

The Journal of
THE ROYAL
AERONAUTICAL
SOCIETY



MARCH 1947 · NO 435 · VOL. 51

FLY

TO EUROPE
IN NEXT TO
NO TIME

SEATS NOW AVAILABLE AT SHORT NOTICE

BEA



THE KEY TO
EUROPE

BRITISH EUROPEAN AIRWAYS HEADQUARTERS NORTHOLT MIDDLESEX
Reservations and enquiries through all principal travel agents and at Airways Terminal SW1 Telephone: VICTORIA 2323

Stewart

*There's something you
should know!*



Can you speak with authority on the application of magnesium alloys to your firm's products—whether their use could save weight, increase sales, step up production as they are doing in so many widely different industries today?

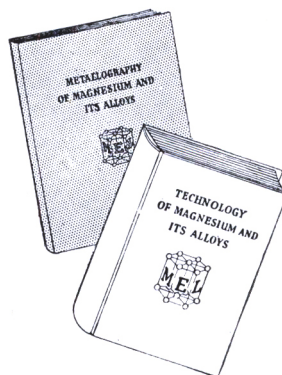
The "know-how" of magnesium is fully explained in publications issued by the pioneers in these alloys. Write for details on your business notepaper to the

METALS DEPARTMENT F. A. Hughes & Co. Ltd. Abbey House, London N.W.1

"Technology of Magnesium and Its Alloys". 512 pages, size Royal 8vo, illustrated with 524 photographs and diagrams. Price 30/- plus 7d. postage. (Prospectus available on request).

"Metallography of Magnesium and Its Alloys". 118 pages, size Royal 8vo, with 225 photographic illustrations. Price 15/- plus 6d. postage. (Prospectus available on request).

Other publications available, without charge, cover properties, casting design, manipulation etc.



ELEKTRON

MAGNESIUM ALLOYS



Exact information, responsible commentaries and topical illustrations are among the features which have given these four representative Temple Press Publications positions of authority in the world of aviation.

TEMPLE PRESS LIMITED

BOWLING GREEN LANE, LONDON, E.C.1. TERMINUS 3636





In Empire Air Development

FIRST Aerial Service in Eastern Australia Charleville to Cloncurry. Hence 'Queensland and Northern Territory Aerial Services' Q.A.N.T.A.S. 1922

FIRST Aircraft to be manufactured in Australia under licence from overseas . . . a DH50A; built by Qantas at Longreach 1926

FIRST Flying Doctor service established in Australia by Qantas at Cloncurry 1928

FIRST Official experimental Airmail between Australia and Britain, in association with Imperial Airways 1931

FIRST Four-engined Plane used in Australia

. by Qantas on Brisbane-Singapore service (a DH86). 1935

FIRST Through Flying Boat service to Singapore by Qantas, and—in association with Imperial Airways—to London . . 1938

FIRST Regular Crossing of the Indian Ocean . . . the world's longest air hop . . . by Qantas in association with B.O.A.C. with Catalinas 1943

FIRST With B.O.A.C. and Tasman Empire Airways, to re-establish the British Air Route . . . to help maintain British Empire Air supremacy in the revolutionary developments in the Age of Flight 1946



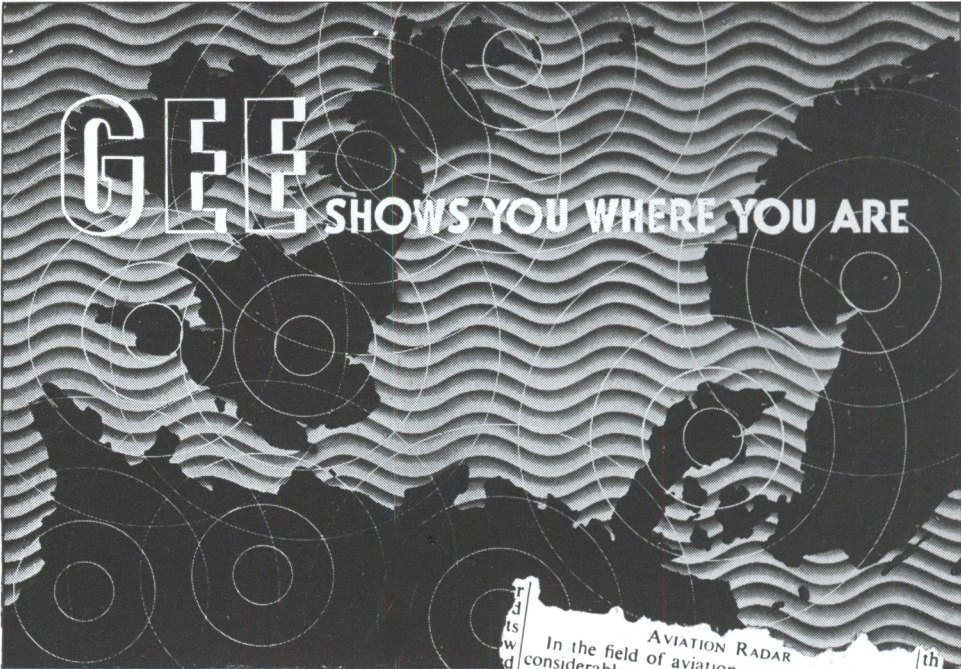
AUSTRALIA'S INTERNATIONAL AIRLINE

Qantas Empire Airways

in association with

BRITISH OVERSEAS AIRWAYS CORPORATION

B.O.A.C.



