

The JOURNAL of NAVIGATION

VOL. 30, NO. 3

SEPTEMBER

1977

Operational Experience in the Use of Omega PAPERS BY D. W. BROUGHTON, R. H. N. BRADLEY, P. R. J. REYNOLDS, A. P. RILEY	339
Navigation in the Gulf of Suez RAFAAT RASHAD	366
A Survey of Marine Traffic in the Southern North Sea E. M. GOODWIN AND J. F. KEMP	378
A Method for Estimating the Voyage Distribution of Marine Traffic KIYOSHI HARA	386
Some Mathematical Aspects of Air Traffic Systems V. W. ATTWOOLL	394
The Dissemination of Navigational Information PAPERS BY L. T. J. SALMON, K. D. JONES AND L. A. HOLDER, A. J. WRIGHT	415
The Fully Automatic Radar Plotter in the Context of Some Past Collisions—II F. J. WYLIE	441
A Horizontal Radar Display WERNER HINSCH	454
The First Navigation of Torres Strait BRETT HILDER	459
Safety of Navigation Under Sail PAPERS BY C. N. PHELAN, R. N. B. GATEHOUSE, ALAN WATTS, BERNARD HAYMAN, A. HARRISON, J. F. KEMP, R. K. N. EMDEN, ROBIN KNOX-JOHNSTON	467
FORUM	
A Case of Random Collision Probabilities E. M. GOODWIN AND J. F. KEMP	509
Inertial Navigation CLAUD POWELL	511
'The Role of Lighting in Aids to Marine Navigation' P. CLISSOLD	512
A Polar Compass F. G. WOLFF	513
The Conception and Development of Weir's Diagram C. H. COTTER	517
Record	520
Reviews	525

THE ROYAL INSTITUTE OF NAVIGATION
AT THE ROYAL GEOGRAPHICAL SOCIETY
1 KENSINGTON GORE LONDON SW7 2AT

SCOTTISH ACADEMIC PRESS LTD., 33 MONTGOMERY STREET, EDINBURGH EH7 5JX

THE ROYAL INSTITUTE OF NAVIGATION

Patron

H.R.H. THE PRINCE PHILIP DUKE OF EDINBURGH, K.G., K.T., O.M.

OFFICERS AND COUNCIL 1976-7

President

Sir Edward Fennessy, C.B.E.

Vice-Presidents

Captain B. J. Calvert

Mrs. Mary Pera

Honorary Treasurer

Lieut-Comdr. R. B. Richardson

Chairman of the Technical Committee

Captain R. Maybourn

Chairman of the Membership and Fellowship Committee

Rear Admiral D. W. Haslam, O.B.E.

Other Members of Council

V. W. Attwooll

Prof. A. N. Black

Captain G. Dudley

Captain R. K. N. Emden, D.S.C.

Miss A. M. Ferrar

Dr. J. F. Kemp

S. Ratcliffe

Group Captain H. L. Sheppard, R.A.F.

F. S. Stringer

Lieut-Comdr. D. W. Waters

Director M. W. Richey, M.B.E.

