

# **29th AIAA Applied Aerodynamics Conference 2011**

**Honolulu, Hawaii, USA  
27-30 June 2011**

**Volume 1 of 4**

**ISBN: 978-1-61839-168-1**

**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.**

The contents of this work are copyrighted and additional reproduction in whole or in part are expressly prohibited without the prior written permission of the Publisher or copyright holder. The resale of the entire proceeding as received from CURRAN is permitted.

For reprint permission, please contact AIAA's Business Manager, Technical Papers. Contact by phone at 703-264-7500; fax at 703-264-7551 or by mail at 1801 Alexander Bell Drive, Reston, VA 20191, USA.

# TABLE OF CONTENTS

Volume 1

<b>A Heuristic Approach to Dynamic Design Space Definition for NLF Aerofoil Optimisation</b> .....	1
<i>Richard McRoberts, Juiana Early, Lee Cameron, Stephen Spence</i>	
<b>Metamodel Assisted Multi-Objective Global Optimisation of Natural Laminar Flow Aerofoils</b> .....	21
<i>Lee Cameron, Juiana Early, Richard McRoberts</i>	
<b>Comparison of Parameter Tuning Strategies for RBF Surrogate Models with Adaptive Sampling</b> .....	33
<i>Thomas Mackman, Christian Allen</i>	
<b>A Full Navier-Stokes Based Optimal Design of Bleed Flow for Supersonic Inlets</b> .....	47
<i>May-Fun Liou</i>	
<b>Integrative Design Loop for the Preliminary Study of a Suborbital Transportation System</b> .....	64
<i>P. Wilhelm, P. Leyland, P. Jaussi, R. Wiesendanger, A. Ivanov, L. Gathier, P. Coue, F. Lemaingue, P. Da Silva Passos</i>	
<b>A Method to Predict Deep Stall</b> .....	81
<i>Willem Anemaat, Balaji Kaushik, Ken Po</i>	
<b>Numerical Simulations of Turbulent Flow over a High-Lift Configuration</b> .....	107
<i>Alexandre Antunes, Joao Luiz Azevedo, Ricardo Da Silva</i>	
<b>A Discrete Vortex Method Application to High Angle of Attack Maneuvers</b> .....	124
<i>P. Hammer, A. Altman, F. Eastep</i>	
<b>CFD Computations for a Generic High-Lift Configuration Using TetrUSS</b> .....	137
<i>M. Pandya, K. Abdol-Hamid, E. Parlette</i>	
<b>Influence of Transition on High-Lift Prediction with the NASA Trap Wing Model</b> .....	158
<i>Peter Eliasson, Ardeshir Hanifi, Shia-Hui Peng</i>	
<b>Airfoil Flow Analysis of a High Lift System with the Vortex Blob Method</b> .....	170
<i>Carmine Golia, Antonio Viviani</i>	
<b>Viscous Flow Analysis of a Twin-engine Commercial Transport Aircraft in High Lift Landing Configuration</b> .....	182
<i>R. Ranjan, A. Khare, S. Shah, K. Nikam, A. Moitra</i>	
<b>Analysis of Landing Phase of Rocket Based Combined Cycle Model in Subsonic Conditions</b> .....	196
<i>Martiqua Post, Jacob Ricks, Adrian Ramos, Barry Hellman</i>	
<b>Comparison of Ares I-X Wind-Tunnel Derived Buffet Environment with Flight Data</b> .....	215
<i>David Piatak, Martin Sekula, Russ Rausch</i>	
<b>Lateral-Directional Parameter Estimation on the X-48B Aircraft Using an Abstracted Multi-Objective Effector Model</b> .....	240
<i>Nalin Ratnayake, Erin Waggoner, Brian Taylor</i>	
<b>Ares I-X Fluctuating Pressure Predictions and Comparison to Flight: Data Processing Techniques and Observations</b> .....	257
<i>R. Williams, S. McCall, J. Brekke, D. Knox, B. Prock, M. Smith</i>	
<b>Wall Interference Analysis of Transonic Wind Tunnel with Porous Wall Model</b> .....	267
<i>Atsushi Hashimoto, Masataka Kohzai, Takashi Aoyama, Mitsuhiro Murayama</i>	
<b>Grid Fin Stabilization of the Orion Launch Abort Vehicle</b> .....	281
<i>D. Pruzan, M. Mendenhall, W. Rose, D. Schuster</i>	
<b>An Investigation into a Non-Axisymmetric Tension Shell Decelerator Concept via a Computational Design Procedure</b> .....	298
<i>Vladimir Gidzak, Graham Candler</i>	
<b>A Steady Aeroelastic Analysis of an Unmanned Combat Aircraft Vehicle Conceptual Design</b> .....	309
<i>Guido Voss, Sunpeth Cummuntip, Jens Neumann</i>	
<b>Coupled Aeroelastic Vortex Lattice Modeling of Flexible Aircraft</b> .....	320
<i>N. Nguyen, K. Trinh, S. Frost, K. Reynolds</i>	
<b>Tightly Coupled CFD/Multibody Analysis of Flapping-Wing Micro-Aerial Vehicles</b> .....	346
<i>Pierangelo Masarati, Marco Morandini, Giuseppe Quaranta, Dominic Chandar, Beatrice Roget, Jayanaryanan Sitaraman</i>	
<b>Parametric Study of a Two-dimensional Membrane Wing in Viscous Laminar Flow</b> .....	364
<i>Sonya Tiomkin, Daniella Raveh, Rimon Arieli</i>	
<b>Experimental Investigation of Coupled Heave/Pitch Oscillations in Transonic Flow</b> .....	387
<i>Axel Hartmann, Michael Klaas, Wolfgang Schröder</i>	
<b>Aero-Structural Performance of Multiplane Wind Turbine Blades</b> .....	399
<i>Richard Wirz, Perry Johnson</i>	

