

# The AERONAUTICAL Journal



## Contents

**A. B. Haines**

27th Lanchester Memorial Lecture —  
scale effect in transonic flow

**J. S. Smith and D. S. Woodward**

An assessment of the use of low-  
order panel methods for the  
calculation of supersonic flows

**M. S. Ishaq and L. Bernstein**

On the speed of progressive waves  
in gust-tunnels of the QMC-type

**B. K. Singh and B. C. Basu**

A numerical model for analysis of  
thin wings in inviscid incompressible  
flow

**Library reviews, additions and  
reports**

Incorporating

**The Aeronautical Quarterly**

**Volume 91 Number 907 August/September 1987**

## NOTES ON THE PREPARATION OF PAPERS FOR PUBLICATION IN THE AERONAUTICAL JOURNAL

All papers submitted for publication are sent to two referees.

Three clear copies of the manuscript, each complete with illustrations, should be submitted. Papers should be typed in double spacing and not exceed 10 000 words. Handwritten manuscripts cannot be accepted.

A list of all symbols used, both in the illustrations and in the text, should be given in alphabetical order at the beginning of the paper whether or not they are standard. All unfamiliar terms must be explained.

Symbols and formulae should be typewritten if possible. The use of dots, bars and so on, over symbols, or the use of dots as multiplication signs and bars for brackets should be avoided. Suffixes and indices must be clearly indicated and complicated suffixes avoided.

References should be numbered in the text where they occur, and a complete list of references given at the end of the paper. (The *Aeronautical Journal* uses the BSI Numeric System for reference — eg, author(s), title of contribution, title of periodical, year of publication, volume number, page numbers.)

Illustrations should be kept to a minimum. When the paper is first submitted they can be clear prints or graphs, sketches or photographs. If the paper is accepted, authors are asked to provide the original drawings, if possible, and clear, glossy, black-and-white photographs. All diagrams should be produced to the same scale.

### Conditions of Publication

An author must obtain consent, where necessary, to use any material in a paper which is copyright or the property of any other person or his employers.

Security clearance, if appropriate, must be obtained by the author before the paper is submitted.

The copyright of papers printed in the *Aeronautical Journal* is the property of The Royal Aeronautical Society. Permission to reprint or to use any paper will not be refused unreasonably.

Authors are entitled to 50 complimentary reprints of their papers. Authors may order any number of additional reprints at the time of printing and quotations can be provided.

# The AERONAUTICAL Journal

Incorporating the Aeronautical Quarterly



Head of Publications:  
Robert Bryanton

Editor: Jay Wolff,  
Assoc. Member RAeS

Deputy Editor: Michèle Didyk

Associate Editor:  
Professor L. F. Crabtree,  
PhD, CEng, FRAeS

4 Hamilton Place, London W1V 0BQ  
Tel: 01-499 3515

Telex: 262826 RAESOC

Fax: 01-499 6230

Cables: Didaskalos,  
London W1

Advertisements:  
Kevin Shead,  
T. G. Scott & Son,  
30-32 Southampton Street,  
London WC2E 7HR.  
Tel: 01-240 2032

Telex: 299181.

(Telecopier facilities available)

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  
Manor Park Press Ltd.  
Unit 7, Highfield Industrial Estate,  
Edison Road, Hampden Park,  
Eastbourne.

Subscriptions: £122 per annum,  
post free.

RAeS members: £11.00 per  
annum.

Single copies, including back  
numbers: £12.

All foreign currency rates on  
application.

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

ISSN: 0001-9240

**PUBLISHED MONTHLY  
EXCEPT JUNE AND  
AUGUST**

## Contents

**291**

**A. B. Haines**

27th Lanchester Memorial Lecture —  
scale effect in transonic flow

**314**

**J. S. Smith and D. S. Woodward**

An assessment of the use of low-  
order panel methods for the  
calculation of supersonic flows

**321**

**M. S. Ishaq and L. Bernstein**

On the speed of progressive waves  
in gust-tunnels of the QMC-type

**333**

**B. K. Singh and B. C. Basu**

A numerical model for analysis of  
thin wings in inviscid incompressible  
flow

**338**

**Library reviews, additions  
and reports**

**Incorporating the Journals of The  
Institution of Aeronautical Engineers and  
The Helicopter Association of Great  
Britain**

## DIVISIONS AND BRANCHES OF

# THE ROYAL AERONAUTICAL SOCIETY

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

*President:* D. R. REES, CEng, FRAeS. *Hon. Secretary:* R. D. BARKLA, PO Box 573, Mascot, NSW 2020.

