



# THE AERONAUTICAL JOURNAL

MARCH 1969

NOTICES

GRADUATES' AND STUDENTS' SECTION

BRANCHES

**J. T. Stamper** LOOKING AHEAD IN AERONAUTICS—16: MANAGEMENT OF DESIGN

THE CEI AND ITS EFFECTS ON THE SOCIETY AND ITS MEMBERS

**G. S. Schairer** THE ROLE OF COMPETITION IN AERONAUTICS

**C. Abell** OPERATIONAL ASPECTS OF THE SUPERSONIC TRANSPORT

CORRESPONDENCE

TECHNICAL NOTES

**J. H. Argyris and  
D. W. Scharpf**

Some General Considerations on the Natural Mode Technique

**B. S. Massey and  
B. R. Clayton**

A Note on the Accuracy of Similar Solutions of the Equations for Laminar Boundary Layers on Curved Surfaces

**A. Quarmby and  
H. K. Das**

Measurement of Skin Friction Using a Rectangular Mouthed Preston Tube

THE LIBRARY

Reviews: Handbook of the Vickers Viscount—Manufacturing and Machine Tool Operations—New Soaring Pilot—I Must Fly

Additions to the Library. Reports

THE ROYAL AERONAUTICAL SOCIETY

4 HAMILTON PLACE LONDON W1

# Our nest eggs are aluminium.



And they save *you* money, like everything we hatch in aluminium. All in the same H.D.A. clutch are forgings, die-castings, extrusions and sheet – in various shapes and for many uses. We know we can help you so drop us a line and we'll gladly tell you more.

**HDA**  
HIGH DUTY ALLOYS LIMITED,  
SLOUGH, BUCKS,

 **HAWKER SIDDELEY  
COMPANY**

Hawker Siddeley Group supplies mechanical, electrical and aerospace equipment with world-wide sales and service.

# THE AERONAUTICAL JOURNAL

THE ROYAL AERONAUTICAL SOCIETY

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

Published Monthly at 4 HAMILTON PLACE, LONDON W1V 0BQ

Telephone: 01-499 3515      Telegrams: Didaskalos, London, W1

VOLUME 73

NUMBER 699

MARCH 1969

## CONTENTS

	Page
NOTICES	XXI
GRADUATES' AND STUDENTS' SECTION	XXVII
BRANCHES	XXVIII
<b>J. T. Stamper</b> LOOKING AHEAD IN AERONAUTICS—16: MANAGEMENT OF DESIGN	173
THE CEI AND ITS EFFECTS ON THE SOCIETY AND ITS MEMBERS	186
<b>G. S. Schairer</b> THE ROLE OF COMPETITION IN AERONAUTICS	195
<b>C. Abell</b> OPERATIONAL ASPECTS OF THE SUPERSONIC TRANSPORT	208
CORRESPONDENCE	216
TECHNICAL NOTES	
<b>J. H. Argyrils and D. W. Scharpf</b> Some General Considerations on the Natural Mode Technique	218
<b>B. S. Massey and B. R. Clayton</b> A Note on the Accuracy of Similar Solutions of the Equations for Laminar Boundary Layers on Curved Surfaces	226
<b>A. Quarmby and H. K. Das</b> Measurement of Skin Friction Using a Rectangular Mouthed Preston Tube	228
THE LIBRARY	231
Reviews: Handbook of the Vickers Viscount—Manufacturing and Machine Tool Operations—New Soaring Pilot—I Must Fly	
Additions to the Library.      Reports	

SUPPLEMENTARY PAPERS

See Facing page 236

*Editor:* JOAN BRUCE, BSc, CEng, AFRAeS.

