The JOURNAL of NAVIGATION

or.	25, NO. 3 Jul	Y	197
	The Loss of Two British Trawlers— Refraction W. J. Pierson	-A Study in Wave	291
	Ship Navigation—The Means and T	he End	305
	Ocean Voyaging under Sail H. W. TILMAN		327
	A Stranding in the West Indies L. Ouder		337
	Navigational Globes: Ancient and C. H. COTTER	Modern	345
	Relative Navigation A Discussion		350
	Right- and Left-hand Dominance is	n Navigation	359
	FORUM		
	Traffic Distribution and Collision Rate/Size Cor- Straits Survey Data E. M. GOODWIN	relations Derived from Dover	370
	'By the Mark' R. L. HEWITT		374
	The Treble Bearing Problem C. H. COTTER		375
	'A Prospect of Navigation' S. Mabuchi		377
	Marine Traffic Engineering Papers Presented at the Conference		379
	Reviews		419

THE ROYAL INSTITUTE OF NAVIGATION AT THE ROYAL GEOGRAPHICAL SOCIETY 1 KENSINGTON GORE LONDON SW 7

JOHN MURRAY (PUBLISHERS) LTD., 50 ALBEMARLE STREET, LONDON WI

THE ROYAL INSTITUTE OF NAVIGATION

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

OFFICERS AND COUNCIL 1971-72

President

Rear-Admiral G. S. Ritchie, C.B., D.S.C., F.R.I.C.S.

Vice-Presidents

Group Captain D. F. H. Grocott, C.B.E., A.F.C., R.A.F. Captain A. J. R. Tyrrell

> Honorary Treasurer F. A. Haworth

Chairman of the Technical Committee H. E. Smith, O.B.E.

Chairman of the Membership and Fellowship Committee Captain V. A. M. Hunt, C.B.E.

Other Members of Council

J. H. Beattie

Captain C. H. Cotter

S. S. D. Jones

Captain F. L. Main

Captain R. Maybourn

Colin Mudie

Captain F. Ormonroyd, D.F.M.

P. G. Reich

R. B. Richardson

Captain P. A. Thompson

Executive Secretary M. W. Richey, M.B.E.

The Journal of Navigation

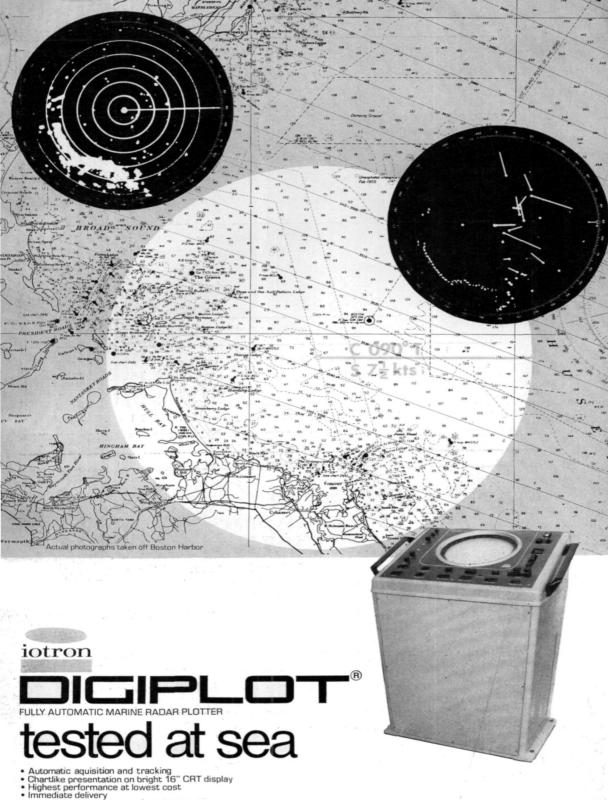
THE Journal is published quarterly by the Institute and is edited by M. W. RICHEY. It contains original papers contributing to the science of navigation, including those presented at meetings of the Institute together with the ensuing discussion. In addition the Journal includes a record of current navigational 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 one pound fifty per copy or, by subscription, at six pounds thirty-five per annum (post free) and may be obtained through all booksellers and John Murray (Publishers) Ltd., 50 Albemarle Street, London W1. 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 Institute offices.

