

The JOURNAL of THE INSTITUTE OF NAVIGATION

VOL. 17, NO. 3

JULY

1964

The Safety and Reliability of Sea and Air Transport Recommended Routes for Ships in Congested Waters	217
A. F. DICKSON	
Regulation of Traffic on the North Atlantic Routes and in Landfall Areas	233
J. TRAISET AND M. LE BIHAN	
North Sea Nemedri Routes—A Collision Problem	243
J. H. BEATTIE	
An Alternative to Full Inertial Systems	250
J. D. STEVENSON AND D. L. WRIGHT	
French Experimental Work on All-Weather Landing	262
J. VILLIERS	
ILS and Landing in Zero Visibility	266
M. LEBLEU	
The Reduction of Weather Minima and the Improvement of Scheduled Regularity	269
A. M. A. MAJENDIE AND J. A. GORHAM	
Ara Moana: Stars of the Sea Road	278
D. H. LEWIS	
Lasers and their Application to Navigation	289
P. G. R. KING	

FORUM

The Use of Apparent Consistency in Errors of Latitude in the Identification of 16th and 17th Century Pacific Island Discoveries	311
C. JACK-HINTON	
Long-range Navigation Aids	313
J. E. D. WILLIAMS	
Reduction to the Prime Vertical Circle	315
C. H. COTTER	
Astrofix and Rectofix Tables	319
D. H. SADLER	
Manned Space Flight Navigation Techniques	320
F. D. P. WICKER	
Record	323
Reviews	328

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

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

PRICE TWENTY SHILLINGS

THE INSTITUTE OF NAVIGATION

Patron

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

OFFICERS AND COUNCIL 1963-64

President

Dr. G. E. R. Deacon, C.B.E., F.R.S.

Vice-Presidents

Air Marshal Sir Edward Chilton, K.B.E., C.B.

Rear Admiral E. G. Irving, C.B., O.B.E.

Honorary Treasurer

Captain M. E. Butler Bowdon, O.B.E., R.N.

Chairman of the Technical Committee

Mr. G. E. Beck

Chairman of the Membership and Fellowship Committee

Captain A. J. R. Tyrrell

Council Members

Captain R. C. Alabaster, D.S.O., D.F.C.

Mr. F. G. G. Carr, C.B.E.

Mr. Francis Chichester

Captain W. R. Colbeck, R.N.R.

Captain A. F. Dickson

Wing Commander D. F. H. Grocott, A.F.C.

Air Vice Marshal W. E. Oulton, C.B.,
C.B.E., D.S.O., D.F.C.

Mr. D. M. Page

Mr. C. Powell

Mr. W. C. Woodruff

Executive Secretary : M. W. Richey

Deputy Secretary : F. George

The Journal of the Institute 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.

The *Journal* is free to all members of the Institute. It is sold to the public at twenty shillings per copy or, by subscription, at eighty-four shillings per annum (post free) and may be obtained through all booksellers and John Murray (Publishers) Ltd., 50 Albemarle Street, London W1.

Contributions, which are welcomed from both members and non-members, should be addressed to the Editor.

Enquiries for advertising space should be addressed to the Institute offices.

The postal address of the Institute is :

The Institute of Navigation,
at The Royal Geographical Society,
1 Kensington Gore, London SW7.

Telephone: Kensington 5021



AHEAD OF ITS TIME

This Hawker Siddeley Twin Turbo-Prop 748 will always be ahead of its time, because it recently joined the research team of the acknowledged world leaders in flight control and automatic landing systems. Its flight control equipment will be years in advance of that in current airline and service use.

