

# The JOURNAL of NAVIGATION

VOL. 27, NO. 2

APRIL

1974

<b>The Pay-off from Improved Marine Navigational Aids</b>	133
R. MAYBOURN AND W. MATEER	
<b>The Maritime Use of V.H.F. Radio-telephony—Present and Future</b>	158
A. G. CORBET AND D. H. THOMAS	
<b>Computer-controlled Path Guidance with Reference to Radio Navigation</b>	163
W. KUNDLER	
<b>Aircraft Characteristics and Air Traffic Systems</b>	173
V. W. ATTWOOLL	
<b>The Vinland Map</b>	195
E. G. R. TAYLOR (an early paper)	
<b>Position Fixing for North Sea Oil</b>	206
I—North Sea Oil	206
T. F. GASKELL	
II—Position Fixing in the North Sea	211
K. V. BLAICKLOCK, O.B.E.	
<b>Ship Casualties in the Baltic, Gulf of Finland and Gulf of Bothnia in 1971–2</b>	220
V. KOSTILAINEN AND M. HYVÄRINEN	
<b>Some Factors Affecting the Frequency of Accidents in Marine Traffic</b>	235
I—The Diameter of Evasion for Crossing Encounters	235
R. OSHIMA AND Y. FUJII	
II—The Probability of Stranding	239
Y. FUJII, H. YAMANOUCHI AND N. MIZUKI	
III—The Effect of Darkness on the Probability of Collision and Stranding	243
Y. FUJII	
IV—Visual Range and the Degree of Risk	248
Y. FUJII AND H. YAMANOUCHI	

## FORUM

<b>An Abacus for Windward Performance</b>	253
J. ELLIOT	
<b>The Use of ABC Tables in Preparing for Star Observations</b>	259
P. A. THOMPSON	
<b>Irradiation: A Note</b>	261
C. H. COTTER	
<b>'Behaviour Patterns in Encounters between Ships'</b>	265
G. R. SPOONER	
<b>A New Use for the Traverse Table</b>	266
P. SORAB	
<b>'Martelli's Tables'</b>	266
A. N. BLACK	
<b>An Examination of Criticisms of Automatic Radar Plotting Systems and their Advantages in Relation to Manual and Semi-auto Systems</b>	268
A. HARRISON	

<b>Record</b>	271
<b>Reviews</b>	273

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

JOHN MURRAY (PUBLISHERS) LTD., 50 ALBEMARLE STREET, LONDON W1

PRICE TWO POUNDS (£2.00)

---

THE ROYAL INSTITUTE OF NAVIGATION

*Patron*

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

OFFICERS AND COUNCIL 1973-74

*President*

G. E. Beck

*Vice-Presidents*

F. A. Haworth

Captain V. A. M. Hunt, C.B.E.

*Honorary Treasurer*

Lieut-Comdr. R. B. Richardson, R.N. (Ret.)

*Chairman of the Technical Committee*

Captain R. Maybourn

*Chairman of the Membership and Fellowship Committee*

Captain C. H. Cotter

*Other Members of Council*

Lieut-Comdr. A. G. Dyer, R.N.

Captain I. S. S. Mackay, R.N.

Air Commodore B. Hamilton,

Captain A. C. Manson

O.B.E., D.F.C., A.F.C.

Mrs. Mary Pera

A. H. Jessell

P. G. Reich

S. S. D. Jones

Captain P. A. Thompson

Captain R. J. Turner

---

*Director* 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 two pounds per copy or, by subscription, at eight 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 0HT.

# NAUTOMAT

Anschütz & Co. GmbH. Germany  
23 Kiel 14 Postfach 6040  
Tel. (0431) 30681 Telex 02 92 804



**SHIPS  
DRIVING  
ON  
RAILS?**



**High precision path guidance  
based on radio aids  
with ANSCHÜTZ-NAUTOMAT**

ACC 40.017

## Institute Publications

### The Use of Radar at Sea

Fourth revised edition now reprinted. 'An excellent book which fulfils admirably the function for which it was conceived. It should find a place in the chart-room bookcase of every radar-fitted vessel and in the private reference library of every navigator'. (*Journal of the Honourable Company of Master Mariners.*) (Hollis & Carter, £3.75)

### 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 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.

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.