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

Volumes of the Journal can be bound for two pounds. The parts should be sent to William Clowes & Sons Ltd., 15 Cavendish Square, London, W1M oHT.



IOTRON CORPORATION • 5 ALFRED CIRCLE • BEDFORD, MASSACHUSETTS U.S.A. • CABLE: IOTRON BOSTON

'Electronic Chernikeeff'

SOLID STATE

Accurate and dependable at all speeds down to 1-knot and distance run to within 1%. Suitable for Ship's Side or Bottom mounting—equal accuracy.

Linear Speed Analog Voltage Transmission available direct from Log.

Has built-in Transmission for 'True-motion' Radar.

Low installation costs—simple maintenance.

The Retractable Log Tube can be provided remotely controlled from the Wheelhouse.

The ideal Log for all Mercantile Vessels—backed by over 50 years actual experience in the design and manufacture of Chernikeeff's Impeller System.

Log makers to the British Navy and Overseas Navies for more than 40 years.

MARCONI-MARINE world wide service available to users.

Sole Makers

The Submerged Log Company (1962) Limited, 565/569 High Road, Chiswick, London, W4 3AW, England.

Telephone: CHISWICK 01-994 6685/6 Telegra

Telegrams: CHERLOG LONDON W.4

MARINE OBSERVER

A quarterly journal of maritime meteorology prepared by the Marine Division of the Meteorological Office, containing articles on weather, currents, ice conditions, meteorological observing at sea, and the practical use of a knowledge of meteorology to seamen. A large part of each issue is devoted to reports of meteorological and other scientific phenomena which have been contributed by voluntary observing ships.

Published in January, April, July, October, by Her Majesty's Stationery Office. 42½p (by post 46p) per issue; annual subscription £1.88 including postage

Available from the Government Bookshops in London, (post orders to PO Box 569, SE1 9NH), Edinburgh, Cardiff, Belfast, Manchester, Birmingham and Bristol, or through booksellers

at sea you need the confidence Kelvin Hughes inspires

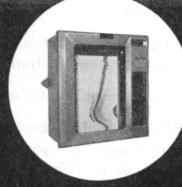
all round confidence

Kelvin Hughes Radar and Radio Communications equipment give you complete visual and audio information – unfailingly



confidence in depth

Unerring indication of depth, underwater contours, where the fish are. Kelvin Hughes Echo Sounders help you all the time.







KELVIN HUGHES
A DIMSION OF SMITHS INDUSTRIES LIMITED

New North Road, Hainault, Ilford, Essex, England.

https://doi.org

THE INTERNATIONAL HYDROGRAPHIC BUREAU

Avenue Président J. F. Kennedy, MONACO

publishes

twice a year in January and July, an English and a French edition of

THE INTERNATIONAL HYDROGRAPHIC REVIEW

This publication contains articles of topical interest on hydrography, hydrographic surveying and related subjects.

Each number contains an average of 160 pages, 18×27 cm., and numerous illustrations.

Price per number £2.50 or \$6 (U.S.), plus postage.

Orders should be sent direct to the Bureau's Headquarters in Monaco, but payments can be made to the Bureau's account at Barclays Bank Ltd., Chief Foreign Branch, 152-156 Upper Thames Street, London, E.C.3. Specify English or French edition when ordering.

A reduction of 25% on the list price is allowed to booksellers. A 30% reduction is granted to government offices and to naval or merchant marine officers of the IHO's Member States who send their orders direct to the Bureau.

USEFUL BOOKS ON NAVIGATION AND SHIPPING LAW

NICHOLLS'S CONCISE GUIDE

Vol. I Fundamental Principles and Second Mates Revised by H. H. BROWN, D.S.C.*, R.D. Extra Master.

