

International Specialists Meeting on Unmanned Rotorcraft 2009

**Phoenix, AZ
20-22 January 2009**

ISBN: 978-1-61567-006-2

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2009) by the American Helicopter Society International
All rights reserved.

Printed by Curran Associates, Inc. (2009)

For permission requests, please contact the American Helicopter Society International
at the address below.

American Helicopter Society International
217 N. Washington Street
Alexandria, VA 22314-2538

Phone (703) 684-6777
Fax: (703) 739-9279

staff@vtol.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

SESSION 1 – INVITED SPEAKERS

US Army Aviation S&T for the Future	1
<i>James R. Snider</i>	
Future Vertical Lift (FVL) Capabilities Based Assessment	16
<i>James Durham</i>	
UAS - PEO Aviation Update	27
<i>Layne Merritt</i>	
Unmanned Aircraft Capabilities for the Future	52
<i>Steven W. Kihara</i>	
Unmanned Aircraft Program Office, Current Activities	74
<i>George Salmons</i>	
Autonomous Air System Technologies Development at the Army Research Laboratory	94
<i>Mark W. Nixon</i>	

SESSION 2 – INVITED SPEAKERS

Applications of Intelligent Autonomy Technologies to Improved UAV Reliability and Sense and Avoid Operations in Uncontrolled Airspace	117
<i>Robert M. Williams</i>	
Cargo Unmanned Aerial System for Battlefield Logistic Support and Casualty Evacuation	161
<i>Rafi Yoeli</i>	
The Necessary Role for VTOL Micro Air Vehicles (MAVs) In Advancement of Micro Autonomous Systems & Technology (MAST)	177
<i>Daniel P. Schrage, Mark Costello, Eric Beyer</i>	
Autonomous Helicopter Research at the Army Aeroflightdynamics Directorate	223
<i>Matthew S. Whalley</i>	
MAV Program Overview	244
<i>Vaughn Fulton</i>	
A160T System Maturation for Military Missions	254
<i>M. J. Adriams, David Paul, Ben Ingram, Brad P. Gupta</i>	
Lessons Learnt from the ReSSaC Project: First Results from the SPIDER Project Towards Safe VTOL UAV Operations in Various Environments	281
<i>Patrick Fabiani, Yoko Watanabe, Guy Le Besnerais, Martial Sanfourche, Vincent Furtés, Roger Mampey, Alain Piquereau</i>	

TECHNICAL SESSION 3 – CONTROL AND AUTONOMY

On Flight Path Control of an Unmanned Helicopter in Forward Flight using an Optimal Inner Loop with Body Frame Velocities	315
<i>J. Benton Derrick, J. Michael Spires</i>	

Vision-Augmented Inertial Navigation by Sensor Fusion for an Autonomous Rotorcraft Vehicle	324
<i>Carlo L. Bottasso, Domenico Leonello</i>	
Unmanned Little Bird Command and Control	335
<i>J. Graham, D. Caldwell, G. Dockter, D. Cerchie</i>	
Feasibility Studies for VTOL UAV Autonomous Operations with the Possibility of Shipboard Auto Recovery	339
<i>Bernard Ferrier, John Duncan, David Ludwig, Fu Chen</i>	
Aggressive Maneuvering for Obstacle Avoidance with Envelope Protection for Autonomous UAVs	351
<i>Jongki Moon, J. V. R. Prasad</i>	
Local Terrain Mapping for Obstacle Avoidance using Monocular Vision	360
<i>Sean Quinn Marlow, Jack W. Langelaan</i>	
Ground Based Sense and Avoid (GBSAA) Technology to Enable Unmanned Aircraft Flights in the U.S. National Airspace at Night	380
<i>John A. Wade, M. Viva Austin</i>	

TECHNICAL SESSION 4 – MICRO AIR VEHICLES

Development of Closed Loop Flight Control for a Shrouded Rotor Micro Air Vehicle with Anti-Torque Vanes	395
<i>Vikram Hrishikeshavan, Inderjit Chopra</i>	
Experiments on the Optimization of MAV-Scale Cycloidal Rotor Characteristics Towards Improving Their Aerodynamic Performance	410
<i>Moble Benedict, Manikandan Ramasamy, Inderjit Chopra, J. Gordon Leishman</i>	
Numerical Study of the Effects of Leading and Trailing Edge Geometries and Planform on Micro Hovering Rotor	430
<i>Vinod K. Lakshminarayan, James D. Baeder</i>	
Mechanical Samara Deployment and Passive Distribution by a Fixed Wing Unmanned Air Vehicle	453
<i>Evan R. Ulrich, Darryll J. Pines, Cyrus Abdollahi, Joe Park</i>	
Numerical Methods for the Aeromechanical Design of Flapping Wing Hovering MAVs	462
<i>G. R. Whitehouse, T. R. Quackenbush, A. H. Boschtisch, J. D. Keller</i>	
Understanding Insect-Based Flapping Flight from a Micro Air Vehicle Perspective	480
<i>Pranay Seshadri, Moble Benedict, Inderjit Chopra</i>	

TECHICAL SESSION 5 – DESIGN AND TESTING

Unmanned Little Bird Testing Approach	496
<i>Mark Hardesty, David Guthrie, Dino Cerchie</i>	
Conceptual Design of a Ducted Fan-Based Vertical Takeoff and Landing Tactical Unmanned Aerial Vehicle	508
<i>Jonathan D. Keith, Ryan S. Wood</i>	
The A160T VTOL UAS: Payload Integration, and Operational Experimentation	N/A
<i>Thomas K. Berger, Brad Gupta</i>	
Unmanned Little Bird Analytic Tools	518
<i>J. Graham, H. Tadghighi, D. Caldwell, D. Cerchie</i>	

**Design Analysis of Pericyclic Variable-Speed Transmission System for a 600 HP Class
Unmanned Rotorcraft**.....529
Zihni B. Saribay, Edward C. Smith, Robert C. Bill, Suren Rao, Kon-Well Wang

Author Index