(Cambridge University Press, £5.90  
Members £4.43 plus postage)

### The Mathematical Practitioners of Hanoverian England

by E. G. R. Taylor.

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.

(Cambridge University Press, £6.90  
Members £5.17 plus postage)

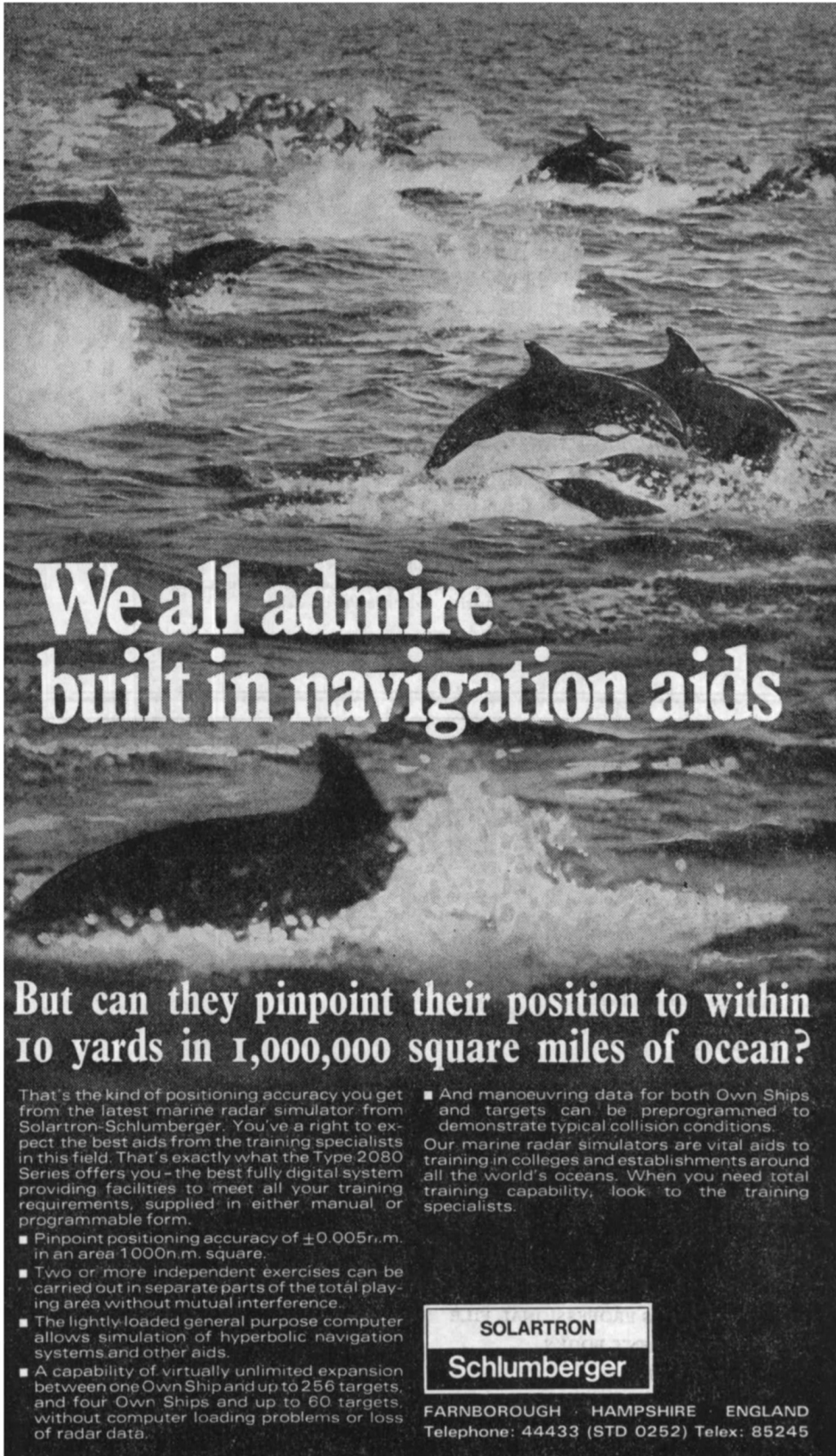
### In the Wake of the Torrey Canyon: Reflections on a Disaster

by L. Oudet.