<b>Virtual Fly-Out Simulations of a Spinning Projectile from Subsonic to Supersonic Speeds</b> .....	414
<i>Jubaraj Sahu</i>	
<b>CFD and Parametric Study on a 155 mm Artillery Shell Equipped with a Roll-decoupled Course Correction Fuze</b> .....	429
<i>Nicolas Hamel, Eric Gagnon</i>	
<b>Numerical Prediction of Pitch Damping Stability Derivatives for Finned Projectiles</b> .....	439
<i>Vishal Bhagwandin, Jubaraj Sahu</i>	
<b>A Comprehensive Approach to Cataloging Missile Aerodynamic Performance using Surrogate Modeling Techniques and Statistical Learning</b> .....	460
<i>Mark Carpenter, R. Hartfield, John Burkhalter</i>	
<b>Navier-Stokes Predictions of Aerodynamic Coefficients and Dynamic Derivatives of a 0.50-cal Projectile</b> .....	474
<i>Sidra Silton</i>	
<b>Factors Affecting Reaction Jet Interaction Effects on Projectiles</b> .....	491
<i>James Despirito</i>	
<b>USNA Ship Air Wake Program Overview (Invited)</b> .....	513
<i>M. Snyder, H. Kang, C. Brownell, L. Luznik, D. Miklosovic, J. Burks, C. Wilkinson</i>	
<b>USNA Contributions to US Navy Aircraft/Store Integration (Invited)</b> .....	525
<i>E. Hallberg, M. Snyder, A. Cenko</i>	
<b>Ship Air Wake Wind Tunnel Test Results (Invited)</b> .....	534
<i>D. Miklosovic, H. Kang, M. Snyder</i>	
<b>Ship Air Wake CFD Comparisons to Wind Tunnel and YP Ship Results (Invited)</b> .....	556
<i>F. Roberson, H. Kang, M. Snyder</i>	
<b>Effects of the Litening and ATFLIR External Targeting Pods on F/A-18C Hornet Weapons Release (Invited)</b> .....	579
<i>S. Simpson, M. Snyder, A. Cenko</i>	
<b>Litening Pod Modification to Improve Mk-83 Store Trajectories (Invited)</b> .....	587
<i>M. Shea, M. Constantino, C. O'Brien, M. Snyder, S. Simpson, A. Cenko</i>	
<b>Strut Effects on Store Freestream Aerodynamics</b> .....	594
<i>M. Snyder, R. Shah, C. O'Brien, N. Davis, J. Metzger, R. Nordlund, M. Smith, A. Cenko</i>	
<b>Aerodynamic and Aeroacoustic Wind Tunnel Testing of the Orion Spacecraft</b> .....	605
<i>James Ross, G. Brauckmann</i>	
<b>Flight Reynolds Number Testing of the Orion Launch Abort Vehicle in the NASA Langley National Transonic Facility (Invited)</b> .....	624
<i>D. Chan, G. Brauckmann</i>	
<b>Validation of Computational Fluid Dynamics Analysis Methods on the Orion Launch Abort Vehicle (Invited)</b> .....	661
<i>M. McMullen, R. Childs, P. Stremel, J. Garcia, J. Melton</i>	
<b>Overflow Simulation Guidelines for Orion Launch Abort Vehicle Aerodynamic Analyses (Invited)</b> .....	679
<i>R. Childs, J. Garcia, John Melton, Stuart Rogers, Andrea Shestopolov, Darby Vicker</i>	
<b>Contributions of TetrUSS to Project Orion (Invited)</b> .....	719
<i>Susan McMillin, Neal Frink, Johannes Kerimo, Ejiang Ding, Sudheer Nayani, Edward Parlette</i>	
<b>Demonstration of a Temperature-Compensated Pressure Sensitive Paint on the Orion Launch Abort Vehicle (Invited)</b> .....	759
<i>M. Sellers</i>	
<b>A New Aerodynamic Data Dispersion Method for Launch Vehicle Design (Invited)</b> .....	776
<i>Jeremy Pinier</i>	
<b>Active Flow Separation Control on a High-Lift Wing-Body Configuration Part 1: Baseline Flow and Constant Blowing</b> .....	789
<i>Timo Kühn, Vlad Ciobaca, Ralf Rudnik, Burkhard Gölling, Wiebke Breitenstein</i>	
<b>Active Flow Separation Control on a High-Lift Wing-Body Configuration Part 2: The Pulsed Blowing Application</b> .....	800
<i>Vlad Ciobaca, Timo Kühn, Ralf Rudnik, Matthias Bauer, Burkhard Gölling</i>	
<b>Development of the Dual Aerodynamic Nozzle Model for the NTF Semi-Span Model Support System</b> .....	815
<i>Gregory Jones, William E. Milholen II, Scott L. Goodliff</i>	
<b>Numerical Investigation on Two-orifice Synthetic Jet Actuators of Varying Orifice Spacing and Diameter</b> .....	827
<i>Hamed Riazi, Noor Ahmed</i>	
<b>Parameters Governing Separation Control with Sweeping Jet Actuators</b> .....	840
<i>Rene Woszidlo, I. Wygnanski</i>	
<b>Pulsed Blowing on a Laminar Airfoil at Low Reynolds Number</b> .....	859
<i>Nathan Packard, Jeffrey Bons</i>	