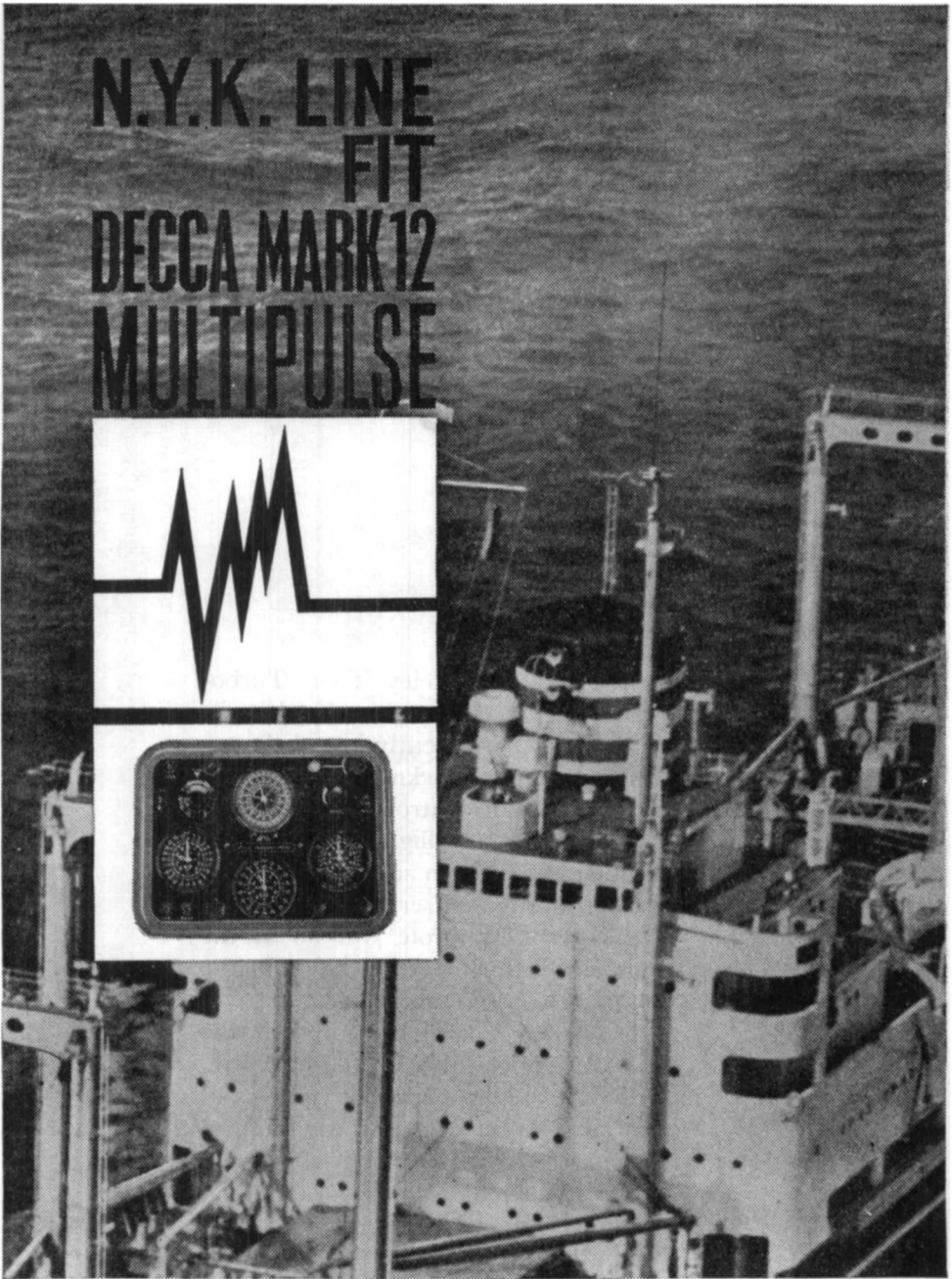
The 748's initial role will be in the flight development of the latest in the SMITHS range of flight control systems – the Series 6 which comprises the SEP6 Autopilot, the SFS6 Flight System, the SCS6 Lightweight Compass and the STS6 Automatic Throttle Control System. It will also be closely concerned with SMITHS long-term programme in the development of gyros, air data computers, take-off and landing indicators, ground manoeuvring devices and other advanced all-weather and automatic landing equipment.



SMITHS AVIATION DIVISION

The Aviation Division of S. Smith & Sons (England) Ltd.