'... should be essential and compulsory reading for every navigator of every ship under every flag'. (*Nautical Magazine.*)

'Were I a fleet owner or manager, I'd see that every deck officer in my company had a copy of this excellent book.' (*Navigation.*)

(Hollis & Carter, £1.00  
Members 75p)



# We all admire built in navigation aids

**But can they pinpoint their position to within  
10 yards in 1,000,000 square miles of ocean?**

That's the kind of positioning accuracy you get from the latest marine radar simulator from Solartron-Schlumberger. You've a right to expect the best aids from the training specialists in this field. That's exactly what the Type 2080 Series offers you - the best fully digital system providing facilities to meet all your training requirements, supplied in either manual or programmable form.

- Pinpoint positioning accuracy of  $\pm 0.005$  r.m. in an area 1000 n.m. square.
- Two or more independent exercises can be carried out in separate parts of the total playing area without mutual interference.
- The lightly-loaded general purpose computer allows simulation of hyperbolic navigation systems and other aids.
- A capability of virtually unlimited expansion between one Own Ship and up to 256 targets, and four Own Ships and up to 60 targets, without computer loading problems or loss of radar data.

■ And manoeuvring data for both Own Ships and targets can be preprogrammed to demonstrate typical collision conditions.

Our marine radar simulators are vital aids to training in colleges and establishments around all the world's oceans. When you need total training capability, look to the training specialists.



FARNBOROUGH · HAMPSHIRE · ENGLAND  
Telephone: 44433 (STD 0252) Telex: 85245

## '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 £5.00 per annum. The April 1974 issue contains the following papers.

### I. LES NOUVEAUTES TECHNIQUES—

1. La radiolocalisation "TRIDENT II" par J. PRUVOST & LANGLET
2. Un système à satellite pour la navigation et le contrôle maritime. A. PINGLIER

### II. LE CONTROLE DU TRAFIC—

1. Le contrôle de la circulation aérienne dans la région d'EUROCONTROL  
G. H. TROW (2<sup>e</sup> partie)
2. Les nouveaux radars de surveillance dans l'espace aérien français  
J. M. FAYSSE (STNA)
3. L'OACI et le système d'atterrissage futur. P. FOMBONNE

### III. CHRONIQUE DU NAVIGANT—

1. Navigation et microcalculateur. J. THIBERGE
2. Navigation aérienne en rase-motte. P. H.
3. Les remorqueurs ravitailleurs type "F.I.S.H.". P. MARCHAND

### IV. INFORMATIONS—

1. Le VI<sup>e</sup> colloque de l'ASTEO sur l'exploitation des océans
2. Développements techniques et opérationnels du service d'information et de surveillance du trafic maritime dans le Pas de Calais

