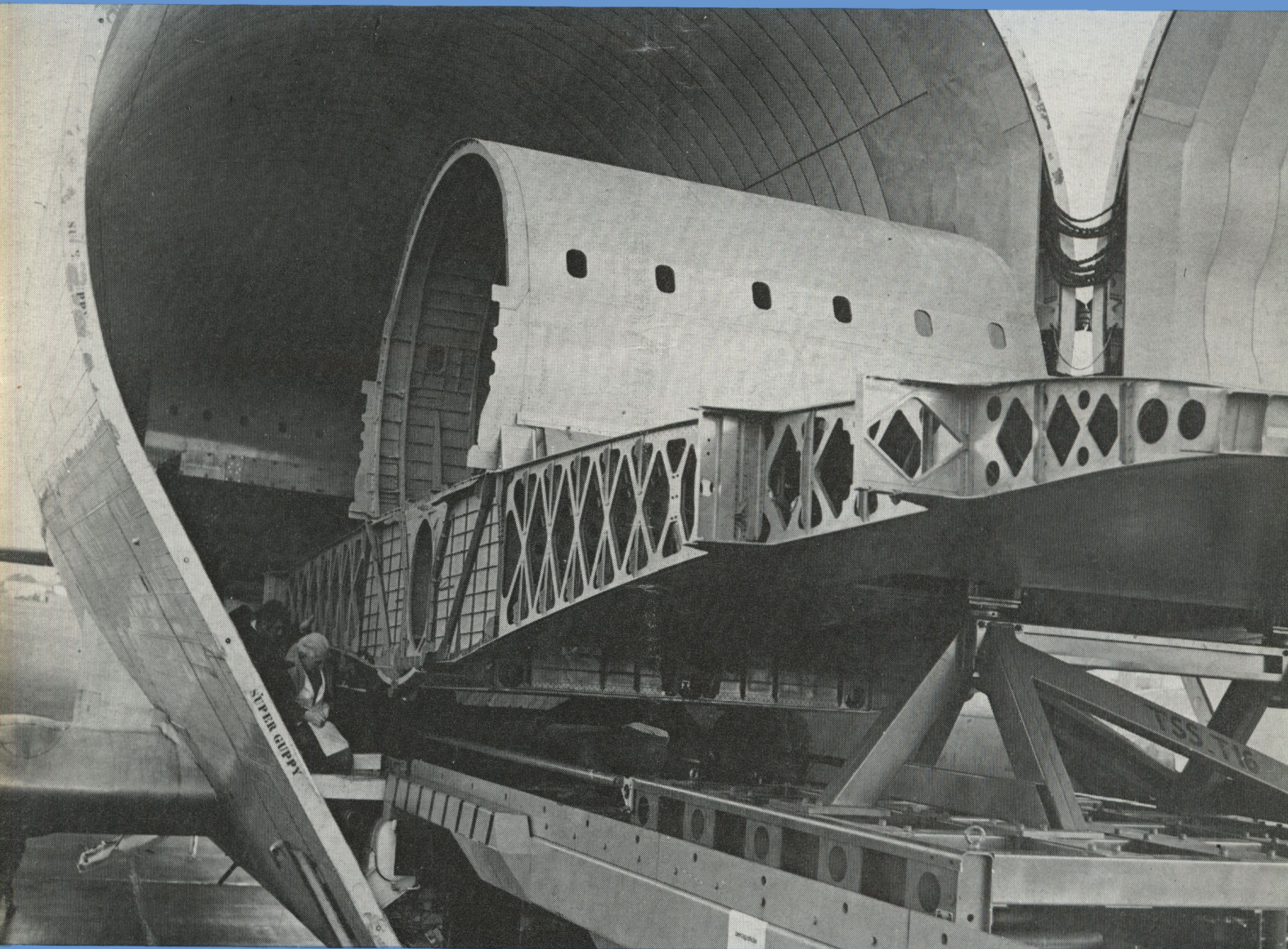




JULY 1976

THE
aeronautical
JOURNAL



THE ROYAL AERONAUTICAL SOCIETY



SEA KING

Today's most effective, long range, all-weather, search and rescue helicopter – fully equipped with specially developed advanced surface search and navigational aids, and able to take 18 survivors per trip. Sea King from Westland.

Westland[®]
WESTLAND HELICOPTERS YEOVIL ENGLAND

*7 times winner of the Queen's Award to Industry
and winners of the MacRobert Award
for innovation in engineering*