The Journal of Navigation

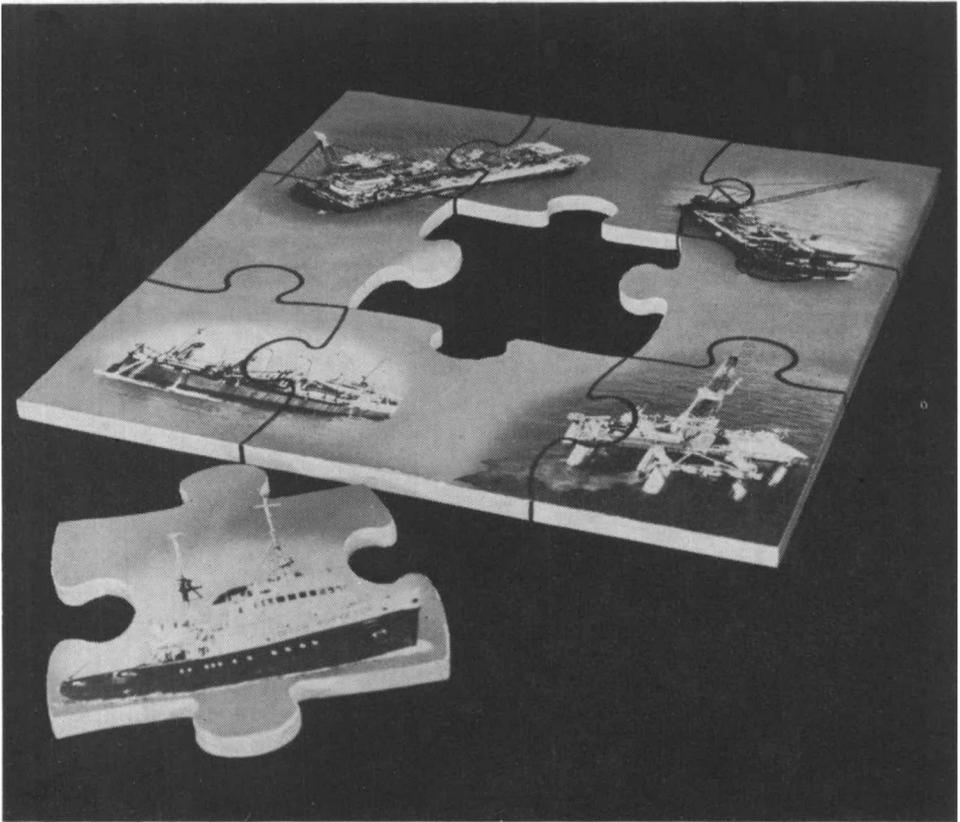
THE *Journal* is published three times a year by the Institute and is edited by M. W. RICHEY. It contains original papers contributing to the science of navigation, including those presented at meetings of the Institute together with the ensuing discussion. In addition the *Journal* includes a record of current navigational work, reviews of important books, and other matters of concern to those interested in navigation. The views expressed in the *Journal* are not necessarily those of the Institute, or of any organization or department to which the authors may belong. Crown Copyright may be reserved.

The *Journal* is issued free to all Members of the Institute. It is sold to the public at four pounds fifty per copy or, by subscription, at thirteen pounds fifty per annum (plus postage) and may be obtained through all booksellers and Scottish Academic Press Ltd., 33 Montgomery Street, Edinburgh EH7 5JX. Back numbers dated two years prior to the current volume may be obtained from William Dawson & Sons, Ltd., (Back Issues Department), Cannon House, Folkestone, Kent.

Enquiries for advertising space should be addressed to The Advertisement Manager (Noel S. O'Doherty) 28 Walton Street, Tadworth, Surrey KT20 7RT. (Telephone: Tadworth 3063).

The postal address of the Institute is The Royal Institute of Navigation, at The Royal Geographical Society, 1 Kensington Gore, London SW7 2AT. (Telephone: 01-589 5021).

Volumes of the *Journal* can be bound for three pounds seventy five including postage. The parts should be sent, together with the appropriate remittance, to Fowler-Wilson Bookbinders, Unit 4, Middlefield Industrial Estate, Sandy, Beds.



We're great at putting everything in its proper place—precisely.

Because positioning is our business. And because we've been doing it for a long time now. For over 30 years, we have been steadily developing and improving electronic positioning aids.