### V. 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 20, No. 4 (Winter 1973-74), contains the following papers.

### NONLINEAR TRAJECTORY-FOLLOWING AND CONTROL TECHNIQUES IN THE TERMINAL AREA USING THE MLS NAVIGATION SENSOR

*P. Madden and M. Desai*

### AIR ROUTE CAPACITY MODELS

*W. Siddiquee*

### A SURVEY OF SATELLITE-BASED SYSTEMS FOR NAVIGATION, POSITION SURVEILLANCE, TRAFFIC CONTROL, AND COLLISION AVOIDANCE

*Keith D. McDonald*

### AN ATTITUDE REFERENCE SYSTEM WITH ELECTRICALLY SUSPENDED GYROS

*D. F. Elwell*

### COMMUNICATIONS AND POSITION FIXING EXPERIMENTS USING THE ATS SATELLITES

*Roy E. Anderson*

### AN EXACT SOLUTION TO A PROBLEM IN POSITIONING

*Myron C. Young*

### EFFECTIVENESS LIMITATIONS OF MIDAIR COLLISION AVOIDANCE STRATEGIES

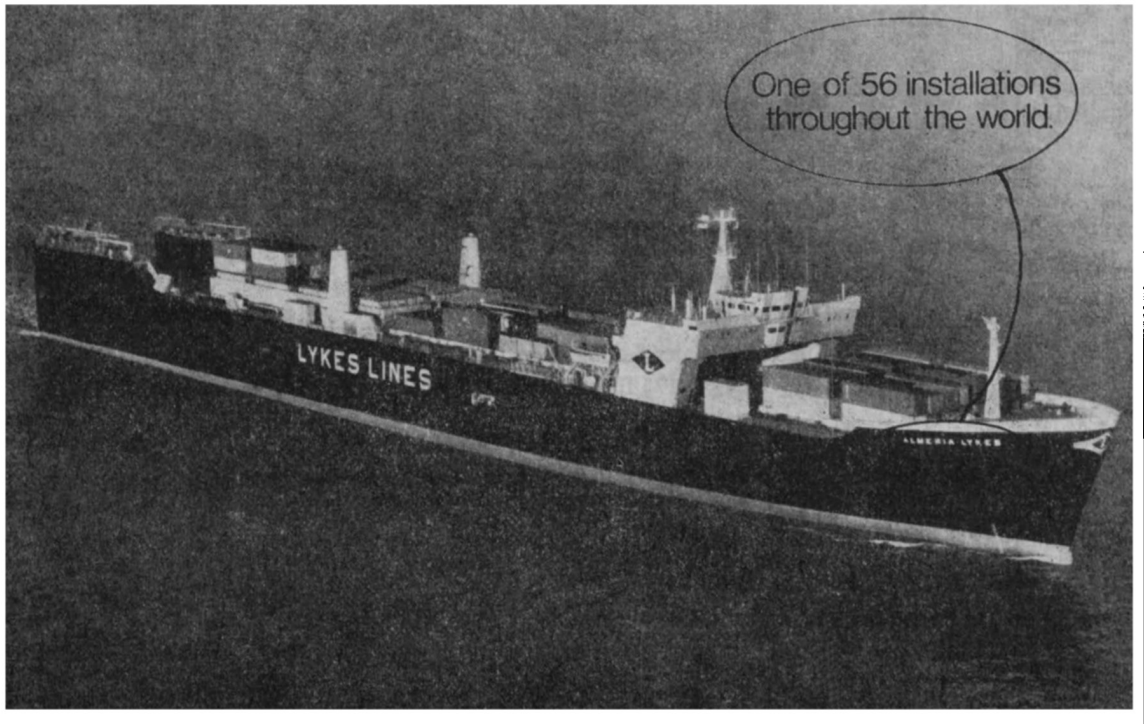
*John L. Ramsey*

### THE INSTITUTE'S PROFESSIONAL FILE

### REVIEWS OF RECENT BOOKS

### INDEX TO VOLUME 20

# LYKES SELECTS DIGILOT COLLISION AVOIDANCE



## DIGILOT<sup>®</sup>

### FULLY AUTOMATIC MARINE RADAR PLOTTER

- Chartlike presentation on bright 16" CRT display.
- Automatic acquisition and tracking.
- Automatic plotting continuously updated without manual assistance.
- Potential collision threats assessed at a glance at all times.
- Automatic CPA Alarm and trial maneuver facilities.
- World-wide installation and service.



