

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 Cambridge

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
University of the Witwatersrand, 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

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 John Stollery
Cranfield University

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 W1J 7BQ, United Kingdom or wayne.davis@aerosociety.com



CONTENTS

Volume 117 Number 1189

March 2013

P. Perfect and A.W. Gubbels

Rotorcraft simulation fidelity: new methods for quantification and assessment 235

Y. Liu

Assessment of surface roughness for a 'silent' aircraft 283

R.M. Ajaj, M.I. Friswell, W.G. Dettmer, A.T. Isikveren and G. Allegri

Roll control of a MALE UAV using the adaptive torsion wing 299

A. García Naranjo, I. Cowling, J.A. Green and N. Qin

Aerodynamic performance benefits of utilising camber morphing wings for unmanned air vehicles 315

P.O. Jemitola, G. Monterzino and J. Fielding

Wing mass estimation algorithm for medium range box wing aircraft 329

Front Cover: The Cambridge University and the Massachusetts Institute of Technology (MIT)
SAX-40 concept design from the the 'Silent' Aircraft Initiative. (© 2006 Cambridge-MIT Institute)



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
e-mail: 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

Wyndeham Gait Ltd
Victoria Street
Grimsby
Lincolnshire
DN31 1PY

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**