GEE

The Pulse System of Hyperbolic Navigation

DAY AND NIGHT RANGE of 300 miles at 5,000 feet and 150 miles at 2,100 feet.

ACCURACY of 100 yards or $\frac{1}{2}\%$ of Range whichever is the greater.

OPERATION TIME of 10 seconds per fix.

IMMEDIATELY operative within service range of any chain of GEE ground stations.

UNAFFECTED by static interference.

CONTINUITY unaffected by service interruptions.

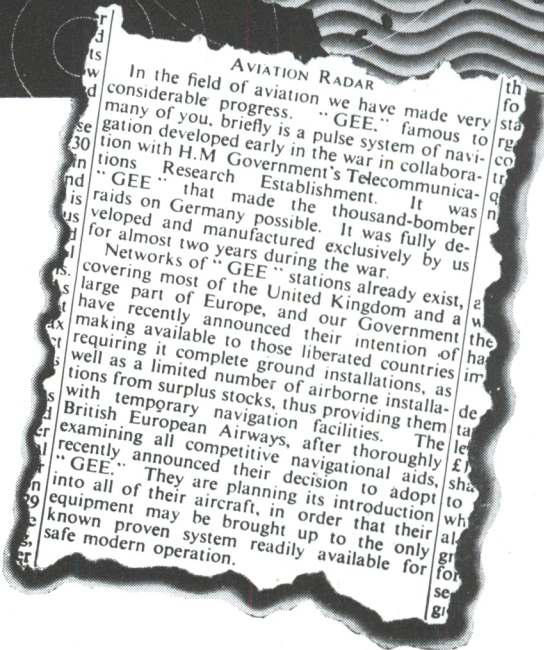
NOT SUSCEPTIBLE to jamming.

NO AMBIGUITIES.

GEE airborne and ground equipment developed, engineered and FIRST PRODUCED by



FIRST IN THE WORLD WITH RADAR RECEIVERS



Extract from an address made by Mr. T. A. Macauley, Chairman of A. C. Cossor Ltd., on 14th August, 1946, at the company's 8th General Meeting.



THE INCOMPARABLE SPITFIRE, for six years of war Britain's first-line fighter, is now available as a 2-seater trainer with the highest performance of its class in the world. Thus Vickers-Armstrongs offers to the next generation of pilots the fruits of nearly ten years unbroken development work on the type—work shaped and proved by tens of thousands of operational hours flying in all the climates, and many of the countries, of the world.



VICKERS-ARMSTRONGS LIMITED · AIRCRAFT SECTION · VICKERS HOUSE · BROADWAY · S.W.1

PRECISION CASTING

An American Authority recently stated :

'Precision investment casting is a comparatively undeveloped industrial art, but it has reached the stage where it is reducing costs and improving qualities on tens of thousands of products. It is capable of accuracies roughly approximate to those of grinding. It can handle practically any metal that can be cast at all. The process makes its most valuable contributions by producing intricacies in parts, and by handling with ease metals that are difficult or even impossible to fabricate economically by other methods.'

MATERIALS AND METHODS, *March 1946*

*If that extract interests you, we welcome an opportunity
to supply some details of the part played by
Ethyl Silicate in precision casting*