IOTRON CORPORATION • 5 ALFRED CIRCLE • BEDFORD, MA. U.S.A.  
CABLE: IOTRON BOSTON • TELEX: 92-3426

# **Authoritative Sailing-Ship Books**

## **COOLIE SHIPS AND OIL SAILERS**

This book is a record of two special phases of sea life in Sailing Ships

190 Pages 9½" × 7½" 56 Illustrations £2.55 (per post £2.82)

## **THE COLONIAL CLIPPERS**

The Great Wooden Ships of the Blackwall and other lines

400 Pages 9½" × 7½" 81 Illustrations, 4 Plans £2.70 (per post £2.97)

## **THE CHINA CLIPPERS**

A History of the celebrated Clipper Ships in the Chinese Opium and Tea Trades

310 Pages 9½" × 7½" 34 Illustrations £2.80 (per post £3.07)

## **THE LOG OF THE "CUTTY SARK"**

The most authentic work, compiled from her log books and captain's abstracts

344 Pages 9½" × 7½" 52 Illustrations, 9 Plans £3.80 (per post £4.07)

## **THE LAST OF THE WINDJAMMERS**

Vol. I. The Sailing Ships of the Seventies-Eighties

535 Pages 9½" × 7½" 126 Illustrations, 17 Plans £4.50 (per post £4.77)

Vol. II. The Deep-Water Sailing Ships, 1888-1928

470 Pages 9½" × 7½" 174 Illustrations, 17 Plans £4.50 (per post £4.77)

By BASIL LUBBOCK

All Lubbock's work is the product of original and comprehensive research. These books are recommended without reserve to the student of the sailing-ship

## **MASTING AND RIGGING**

The Clipper Ship and Ocean Carrier

£4.20 (per post £4.47)

## **SAILING SHIP RIGS AND RIGGING**

With authentic plans of famous vessels

£2.00 (per post £2.22)

## **PLANK-ON-FRAME MODELS and Scale Mastng and Rigging**

Vol. I. Reprinting Vol. II. £2.50 (per post £2.72)

By HAROLD A. UNDERHILL

A leading authority on Sail and Ship Modelling

*Catalogue "N" giving further titles and details, free on request*

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



**INTERNATIONAL HYDROGRAPHIC BUREAU**

**Avenue Président J. F. Kennedy, Monte-Carlo, Monaco**

**publishes**

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

**THE INTERNATIONAL  
HYDROGRAPHIC REVIEW**

This publication contains papers and articles of topical interest on hydrography, oceanography and related ocean technology and sciences.

Approx. 160 pages, 18×27 cm; numerous illustrations.

Annual subscription: 67.00 French Francs, plus postage.

Original articles for publication are welcome. Authors will be paid an honorarium at the rate of 15 Gold Francs (about 5 U.S. Dollars) per printed page of 600 words.

---

**The Bureau also publishes monthly, the**

**INTERNATIONAL  
HYDROGRAPHIC BULLETIN**

which contains topical news and reports the work of the world hydrographic community as well as lists all charts and publications issued by Member States' Hydrographic Offices.

(Bi-lingual publication—English and French)