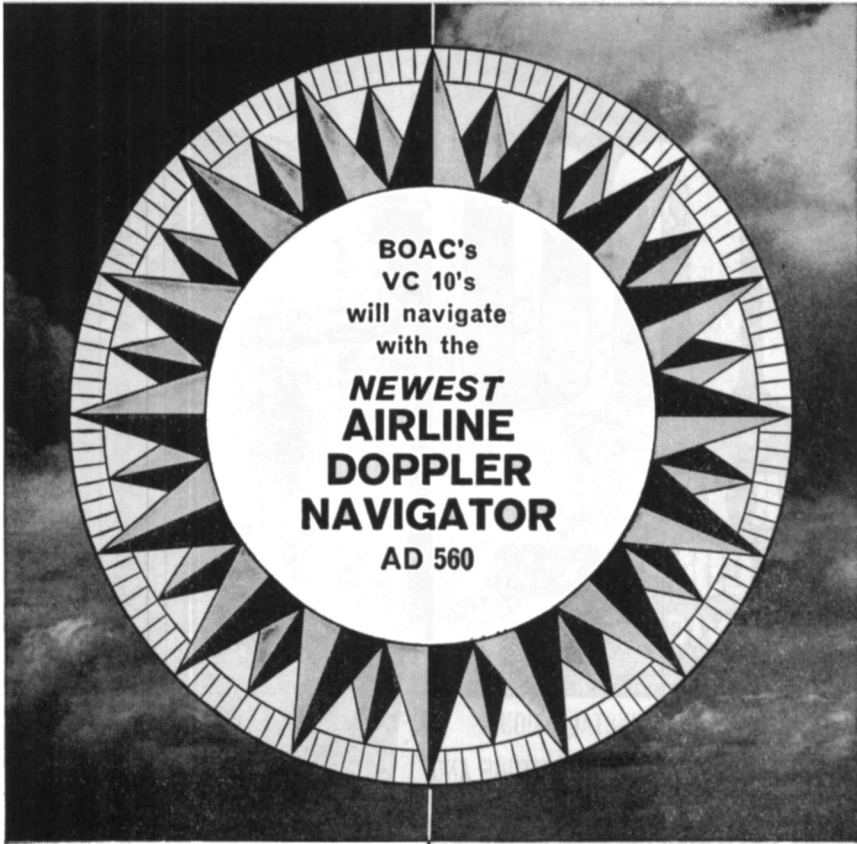
**KELVIN HOUSE, WEMBLEY PARK DRIVE, WEMBLEY, MIDDLESEX
WEMBLEY 8888 AIRSPEED WEMBLEY TELEX: 25366 SAV 0567**



THE DECCA NAVIGATOR

Nippon Yusen Kaisha have equipped M.S. Yamanashi Maru with the Decca Mark 12—the new receiver that increases Decca coverage and improves performance at the longer ranges.

THE DECCA NAVIGATOR COMPANY LIMITED • LONDON • ENGLAND



The Marconi AD 560 Airline Doppler Navigator is the product of ten years of Doppler design, manufacture and user experience

- AD 560 *Fully Automatic Operation*
- AD 560 Accuracy better than 0.3%
- AD 560 Solid State Design
- AD 560 "In flight" Self Testing
- AD 560 "Built-in" Ramp Rest
- AD 560 Conforms to ARINC 540
- AD 560 Sixty Series Reliability



 **SIXTY SERIES RELIABILITY**

Marconi airradio systems

The Marconi Company Limited, Aeronautical Division, Basildon, Essex, England

500

MARK XX GYRO COMPASSES IN SERVICE

- WHEELHOUSE INSTALLATION.
- AUTOMATIC SPEED, LATITUDE AND COURSE CORRECTIONS.
- MASTER AND REPEATERS READ TRUE NORTH.
- SELF-CONTAINED TRANSMISSION TO EIGHT REPEATERS.
- SOLID-STATE ELECTRONICS.
- TWO YEARS BETWEEN INSPECTIONS
- NO ROUTINE MAINTENANCE.



