, CBE, AFC.
Chairman: Wg. Cdr. J. SANDFORD, AFRAES.
Hon. Secretary: F. A. BRISTOW, AFRAES.
Dept of Engineering, RAF College, Cranwell, Sleaford, Lincs. Tel: Cranwell 201.

Derby

President: DENNING President: Sir DENNING PEARSON. HonFRAeS. Chairman: S. L. BRAGG, FRAeS. Hon. Secretary: J. R. COWNIE, AFRAeS, Rolls-Royce Ltd, Derby, DE2 8BJ. Tel: Derby 42424. Sir PEARSON.

Dublin

President: Capt. J. C. KELLY-ROGERS, OBE, FRAeS.
Chairman: A. J. WALLS, FRAeS.
Hon. Secretary: Dr. K. J. HOLDEN, AFRAeS,
Aer Lingus, PO Box 180, Dublin Airport.

Glasgow

President: Dr. A. W. BABISTER, AFRAeS. Chairman: G. M. ADDISON, AFRAeS. Hon. Secretary: T. K. BLACK, 43 Partickhill Road, Glasgow, W.1.

Gloucester and Cheltenham

Cheltenham, Glos. Tel: Bishops Cleeve, Cheltenham, Glos. Tel: Bishops Cleeve, Cheltenham, Glos. Tel: Bishops Cleeve, Cheltenham, Glos. Tel: Bishops Cleeve

Halton

President: Air Vice-Marshal J. H. HUNTER-TOD, OBE, FRAeS.
Chairman: Gp. Capt. M. F. HATTON, OBE.
Hon. Secretary: Fit. Lt. C. R. MILES,
Officers' Mess, RAF Halton, Bucks. Tel:
Wendover 2241.

Hatfield

President: Sir HARRY BROADHURST.
Chairman: G. R. WILKINSON.
Hon. Secretary: G. B. EVANS, FRAES,
Drawing Office, Hawker Siddeley Aviation
Ltd, Hatfield, Herts. Tel: Hatfield 2345.

Isle of Wight

President: R. STANTON JONES, AFRAeS.
Chairman: D. J. HARDY, AFRAeS.
Hon. Secretary: H. A. POOK, AFRAES.
British Hovercraft Corporation Ltd, East
Cowes, Isle of Wight. Tel: Cowes 4121.

London Airport

President: C. ABELL, OBE, FRAeS.
Chairman: F. J. LOW, ARAeS.
Hon. Secretary: N. BROWN, ARAeS, Technical Publications, Technical Block A, G.3, BOAC, PO Box 10, Hounslow, Middlesex. Tel: Skyport 5511.

Loughborough

President: Professor K. L. C. LEGG, FRAeS. Chairman: Dr. K. B. AYERS, FRAES. Hon. Secretary: F. G. MACCABEE, AFRAES, 56 Holywell Drive, Loughborough, Leics.

Luton and Stevenage

President: J. E. RIDGWAY.
Chairman: Dr. W. F. HILTON, FRAES.
Hon. Secretary: D. B. COLLINS, ARAES,
English Electric Co. Ltd, Special Products Group, The Airport, Luton, Beds.
Tel: Luton 31441.

President: C. E. FIELDING, OBE, FRAES.
Chairman: M. J. BRENNAN, FRAES.
Hon. Secretary: J. A. E. WATERFALL,
56 Manor Avenue, Ashton-on-Mersey,
Cheshire. Tel: Failsworth 2020.

Merthyr and Treforest

President: G. W. MOORE.
Chairman: E. R. CHAYTOR, AFRAES.
Hon. Secretary: Dr. G. O. FORESTER.
AFRAES, Chief of Research, Teddington
Aircraft Controls Ltd, Cefn Coed, Merthyr
Tydfil, South Wales. Tel: Merthyr Tydfil
3261.

Preston

President: F. D. CROWE. FRAeS.
Chairman: F. E. ROE, AFRAES.
Hon Secretary: L. A. WILLOTT, AFRAES,
BAC Ltd, Preston Division, Warton
Aerodrome, Preston, Lancashire. Tel:
Freckleton 531.

Prestwick

President: R. McINTYRE, FRAeS.
Chairman: Dr. W. G. WATSON.
FRAES.
Hon. Secretary: J. FISHER, Scottish Aviation
Ltd, Design Office, Prestwick Airport,
Ayrshire. Tel: Prestwick 79888.

President: E. N. MOBBS.
Chairman: J. T. APPLEBY, FRAES.
Hon. Secretary: K. O. SCOTT, AFRAES,
M. L. Aviation Co. Ltd, White Waitham.
Maidenhead, Berks. Tel: Littlewick
Green 3361.

Southampton

President: A. N. CLIFTON, FRAES.
Chairman: Professor G. M. LILLEY, FRAES.
Hon. Secretary: P. W. FORTESCUE, AFRAES,
Dept. of Aeronautics and Astronautics,
The University, Southampton. Tel: Southampton 56331.

Southend

President: J. R. BATT, ARAES.
Chairman: K. A. COLE, AFRAES.
Hon. Secretary: Wg. Cdr. E. F. PRICE,
ARAES, Aviation Traders (Eng) Ltd,
Southend Airport, Essex. Tel: Southend
49471.