<b>Detached-Eddy Simulation of Pulsed Blowing Actuation on the Flap of a High-Lift Configuration</b> .....	873
<i>Tobias Höll, Alexander Kabat Vel Job, Pablo Giacopinelli, Frank Thiele</i>	
<b>Numerical Study on Control of Tollmien-Schlichting Waves Using Plasma Actuators</b> .....	888
<i>M. Kotsonis, R. Giepmans, L. Veldhuis</i>	
<b>A Systematic Study on the Impact of Dimensionality for a Two-Dimensional Aerodynamic Optimization Model Problem</b> .....	903
<i>J. Vassberg, N. Harrison, D. Roman, A. Jameson</i>	

Volume 2

<b>Transonic Airfoil Shape Optimization Using Variable-Resolution Models and Pressure Distribution Alignment</b> .....	922
<i>Slawomir Koziel, Leifur Leifsson</i>	
<b>Design of Low-Sweep Wings for Maximum Range</b> .....	935
<i>Timothy Leung, David Zingg</i>	
<b>Multidisciplinary Design Optimization of a Truss Braced Wing Aircraft with Upgraded Aerodynamic Analyses</b> .....	946
<i>G. Seber, H. Ran, J. Schetz, D. Mavris</i>	
<b>Aircraft Design with Maneuver and Gust Load Alleviation</b> .....	961
<i>Jia Xu, Ilan Kroo</i>	
<b>Discrete Blade Model for Rotorcraft Brownout</b> .....	976
<i>William Polzin, Kanchan Guntupalli, R. Ganesh Rajagopalan</i>	
<b>On the Possibilities of Brownout Mitigation Using a Slotted-Tip Rotor Blade</b> .....	992
<i>Monica Syal, Jürgen Rauleder, John Tritschler, J. Gordon Leishman</i>	
<b>Experimental and Numerical Investigation of a Counter Rotating Open Rotor Flow Field</b> .....	1014
<i>Eric W. M. Roosenboom, Andreas Schroeder, Reinhard Geisler, Dieter Pallek, Janos Agocs, Arne Stürmer, Carlos Marquez Gutierrez</i>	
<b>High-Order Accurate CFD/CSD Simulation of the UH60 Rotor in Forward Flight</b> .....	1024
<i>Jasim Ahmad, Neal Chaderjian</i>	
<b>Skin Friction Predictions over a Hovering Tilt-Rotor Blade Using OVERFLOW2</b> .....	1038
<i>Upendar Kaul, Jasim Ahmad</i>	
<b>Numerical Optimization for High Efficiency, Low Noise Airfoils</b> .....	1057
<i>Nadia Bizzarrini, Francesco Grasso, Domenico Coiro</i>	
<b>Effect of an Extended Shelf on Near Field Development of Supersonic Jet Plumes from Rectangular Nozzles</b> .....	1071
<i>Parviz Behrouzi, James McGuirk</i>	
<b>A Partial Mixer Nozzle for Turbofan Nacelles to Provide Significant Jet Mixing Control</b> .....	1084
<i>Kurt Acheson, Edward Marques, Matthew Moore</i>	
<b>Firebolt v1.0 - Coupling of Transient and Steady Engine Performance Models with a High Fidelity Navier-Stokes Code</b> .....	1094
<i>Robert Nichols, Andrew Denny, Joshua Calahan, Steven Savelle, Bonnie Heikkinen</i>	
<b>Optimal Bypass Shape Design of Low Boom Supersonic Inlet</b> .....	1116
<i>H. Kim, M. Liou, L. Pavinelli</i>	
<b>Experimental and Computational Investigation of Mass Injection Induced Unstart</b> .....	1131
<i>Jeffrey Fike, Karthik Duraisamy, Juan Alonso, Hyungrok Do, Seong-Kyun Im, Mark Cappelli</i>	
<b>Application of a Reynolds-Averaged Navier-Stokes Approach to Supersonic Retropropulsion Flowfields</b> .....	1150
<i>Ashley Korzun, Ian Clark, Robert Braun</i>	
<b>Analysis of Inviscid Simulations for the Study of Supersonic Retropropulsion</b> .....	1169
<i>N. Bakhtian, M. Aftosmis</i>	
<b>Near Field Acoustic Test on a Low Boom Configuration in Langley's 4 x 4 Wind Tunnel (Invited)</b> .....	1189
<i>T. Wayman, K. Waithe, D. Howe, L. Bangert, F. Wilcox</i>	
<b>Force and Moment Test on a Low Boom Configuration in Glenn's 8 x 6 Wind Tunnel (Invited)</b> .....	1207
<i>Thomas Wayman, G. Hicks, Jason Merret</i>	
<b>Near Field Sonic Boom Test on Two Low-Boom Configurations Using Multiple Measurement Techniques at NASA Ames (Invited)</b> .....	1218
<i>Donald Durston, S. Cliff, Thomas Wayman, Jason Merret, A. Elmiligui, L. Bangert</i>	
<b>Design of a Wind Tunnel Mount for a Low Boom Test (Invited)</b> .....	1263
<i>Kenrick Waithe</i>	
<b>USM3D Analysis of Low Boom Configuration (Invited)</b> .....	1277
<i>Melissa Carter, R. Campbell, S. Nayani</i>	