MARINE GROUP

SPERRY GYROSCOPE COMPANY LTD., BRENTFORD, MIDDX. TELEPHONE: ISLEWORTH 1241



150 SPERRY SERVICE STATIONS SPAN THE WORLD

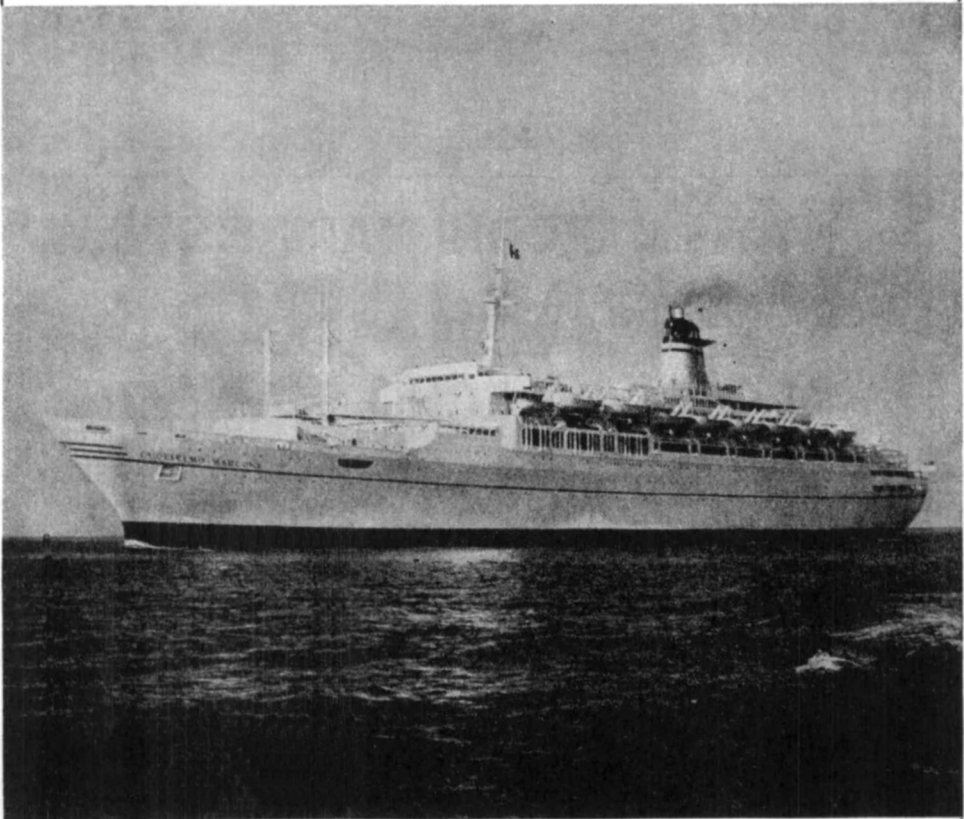
FOR SAFETY AND PUNCTUALITY

Decca True Motion Radar is the choice

Seven of the world's latest passenger liners are fitting Decca True Motion, the world's most effective type of marine radar.

GALILEO GALILEI	Lloyd Triestino
GUGLIELMO MARCONI	Lloyd Triestino
MICHELANGELO	Societa Italia
NEWBUILDING 728	Svenska Amerika
OCEANIC	Home Lines
RAFFAELLO	Societa Italia
SHALOM	Zim Israel

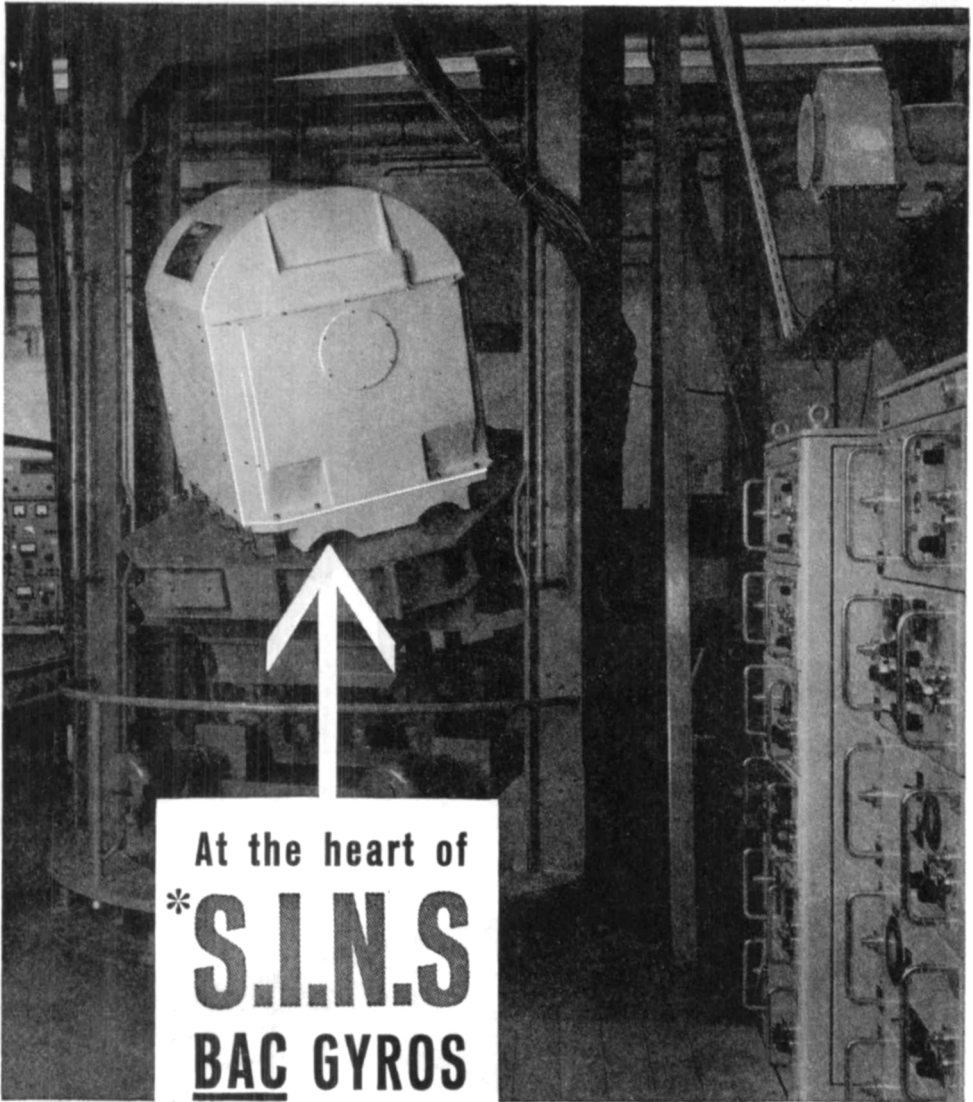
The most widely used marine radar in the world