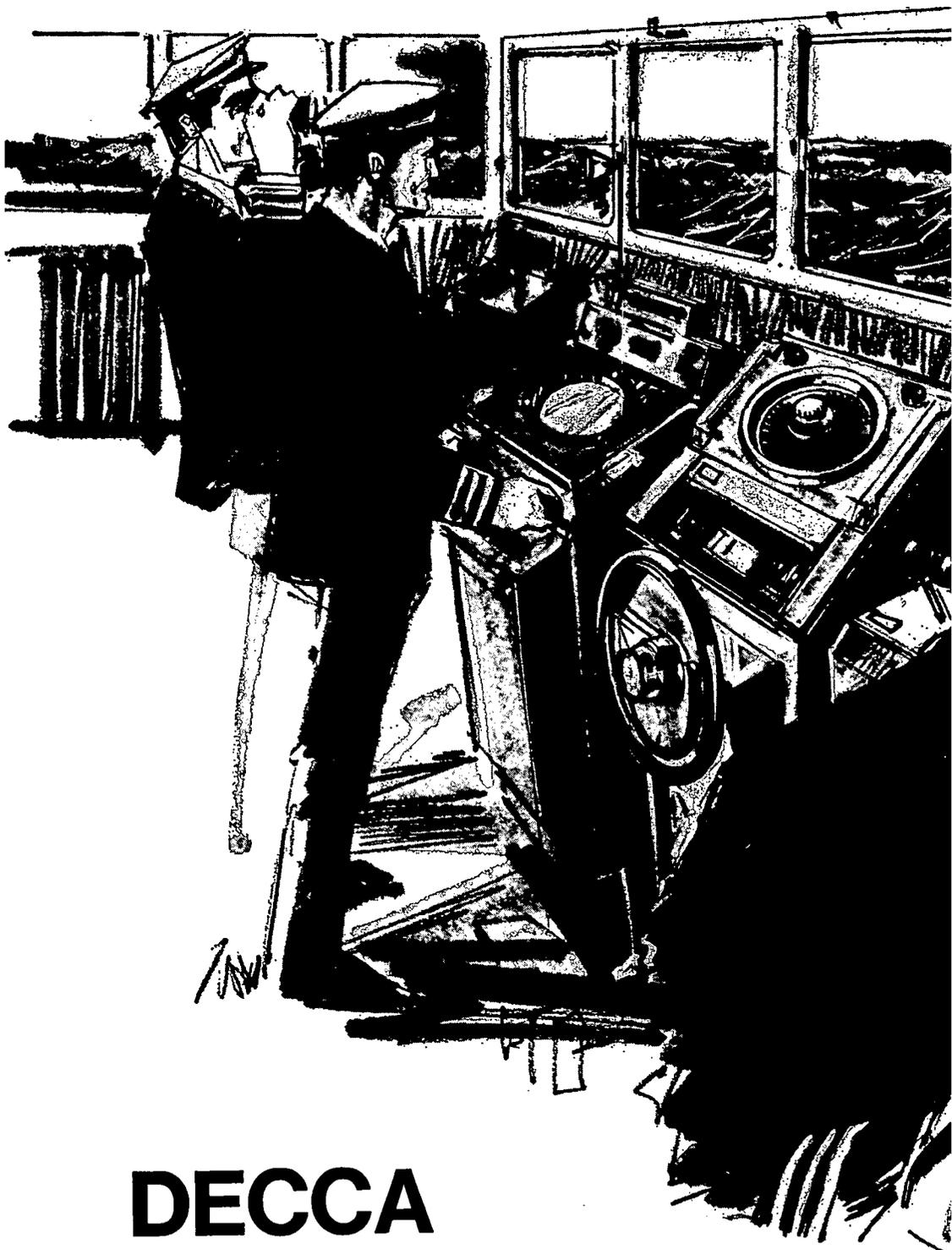
Today, as the Decca Survey Group of companies, we are strategically stationed to provide a comprehensive survey service anywhere on demand. Precisely positioning rigs and platforms in the search for oil and minerals offshore. Undertaking the vital survey work associated with dredging and port and harbour maintenance and

development. And surveying the routes for pipes and cables in the seas and oceans of the world.

We have the most experienced personnel. The most comprehensively fitted vessels. And the most advanced electronic equipment—including acoustic and satellite positioning aids.

Whenever you need precise positioning services, you need us. The Decca Survey Group. In positioning, we're *precisely* the people who matter.