ALBRIGHT & WILSON



ETHYL SILICATE

Albright & Wilson Ltd., 49 Park Lane, W.1 *Tel: Gro 1311*

TBW

8/21

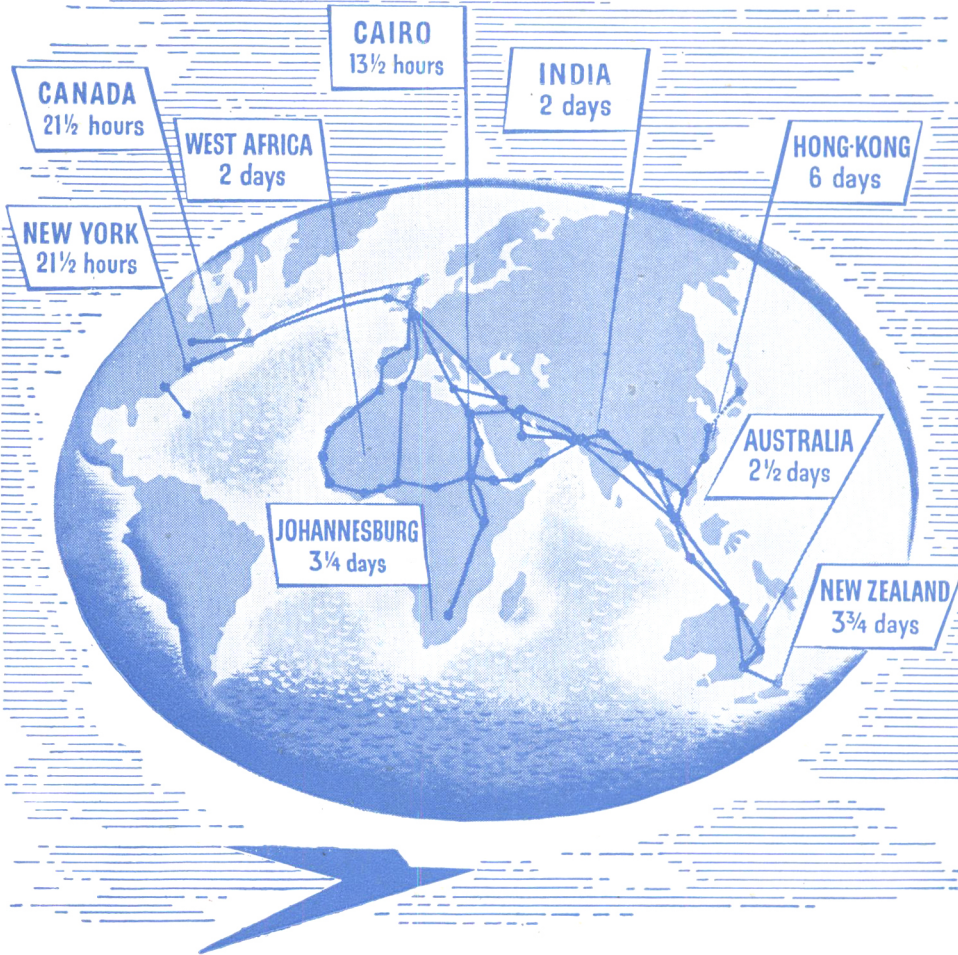


The **Blackburn**
"FIREBRAND" IV

STRIKE AIRCRAFT OF THE ROYAL NAVY

ix

Across the World from London



B·O·A·C

SPEEDBIRD ROUTES ACROSS THE WORLD

BRITISH OVERSEAS AIRWAYS CORPORATION IN ASSOCIATION WITH QANTAS EMPIRE AIRWAYS,
SOUTH AFRICAN AIRWAYS, TASMAN EMPIRE AIRWAYS

PITMAN'S Books on Aviation and Aeronautics



MATERIALS OF AIRCRAFT CONSTRUCTION

By F. T. Hill, F.R.Ae.S., M.I.Ae.E. This practical book covers the entire range of materials used in modern aeronautical engineering, and is a useful source of facts concerning their special properties, treatments and applications for aircraft purposes. 20s. net.

"Here is one of the best books on aircraft materials and might well be taken as the standard work of reference on the subject."—*THE AEROPLANE*.

AIRCRAFT INSPECTION METHODS

By N. C. Bartholomew. An American book of special interest at the present time, as it aims to improve the average standard of aircraft inspection. Every aircraft engineer and student should have this book. 7/6 net.

AIRMEN'S MATHEMATICS

By M. J. G. Hearley, B.Sc., and R. Leverington Smith, B.Sc., A.K.C. A useful book which deals comprehensively with the

mathematics required by pilots, navigators, and those engaged in ground duties. Illustrated with diagrams, and including exercises with answers. 3/6 net.

BENNETT'S COMPLETE AIR NAVIGATOR

This is the standard work by Air Vice-Marshal D. C. T. Bennett, C.B.E., D.S.O., F.R.Ae.S., F.R.Met.S. It covers the syllabus of the First Class Air Navigator's Licence, dealing fully with astronomical navigation, direction-finding wireless, etc., and including an important chapter on meteorology. Fourth Edition. Illustrated. 15s. net.

BENNETT'S AIR MARINER

Also by Air Vice-Marshal Bennett, this book gives information on everything concerned with flying-boats and seaplanes, the technique of handling in water, taking off, flying and landing, anchoring and weighing anchor, with vital facts on marine equipment and moorings, navigation regulations, signals, tide calculations, etc. Second Edition. 7/6 net.

