

THE JOURNAL OF
Navigation

VOLUME 63 NUMBER 1 JANUARY 2010



Royal Institute of Navigation
Science Technology Practice

CAMBRIDGE
UNIVERSITY PRESS

THE ROYAL INSTITUTE OF NAVIGATION

Patron

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

OFFICERS AND COUNCIL 2009–2010

<i>President</i>	D. H. Barnes
<i>Vice Presidents</i>	Prof. T. Moore C. M. D. Beatty
<i>Honorary Treasurer</i>	I. P. A. Stitt
<i>Chairman of the Technical Committee</i>	Prof. A. P. Norris
<i>Chairman of the Membership & Fellowship Committee</i>	P. Chapman-Andrews, LVO MBE
<i>Other Members of Council</i>	
Wg Cdr C. S. Blount RAF	Mrs C. Robinson
D. Cockburn	Capt I. A. Smith
Dr N. D. Hughes OBE	J. B. Taylor OBE
Prof. W. Y. Ochieng	G. L. White
R. D. Pike	Capt R. J. Wild
<i>Director</i>	Gp Capt D. W. Broughton, MBE

THE JOURNAL OF NAVIGATION

Editor Dr Norman Hughes, OBE

Assistant Editor Tony Fyler

The *Journal* is published four 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. Papers may be submitted to the Editor for consideration. Instructions for contributors are available by email from: editor@rin.org.uk. 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 63, 2010, which includes print and electronic access, is £291 (USA, Canada and Mexico us \$561) and includes delivery by air; single parts are available at £77 (USA, Canada and Mexico us \$146) plus postage. The electronic-only price available to institutional subscribers is £255 (USA, Canada and Mexico us \$488). 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 8RU, or in the USA, Canada and Mexico to Cambridge University Press, Journals Fulfillment Department, 100 Brook Hill Drive, West Nyack, New York 10994–2133. Japanese prices for institutions 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.

Internet Access

This journal is included in the Cambridge Journals Online service which can be found at <http://journals.cambridge.org> For further information on other Press titles access <http://www.cambridge.org>

The postal address of the Institute is The Royal Institute of Navigation, at The Royal Geographical Society, 1 Kensington Gore, London SW7 2AT (Telephone: 020 7591 3130 Fax: 020 7591 3131).

Website: www.rin.org.uk; E-mail: editor@rin.org.uk

This journal issue has been printed on FSC-certified paper and cover board. FSC is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world's forests. Please see www.fsc.org for information.