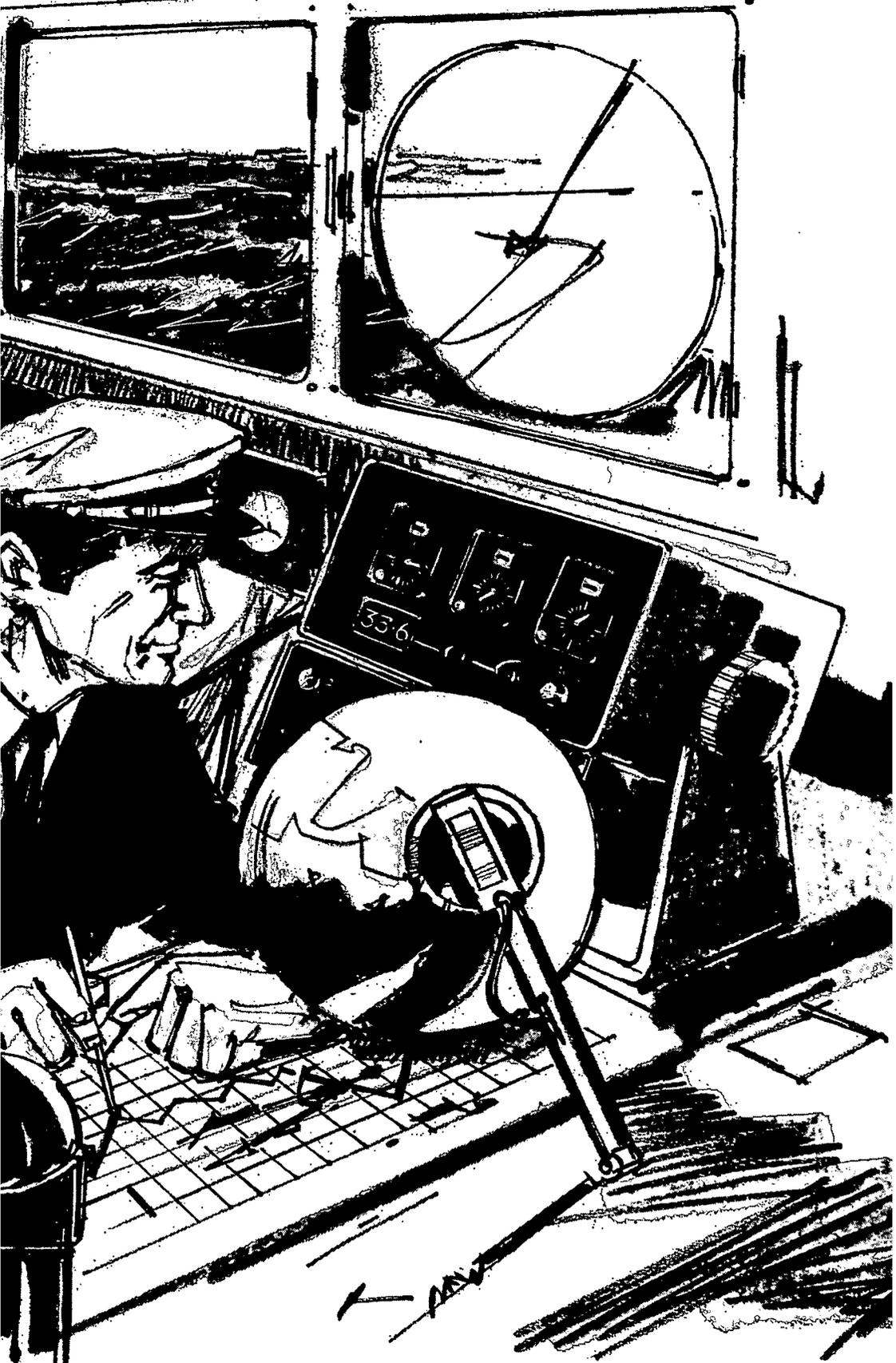
ds DECCA SURVEY GROUP
anytime anywhere

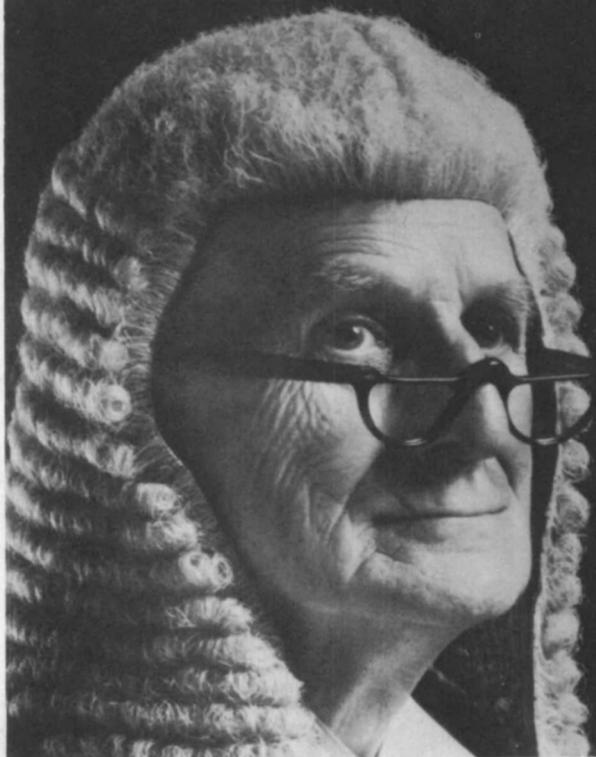


DECCA

**for the greater efficiency
and safety of ships at sea**

THE DECCA NAVIGATOR COMPANY LIMITED. DECCA RADAR LIMITED. LONDON





Judge it on
value-for-money

Judge it on
power-for-size

Judge it on
versatility in
every size and
type of vessel

Marconi Marine's TRANSOCEAN self-tuning mf/hf SSB transmitter

Transocean is a compact, 400W, synthesised drive, SSB transmitter designed to comply with all known international requirements for SSB working in the marine radiotelephone bands between 1.6MHz and 25MHz. It can also be used as an hf telegraphy transmitter and additionally provides facilities for telex circuits.

A memory can store up to 128 channel frequencies, generated by a synthesiser which is programmable in 100kHz steps. The frequency selected is shown on a 6-digit l.e.d. display.

A single switch selects 2182kHz regardless of bandswitch setting, and a two-tone radio alarm is incorporated.

Compact size and remarkable simplicity of operation make this versatile transmitter particularly suitable for installation in vessels where it is to be operated by the navigating officers. Please ask for full details.



Marconi Marine communication

The Marconi International Marine Co. Ltd.

Chelmsford Essex England

Tel. (0245) 61701 Telex 99228

A GEC-Marconi Electronics Company



COMMUNICATION
NAVIGATION
RADAR
SOUND AND TV

BOOKS OF INTEREST TO SHIPPING ENTHUSIASTS

SEA PORTS

By Captain L. G. Taylor