DECCA RADAR

DECCA RADAR LIMITED · LONDON · ENGLAND

Photograph by courtesy of Sperry Gyroscope Co. Ltd.



* Ships' Inertial Navigation Systems

An inertial navigation system is only as good as its gyros. S.I.N.S.—developed by the Admiralty and manufactured by Sperry—relies on gyros designed and produced by BAC. Gyros from BAC are also used in the navigation system of the TSR2 and in many other systems where exceptional standards of accuracy and precision are required.

BRITISH AIRCRAFT CORPORATION
PRECISION PRODUCTS GROUP • GUIDED WEAPONS DIVISION
STEVENAGE WORKS • HERTFORDSHIRE • ENGLAND

TORAN

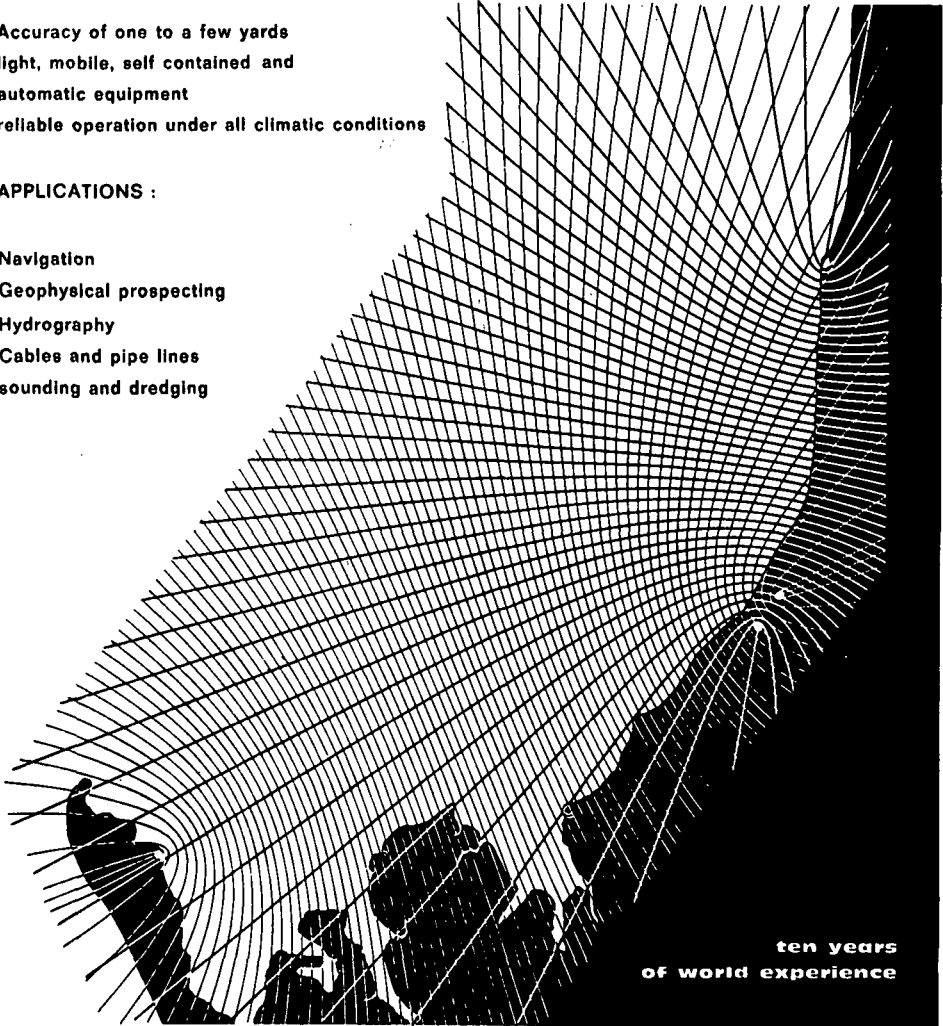
**Radio Navigation
and Radio Location system for maritime, on land
and airborne applications.**