This is only a very small selection, made quite at random, of our numerous books on aviation and aeronautics. If you haven't found your subject here, there's sure to be a book on it in our list. Write to SERVICE DEPARTMENT
**SIR ISAAC PITMAN
& SONS, LIMITED**
Parker St., Kingsway,
London, WC2.

AERONAUTICAL CLASSICS

A limited number of reprints of the following works of the Early Pioneers are still available at the following prices, including postage:—

3. **THE ART OF FLYING**, by Thomas Walker (1810) ... 3/3
4. **THE AERIAL SHIP**, by Francesca Lana (1670) ... 5/3
5. **GLIDING**, by Percy S. Pilcher (1897) to which is added the *Aeronautical Work of John Stringfellow* ... £1 1 3
6. **THE FLIGHT OF BIRDS**, by G. A. Borelli (1680) ... 2/9

In addition, a few copies are still available of

- Report of the Bird Construction Committee (1911)** ... 10/3
History of the Royal Aeronautical Society, 1866-1946 .. 5/3

THE ROYAL AERONAUTICAL SOCIETY

4 Hamilton Place, London W1

Grosvenor 3515



**WORLD
WIDE
AUTHORITIES**

**COVERING EVERY
PHASE OF DESIGN,
OPERATION AND
PRODUCTION OF ALL
TYPES OF AIRCRAFT**

FLIGHT (weekly) provides the most authentic information on world aeronautical affairs. It covers every aspect of development and progress in aircraft and power unit design and operation. AIRCRAFT PRODUCTION (monthly) is the journal of the aircraft manufacturing industry, specialising in tools and works production processes. Both journals serve the interests of all concerned with the future progress of British aviation. Technical information is supplemented by brilliant functional drawings. Circulation is world wide. Annual subscriptions (Home and Overseas): FLIGHT, £3 1s. od.; AIRCRAFT PRODUCTION, £1 14s. 6d.

Published in conjunction with these journals, FLIGHT HANDBOOK (212 pages, 7s. 6d. net) is essentially a manual for the student, whilst GAS TURBINES AND JET PROPULSION (272 pages, 12s. 6d. net) by G. Geoffrey Smith, has been widely adopted as the standard text on the subject.



**ASSOCIATED
ILIFFE
PUBLICATIONS**

DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1. WATERLOO 3333 (50 LINES)

THE JOURNAL OF THE ROYAL AERONAUTICAL SOCIETY

With which is incorporated The Institution of Aeronautical Engineers

CONTENTS

MARCH 1947

PROTECTION OF AIRCRAFT AGAINST ICE

By J. K. Hardy :: :: :: :: 271—305

LOFTING AND TEMPLATE REPRODUCTION

By S. P. Woodley, M.B.E. :: :: :: 306—328

ON THE NATURE AND CONDITIONING OF LEAST WORK EQUATIONS IN STRUCTURES

By Captain J. Morris :: :: :: :: 329—333

DESIGN FOR MAINTENANCE

By Lt. (A) (A/E) T. E. G. Bowden, R.N.,
Grad.R.Ae.S. :: :: :: 334—337

REVIEW :: :: :: :: 337—338

The Journal is published monthly at the Offices of the Society, 4 Hamilton Place, Piccadilly, London, W1. None of the papers or paragraphs must be taken as expressing the opinion of the Council of The Royal Aeronautical Society unless such is definitely stated to be the case. Subscriptions per annum, £4 13 0 including postage; Single Numbers 7/6 or 7/9 post free. All communications for publication or Advertisements in the Journal, or on general matters affecting the Society should be addressed to—The Secretary, J. Laurence Pritchard, 4 Hamilton Place, W1. The Society's Bankers are Messrs. Coutts and Co.

Telephone: Grosvenor 3515 (5 lines) Telegraphic Address: Didaskolas, Audley, London.



**Comprehensive in range . . . standardized
in all British Service aircraft . . . recognised
by the aircraft industry as the highest
standard.**

Produced by the Aviation Division of
THE HYMATIC ENGINEERING COMPANY, LIMITED,
REDDITCH, WORCESTERSHIRE, ENGLAND.
Telephone: Redditch 743.

HYMATIC EQUIPMENT PROVIDES

Air Compressors ; Automatic Regulators ; Oil and Water Traps ; Relief Valves ; Anti-freeze Systems ; Pressure Maintaining Valves ; Reducing Valves ; Emergency Air Valves ; Non-return Valves ; Shuttle Valves ; Emergency Air Release Mechanism ; Air Reservoirs ; Engine Primers (manual) ; Engine Primers (automatic) ; Undercarriage Selectors ; Flap Selectors ; Restrictors ; Flap Rams ; Nose Wheel Rams ; Main Wheel Rams ; Hot Air Intake Rams ; Radiator Flap Rams ; Carburettor Control Rams ; Ground Charging Connections.

RESEARCH · DEVELOPMENT · PRODUCTION