£4.20

Per post £4.86

THE ATLANTIC OCEAN

By Charles H. Cotter

£3.75

Per post £4.41

NAVIGATION FOR SCHOOL AND COLLEGE

By A. C. Gardner and W. G. Creelman

£6.80

Per post £7.35

COMPASS-WISE

or **GETTING TO KNOW YOUR COMPASS**

By J. Klinkert, F.R.I.N.

£5.60

Per post £6.14

AIR NAVIGATION

By W. H. P. Canner

£9.00

Per post £9.55

BROWN, SON & FERGUSON, LTD.,
52 DARNLEY STREET, GLASGOW, G41 2SG

THE INTERNATIONAL HYDROGRAPHIC REVIEW

Half-yearly, 160 pages (approx), 18×27 cm. Price 50 French francs.*

Among the papers of navigational interest in the number of
July 1977 are :

- The storing, updating and presentation of navigational information
(I. M. J. CLARKE)
- The Kelvin-Hughes MS-48 echosounder – an evaluation by the UK
Hydrographic Dept. (C. S. GOBEY)
- The General Bathymetric Chart of the Oceans; 73 years of international
cooperation in small-scale thematic mapping (D. MONAHAN)

PUBLISHED BY THE

INTERNATIONAL HYDROGRAPHIC BUREAU
Avenue Président J. F. Kennedy, Monte-Carlo, Monaco

The Bureau also publishes monthly

THE INTERNATIONAL HYDROGRAPHIC BULLETIN

A bi-lingual journal—English and French—giving news of hydrographic activities worldwide. Lists in detail all new charts published by Member States of the International Hydrographic Organization, and contains an extensive monthly bibliography on Oceanography, Navigation, etc.

Approx. 30 pages, 21×30 cm, 6 francs per copy*.

Yearly subscription : 60 francs.

*30% reductions for naval & merchant marine officers of IHO Member States ordering direct from the Bureau.



