THE AERONAUTICAL JOURNAL

Covering all aspects of Aerospace

Volume 115 Number 1174

December 2011



2010 RAeS 2nd Aircraft Structural Design Conference A Special Issue



THE AERONAUTICAL JOURNAL

Editor-in-chief: Prof Peter Bearman

Associate Editors

Chairman: Prof Mike Graham

Professor Chris Atkin	Professor Holger Babinsky	Professor Ken Badcock	Professor Rene de Borst
City University, London	University of Cambridge	University of Liverpool	Eindhoven University of Technology
Dr Trevor Birch	Wg Cdr Mike Bratby	Professor Richard Brown	Professor Jonathan Cooper
DSTL	RAeS Air Power Group	University of Strathclyde, Glasgow	University of Liverpool
Mr Anthony Cross	Professor Laurent Dala	Professor Glyn Davies	Professor Dimitris Drikakis
BAE Systems, Warton Uni	versity of the Witwatersrand, Johannest	burg Imperial College, London	Cranfield University
Mr Chris Fielding BAE Systems, Warton Professor V University of	ictor Giurgiutiu South Carolina Professor Ism University	net Gursul Dr John Greer of Bath Consultant Chief Scient	n Professor Keith Hayward ist, ARA RAeS Head of Research
Professor Michael J de C Henshaw	Professor Richard Hillier	Dr John Loizou	Professor Ken Morgan
Loughborough University	Imperial College, London	VEGA Space	Swansea University
Dr Ravi Nayak	Professor Gareth Padfield	Professor Shahrokh Shahpar	Dr Howard Smith
National Aerospace Laboratories, Indi	a University of Liverpool	Rolls-Royce	Cranfield University
Professor Marilyn Smith	Professor Constantinos Soutis	Professor John Stollery	Professor Anthony Waas
Georgia Institute of Technology	University of Sheffield	Cranfield University	University of Michigan

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

Subscriptions

Non-members

Annual subscription (12 issues) £399, Single copies, including back issues £36; 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) £69, Single copies, including back issues £6; 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

All papers are available to view free of charge for subscribers and to purchase by others at: www.aerosociety.com

iii



CONTENTS

Volume 115 Number 1174

Editorial	IV
R. De Breuker, M. Abdalla and Z. Gürdal Design of morphing winglets with the inclusion of nonlinear aeroelastic effects	713
A. March, K. Willcox and Q. Wang Gradient-based multifidelity optimisation for aircraft design using Bayesian model calibration	729
C. Hannon, O.M. Querin and V.V. Toropov A neuro-fuzzy approach to the weight estimation of aircraft structural components	739
S. Mistry, M. R. Mofakhami and J. Pinsonnault Evolving fuselage designs by incorporating SHM technologies	749
M. Bolinches, A.J. Keane, A.I.J. Forrester, J.P. Scanlan and K. Takeda Design, analysis and experimental validation of a morphing UAV wing	761
M. Y. Harmin and J. E. Cooper Aeroelastic behaviour of a wing including geometric nonlinearities	767
M. van Tooren, C. Kasapoglou and H. Bersee Composite materials, composite structures, composite systems	779
A. Velicki and P. Thrash Damage arrest design approach using stitched composites	789
Index to Volume 115	796

New Format

Please note that from next month, we will be altering the size and look of *The Aeronautical Journal*. We hope the new smaller A5 sized *Aeronautical Journal* will be easier to read and handle both in printed and electronic form. There will be no reduction in the quantity of papers and book reviews published.

Front Cover: A C-130J Super Hercules on the Lockheed Martin production line. (© Lockheed Martin)

www.fsc.org Cert no. TT-COC-002794 © 1996 Forest Stewardship Council

FSC