*Secretary of the Society:* A. M. BALLANTYNE, OBE, TD, BSc, PhD, CEng, HonFCASI, FAIAA, FRAeS.  
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 as expressing the opinion of the Council unless otherwise stated.**

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

## **Australian** Branches at: Canberra, Sydney, Melbourne and Adelaide.

*President:* Dr. M. W. WOODS, FRAeS. *Hon. Secretary:* R. R. GREEN, AFRAeS, Science House, Gloucester and Essex Streets, Sydney 2000.

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

*Hon. President:* Sir HUMPHREY GIBBS, KCMG, OBE. *President:* I. NESBIT, ARAeS. *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:* Capt. J. H. MALCOLM, ARAeS. *Hon. Secretary:* A. A. HOFFMAN, ARAeS, New Zealand National Airways Corp., P.O. Box 96, Wellington.

## **Southern Africa** 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.

## **Bedford**

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

## **Belfast**

*President:* P. F. FOREMAN, FRAeS.  
*Chairman:* W. KAY, AFRAeS.  
*Hon. Secretary:* T. E. MORRISON, AFRAeS,  
4 Kingsland Park, Cherryvalley, Belfast 5.

## **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, Wolver-  
hampton, Staffs. *Tel:* Fordhouses 2381.

## **Boscombe Down**

*President:* Air Cdre. C. D. A. BROWNE, DFC.  
*Chairman:* G. MACLAREN HUMPHREYS,  
MBE, FRAeS.  
*Acting Hon. Secretary:* R. S. KING, Photo-  
graphic Division, A & AEE, Boscombe  
Down, Amesbury, Salisbury, Wilts. *Tel:*  
Amesbury 3331.

## **Bristol**

*President:* F. H. POLLICUTT, FRAeS.  
*Chairman:* T. V. LAWSON, FRAeS.  
*Hon. Secretary:* N. H. WOOD, Rolls-Royce  
Ltd, Bristol Engine Division, Filton,  
Bristol 7. *Tel:* Bristol 693871.

## **Brough**

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

## **Cambridge**

*President:* Professor W. A. MAIR, FRAeS.  
*Chairman:* R. O. GATES, AFRAeS.  
*Hon. Secretary:* D. J. COLE, Marshall of  
Cambridge (Engineering) Ltd, The Air-  
port, 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:* H. E. VINCENT, 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,  
CVO, CBE, AFC.  
*Chairman:* Wg. Cdr. J. SANDFORD, AFRAeS.  
*Hon. Secretary:* J. KIRKLAND, ARAeS, Dept of  
Engineering, RAF College, Cran-  
well, Sleaford, Lincs. *Tel:* Cranwell 201.

## **Derby**

*President:* Sir DENNING PEARSON,  
HonFRAeS.  
*Chairman:* D. McLEAN, FRAeS.  
*Hon. Secretary:* V. R. HAAS, AFRAeS, Rolls-  
Royce Ltd, Derby. DE2 8BJ. *Tel:* Derby  
42424.

## **Dublin**

*Chairman:* Capt. J. C. KELLY-ROGERS, OBE,  
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**

*President:* Sir GEORGE DOWTY, HonFRAeS.  
*Chairman:* D. L. BROWN, FRAeS.  
*Hon. Secretary:* C. E. HUTT, ARAeS, c/o  
Smiths Industries Ltd, Bishops Cleeve,  
Cheltenham, Glos. *Tel:* Bishops Cleeve  
3333.

## **Halton**

*President:* Air Vice-Marshal J. H. HUNTER-  
TOD, OBE, FRAeS.  
*Chairman:* Gp. Capt. M. F. HATTON, OBE.  
*Hon. Secretary:* Flt. 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:* A. J. DEVEREUX, 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, Tech-  
nical Publications, Technical Block A,  
G.3, BOAC, PO Box 10, Hounslow, Middle-  
sex. *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 Pro-  
ducts Group, The Airport, Luton, Beds.  
*Tel:* Luton 31441.

## **Manchester**

*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:* A. F. ATKIN, FRAeS.  
*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,  
AFRAeS.  
*Hon. Secretary:* J. FISHER, Scottish Aviation  
Ltd, Design Office, Prestwick Airport,  
Ayrshire. *Tel:* Prestwick 79888.