Brookes & Gatehouse supply a complete range of hermetically sealed electronic aids to navigation for ocean racing and cruising, both power and sail. A special version of the HECTA echo sounder is available for hydrographers.

BROOKES & GATEHOUSE LTD

Pioneers and world leaders in electronic instrumentation for yachts
Bath Road, Lymington, Hants. Tel: (0590) 74252. Telex 477724

and a branch in the U.S.A. **BROOKES & GATEHOUSE INC**

154 East Boston Post Road, Mamaroneck, New York 10543

'NAVIGATION'

NAVIGATION (Paris), the quarterly Journal of the French Institute of Navigation, is available to Members of the Institute at the preferential subscription rate of £7.00 per annum. The July 1977 issue contains the following papers.

I. LES NOUVEAUTÉS TECHNIQUES—

- 1.—Examen et applications des transmissions V.L.F. & L.F. pour la navigation et la poursuite automatique par J. M. BEUKERS
- 2.—Localisation par mesures de distances par P.H.
- 3.—Un calculateur de poche spécial pour la navigation aérienne, et maritime par M. ZIMBRAY (SONOTEC)

II. CHRONIQUE DU NAVIGANT—

- 1.—La manoeuvrabilité des pétroliers de 550.000 tonnes par M. DELVIGNE & J. J. GATEPAILLE
- 2.—Perspectives d'utilisation de l'espace aérien: l'Atlantique Nord en 1978 par J. FOURNIER
- 3.—Le nouveau règlement international pour prévenir les abordages en mer: questions aux marins, juristes et juges, par J. P. LE COZ

III. L'HISTOIRE ET LA NAVIGATION—

- 1.—Deux siècles d'instruments de navigation au Japon par T. MOZAI

IV. INFORMATIONS—

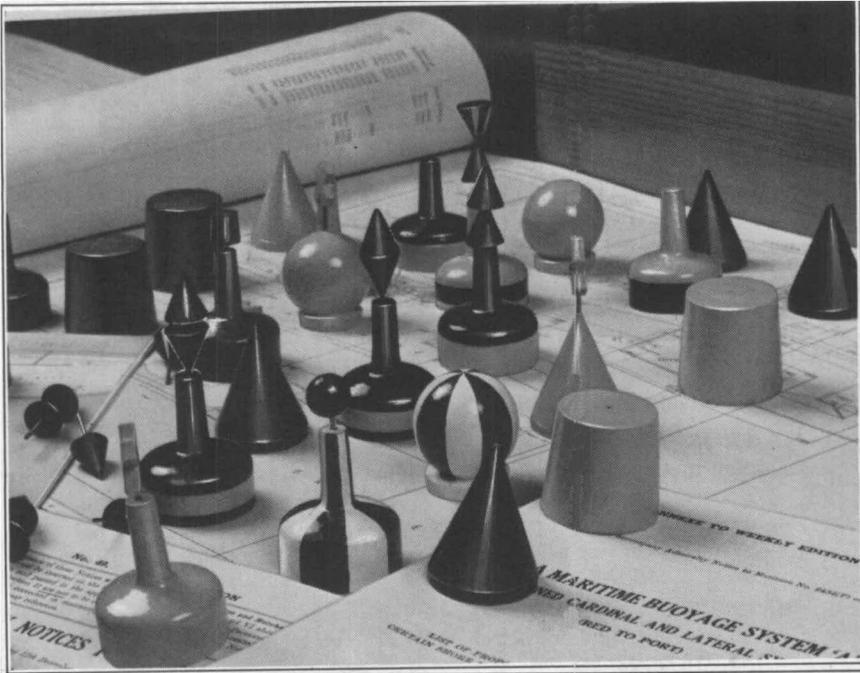
- 1.—La XXIV^e Assemblée Générale de l'I.F.N. (20 Avril 1977)
- 2.—La XI^e Conférence Hydrographique Internationale (MONACO 18-30 AVRIL 1977)
- 3.—La journée de la Mer (PARIS 15 AVRIL 1977)
- 4.—Faut-il laisser supprimer l'émission de D.T.U.₁?
- 5.—Symposium sur le trafic maritime

V. CHRONIQUE DES LIVRES & REVUES

I.A.L.A. MARITIME BUOYAGE SYSTEM A

At Potters, updating maritime knowledge is a continuous process. We are a focal point for receiving information and a centre for its dissemination. Notices to Mariners, Tracings to, facilitate on board chart correction—New Editions of charts automatically mailed on issue—Statutory Instruments in stock on publication and a full

maritime library of books and papers is available to the shipping world with the latest facts, opinions and experiences from authors far and wide. Potters models of the new I.A.L.A. buoyage system for educational purposes is just another example of our continuing effort to provide updated information.