£4.00

Per Post £4.25

Vol. II Mate, Master and Extra Master

£2.20

Per Post £2.45

PRACTICAL NAVIGATION FOR SECOND MATES

Revised by Capt. G. C. JOHNSON £2.10

Per Post £2.201

A HISTORY OF THE PRACTICE OF NAVIGATION

By J. B. HEWSON, F.R.G.S., R.D., R.N.R.(Retd.) £2.00

Per Post £2.25

SHIP BROKERS AND THE LAW

By E. J. EDWARD, L.L.B.(Lond.) £1.50

Per Post £1.631

LAW AND PRACTICE OF SEA TRANSPORT

By Capt. L. F. H. STANTON, A.M.INST.T. £3.15

Per Post £3.40

Catalogue "N" free on request

BROWN, SON & FERGUSON, LTD





Institute Publications

The Haven Finding Art

by E. G. R. Taylor.

'A better book on the art of navigation down to Captain Cook's days has not been written in the English language.' (Mariner's Mirror.)

This new edition contains an appendix by Joseph Needham, F.R.S., on the history of navigation in China. (Hollis & Carter, £2·50. Members £2·00 plus postage.)

The Use of Radar at Sea

A Handbook on Marine Radar. (Hollis & Carter, £3.50)

Observational Errors

An elementary account of the ideas behind the statistical theory of errors, by E. W. Anderson & J. B. Parker. (John Murray, 25 p)

The Geometrical Seaman

An illustrated work on early navigational instruments, by E. G. R. Taylor & M. W. Richey. (Hollis & Carter, £1.50)

The Mathematical Practitioners of Tudor and Stuart England

by E. G. R. Taylor.

(Cambridge University Press, £4.00 Members £3.00 plus postage.)

An account of the ideas, instruments and methods in navigation and surveying between 1485 and 1715 with lists of the mathematical practitioners with biographical notes and details of their work.

The Mathematical Practitioners of Hanoverian England

by E. G. R. Taylor.

(Cambridge University Press, £4.50 Members £3.37 plus postage.)

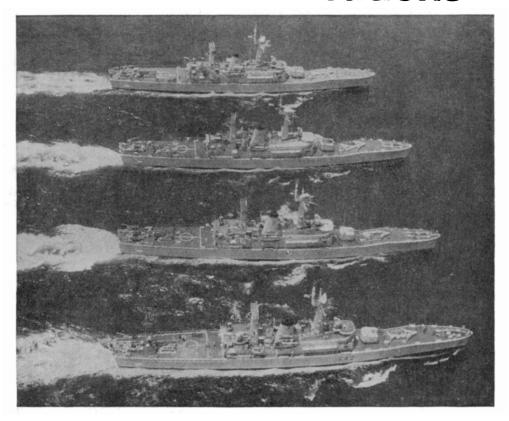
This book, a sequel to the earlier volume, takes the story up to 1840, by which time the independent mathematical practitioner had virtually disappeared, absorbed into the large firm or organization as a consequence of industrial and social change.

In the Wake of the Torrey Canyon: Reflections on a Disaster

by L. Oudet

An investigation of all the implications for shipping today of the great oilspill of 1967. (Hollis & Carter, £1.00. Members 75P.)

Marconi complete naval communications



The Marconi comprehensive range of s.s.b/i.s.b naval communications equipment meets all present and foreseeable requirements for voice and automatic telegraphy.

The complete range conforms to Royal Naval standards of resistance to shock, vibration and climatic conditions, and has been NATO codified by the British Ministry of Defence. It is in wide use by the Royal Navy and in the modernization of twenty other navies.

Marconi Communication Systems Limited also has a complete range of communications

equipment available for shore stations; digital transmission, and airborne communications.

In addition the Company is able to assist naval departments and shipbuilders with the planning, fitting, testing and tuning of complete ship communications installations.