## **Reading**

*President:* E. N. MOBBS.  
*Chairman:* J. T. APPLEBY, FRAeS.  
*Hon. Secretary:* E. W. C. ANGELL, ARAeS,  
M. L. Aviation Co. Ltd, White Waltham,  
Maidenhead, Berks. *Tel:* Littlewick  
Green 248.

## **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:* South-  
ampton 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**

*President:* W. GILLESPIE, AFRAeS.  
*Chairman:* E. J. DAVIS, AFRAeS.  
*Hon. Secretary:* L. A. LANSDOWN, AFRAeS,  
Vickers Ltd, South Marston, Swindon,  
Wilts. *Tel:* Stratton St. Margaret 3241.

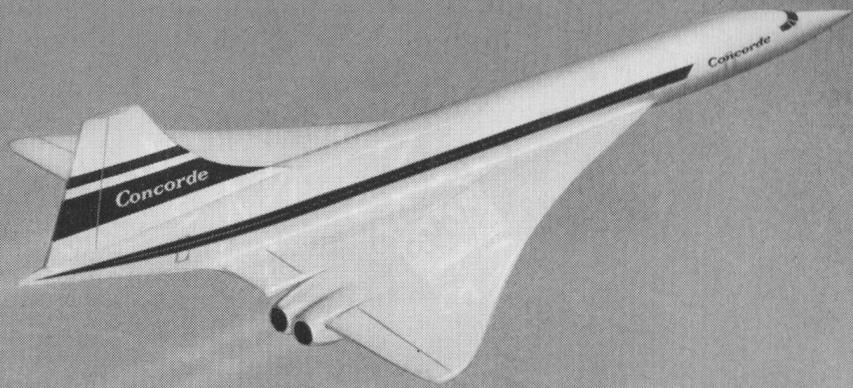
## **Weybridge**

*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.

## **Yeovil**

*President:* E. C. WHEELDON, CBE, FRAeS.  
*Chairman:* Dr. G. S. HISLOP, FRAeS.  
*Hon. Secretary:* L. A. LANSDOWN, AFRAeS,  
Westland Aircraft Ltd, Yeovil, Somerset.  
*Tel:* Yeovil 5222.

MARCH 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.

