

THE AERONAUTICAL JOURNAL

Covering all aspects of aerospace

Volume 117 Number 1194

August 2013



ROYAL
AERONAUTICAL
SOCIETY

THE AERONAUTICAL JOURNAL

Editor-in-chief: Prof Peter Bearman

Associate Editors

Chairman: Prof Mike Graham

Professor David Allerton
University of Sheffield

Professor Chris Atkin
City University, London

Professor Holger Babinsky
University of Cambridge

Professor Ken Badcock
University of Liverpool

Professor Rene de Borst
University of Glasgow

Dr Trevor Birch
DSTL

Wg Cdr Mike Bratby
RAeS Air Power Group

Professor Richard Brown
University of Strathclyde, Glasgow

Professor Jonathan Cooper
University of Bristol

Professor Laurent Dala
Witwatersrand University, Johannesburg SA

Professor Dimitris Drikakis
Cranfield University

Professor Brian Falzon
Queen's University, Belfast

Mr Chris Fielding
BAE Systems, Warton

Professor Victor Giurgiutiu
University of South Carolina

Dr John Green
Consultant Chief Scientist, ARA

Professor Ismet Gursul
University of Bath

Professor Keith Hayward
RAeS Head of Research

Professor Li He
University of Oxford

Professor Michael Henshaw
Loughborough University

Professor Richard Hillier
Imperial College, London

Dr M R Nayak
National Aerospace Laboratories, India

Professor Gareth Padfield
University of Liverpool

Professor Ning Qin
University of Sheffield

Dr Arthur Richards
University of Bristol

Professor Shahrokh Shahpar
Rolls-Royce, Derby

Professor Howard Smith
Cranfield University

Professor Marilyn Smith
Georgia Institute of Technology, USA

Professor Constantinos Soutis
University of Manchester

Professor Anthony Waas
University of Michigan, USA

Aims and scope

The aims and scope of The Aeronautical Journal are intended to reflect the objectives of the Royal Aeronautical Society as expressed in its Charter of Incorporation. Briefly, these are to encourage and foster the advancement of all aspects of aeronautical and space science. Thus the topics of The Aeronautical Journal include most of those covered by the various Specialist Groups of the Society, which include:

Aircraft design, aerodynamics, air law, air power, air transport, air navigation, airworthiness and maintenance, aviation medicine, avionics and systems, environmental issues, flight operations, flight simulation, fluid dynamics, fluid mechanics, general aviation, guided flight, human factors, human powered flight, light aviation, management studies, propulsion, rotorcraft, safety, space, structures and materials, structural mechanics, systems and test procedures and UAVs.

Papers are therefore solicited on all aspects of research, design and development, construction and operation of aircraft and space vehicles. Papers are also welcomed which review, comprehensively, the results of recent research developments in any of the above topics.

We recognise the inhibiting pressures of time and confidentiality and acknowledge that many of the design testing, manufacturing and operational problems that industry has to solve contain important information for the whole aerospace community. The Aeronautical Journal provides a platform for refereeing and presenting your work to an international audience.

Papers will be considered for publication in The Aeronautical Journal if they meet the terms and conditions listed in The Instructions for authors. If these are not met, the Editor reserves the right to withdraw the paper without redress, which may be at any time up to publication.

**Papers should be sent to: Prof Peter Bearman, Royal Aeronautical Society, No.4 Hamilton Place,
London W1S 1BQ, United Kingdom or peter.davis@aerosociety.com**



CONTENTS

Volume 117 Number 1194

August 2013

- T.J. Tipnis, M.V. Finnis, K. Knowles and D. Bray**
Density measurements for rectangular free jets using background-oriented schlieren 771
- R.S. Félix Patrón, R.M. Botez and D. Labour**
New altitude optimisation algorithm for the flight management system CMA-9000 improvement on the A310 and L-1011 aircraft 787
- G. Mengali and A.A. Quarta**
Constrained large angle reorientation manoeuvres of a space telescope using potential functions and a variable control gain 807
- A.J. Irwin and P.M. Render**
The influence of simulated missile warhead fragment damage on the aerodynamic characteristics of two-dimensional wings 823
- A.R. Babaei, M. Mortazavi and M.B. Menhaj**
Robust and computational efficient autopilot design: A hybrid approach based on classic control and genetic-fuzzy sliding mode control 839
- Book reviews** 861

The new Aeronautical Journal Manuscript Management system

The Aeronautical Journal now operates an online Manuscript Management System (MMS) which processes manuscripts from receipt to print. Authors must now submit their manuscripts directly to us through our website to be considered for review and publication. The whole manuscript review process including revisions is now carried out via our user-friendly online manuscript processing system. Papers now will only be considered for publication if they have been submitted through the MMS.

We hope this new automated system will lead to a speedier and more efficient way of reviewing manuscripts.

Manuscripts should be submitted at: <http://www.edmgr.com/aeroj> where easy-to-follow instructions will guide you through the process.

Front Cover: An artist's illustration of the Chandra X-ray Observatory. (NASA)



**ROYAL
AERONAUTICAL
SOCIETY**

Editor-in-Chief

Professor Peter Bearman

Publishing Manager

Chris Male

Production Editor

Wayne J Davis

Publications Officer

Annabel L Hallam

Production

Bill Read

Tim Robinson

Book Review Editor

Brian Riddle

Publisher

Royal Aeronautical Society (RAeS)

No.4 Hamilton Place

London W1J 7BQ, UK

Tel: +44 (0)20 7670 4300

Fax: +44 (0)20 7670 4309

email: publications@aerosociety.com

<http://www.aerosociety.com>

RAeS Chief Executive

Simon Luxmoore

Subscriptions

Non-members

Annual subscription (12 issues) £436, Single copies, including back issues £39; Non-member subscription orders are available from; Royal Aeronautical Society, Publications Subscriptions Department, Dovetail Services Ltd, 800 Guillat Avenue, Kent Science Park, Sittingbourne, Kent ME9 8GU, UK.

Tel: +44 (0)844 848 8426, Fax: +44 (0)844 856 0650, email: ras@servicehelpline.co.uk

RAeS members

Annual subscription (12 issues) £75, Single copies, including back issues £6.80; member subscription orders are available from; Membership Department, Royal Aeronautical Society, No.4 Hamilton Place, London W1J 7BQ, UK.

Tel: +44 (0)20 7670 4300, Fax: +44 (0)20 7670 4309, email: membership@aerosociety.com

RAeS Conference Proceedings

Details, price and availability of Royal Aeronautical Society Conference Proceedings can be obtained from; RAeS Conference and Events Department, No.4 Hamilton Place, London W1J 7BQ, UK. Tel: +44 (0)20 7670 4300, email: conference@aerosociety.com or via www.aerosociety.com/proceedings

Reproduction of any of the papers published in this journal is not permitted without the written consent of the Editor.

The content does not necessarily express the opinion of the Council of the Royal Aeronautical Society.

The Royal Aeronautical Society is a registered charity: No 313708

Advertisement Sales

Emma Bossom

+44 (0)20 7670 4342

emma.bossom@aerosociety.com

Printer

Buxton Press Limited

Palace Road

Buxton

Derbyshire SK17 6AE

UK

ISSN: 0001-9240

Published monthly

**All papers are available to view free of charge for subscribers and to purchase by others at:
www.aerosociety.com/news/publications/aero-journal**