Range greater than 160 n.m.

**Accuracy of one to a few yards
light, mobile, self contained and
automatic equipment
reliable operation under all climatic conditions**

APPLICATIONS :

- Navigation**
- Geophysical prospecting**
- Hydrography**
- Cables and pipe lines
sounding and dredging**



**Société d'Études, Recherches et
Constructions Électroniques**

96, avenue Verdier - MONTROUGE (Seine) - Tél. : 253-37-74

a subsidiary of

Compagnie Générale de Géophysique





ESCORT 650 SERIES

BIG SHIP

radar performance
at small-ship cost

Seeing further and clearer

The ESCORT 650 series radars each have 20 kW transmitter power, yet prices are comparable with small ship radars. High power plus 4 pulse-lengths ensure clear, sharp pictures down to 15 yards and out to 48 miles. The series comprises six models, the choice of model depending on size and function of the vessel.

Close inshore—or out of soundings

These multi-purpose radars combine the range and bearing discrimination required for river and coastal navigation, with the power needed for early warning on ocean passages. Ships for which all these radar functions were desirable but too expensive need no longer compromise.

Note these technical features

- 20 kW transmitter power
- 4 pulse-lengths—choice of 0.05 or 0.1 microseconds plus 0.25 and 1.0 microseconds
- 3-tone P.P.I. display with 7 range scales
- slotted waveguide aerial with exceptionally high gain and providing excellent bearing discrimination. Beam width: 8 ft. aerial—better than 1.0°. 12 ft. aerial 0.7°
- full performance and extensive transistorisation for compactness and reliability.

the performance
of two radars
for less than
the price of one



AEI MARINE

Please complete this coupon for full details.

**TO: AEI, Electronic Apparatus Division,
Radar Sales, New Parks, Leicester, England.
Tel: Leicester 871331 ext. 336**

Please send me details of AEI ESCORT 650 Series Radars.

NAME _____

APPOINTMENT _____

ADDRESS _____

ELECTRONIC APPARATUS DIVISION, RADAR SALES, NEW PARKS, LEICESTER, ENGLAND

THE INTERNATIONAL HYDROGRAPHIC BUREAU

Quai des Etats-Unis, MONACO

publishes

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

THE INTERNATIONAL HYDROGRAPHIC REVIEW

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

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

Price per number \$5 (U.S.) excluding 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, 168 Fenchurch Street, London, E.C.3.

A reduction of 30% on the price quoted is allowed to booksellers. The same reduction is granted to government offices and to naval or merchant marine officers of the Bureau's States Members, provided the order is sent direct to the Bureau.

Authoritative Sailing-Ship Books

By **BASIL LUBBOCK**

LOG OF THE "CUTTY SARK"

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

344 Pages. 9 $\frac{3}{4}$ " \times 7 $\frac{1}{4}$ ". 52 Illustrations, 9 Plans.

36/- Per Post 38/3

THE LAST OF THE WINDJAMMERS

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

535 Pages. 9 $\frac{3}{4}$ " \times 7 $\frac{1}{4}$ ". 126 Illustrations, 17 Plans.

50/- Per Post 52/6

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

470 Pages. 9 $\frac{3}{4}$ " \times 7 $\frac{1}{4}$ ". 174 Illustrations, 17 Plans.

45/- Per Post 47/6

By **HAROLD A. UNDERHILL**

The leading authority on Sail and Ship Modelling

SAIL TRAINING AND CADET SHIPS

This Magnificent Volume is a most complete record.

366 Pages. 9 $\frac{3}{4}$ " \times 7 $\frac{1}{4}$ ". 132 Illustrations, 45 Folding Plans.

60/- Per Post 62/6

DEEP-WATER SAIL

For all Students of Sail and lovers of the Windjammer.