<b>Hybrid CART3D/OVERFLOW Near-Field Analysis of a Low Boom Configuration with Wind Tunnel Comparisons (Invited)</b> .....	1289
<i>D. Howe</i>	
<b>Low Boom Configuration Analysis with FUN3D Adjoint Simulation Framework (Invited)</b> .....	1303
<i>Michael Park</i>	
<b>Evaluation of Refined Tetrahedral Meshes with Projected, Stretched, and Sheared Prism Layers for Sonic Boom Analysis (Invited)</b> .....	1325
<i>S. Cliff, A. Elmiligui, R. Campbell, S. Thomas</i>	
<b>Computational Challenges in Simulating Powered Flight of the Orion Launch Abort Vehicle (Invited)</b> .....	1355
<i>Stuart Rogers, Thomas Pulliam</i>	
<b>Turbulence Model Assessment for Hot Plumes (Invited)</b> .....	1383
<i>A. Shestopalov, R. Childs, J. Melton</i>	
<b>Rocket Plume Sealing for Orion Wind Tunnel Testing (Invited)</b> .....	1416
<i>G. Brauckmann, J. Greathouse, M. White</i>	
<b>Aerodynamic Testing of the Orion Launch Abort Tower Separation with Jettison Motor Jet Interactions (Invited)</b> .....	1435
<i>M. Rhode, D. Chan, C. Niskey, T. Wilson</i>	
<b>Orion Launch Abort Vehicle Attitude Control Motor Testing</b> .....	1462
<i>K. Murphy, G. Brauckmann, K. Paschal, D. Chan, E. Walker, R. Foley, D. Mayfield, J. Cross</i>	
<b>Modeling Powered Aerodynamics for the Orion Launch Abort Vehicle Aerodynamic Database (Invited)</b> .....	1490
<i>D. Chan, E. Walker, Philip Robinson, T. Wilson</i>	
<b>Constellation Program Lessons Learned in the Quantification and Use of Aerodynamic Uncertainty (Invited)</b> .....	1521
<i>E. Walker, Michael Hensch, Jeremy Pinier, K. Bibb, D. Chan, Jeremy Hanke</i>	
<b>Application of CFD to Anemometer Position Evaluation: A Feasibility Study</b> .....	1535
<i>S. Polsky, T. Ghee, J. Butler, R. Czerwicz</i>	
<b>Computational Investigation of the DTMB Series 66 Hull Forms</b> .....	1549
<i>Keegan Delaney</i>	
<b>Computation of Dynamic Stability and Control Derivatives</b> .....	1563
<i>Abdollah Arabshahi, Lafayette Taylor, David Whitfield</i>	
<b>Investigation of Unsteady Vehicle Aerodynamics Under Time-Dependent Flow Conditions</b> .....	1572
<i>J. Wojciak, N. Adams, T. Indinger, P. Theissen, R. Demuth</i>	
<b>Fan Interaction Study for Distributed Ducted Fan Systems in Hover and Transition</b> .....	1587
<i>Kurt Acheson</i>	
<b>CFD Study of Bluff Body Wake from a Hangar with Comparison to Experimental Data</b> .....	1597
<i>S. Polsky, D. Miklosovic</i>	
<b>Analysis of Asymmetric Aircraft Aerodynamics Due to an Experimental Wing Glove</b> .....	1610
<i>F. Hartshorn</i>	
<b>Plasma Actuators for Active Flow Control on Wind Turbine Blades</b> .....	1629
<i>J. Meijerink, H. Hoeijmakers</i>	
<b>Steady Aerodynamics of Miniature Trailing-Edge Devices in Transonic Flows</b> .....	1647
<i>Kai Richter, Henning Rosemann</i>	
<b>High-lift Enhancement Using Active Flow Control</b> .....	1666
<i>M. Desalvo, E. Whalen, A. Glezer</i>	
<b>Reduction of Helicopter BVI Noise Using Active Flow Control; The Case of Vortex Street Interactions</b> .....	1682
<i>P. Coronado, H. Al-Kuran, M. Ilie, D. Duhamel, Y. Ouarit</i>	
<b>Some Effects of Blowing, Suction and Trailing Edge Bluntness on Flow Separation from Thick Airfoils; Computations &amp; Measurements</b> .....	1694
<i>R. Seele, C. Chen, C. Bhamburkar, I. Wagnanski</i>	
<b>Aircraft Cabin Flow Pattern Under Unsteady Air Supply</b> .....	1712
<i>Chaofan Wu, Noor Ahmed</i>	
<b>Active Flow Control on the Flap of a 2D High-Lift Wing Section at <math>Re=1 \cdot 10^6</math></b> .....	1724
<i>Frank Haucke, Wolfgang Nitsche</i>	
<b>Aerodynamic Aspects and Cooling Techniques of Turbine Blade; Numerical Studies Using URANS and LES</b> .....	1732
<i>H. Al-Kuran, C. Velez, P. Coronado, M. Ilie</i>	
<b>Convergence Study of Inlet Buzz Frequency with Computational Parameters</b> .....	1739
<i>Einkeun Kwak, Seungsoo Lee</i>	
<b>Comparison of Stability of Hypersonic Rectangular and Three-Dimensional Inlets to Unsteady Perturbations Using Entropy Considerations</b> .....	1751
<i>G. Bussey, M. Lewis</i>	