Approx. 40 pages, 18×27 cm

Yearly subscription: 45 French Francs

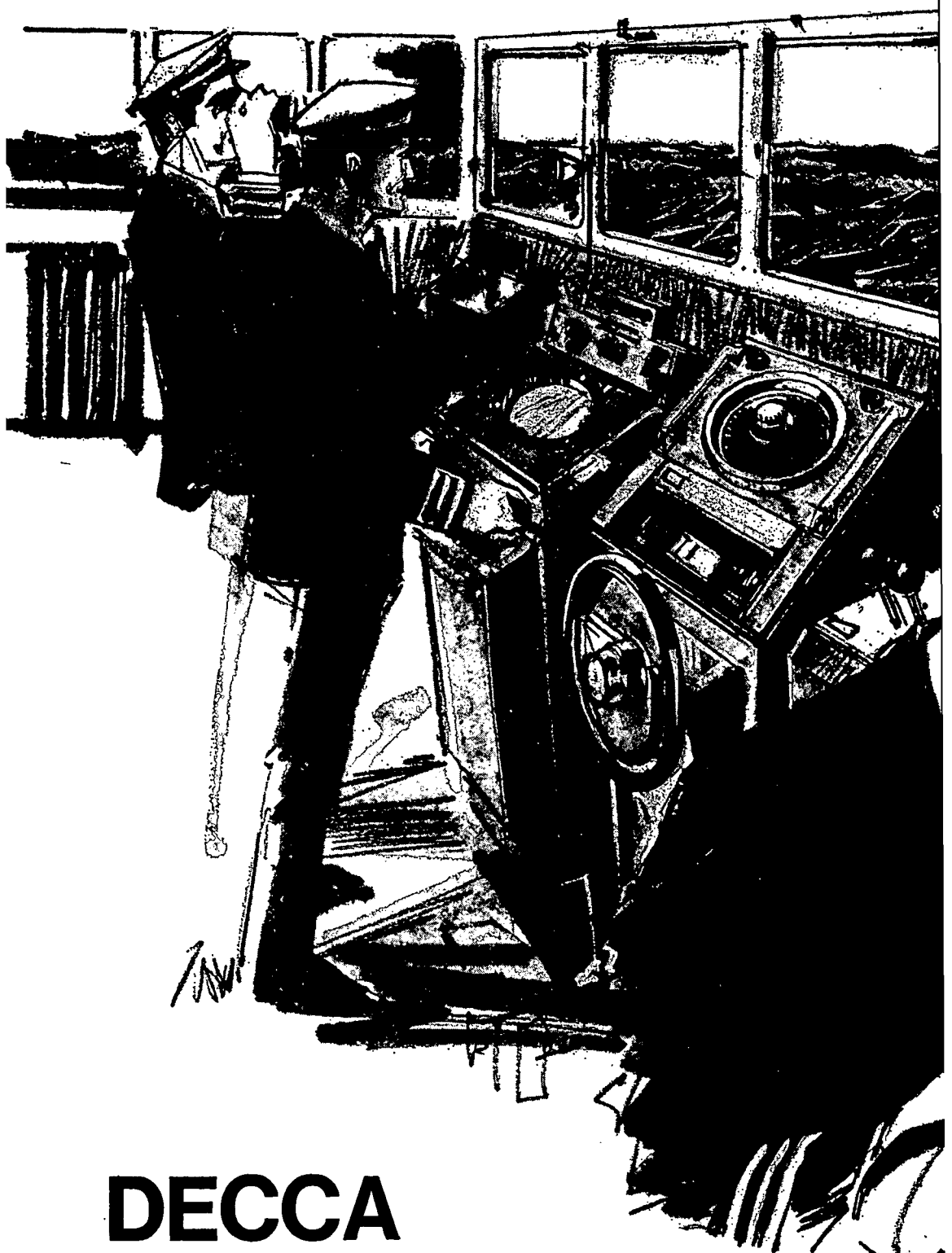
Individual issue: 4.50 French Francs

---

A reduction of 25% is allowed to booksellers. A 30% reduction is granted to research institutions, government offices, naval or merchant marine officers and to practising hydrographic surveyors of the IHO's Member States who send their orders direct to the Bureau.

---

**The list of International Hydrographic Bureau publications, and the conditions of sale, will be supplied free on request.**



