THE ROYAL INSTITUTE OF NAVIGATION

Aims and Objects

The objects of the Institute are to unite in one body those who are concerned with or who are interested in navigation and to further its development. Navigation is conceived as applying to locomotion of all kinds and is perceived as encompassing aspects of: command and control, psychology and zoology, operational research, risk analysis, theoretical physics, operation in hostile environments, instrumentation, ergonomics, financial planning and law as well as electronics, astronomy, mathematics, cartography and other subjects traditionally associated with navigation.

The aims of the Institute are to encourage the creation and dissemination of knowledge through research and development, to co-ordinate information from all the disciplines involved, to provide a forum in which new ideas and new products can have the benefit of informed and professional scrutiny and to further education and communication. The Institute initiates conferences and symposia on specific subjects and has a programme of meetings at which lectures are given and discussed. There are standing Special Interest Groups (SIGs), which keep under constant review pertinent aspects of navigation. The success of these Special Interest Groups is crucially dependent on the active involvement of members.

The SIGs include: Land Navigation and Location Group (LN&L), General Aviation Navigation Group (GANG), History of Air Navigation Group (HANG), Civil and Military Air Group (CMAG), Marine Traffic & Navigation Group (MT&NG), Small Craft Group (SCG), Space Group (Space), Animal Navigation Group (ANG) and Research & Development Group (R&D).

The Institute publishes *The Journal of Navigation* six times a year. It contains papers which have been presented at meetings, other original papers and selected papers and reports from Special Interest Groups. The Institute also publishes *Navigation News* six times a year which contains a full account of the Institute's proceedings and activities. This includes Branch News, a record of current navigational work, a diary of events, topical articles, news about Membership and advertising. A great deal of the Institute's work is international in character and is coordinated with that of similar organisations in other countries.

Membership

There are nine classes of membership under which individuals or organisations may apply to join the Institute. Details of the various membership criteria and current subscriptions are available on the RIN website (Home / Join the RIN / Membership Types http://www.rin.org.uk/general.aspx?ID=59) and from the Membership Secretary (membership@rin.org.ukTel: +44(0)20 7591 3130 Fax: 44(0)20 7591 3131).

- (1) Ordinary Membership
- (2) Associate Membership
- (3) Associate Fellow Membership
- (4) Student Membership
- (5) Junior Associate Membership
- (6) Corporate Membership
- (7) Small Business Membership
- (8) Affiliate College University Membership
- (9) Affiliate Club Membership

Additional membership classes of Fellowship, Honorary Fellowship, Retired Membership and Affiliate Membership also exist and details are available from the Membership Secretary.

The subscription price (excluding VAT) to The Journal (ISSN 0373–4633) for Volume 73, 2020, which includes print and electronic access, is £701 (USA, Canada and Mexico US \$1265) and includes delivery by air; single parts are available at £127 (USA, Canada and Mexico US \$229) plus postage. The electronic-only price available to institutional subscribers is £543 (USA, Canada and Mexico US \$990). 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, UPH, Shaftesbury Road, Cambridge CB2 8BS, or in the USA, Canada and Mexico to Cambridge University Press, Journals Fulfillment Department, 1 Liberty Plaza, Floor 20, New York, NY 10006, USA. Japanese prices for institutions are available from Kinokuniya Company Ltd, P.O. Box 55, Chitose, Tokyo 156, Japan.

© 2020 The Royal Institute of Navigation Printed in Great Britain by Bell & Bain Ltd, Glasgow.

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.

THE JOURNAL OF NAVIGATION

VOLUME 73 • NUMBER 6 • NOVEMBER 2020

CONTENTS

Navigating Through Pandemic: The Use of Positioning Technologies Anahid Basiri	1179
An Improved Fingerprint Algorithm with Access Point Selection and Reference Point Selection Strategies for Indoor Positioning Changgeng Li, Hui Huang and Bowen Liao	1182
A Computation Effective Range-Based 3D Mapping Aided GNSS with NLOS Correction Method Hoi-Fung Ng, Guohao Zhang and Li-Ta Hsu	1202
Frequency Domain Design Method of Wavelet Basis Based on Pulsar Signal Sihai You, Hongli Wang, Yiyang He, Qiang Xu and Lei Feng	1223
Performance Evaluation of Maritime Search and Rescue Missions Using Automatic Identification System Data Fan Zhou, Hua Chen and Peng Zhang	1237
An A*-based Bacterial Foraging Optimisation Algorithm for Global Path Planning of Unmanned Surface Vehicles Yang Long, Zheming Zuo,Yixin Su, Jie Li and Huajun Zhang	1247
Design of a Low Earth Orbit Satellite Constellation Network for Air Traffic Surveillance Jianming Guo, Lei Yang, Quan Chen, Sunquan Yu, Xiaoqian Chen and Yong Zhao	1263
Impact of New GPS Signals on Positioning Accuracy for Urban Bus Operations Mireille Elhajj and Washington Ochieng	1284
Dynamic Collision Avoidance Algorithm for Unmanned Surface Vehicles via Layered Artificial Potential Field with Collision Cone Xinli Xu,Wei Pan,Yubo Huang and Weidong Zhang	1306
Differential Timing Method Based on Modified Traceability Model Ying Liu,Wenhai Jiao, Longxia Xu and Xiaohui Li	1326
Causal Factors and Symptoms of Task-Related Human Fatigue in Vessel Traffic Service: A Task-Driven Approach Fan Li, Chun-Hsien Chen, Gangyan Xu, Danni Chang and Li Pheng Khoo	1340
Research on Real-Time Obstacle Avoidance Planning for an Unmanned Surface Vessel based on the Grid Cell Mechanism Yun Li and Jian Zheng	1358
Maximum Ratio Principle-Based Estimation of Difference Inter-System Bias Zihan Peng, Chengfa Gao and Rui Shang	1372