<b>Linearized Euler Solver for Rapid Frequency-Domain Aeroelastic Analysis</b> .....	1765
<i>Z. Zhang, Shuchi Yang, P. Chen</i>	
<b>Automatic Transition Prediction in Unsteady Airfoil Flows Using an Unstructured CFD Code</b> .....	1783
<i>A. Krumbain, N. Krimmelbein, C. Seyfert</i>	
<b>Landing Gear Aerodynamic Noise Prediction Using Building-Cube Method</b> .....	1814
<i>Daisuke Sasaki, Hiroshi Onda, Akihito Deguchi, Ryotaro Sakai, Kazuhiro Nakahashi</i>	
<b>Numerical Flow Simulation of a Reusable Sounding Rocket During Turnover</b> .....	1833
<i>Kazuto Kuzuu, Keiichi Kitamura, Keiichiro Fujimoto, Eiji Shima</i>	

Volume 3

<b>Helicopter Aeroelastic Analysis in Forward Flight Using Dynamic Wake Model</b> .....	1847
<i>Joonbae Lee, Sejong Oh, Kwanjung Yee, Seung-Jae Yoo, Min-Soo Jeong, In Lee, Deog-Kwan Kim</i>	
<b>The Effect of Dynamic Stall on the Aerodynamics of Vertical-Axis Wind Turbines</b> .....	1857
<i>Frank Scheurich, Richard Brown</i>	
<b>PIV Measurements in the Wake of a Full-Scale Rotor in Forward Flight</b> .....	1874
<i>Alan Wadcock, Gloria Yamauchi, Eduardo Solis, Ashley Pete</i>	
<b>Dynamic Stall Control by Passive Disturbance Generators</b> .....	1897
<i>Benjamin Heine, Karen Mulleners, Gilles Joubert, Markus Raffel</i>	
<b>Optimum Operational Parameters for Tethered, Yawed Wind Turbines</b> .....	1911
<i>D. Peters, J. Loyet, W. Chan, L. Ahaus</i>	
<b>MEXICO Wind Tunnel and Wind Turbine Modelled in CFD</b> .....	1947
<i>Pierre-Elouan Réthoré, Niels Sørensen, Frederik Zahle, Andreas Bechmann, Helge Madsen</i>	
<b>Helicopter Rotor BVI Airloads Computation Using Advanced Prescribed Wake Modelling</b> .....	1957
<i>Berend Van Der Wall</i>	
<b>Sonic Boom Computations for a Mach 1.6 Cruise Low Boom Configuration and Comparisons with Wind Tunnel Data (Invited)</b> .....	1978
<i>A. Elmiligui, S. Cliff, F. Wilcox, M. Nemec, L. Bangert, M. Aftosmis</i>	
<b>Sonic Boom Adjoint Methodology and Its Applications</b> .....	2007
<i>Sriram Rallabhandi</i>	
<b>Inverse Design of Low-Boom Supersonic Concepts Using Reversed Equivalent-Area Targets (Invited)</b> .....	2025
<i>Wu Li, Sriram Rallabhandi</i>	
<b>CFD-Based Redesign of a Low-Boom Supersonic Demonstrator Concept (Invited)</b> .....	2036
<i>E. Shields, W. Li</i>	
<b>Adjoint-Based Low-Boom Design with Cart3D (Invited)</b> .....	2044
<i>M. Aftosmis, Marian Nemec, S. Cliff</i>	
<b>Wedge and Conical Probes for the Instantaneous Measurement of Free-Stream Flow Quantities at Supersonic Speeds</b> .....	2061
<i>P. Bobbitt, J. Maglieri, D. Banks, A. Fuchs</i>	
<b>Orion Crew Module Aerodynamic Testing</b> .....	2100
<i>K. Murphy, K. Bibb, G. Brauckmann, M. Rhode, D. B. Owens, D. Chan, E. Walker, J. Bell, T. Wilson</i>	
<b>Computational Aerodynamic Simulations of the Orion Command Module (Invited)</b> .....	2123
<i>Paul Stremel, Matthew McMullen, J. Garcia</i>	
<b>Overview of Orion Crew Module and Launch Abort Vehicle Dynamic Stability (Invited)</b> .....	2136
<i>D. B. Owens, Vanessa Aubuchon</i>	
<b>Drogue Parachute Effects on the Orion Crew Module Stability</b> .....	2160
<i>Vanessa Aubuchon, D. B. Owens, Mike Fremaux</i>	
<b>Development of the Orion Crew Module Static Aerodynamic Database, Part I: Hypersonic</b> .....	2172
<i>K. Bibb, E. Walker, G. Brauckmann, P. Robinson</i>	
<b>Development of the Orion Crew Module Static Aerodynamic Database, Part II: Subsonic/Supersonic</b> .....	2195
<i>K. Bibb, E. Walker, G. Brauckmann, P. Robinson</i>	
<b>A Unified Baseline Grid about the Common Research Model Wing/Body for the Fifth AIAA CFD Drag Prediction Workshop (Invited)</b> .....	2229
<i>John Vassberg</i>	
<b>Further Studies of Airfoils Supporting Non-unique Solutions in Transonic Flow</b> .....	2238
<i>Antony Jameson, John Vassberg, Kui Ou</i>	
<b>CFD Prediction of the Flowfield Behind the KC-135R Tanker</b> .....	2260
<i>Mark Jurkovich</i>	
<b>Investigation of Dynamic Stall of Airfoils and Wings by CFD</b> .....	2269
<i>E. Dumlupinar, V. Murthy</i>	