Swindon

VINGON
President: W. GILLESPIE, AFRAES.
Chairman: E. J. DAVIS, AFRAES.
Hon. Secretary: G. N. GINGELL, AFRAES,
Vickers Ltd, South Marston, Swindon,
Wilts. Tel: Stratton St. Margaret 3241.

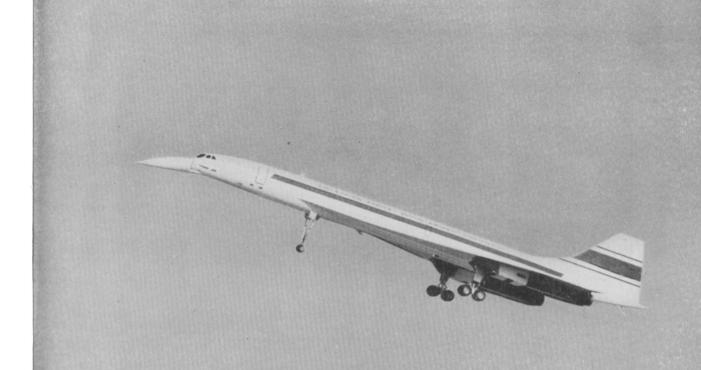
Weybridge

President: Sir GEORGE EDWARDS, CBE, FRS, HonFRAeS.
Chairman: E. S. ALLWRIGHT, FRAeS.
Hon. Secretary: A. M. DOBSON, AFRAeS, BAC Ltd, Weybridge Division, Weybridge, Surrey. Tel: Weybridge 45555.

Yeovii

President: E. C. WHEELDON, CBE, FRAeS. Chairman: Dr. G. S. HISLOP. FRAES. Hon. Secretary: F. N. R. BALLAM, ARAES, Westland Aircraft Ltd, Yeovil, Somerset. Tél: Yeovil 5222.

JULY 1969



The bird has flown.

Concorde takes wing. And takes us along too.

For the past nine years we have been involved in the project with both Rolls Royce and the British Aircraft Corporation.

BP have produced a unique high performance turbine lubricant.

Shell have carried out an extensive research programme into the fuel requirements.

(When a plane uses 65 tons of fuel in one trans-Atlantic flight you get some idea of the size of the problems that have had to be solved.)

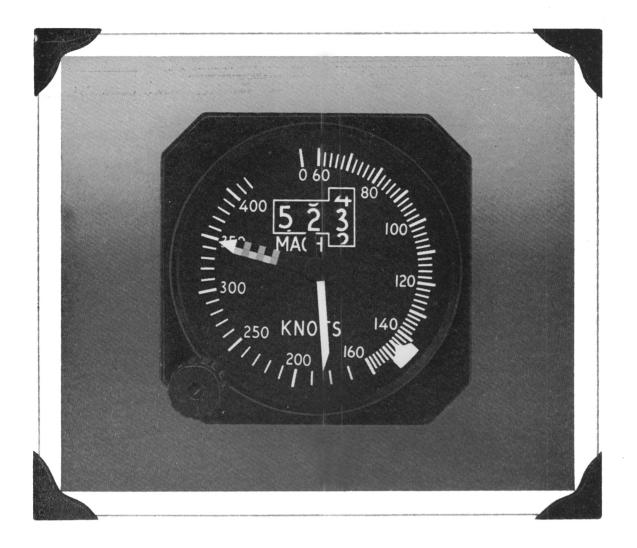
But this is only the first phase of the comprehensive flight test programme before Concorde enters service with the world airlines.

And Shell-Mex and B.P. Ltd. will be with her all the way.





SHELL-MEX AND B.P. LTD. Operators in the U.K. of the Shell and the BP Aviation Services



Portrait of a happy marriage

Barometric airspeed indication and servoed digital mach read-out are happily united in this Combined Mach Airspeed Indicator—another contribution by Smiths Industries Aviation Division to clearer and more compact instrumentation. The display includes large 3 digit mach counter, single airspeed pointer and maximum safe operating airspeed (Vmo) pointer. Autothrottle coupling facilities and, if required, adjustable speed index 'bugs' can be provided. Variants with alternative mach and

airspeed ranges and metric calibration are available. The instrument has TSO.C46 approval. The comprehensive range of Smiths airspeed displays also includes conventional Mach Airspeed Indicators. These barometric instruments have Vmo pointers and autothrottle coupling facilities. Smiths Mach Airspeed Indicators are housed in 3ATI cases, have integral lighting and are being supplied to Boeing for 707 and 737 aircraft.



Cheltenham Road, Bishops Cleeve, Cheltenham, Gloucestershire. Telephone: Bishops Cleeve 3333

FLIGHT DECK INSTRUMENTS FLIGHT CONTROL SYSTEMS ENGINE EQUIPMENT FUEL GAUGING EQUIPMENT COMPONENTS

SAV 5930

ADVERTISEMENTS JULY 1969]

4 [THE AERONAUTICAL JOURNAL OF THE ROYAL AERONAUTICAL SOCIETY