**Zimbabwe** Branches at: Bulawayo, Gweru and Harare.

*President:* Wg. Cdr. F. R. SIMMONDS, CEng, MRAeS, Private Bag 6003, Harare Airport.

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

*President:* Wg. Cdr. G. MURRAY, CEng, MRAeS. *Hon. Secretary:* P. J. GAUNT, PO Box 3813, Wellington.

**Southern Africa** *President:* B. H. PRESCOTT, CEng, MRAeS. *Hon. Secretary:* N. A. H. BARRAUD, MRAeS, PO Box 16608, Atlasville, Republic of South Africa, 1465.

### Bedford

*President:* Professor D. HOWE, CEng, FRAeS.

*Chairman:* G. I. PAULEY, CEng, FRAeS.

*Hon. Secretary:* R. W. STERLAND, Sales Dept (W293B), British Aerospace plc, Military Aircraft Div., Warton Aerodrome, Preston, Lancs. PR4 1AX. Tel: 0772 633333. Ex. 4994.

### Belfast

*President:* Sir PHILIP FOREMAN, CBE, FRAeS.

*Chairman:* D. J. GRENVILLE, AMRAeS.

*Hon. Secretary:* W. GORDON, MRAeS, College of Technology, College Square East, Belfast BT1 6DJ. Tel: Work — 0232 227244. Home — 0232 710370.

### Birmingham and Wolverhampton

*President:* R. G. HILTON, MA.

*Chairman:* W. G. MORRIS, AMRAeS.

*Hon. Secretary:* M. FIDDLER, Student RAeS, 12 Engleton Lane, Brewood, Stafford ST19 9DZ. Tel: Work — 0785 52331. Home — 0902 850522.

### Boscombe Down

*President:* Air Cdre. P. D. L. GOVER, AFC, FRAeS, RAF.

*Chairman:* B. W. CHILDES, FRAeS.

*Hon. Secretary:* Major (ret'd), N. C. GRAYSON, CEng, MRAeS, A&AEE Boscombe Down, Salisbury SP4 0JF. Tel: 0980 23331. Ex. 3255.

### Bristol

*President:* D. G. ATKIN, FRAeS.

*Chairman:* M. H. BEANLAND, FRAeS.

*Hon. Secretary:* D. C. GREENMAN, MRAeS, Aerodynamics Dept, No 7 Drawing Office, British Aerospace plc, Civil Aircraft Div., Filton House, Bristol BS99 7AR. Tel: 0272 693831. Ex. 4911.

### Brough

*President:* M. EDWARDS, CEng, FRAeS.

*Chairman:* S. W. FIELD, FRAeS.

*Hon. Secretary:* J. P. NEWTON, AMRAeS, Flight Test Department, British Aerospace, Weybridge Division, Brough, North Humberston HU15 1EQ. Tel: Work — 0482 667121. Ex. 5821. Home — 0405 83893.

### Cambridge

*President:* Professor W. A. MAIR, CBE, FRAeS.

*Chairman:* K. WESTLEY.

*Hon. Secretary:* T. W. CARTER, AMRAeS, Marshall of Cambridge (Engineering) Ltd, Airport Works, Cambridge CB5 8RX. Tel: 0223 61133. Ex. 232 or 434.

### Chester

*President:* R. GRIFFITHS, FRAeS.

*Chairman:* R. A. HUGHES, CEng, MRAeS.

*Hon. Secretary:* J. R. YOUNG, AMRAeS, British Aerospace, Civil Aircraft Division, Chester Road, Broughton, Chester CH4 0DR. Tel: 0244 535333.

### Christchurch

*President:* M. J. COBHAM, FRAeS.

*Chairman:* P. E. COURSE, MRAeS.

*Hon. Secretary:* C. CRUDDAS, FRAeS, Flight Refuelling Ltd, Wimborne, Dorset BH21 2BJ. Tel: 0202 882121. Ex. 2654.

### Coventry

*President:* J. B. ROBERTS, FRAeS.