J. D. POTTER LTD

Serving the world of navigation since 1830. J. D. Potter Ltd., 145 Minories, London EC3N 1NH.
Tel: 01-709 9076 Cables: Adcharts, London EC3N 1NH Telex: 887386. 24 Hour Telephone System.

ROYAL GEOGRAPHICAL SOCIETY

NEW MAP

Mount Everest Region

Scale 1:100 000 Size 73 × 64 cm

Price £5.00

Printed in eight colours. Compiled and drawn by G. S. Holland,
in the Society's Drawing Office, from latest available information.

From

PUBLICATIONS DEPARTMENT, R.G.S.,
1 KENSINGTON GORE, LONDON SW7 2AR

Studies in Maritime History

By Charles H. Cotter (Senior Lecturer, Department of Maritime Studies, University of Wales Institute of Science and Technology; Master Mariner; Fellow of the Royal Institute of Navigation)

This three-volume microfiche series represents extensive research into the art, science and technology of navigation and nautical astronomy by a well-known writer on maritime studies. Individual volumes are:

- **Volume 1**, A History of Nautical Astronomical Tables (10 fiches), £20.00
- **Volume 2**, A History of Ship Magnetism (9 fiches), £18.00
- **Volume 3**, A Pathway to Perfect Sailing: A History of Dead Reckoning Navigation (6 fiches), £12.00

1977, set of 3 titles, total 25 fiches (NMA 98 frame format, silver halide positive, each pocket-held), complete with binder, £42.50, all prices subject to V.A.T. in U.K. only.



Mansell

3 BLOOMSBURY PLACE LONDON WC1A 2QA ENGLAND



Institute Notices

ANNUAL GENERAL MEETING

THE Annual General Meeting will be held at the Royal Geographical Society on Wednesday, 19 October 1977.

COVENANTS

The Institute is not liable to income tax, and the Inland Revenue authorities will refund to the Institute any income tax that has already been paid on annual contributions, provided they are paid under a seven-year covenant. By agreeing to subscribe in this way Members can give great help to the Institute, at very little trouble and no expense to themselves. The Council therefore hopes that as many Members as possible will undertake to covenant. (Only Members who pay income tax at the full British rate are eligible to pay in this way.)

MARINE NAVIGATION SYSTEMS

The Institute of Measurement and Control in association with Brunel University is organizing a symposium on Data and Information Processing in Marine Navigation Systems to take place at Brunel University on 6 September 1977. The Royal Institute of Navigation is a co-sponsor of the meeting and Members of the Institute will be entitled to attend for the same registration rate as Members of the Institute of Measurement and Control. Information may be obtained from: The Secretary, Institute of Measurement and Control, 20 Peel Street, London W8 7PD.

MATHEMATICAL ASPECTS OF MARINE TRAFFIC

The Institute of Mathematics and its Applications, in association with the Royal Institute of Navigation, the Royal Institution of Naval Architects and the National Maritime Institute, is organizing a two-day meeting on 15 and 16 September 1977 to discuss some twenty papers on the application of mathematics to problems of marine traffic. The meeting will be held at Chelsea College, London SW3. Further details may be obtained from the Secretary and Registrar, The Institute of Mathematics and its Applications, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY.

INTERNATIONAL NAVIGATION CONGRESS 1979

The Royal Institute of Navigation in association with the Member Institutes of the International Association of Institutes of Navigation is organizing an International Navigation Congress to be held in England in 1979, probably in September. The theme of the conference is Man and Navigation, a title intended to cover not only the ergonomic aspects of navigation but also the whole relationship between navigation and society. Navigation is understood to mean navigation by sea and air and in space.

Suggestions for papers, which should not be more than 3000 words in length, should be sent to the Director.