VOLUME 80
NUMBER 787
JULY 1976

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

contents

- Editor: G. R. Wrixon, AMRAeS.
Assistant Editors:
Jay Wolff, David Scallan.*
- Secretary of the Society:
E. M. J. Schaffter, MA, CEng,
MRAeS.
4 Hamilton Place, London
W1V 0BQ. Tel: 01-499 3515.
Telegrams: Didaskalos, London, W1*
- 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.*
- Advertisements:
John G. Newman,
Wheelwrights, Dormansland,
Lingfield, Surrey RH7 6PS.
Tel: Lingfield (STD 0342)
832603.*
- Printed by
Lewes Press Ltd.,
Lewes, Sussex, England.
- Subscriptions: £27.50 per annum,
post free.
- Single copies, including back
numbers: £2.50
- Published by
The Royal Aeronautical Society,
4 Hamilton Place,
London W1V 0BQ, England.
- ISSN: 0001-9240
- A. B. Haines**
AERODYNAMICS 277
- M. Lynn Olason and A. Dean Reynolds**
A VIEW OF AIR FREIGHT DEVELOPMENTS IN THE NEXT DECADE 294
- R. D. C. Passey**
REWARDS AND PENALTIES FOR SUPPLIERS OF EQUIPMENT 303
- TECHNICAL NOTES**
- K. Sankara, S. C. Purohit and M. S. Sarma**
Numerical study of non-uniform axisymmetric under-expanded
supersonic jet impingement on a finite disc 313
- Library, Reviews, Additions and Reports** 318

Cover picture:

Air freight has proved to have been of great value in the production of Concorde when major sub-assemblies of the aeroplane have been transported between Filton and Toulouse in a Super Guppy, specially developed for the movement of space booster rockets and other indivisible aeronautical loads. A long look at the more conventional aspects of air freight development is taken by Messrs Olason and Reynolds of Boeing in this issue, and they also discuss the possible emergence of the dedicated freighter.

The Royal Aeronautical Society

FOUNDED 1866

INCORPORATED BY ROYAL CHARTER 1949

Patron: HER MAJESTY THE QUEEN

COUNCIL

President: CHARLES ABELL, OBE, CEng, FSLAET, HonFRAeS

President-Elect: HANDEL DAVIES, CB, MSc, CEng, FRAeS

Vice-Presidents:

PROF. L. F. CRABTREE, PhD, BSc, DIC, CEng, AFAIAA, FRAeS
M. J. BRENNAN, BSc, CEng, FIMechE, FRAeS
R. P. PROBERT, CB, MA, CEng, FRAeS

Past Presidents:

DR G. S. HISLOP, CBE, PhD, BSc, ARCST, CEng, FRAeS
B. P. LAIGHT, OBE, MSc, CEng, MIMechE, FRAeS
AIR MARSHAL SIR CHARLES PRINGLE, KBE, MA, CEng, FRAeS, RAF (Ret'd)

Members:

A. J. ADCOCK, BSc(Eng), AMRAeS
AIR CDRE F. R. BANKS, CB, OBE, HonCGIA, CEng, HonFAIAA, HonFRAeS,
RAF (Ret'd)
F. R. J. BRITTEN, CBE, CEng, MRAeS,
CAPTAIN E. M. BROWN, CBE, DSC, AFC, MA, FRAeS, RN (Ret'd)
J. H. COOK, CEng, MRAeS
N. FALCONER, MRAeS
F. W. FAHY, MRAeS (*President, New Zealand Division*)
PROF. M. G. FARLEY, CEng, FIMechE, FIProdE, MBIM, FRAeS
DR B. W. SKEWS, PhD, MSc(Eng), CEng, MRAeS (*President, Southern Africa
Division*)
CAPTAIN J. R. HEAP, MRAeS (*President, Rhodesia Division*)
P. A. HEARNE, DCAe, DLC, CEng, FRAeS
DR W. F. HILTON, PhD, DSc, CEng, AFAIAA, FRAeS
D. J. LASCELLES, BSc(Tech), AMRAeS (*Chairman, Graduates' and Students'
Section*)
F. J. LOW, MRAeS
E. W. R. MARTIN, MNDTS, LIM, AMRAeS
AIR CDRE J. R. MORGAN, OBE, BSc(Eng), CEng, FIMechE, FRAeS, RAF (Ret'd)
G. M. MOSS, MSc, CEng, MRAeS (*Chairman, Branches Committee*)
DR E. S. MOULT, CBE, BSc, CEng, FIMechE, HonFRAeS
AIR CDRE F. C. PADFIELD, CBE, BSc, CEng, MRAeS (*Chairman, Astronautics and
Guided Flight Section*)
G. K. C. PARDOE, BSc(Eng), DLC, CEng, FBIS, FRAeS
V. A. B. ROGERS, MSc, CEng, FIMechE, FRAeS
J. S. SHAPIRO, Dipl Ing, CEng, FRAeS (*Chairman, Rotorcraft Section*)
J. T. STAMPER, MA, CEng, FRAeS
G. T. WANSBROUGH-WHITE, AMRAeS
J. M. WARNER, BSc(Eng), CEng, FRAeS (*President, Australian Division*)
K. G. WILKINSON, HonDSc, BSc, DIC, FCGI, CEng, FCIT, FRAeS

Officers:

Hon. Treasurer: C. F. HUGHESDON, AFC, FRAeS
Sollicitor: L. A. WINGFIELD, MC, DFC, Hon. Companion RAeS
Secretary: E. M. J. SCHAFFTER, MA, CEng, MRAeS