*Chairman:* T. W. HARPER, FRAeS.

*Hon. Secretary:* R. I. RATCLIFF, Assoc. Member RAeS, 6 Eritway Rd, Green Lane, Coventry CV3 6JT. Tel: 0203 413779. Work — 0203 624000. Ex. 23141.

### Cranwell

*President:* Air Vice Marshal R. H. WOOD, OBE, RAF.

*Chairman:* Wg. Cdr. T. H. BUSH, MRAeS.

*Hon. Secretary:* Sqn. Ldr. G. J. COPSEY, CEng, MRAeS, RAF College, Cranwell, Sleaford, Lincs NG34 8BH. Tel: 0400 61201. Ex. 7303.

### Derby

*President:* J. O. KEIR, FRAeS.

*Chairman:* J. F. BUSH, FRAeS.

*Hon. Secretary:* C. J. ROBINSON, c/o Compressor Research Dept, Rolls-Royce Ltd, PO Box 31, Derby DE2 8BJ. Tel: 0332 42424. Ex. 719.

### Dublin

*President:* R. W. O'SULLIVAN, FRAeS.

*Chairman:* Lt. Col. J. L. MOORE, MRAeS.

*Hon. Secretary:* J. CONNERNEY, Eng. Wing, Air Corps, Baldonnel, Co. Dublin. Tel: 592493. Ex. 28.

### Gatwick

*President:* A. T. PUGH, FRAeS.

*Chairman:* T. J. PATRICK, MRAeS.

*Hon. Secretary:* A. G. SAYCE, MRAeS, Mayfield, Meath Green Lane, Horley, Surrey RH6 8JA.

### Glasgow

*President:* Dr. A. W. BABISTER, MRAeS.

*Chairman:* C. SNOWDON, AMRAeS.

*Hon. Secretary:* F. J. MULLEN, 275 Fenwick Rd, Giffnock, Glasgow G46 6JX. Tel: 041-638 3236.

### Gloucester and Cheltenham

*President:* M. H. SPENCE, CEng.

*Chairman:* K. BEST, FRAeS.

*Hon. Secretary:* N. E. LANGSTONE, CEng, MRAeS, Smiths Industries Aerospace & Defence Systems Ltd, Bishops Cleeve, Cheltenham, Glos GL52 4SF. Tel: 0242 673333.

### Halton

*President:* Gp. Capt. S. M. D. WILLIAMSON-NOBLE, MRAeS, RAF.

*Chairman:* Wg. Cdr. C. J. ROWLAND, MRAeS, RAF.

*Secretary:* Sqn. Ldr. A. W. DEBUSE, CEng, MRAeS, RAF, O/C Aerodynamics Flight, No. 1 School of Technical Training, RAF Halton, Aylesbury, Bucks HP22 5PG. Tel: 0296 623535. Ex. 5014.

### Hatfield

*President:* C. B. G. MASEFIELD, FRAeS.

*Chairman:* F. W. VANN, FRAeS.

*Hon. Secretary:* J. SAUNDERS, MRAeS, Research Dept., Civil Aircraft Division, British Aerospace, plc, Hatfield, Herts. Tel: 07072 62345.

### Isle of Wight

*President:* R. STANTON-JONES, FEng, MRAeS.

*Chairman:* R. L. WHEELER, MRAeS.

*Hon. Secretary:* R. J. PERRY, Stress Office, Westland Aerospace, East Cowes, Isle of Wight. Tel: 0983 294121. Ex. 2025.

### Heathrow

*President:* LORD KING of WARTNABY, Comp. RAeS.

*Chairman:* M. J. J. PERRY, MRAeS.

*Hon. Secretary:* J. D. BROWN, MRAeS, H2TBAS383, British Airways, PO Box 10, London (Heathrow) Airport, Hounslow, Middx TW6 2JA. Tel: 01-562 5958.

### Loughborough

*President:* Professor G. L. WILDE, OBE, FRAeS.

*Chairman:* C. E. BUTLER, Student RAeS.

*Hon. Secretary:* Dr. J. B. OLLERHEAD, MRAeS, Transport Technology Dept, Loughborough University of Technology, Loughborough, Leics. LE11 3TU. Tel: Loughborough 0509 223406.

### Manchester

*President:* Prof. J. L. LIVESEY, CEng, MIMechE.