<b>Assessment of a Corner Plasma Actuator for Flow Control Using Periodic Jets</b> .....	2298
<i>E. Stephen, A. Campbell, J. Nygard, M. Selby, C. Hennig, T. McLaughlin</i>	
<b>Development of Trielectrode Plasma Actuator and Its Application to Delta Wing Vortex Control</b> .....	2317
<i>Takashi Matsuno, Mikimasa Kawaguchi, Gouji Yamada, Hiromitsu Kawazoe</i>	
<b>DBD Plasma Actuator Effect on a 2D Model Laminar Boundary Layer. Transition Delay Under Ionic Wind Effect</b> .....	2331
<i>A. Seraudie, O. Vermeersch, D. Arnal</i>	
<b>Airfoil Flow Control Using Plasma Actuation and Coanda Effect</b> .....	2344
<i>X. Zhang, X. Luo, P. Chen</i>	
<b>Unsteady Aerodynamic Uncertainty Estimation and Robust Flutter Analysis</b> .....	2358
<i>Y. Dai, Z. Zhang, Z. Wu, C. Yang, A. Hou</i>	
<b>A Computational Investigation into the Use of Response Functions for Aerodynamic Loads Modeling</b> .....	2374
<i>M. Ghoreyshi, A. Jirasek, M. Post, R. Cummings, R. Decker</i>	
<b>Far-Field Drag Prediction and Decomposition Method for Unsteady Flows</b> .....	2398
<i>M. Gariepy, J. Trepanier, B. Malonin</i>	
<b>High-Fidelity Optimization of Flapping Airfoils and Wings</b> .....	2415
<i>Matthew Culbreth, Yves Allaneau, Antony Jameson</i>	
<b>Investigation of Transverse Jet Injection in a Supersonic Crossflow Using Fast Responding Pressure-Sensitive Paint</b> .....	2426
<i>J. Crafton, A. Forlines, S. Palluconi, K. Hsu, C. Carter, M. Gruber</i>	
<b>Unsteady Aerodynamics of Multiple Airfoils in Configuration</b> .....	2437
<i>Hossain Aziz, Rinku Mukherjee</i>	
<b>Design of the Subsonic Aircraft Roughness Glove Experiment (SARGE)</b> .....	2458
<i>Michael Belisle, Matthew Roberts, Matthew Tufts, Aaron Tucker, Thomas Williams, William Saric, Helen Reed</i>	
<b>Computational Analysis of the G-III Laminar Flow Glove</b> .....	2480
<i>M. Malik, W. Liao, E. Lee-Rausch, F. Li, M. Choudhari, C. Chang</i>	
<b>The DLR Project LamAiR: Design of a NLF Forward Swept Wing for Short and Medium Range Transport Application</b> .....	2504
<i>A. Seitz, M. Kruse, T. Wunderlich, J. Bold, L. Heinrich</i>	
<b>Progress Toward Efficient Laminar Flow Analysis and Design</b> .....	2518
<i>R. Campbell, M. Campbell, T. Streit</i>	
<b>Error Estimate of the Ares I Vehicle Longitudinal Aerodynamic Characteristics Based on Turbulent Navier-Stokes Analysis</b> .....	2551
<i>K. Abdol-Hamid, Farhad Ghaffari</i>	
<b>Detailed Uncertainty Analysis of the Ares I A106 Liftoff/Transition Database</b> .....	2565
<i>Jeremy Hanke</i>	
<b>Assessment of CFD-based Response Surface Model for Ares I Supersonic Ascent Aerodynamics</b> .....	2588
<i>Jeremy Hanke</i>	
<b>Protuberance Aerodynamic Loads for Space Launch Vehicle Systems Using CFD</b> .....	2613
<i>M. Applebaum, M. Eppard, L. Hall, J. Blevins</i>	
<b>Space-Time Accuracy Assessment of CFD Simulations for the Launch Environment</b> .....	2632
<i>J. Housman, M. Barad, C. Kiris</i>	
<b>Aerodynamic Database Generation for SRB Separation from a Heavy Lift Launch Vehicle</b> .....	2650
<i>M. Gusman, C. Kiris, M. Barad</i>	
<b>Lift Enhancement of Circulation Control as Influenced by Ground Effect</b> .....	2660
<i>Byron Patterson, Gerald Angle, James Smith</i>	
<b>Flow Visualization by a Simplified BOS Technique</b> .....	2673
<i>Junichi Akatsuka, Shinji Nagai</i>	
<b>Three-dimensional Density Measurement and Reconstruction of Asymmetric Flow Field by Colored Grid Background Oriented Schlieren (CGBOS) Technique</b> .....	2681
<i>Masanori Ota, Kenta Hamada, Hiroko Kato, Ryuki Sakamoto, Kazuo Maeno</i>	
<b>Blade Displacement Measurements of the Full-Scale UH-60A Airloads Rotor</b> .....	2688
<i>D. Barrows, A. Burner, A. Abrego, L. Olson</i>	
<b>Experimental Studies on a Propelled Micro Air Vehicle</b> .....	2704
<i>D. Arivoli, R. Dodamani, R. Antony, C. Suraj, G. Ramesh, S. Ahmed</i>	
<b>Unsteady Flows Past Oscillating Airfoils at Low Reynolds Numbers</b> .....	2714
<i>Dan Mateescu, Manuel Munoz, Olivier Scholz</i>	
<b>Computational Investigation of AR and <math>\lambda</math> Effects on Wings Operating in the Transitional Low Reynolds Number Flight Regime</b> .....	2729
<i>S. Hamburg, Z. Napolillo, M. Gautam, W. Huebsch</i>	
<b>Stability Characteristics of Micro Air Vehicles from Experimental Measurements</b> .....	2740
<i>Daniel Uhlig, Michael Selig</i>	



<b>Wing/Wall Aerodynamic Interactions in Free Flying, Maneuvering MAVs</b> .....	2753
<i>Matthew Geyman, A. Altman</i>	