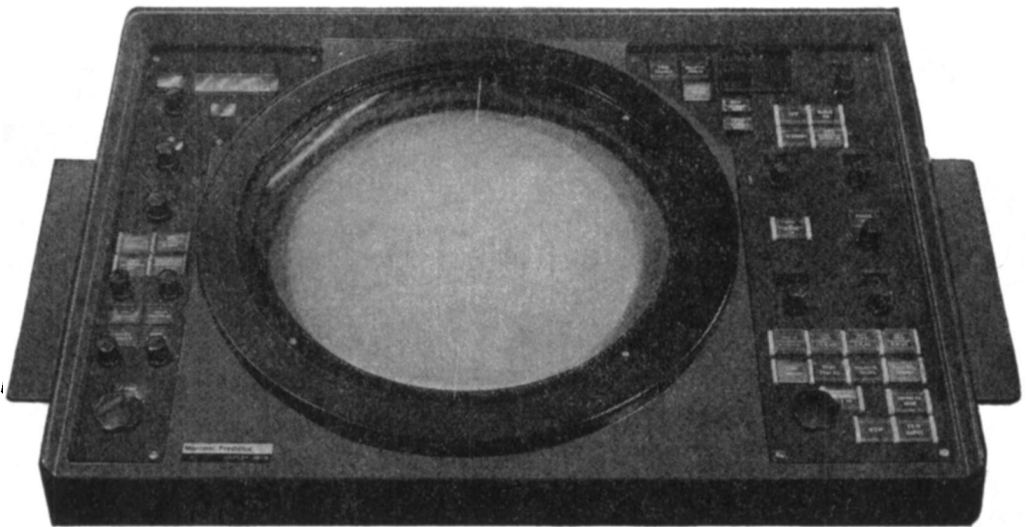
# **DECCA**

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

**THE DECCA NAVIGATOR COMPANY LIMITED. DECCA RADAR LIMITED. LONDON**



# INFALLIBILITY



## PREDICTOR—the most advanced marine radar in the world

Radar plotting is as easy as pressing a button. 'Predictor' radar tracks and plots every target on the screen continuously, automatically and with infallible accuracy. True or relative tracks are presented as 4 plots equally spaced in time, up-dated every 10 seconds.

And before you alter course or speed, 'Predictor' will work out the new triangle of velocities for every target and plot the *impending* situation—before you alter.

### Marconi Marine radar

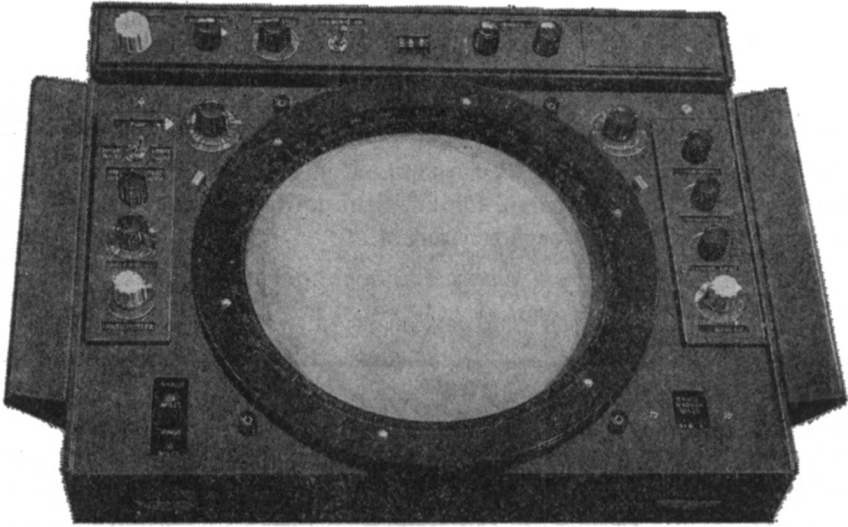
The Marconi International Marine Co. Ltd.  
Chelmsford Essex England

Tel (0245) 61701 Telex 99228 • A GEC-Marconi Electronics Company



COMMUNICATION  
NAVIGATION  
RADAR  
SOUND AND TV

# DEPENDABILITY



## RADIOLOCATOR—radar designed throughout for simplicity and reliability

Conventional . . . yes, but the best of its kind. 'Radiolocator' gives you really dependable, workaday radar at the right price.

Solid-state circuitry. Only two thermionic devices—a long-life magnetron and choice of 12-inch or 16-inch CRT. All normal marine radar facilities, plus true bearing indication, are standard; and options include True Motion, compass stabilisation, reflection plotter, dual displays, and full or partial interswitching of dual installations.

## Marconi Marine radar

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

---

## 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 46½p) 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

*There is a stockist of Government publications in most areas. See the Bookseller section of Yellow Pages.*

---



## HMSO BOOKS

---

ROYAL GEOGRAPHICAL SOCIETY

---

# THE MAKING OF THE BROADS

## RESEARCH SERIES NO. 3

A new edition of this classic work for which there has been heavy demand

146 pp, 8 pp half-tones, 4 folding sheets of diagrams and numerous figures. Price £3.00 (U.S. \$9.00)