Marconi Radio Division, designers and suppliers of h.f and l.f point-to-point systems, line-of-sight and tropospheric scatter microwave systems—part of the total systems capability of Marconi Communication Systems.

Marconi Communication Systems

Complete civil and military static and mobile communication systems

Marconi Communication Systems Limited,

Radio and Space Communications Division, Chelmsford, CM1 1PL, England

A GEC-Marconi Electronics Company

LTD/H94

'NAVIGATION—No. 79' JUILLET 1972

- I. LES NOUVEAUTES TECHNIQUES—
 - 1. Loch accoustique pour sous marins par E. A. CAPORIN
 - 2. Les perspectives et les promesses du système OMEGA par P. HUGON
 - 3. Etude de l'écoulement du trafic aérien et capacité d'un système de contrôle par F COUSIN
 - 4. Le simulateur spatial de navigation maritime tactique par R. HERVIEU
- II. CHRONIQUE DU NAVIGANT-
 - 1. Le système inertiel MGC 30 de Sagem par J. HARDOUIN
 - 2. L'anti-collision aérienne par le Commandant GELY
 - 3. L'enthousiasme pour l'anti-collision se refroidit . . .
- III. L'HISTOIRE ET LA NAVIGATION-

La navigation arabe de jadis par H. GROSSET-GRANGE

IV. TRIBUNE LIBRE—

Navigation maritime et météorologie moderne par C. GALISSOT

- V. INFORMATIONS-
 - 1. Automatisation des informations météo: LE DECLAM
 - 2. La Xº conférence Hydrographique internationale (Monaco 11au 22/4/72)
 - 3. Le Dr Karl SCHUBERT, membre d'honneur de l'IFN
 - 4. Les codes de diffusion de la correction du temps atomique
 - 5. "AEROSAT" et l'OACI-Evolution de la controverse
 - 6. Les journées de l'ATMA
- VI. CHRONIQUE DES LIVRES ET REVUES-

'NAVIGATION, U.S.A.'

Navigation, the quarterly Journal of the American Institute of Navigation, is available to members of this Institute at a reduced subscription of £2 a year. Volume 18, No. 4 (Winter 1971-72), contains the following papers.

CAINS: POINTING TO THE FUTURE Ronald S. Vaughn

AREA NAVIGATION—A QUANTITATIVE EVALUATION OF THE EFFECTIVENESS OF INERTIAL SYSTEM AIDING
Marvin Silver and Melvyn Greenberg

A NEW APPROACH TO ON-BOARD ORBIT NAVIGATION Eugene S. Muller and Peter M. Kachmar

THE STATE OF STRAPDOWN INERTIAL GUIDANCE AND NAVIGATION Andrew Edwards, fr.

A DIGITAL READ-OUT DAY AND NIGHT MARINE SEXTANT Sidney Feldman

AIRCRAFT COLLISION PREVENTION IN HIGHLY DENSE ENVIRONMENTS J. A. Maynard

OPTIMAL AND SUBOPTIMAL METHODS OF SATELLITE SURVEILLANCE FOR TRAFFIC CONTROL OF TRANSOCEANIC FLIGHTS

Herbert Winter

DESIGN CONSIDERATIONS FOR AN INTEGRATED COMMUNICATION, NAVIGATION, IDENTIFICATION SYSTEM Ralph L. Ather

MAINS, A NEW MARINE NAVIGATOR
P. Siskind and E. Von Arx

NEW SHORT METHOD TABLES (K11) FOR DIRECT FINDING OF A TWO STAR FIX WITHOUT USE OF ALTITUDE DIFFERENCE METHOD Stjepo Kotlaric

THE INSTITUTE'S PROFESSIONAL FORUM Contributors-D. H. Sadler, H. C. Ketts, Editorial Comment

THE INSTITUTE'S PROFESSIONAL FILE

REVIEWS OF RECENT BOOKS