387 Pages. 9 $\frac{3}{4}$ " \times 7 $\frac{1}{4}$ ". Over 200 Illustrations, 28 Plates.

60/- Per Post 62/6

PLANK-ON-FRAME MODELS AND SCALE MASTING AND RIGGING

Vol. I. 34/- Per Post 35/3.

Vol. II. 34/- Per Post 35/3.

By **CHARLES BATESON**

THE CONVICT SHIPS 1787-1868

This first complete record opens up a new field of maritime history.

369 Pages. 9 $\frac{1}{8}$ " \times 6 $\frac{3}{4}$ ". 20 Illustrations.

36/- Per Post 38/-

Catalogue "N" giving more titles and more details, free on request.

BROWN, SON AND FERGUSON, LTD.

52 DARNLEY STREET, GLASGOW, S.1.

'NAVIGATION, LOS ANGELES'

Navigation, the quarterly Journal of the American Institute of Navigation, is available to members of this Institute at a reduced subscription of £1 a year. Volume 11, No. 1 (Spring 1964), contains the following papers:

THE STABILIZATION AND CONTROL SYSTEM FOR THE ORBITING ASTRONOMICAL OBSERVATORY.

R. E. Papsco

U.S. ARMY MOBILITY COMMAND

Paul L. Seabase

LIMITATIONS IMPOSED ON CELESTIAL NAVIGATION DUE TO INACCURACIES OF STAR POSITIONS

Francis P. Scott

THE 'LOG' OF CELESTIAL NAVIGATION

T. R. Stenberg

STICK CHARTS OF MICRONESIA

Lt. Col. Charles J. Davis

THE DEVELOPMENT OF MILITARY TECHNOLOGY

Harry Davis

THE AIR FORCE DESIGN AND ENGINEERING APPROACH TO LOW-COST NAVIGATION SYSTEMS

Capt. Russel E. Weaver, Jr., USAF, and Wladimir A. Reichel, USAF

ALL WEATHER HELICOPTER NAVIGATION

Capt. D. W. Hazelton, USN

NAVIGATION REQUIREMENTS OF AERIAL SURVEY OPERATIONS

Milton Glicken

FROM HERE TO AUTOMATION

S/L J. J. Thurmeier

INTEGRATED AVIONICS SYSTEM FOR GENERAL AVIATION AIRCRAFT

M. F. Collins

O'HOCORE, A LOW-COST NAVIGATIONAL COMPUTER MEMORY

Dr. J. S. Sallo and W. A. England

BURTON'S

NAVIGATIONAL PUBLICATIONS LTD.

ALVA, CLACKMANNANSHIRE

**THE ART OF
ASTRONOMICAL
NAVIGATION** 18/6

**FOUR-FIGURE
NAVIGATION
TABLES** 16/6

(In which the versine is used to secure the necessary accuracy in slight-reduction.)

NAUTICAL TABLES 28/6
(Sixth Edition)

Two facsimiles

**THEATRUM
ORBIS
TERRARUM
1570.**

**DE SPIEGHEL
DER ZEEVAERDT
1584.**

Exact reproductions of the first world atlas and the first world nautical atlas. Ready July; pre-publication price and brochures from

Elsevier

RIPPLESIDE COMMERCIAL ESTATE
BARKING - ESSEX

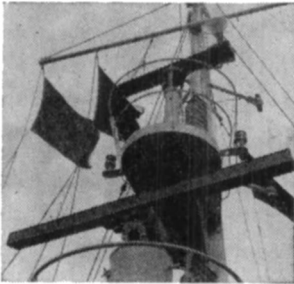


“an outstanding advance in the field of Marine Radar . . .

KELVIN HUGHES PHOTO PLOT RADAR

and a most valuable aid to safe navigation”

This is the verdict given by the Master of the Shell Tanker OSCILLA after using the Kelvin Hughes Photoplot Radar at sea. The equipment provides a bright, stable radar picture of 27 inches diameter on a flat paper-covered surface suitable for plotting. Targets are depicted in black against a white background. The picture can be studied by several observers at the same time, both in daylight and at night, without resorting to a visor or hood. The time interval between the separate radar pictures can be set at 15 seconds, three minutes or six minutes, according to plotting requirements. When the longer time intervals are used, successive radar paints of moving targets become integrated over the selected period. They are then automatically shown on the display as lines of varying length and direction, indicating the track and distance travelled.