Volume 4

<b>Sonic-Boom Prediction of a Scaled Low-Boom Demonstration Aircraft Considering Viscosity Effects</b> .....	2771
<i>H. Ishikawa, Y. Makino, K. Ohira</i>	
<b>Supersonic Bi-Directional Flying Wing Configuration with Low Sonic Boom and High Aerodynamic Efficiency</b> .....	2779
<i>C. Berger, K. Carmona, D. Espinal, H. Im, G. Zha</i>	
<b>Aerodynamic Effects of External Camera Pods and Launch Lugs on a Target Missile Configuration</b> .....	2795
<i>R. Roger, S. Chan, J. Smith</i>	
<b>CFD Assessment of Fin Manufacturing Defect to Set Fin Cant Angle and Achieve Nominal Roll Rate</b> .....	2800
<i>Justin Smith, Jeffrey Cullina</i>	
<b>Analysis of Grid Fins for Launch Abort Vehicle Using a Cartesian Euler Solver</b> .....	2809
<i>J. Kless, M. Aftosmis</i>	
<b>Computational Approximation of Nonlinear Unsteady Aerodynamics Using an Aerodynamic Model Hierarchy</b> .....	2830
<i>M. Ghoreyshi, A. Jirasek, M. Post, R. Cummings</i>	
<b>Computational Sports Aerodynamics of a Moving Sphere: Simulating a Ping Pong Ball in Free Flight</b> .....	2849
<i>Kui Ou, Patrice Castonguay, Antony Jameson</i>	
<b>Investigation of Unsteady Flow Structures in the Wake of a Realistic Generic Car Model</b> .....	2865
<i>Angelina Heft, Thomas Indinger, N. Adams</i>	
<b>On the Aerodynamics of Ground Vehicles Subjected to Crosswind Gust and Its Shape Dependence</b> .....	2879
<i>Makoto Tsubokura, Jun Ikeda, Takuji Nakashima, Kozo Kitoh, Masashi Kitayama</i>	
<b>Coupled Analysis of Unsteady Aerodynamics and 6DOF Motion of a Heavy Duty Truck in Strong Wind Gusts</b> .....	2888
<i>Takuji Nakashima, Makoto Tsubokura, Syumei Matsuda, Yasuaki Doi</i>	
<b>Water Tunnel Experimental Investigation on the Aerodynamic Performance of Flapping Wings for Nano Air Vehicles</b> .....	2899
<i>P. Czekalowski, A. Gronczewski, K. Sibilski</i>	
<b>Experimental Simulation of Flapping Wings for Nano-Air-Vehicles</b> .....	2910
<i>R. Lee, W. Yuan, L. Levasseur, E. Hoogkamp</i>	
<b>Experimental Investigation of Bio-Inspired High Lift Effectors on a 2-D Airfoil</b> .....	2930
<i>Joe Johnston, Ashok Gopalathnam, Jack Edwards</i>	
<b>Figure-8 Flapping Micro Air Vehicle</b> .....	2950
<i>J. Dawson, T. Smith, P. G. Huang, D. Doman</i>	
<b>Quasi-Steady and Computational Aerodynamics Applied to Hovering <i>Drosophila</i> Dynamics</b> .....	2973
<i>K. MacFarlane, B. Bush, I. Faruque, J. Humbert, J. Baeder</i>	