*Chairman:* J. TAYLOR, CEng, MRAeS.

*Hon. Secretary:* J. A. SHIMMIN, CEng, MRAeS, 26 Denison Road, Hazel Grove, Stockport, Cheshire.

### Medway

*President:* P. A. HEARNE, FRAeS.

*Vice President:* M. MOULTON, CEng, MRAeS.

*Chairman:* R. T. TWINE, CEng, MRAeS.

*Hon. Secretary:* G. E. SIM, AMRAeS, c/o GEC Avionics Ltd, Airport Works, Rochester, Kent. Tel: 0634 44400.

### Preston

*President:* M. D. PARRY, FRAeS.

*Chairman:* A. G. BARNES, FRAeS.

*Hon. Secretary:* J. R. HUNTINGTON, MRAeS, British Aerospace plc, Military Aircraft Div, Warton Aerodrome, Preston, Lancs PR4 1AX. Tel: (0772) 633333. Ex. 2282.

### Prestwick

*President:* R. McINTYRE, FRAeS.

*Chairman:* J. THOMAS, MRAeS.

*Hon. Secretary:* R. FROST, AMRAeS, 5 Burnside Road, Monkton, Ayrshire KA9 2RL.

### Southampton

*President:* Professor G. M. LILLEY, FRAeS.

*Chairman:* B. W. MUDDLE, MRAeS.

*Hon. Secretary:* D. R. J. BAXTER, CEng, MRAeS, Dept of Aeronautics and Astronautics, The University, Southampton, Hants SO9 5NH. Tel: 0703 559122.

### Southend

*President:* Vacant

*Chairman:* E. B. GOLDSPIK, Assoc. RAeS.

*Hon. Secretary:* D. M. GLADSTONE, MRAeS, 36 Brooke House, Town Square, Basildon, Essex SS14 1HX. Tel: Basildon 284621; Work: 22861. Ex. 207.

### Stevenage

*President:* H. METCALFE, FEng, FRAeS.

*Chairman:* N. MUIR, CEng, FRAeS.

*Hon. Secretary:* M. J. M. SMITH, BAe Space & Communications Div., Argyle Way, Stevenage, Herts. SG1 2AS. Tel: 313456. Ex. 6464.

### Swindon

*President:* W. GILLESPIE, CEng, MRAeS.

*Chairman:* Sqn. Ldr. J. J. D. RICHARDSON, CEng, MRAeS.

*Hon. Secretary:* V. SIMON, 20 Hawkswood, Covington Park, Swindon, Wilts. Tel: Swindon 25350.

### Weybridge

*President:* N. V. BARBER, BA, MSc, FRAeS.

*Chairman:* B. W. PAYNE, CEng, FRAeS.

*Hon. Secretary:* K. J. DAVIES, CEng, MRAeS and Mrs. R. D. HARPER, MIPM, (Correspondence), British Aerospace plc, Military Aircraft Div., Richmond Road, Kingston-upon-Thames, KT2 5QS. Tel: 0932 45522, Ex. 6945.

### Yeovil

*President:* V. A. B. ROGERS, FRAeS.

*Chairman:* R. I. CASE, CEng, FRAeS.

*Hon. Secretary:* C. I. HUGHES, MRAeS, Box 237, Westland Helicopters Ltd, Yeovil, Somerset. Tel: 0935 75222. Ex. 2923.

## OVERSEAS BRANCHES

### Hong Kong

*Chairman:* S. M. JOHN, FRAeS.

*Hon. Secretary:* M. J. POMFRET, MRAeS, MME Dept, HK Polytechnic, Kowloon, Hong Kong. Tel: Office: 3-639344. Ex. 765. Home: 3-7213732.

### Malaysia

*Chairman:* Lt. Col. Yeoh Kiat BOON, CEng, MRAeS.

*Hon. Secretary:* Capt. Koh Chen TIEN, AIROD, SDN. BHD, Locked Bag 4004, Pejabat Pos Kg Tunku, 47309 Petaling Jaya, Malaysia.

### Pakistan

*Chairman:* M. M. SALIM, FRAeS.

*Hon. Secretary:* Dr. S. A. HASAN, MRAeS, PAF, College of Aeronautical Engineering, Korangi Creek, Karachi 2002, Pakistan.