THE JOURNAL OF Navigation

VOLUME 49 NUMBER 3 SEPTEMBER 1996

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 1995-1996

President W. F. Blanchard Vice Presidents Capt R. A. Smith. RN Capt A. N. Cockcroft Treasurer Air Cdre M. J-C. Burton, OBE Chairman of the Membership & Fellowship Committee Air Cdre N. Bonnor Other Members of Council Mrs C. A. Bloom S. Morice P. L. Cook K. Newman W. H. Sandford Air Cdre D. F. H. Grocott, CBE, AFC W. B. Kendal R. D. Stephenson P. E. G. Moore A. L. Wale

Director

Gp Capt D. W. Broughton, MBE

THE JOURNAL OF NAVIGATION

Editor John Kemp Assistant Editor Rebecca Dudley

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 subscription price (excluding VAT) to The Journal (ISSN 0373-4633) for Volume 49, 1996, is £112 (USA, Canada and Mexico US \$198) post free; single parts are available at £41 (USA, Canada and Mexico US \$70) plus postage. EU subscribers (outside the UK) who are not registered for VAT should add VAT at their country's rate. VAT registered subscribers should provide their VAT registration number. The Journal is issued free to all Members of the Institute. 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, Canada and Mexico to Cambridge University Press, Journals Department, 40 West 20th Street, New York, NY 10011-4211, USA. Japanese prices for institutions (including ASP delivery) are available from Kinokuniya Company Ltd, P.O. Box 55, Chitose, Tokyo 156, Japan.

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: 0171-589 5021 Fax: 0171-823 8671).

Information on *Journal of Navigation* and all other Cambridge journals is available on http://www.cup.cam.ac.uk/ and in North America on http://www.cup.org/.