The Thames Estuary is reproduced in remarkable detail by the Photoplot display whilst the OSCILLA lies at anchor five miles to the east of Southend Pier. Clearly visible are the pier itself, Shoeburyness, the Isle of Grain, buoys marking navigable channels, the north and south shores and boom defences. Dark lines indicate tracks of vessels navigating in the Channel.



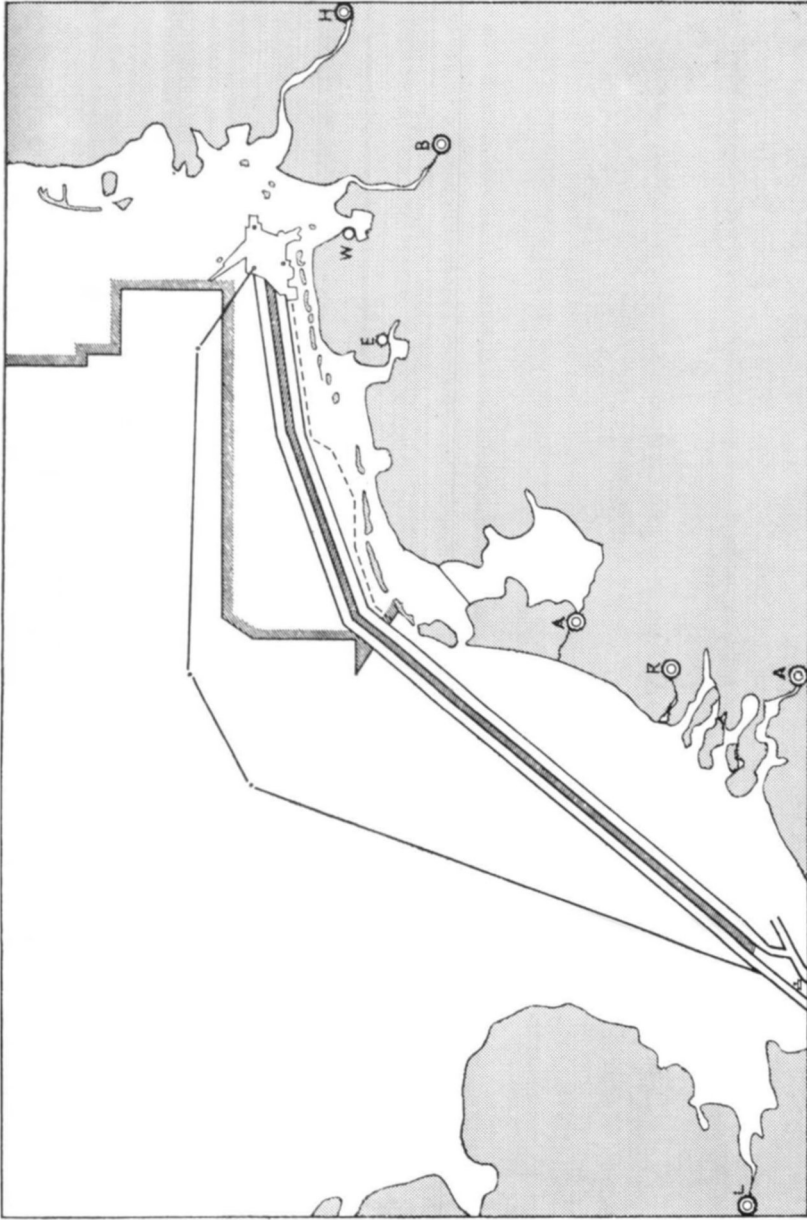
S. Smith & Sons (England) Ltd.



KELVIN HUGHES DIVISION

St. Clare House, Minories, London, E.C.3

Telephone: Royal 8741 Grams: Marinst London—EC3



The division of the traffic on the Netherlands and German coasts proposed at Eastbourne by Captain F. Sohnke of the German Ministry of Transport (the paper will be published in the next number of the *Journal*). The existing line of buoys on the Borkum route would mark the southern boundary of a 3-mile wide recommended track for eastbound vessels. The northern side of the 2-mile wide 'blue line' would mark the southern boundary of the 3-mile wide recommended track for westbound ships. Coastal traffic would use a 1.5-mile wide strip south of the present line of buoys. The new tracks meet, at the Sanddetté L.V., with the recommended tracks proposed by the Dover Strait Working Group.