THE JOURNAL OF

## Navigation

VOLUME 44 NUMBER 2 MAY 1991

The Royal Institute of Navigation Cambridge University Press



## THE ROYAL INSTITUTE OF NAVIGATION

Patron

HRH THE PRINCE PHILIP DUKE OF EDINBURGH, KG, KT, OM

OFFICERS AND COUNCIL 1990-1991

President

N. B. Dahl

Vice Presidents

W. F. Blanchard Rear Admiral R. O. Morris, св

Treasurer

J. H. Beattie

Chairman of the Technical Committee

Group Captain D. W. Broughton, MBE, RAF

Chairman of the Membership & Fellowship Committee

D. M. Page

Other Members of Council

Professor V. Ashkenazi C. M. D. Beatty R. W. Bridge, AFC Captain A. N. Cockcroft B. D'Oliveira OBE Air Marshal Sir Barry Duxbury, KCB, CBE, RAF Dr R. Johannessen Dr J. D. Last J. Mitchell Captain D. G. Ross

Director Rear Admiral R. M. Burgoyne, CB

## THE JOURNAL OF NAVIGATION

Editor John Kemp Assistant Editor Rebecca Archer

The Journal is published three times a year by Cambridge University Press. It contains original papers contributing to the science of navigation, including those presented at the 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. Any facts stated or opinions expressed in this Journal are the sole responsibility of the contributors. Neither the Royal Institute of Navigation, the Editor nor the Publishers can be held responsible for any injury or loss sustained in reliance thereon.

The Journal (ISSN 0373-4633) is issued free to all Members of the Institute. The subscription price to non-members for Volume 44, 1991, is £66 UK, £71 elsewhere (USA and Canada US \$129) post free; single parts are available at £24 (USA and Canada US \$44) plus postage. Orders, which must be accompanied by payment, may be sent to any bookseller or subscription agent or direct to the publishers: Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU, or in the USA and Canada to Cambridge University Press, Journals Department, 40 West 20th Street, New York, NY 10011-4211, USA.

Enquiries for advertising space should be addressed to Cambridge University Press at the address given above.

The postal address of the Institute is The Royal Institute of Navigation, at The Royal Geographical Society, 1 Kensington Gore, London SW7 2AT (Telephone: 071-589 5021 Fax: 071-823 8671).