Thank You! Corporate and Sustaining Members of the Aerospace Medical Association

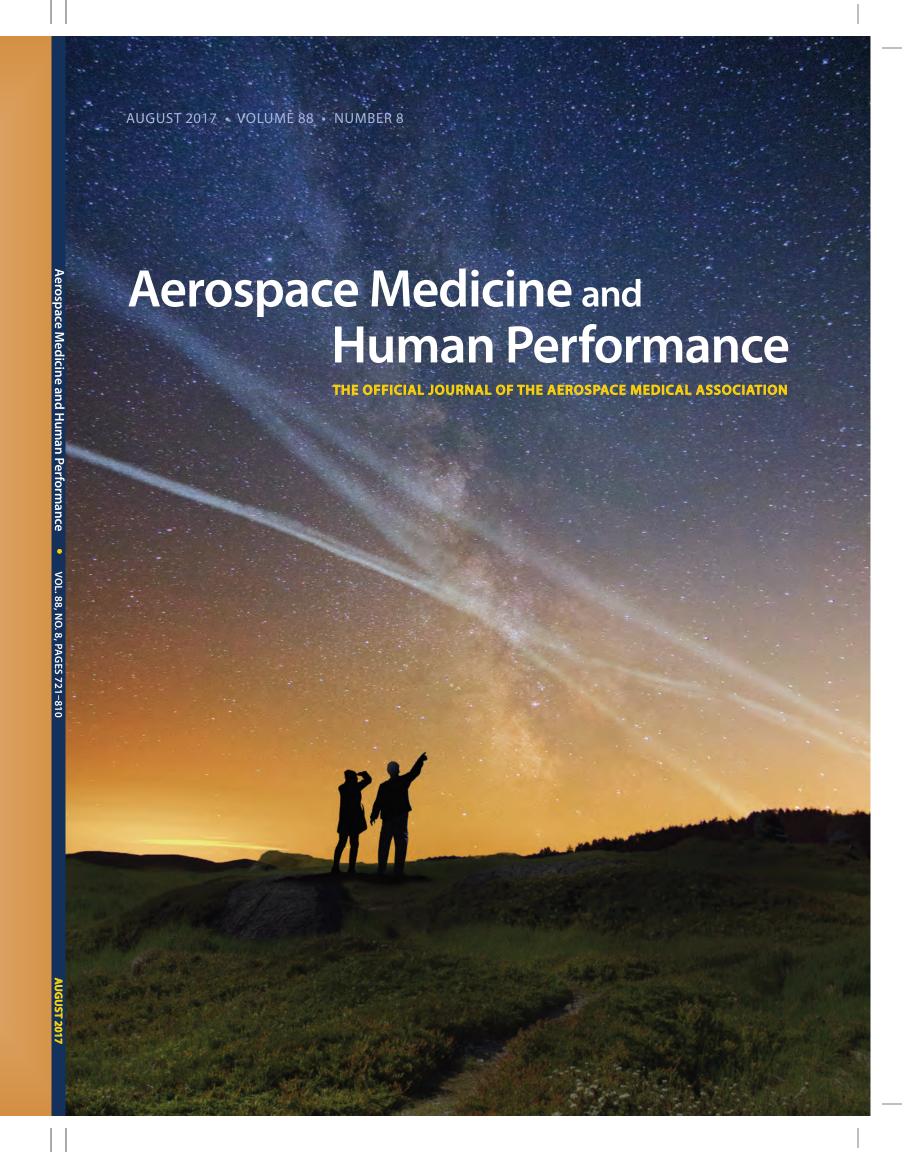
Now in Our 88th Year!



The financial resources of individual members alone cannot sustain the Association's pursuit of its broad international goals and objectives. Our 88-year history is documented by innumerable medical contributions toward flying health and safety that have become daily expectations by the world's entire flying population—commercial, military, and private aviation. However, support from private and industrial sources is essential. The following organizations, who share the Association's objectives or have benefitted from its past or current activities, have affirmed their support of the Association through Corporate Membership.

Adams Advanced Aero Technology Aerospace Medical, PLC Aerospace Medicine Residency Program, UTMB Aircraft Owners and Pilots Association **Armed Forces Benefit** Association Aviation Medicine Advisory Service Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health David Clark Company, Inc. Education Enterprises, Inc.

Environics, Inc. **Environmental Tectonics** Corporation GO₂ Altitude Human Solutions of North America, Inc. Indonesian Association of Aerospace Medicine InoMedic Health Applications, Inc. (IHA) **KBRwyle** Mayo Clinic Monash University, Aviation Medicine Unit Neurostat Analytical Solutions, LLC Pilot Medical Solutions South African Airways



Aerospace Medicine and Human Performance

AUGUST 2017 VOLUME 88 NUMBER 8 [ISSN 2375-6314 (print); ISSN 2375-6322 (online)]

This journal, representing the members of the Aerospace Medical Association, is published for those interested in aerospace medicine and human performance. It is devoted to serving and supporting all who explore, travel, work, or live in hazardous environments ranging from beneath the sea to the outermost reaches of space.

EDITOR-IN-CHIEF

FREDERICK BONATO, PH.D.

E-mail: amhpjournal@asma.org

ASSISTANT TO THE EDITOR

DEBRA SVENTEK, B.S.Office: (703) 739-2240, x103

E-mail: amhpjournal@asma.org

MANAGING EDITOR

PAMELA C. DAY, B.A.