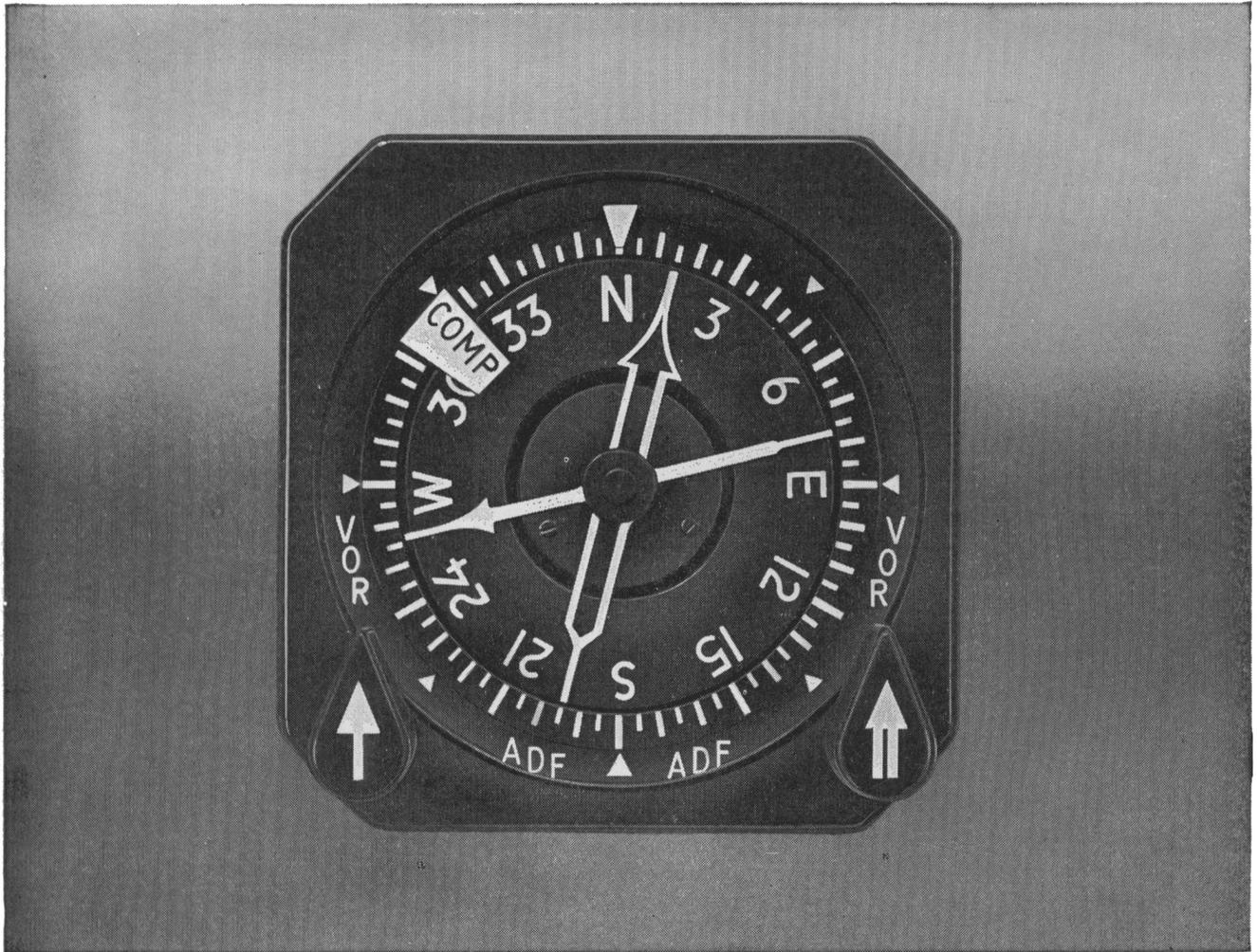
(When a plane uses 65 tons of fuel in one trans-Atlantic flight you get some idea of the size of the problems that have had to be solved.)

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



## more than just a pretty face

It's not only the clear unambiguous presentation that distinguishes this completely new Smiths Radio Magnetic Indicator. A host of hidden features providing increased accuracy and reliability are incorporated in this new 100 RNA series of instruments at no extra cost.

**Basic features common to all instruments are:—**

- New low friction jewelled bearing pointer suspension system
- Integral phase correction circuits in VOR/ADF synchro power lines
- Increased compass card response speed with improved damping
- Integral amplifier utilising latest printed circuit techniques

- 3 ATI case to ARINC specification 408

- Integral lighting to B.S. G191

**Optional facilities available include:—**

- Integral binary VOR/ADF switching
- Bootstrap synchro transmitter for compass heading repeat
- Power failure indication by positive binary action flag
- Failure monitoring circuit

Smiths Radio Navigation Instruments also include Ground Speed and Drift, Hover, Tacan Range and Bearing indicators. Omni Bearing and Radio Bearing Selectors—all of modern design and proven efficacy.

**SMITHS** **FLIGHT DECK INSTRUMENTS**

PRODUCTS OF  **SMITHS INDUSTRIES LIMITED** AVIATION DIVISION

Cheltenham Road · Bishops Cleeve · Cheltenham · Gloucestershire · Tel: Bishops Cleeve 3333

**Flight Deck Instruments**  **Components**  **Fuel Gauging Equipment**  **Engine Equipment**  **Flight Control Systems**

 SAV 5932