Office: (703) 739-2240, ext. 101 E-mail: pday@asma.org

ASSISTANT TO THE MANAGING EDITOR

RACHEL TRIGG, B.A.

Office: (703) 739-2240, ext. 102

E-mail: rtrigg@asma.org

EDITORIAL OFFICE 320 S. Henry St.

320 S. Henry St. Alexandria, VA 22314-3579

ASSOCIATE EDITORS

Clinical Aerospace Medicine:

Jan Stepanek, M.D., M.P.H.

Space Medicine:

Michael R. Barratt, M.D.

Resident Case Reports:

Richard A. Allnutt, M.D.

EDITORIAL BOARD Michael Bagshaw, M.B., Ch.B. Andrew H. Bellenkes, Ph.D. Rebecca Blue, M.D., M.P.H. Eilis A. Boudreau, M.D., Ph.D. Jay C. Buckey, M.D. Bob Cheung, Ph.D. Malcolm Cohen, Ph.D. Victor A. Convertino, Ph.D. Mary Anne Frey, Ph.D. Mitchell A. Garber, M.D., M.S.M.E. David Gradwell, Ph.D., M.B., B.S. Raymond E. King, Psy.D., J.D. Matthew E. Lewis, M.D. David Newman, M.B., B.S., Ph.D. Ries Simons, M.D. James M. Vanderploeg, M.D., M.P.H. Dougal Watson, M.B., B.S

AEROSPACE MEDICAL ASSOCIATION is an organization devoted to charitable, educational, and scientific purposes. The Association was founded when the rapid expansion of aviation made evident the need for physicians with specialized knowledge of the flight environment. Since then, physicians have been joined in this Association by professionals from many fields and from many countries, all linked by a common interest in the health and safety of those who venture into challenging environments.

AEROSPACE MEDICINE AND HUMAN PERFORMANCE, formerly *Aviation, Space, and Environmental Medicine,* is published monthly by the Aerospace Medical Association, a non-profit charitable, educational, and scientific organization of physicians, physiologists, psychologists, nurses, human factors and human performance specialists, engineers, and others working to solve the problems of human existence in threatening environments on or beneath the Earth or the sea, in the air, or in outer space. The original scientific articles in this journal provide the latest available information on investigations into such areas as changes in ambient pressure, motion sickness, increased or decreased gravitational forces, thermal stresses, vision, fatigue, circadian rhythms, psychological stress, artificial environments, predictors of success, health maintenance, human factors engineering, clinical care, and others. This journal also publishes notes on scientific news and technical items of interest to the general reader, and provides teaching material and reviews for health care professionals.

MEMBERSHIP—The Aerospace Medical Association welcomes members interested in aerospace medicine and human performance. Membership applications may be obtained online at www.asma.org or from the Aerospace Medical Association's headquarters at 320 S. Henry Street, Alexandria, VA 22314, or phone the Membership Department at (703) 739-2240; gcarter@asma.org or skildall@asma.org.

SUBSCRIPTIONS—Aerospace Medicine and Human Performance is provided to all members of the Aerospace Medical Association (in print, online, or both). Subscriptions and changes of address should be sent to the Subscription Department, Aerospace Medicine and Human Performance, 320 S. Henry Street, Alexandria, VA 22314, at least 90 days in advance of change. Institutional Subscription Rates (including online version; other options available): U.S.-\$315, Canada-\$330, Other countries-\$365 (includes air delivery); Agent Disc. \$20. Individual Subscription Rates (Print and Online): U.S.-\$270, Canada-\$285, Other countries-\$310 (includes air delivery). Single copies and back issues: \$30+P/H (\$7.50 U.S./\$25 International Air). NOTE TO INTERNATIONAL SUBSCRIBERS: Please add \$50 for bank handling charges on checks not drawn on U.S. banks.

ADVERTISING—Contracts, Insertion Orders, and Ad Materials (except Inserts): *Aerospace Medicine and Human Performance*, c/o Kris Herlitz, AIM Group International Inc., 2 Park Ave., Fl 20, New York, NY 10016-9301; M: 914-424-4247; K.Herlitz@aimgroupinternational.com; www.aimgroupinternational.com. Copy deadline: 10th of second month before date of issue. Inserts: *Aerospace Medicine and Human Performance*, c/o The Sheridan Press, 450 Fame Ave., Hanover, PA 17331.

Aerospace Medicine and Human Performance [ISSN 2375-6314 (print); ISSN 2375-6322 (online)], is published monthly by the Aerospace Medical Association, 320 S. Henry St., Alexandria, VA 22314-3579. Periodicals postage paid at Alexandria, VA, and at additional mailing offices. POST-MASTER: Send address changes to Aerospace Medicine and Human Performance 320 S Henry St., Alexandria, VA 22314-3579. Phone (703) 739-2240. Printed in U.S.A. CPC Int'll Pub Mail #0551775.

The journal Aerospace Medicine and Human Performance does not hold itself responsible for statements made by any contributor. Statements or opinions expressed in the Journal reflect the views of the authors(s) and not the official policy of the Aerospace Medical Association, unless expressly stated. While advertising material is expected to conform to ethical standards, acceptance does not imply endorsement by the Journal. Material printed in the Journal is covered by copyright. No copyright is claimed to any work of the U.S. government. No part of this publication may be reproduced or transmitted in any form without written permission.