<b>Reynolds-Number Dependency of the Leading Edge Vortex on a Fast Pitch-up Flat Plate</b> .....	2982
<i>X. Zhang, V. Chai, J. Schlüter</i>	
<b>Pressure Distribution and Vortex Structures in a Rigid Model of a Human Larynx</b> .....	3001
<i>M. Hosnieh Farahani, F. Alipour, S. Vignostad</i>	
<b>Experimental Investigation of a Large-Scale Low-Boom Inlet Concept (Invited)</b> .....	3008
<i>S. Hirt, R. Chima, M. Vyas, T. Wayman, T. Conners, R. Reger</i>	
<b>The Feasibility of High-Flow Nacelle Bypass for Low Sonic Boom Propulsion System Design</b> .....	3024
<i>T. Conners, T. Wayman</i>	
<b>Experimental Investigation of Micro Vortex Generators on a Low Boom Supersonic Inlet (Invited)</b> .....	3053
<i>Manan Vyas, Stefanie Hirt, R. Chima, David Davis, Thomas Wayman</i>	
<b>Surface Flow and PSP Measurements in the Large-Scale Low-Boom Inlet (Invited)</b> .....	3073
<i>T. Herges, J. Dutton, G. Elliott</i>	
<b>Axisymmetric Calculations of a Low Boom Inlet in a Supersonic Wind Tunnel (Invited)</b> .....	3099
<i>R. Chima, Stefanie Hirt, Robert Reger</i>	
<b>Computational Analysis of a Low Boom Supersonic Inlet (Invited)</b> .....	3111
<i>R. Chima</i>	
<b>Vortex Generators for a Dual-Stream Low-Boom Inlet</b> .....	3125
<i>Tyler Gillen, Eric Loth</i>	
<b>Vortex Generators for a Single-Stream Low-Boom Inlet</b> .....	3160
<i>Michael Rybalko, Eric Loth</i>	
<b>Adjoint Optimization of a Wing Using the CSRT Method</b> .....	3178
<i>M. Straathof, M. Van Tooren</i>	

<b>Aero-Propulsive Optimization of the Boeing-737 Wing-Engine Integrated Geometry Using Smart Panel Approaches and Modified Potential Theory .....</b>	<b>3191</b>
<i>V. Ahuja, R. Hartfield</i>	
<b>Wind Turbine Optimization Under Uncertainty with High Performance Computing.....</b>	<b>3210</b>
<i>G. Petrone, C. De Nicola, D. Quagliarella, J. Witteveen, J. Axerio-Cilies, G. Iaccarino</i>	
<b>Optimization with Gradient and Hessian Information Calculated Using Hyper-Dual Numbers .....</b>	<b>3226</b>
<i>Jeffrey Fike, Sietse Jongsma, Juan Alonso, Edwin Van Der Weide</i>	
<b>Implications of Conical Flow for Laminar Wing Design and Analysis .....</b>	<b>3245</b>
<i>Thomas Streit, Georg Wichmann, Fedime Von Knoblauch Zu Hatzbach, R. Campbell</i>	
<b>Shape Change of the Upper Surface of an Airfoil by Macro Fiber Composite Actuators.....</b>	<b>3264</b>
<i>M. Debiasi, Y. Bouremel, K. Hee, L. Chung, E. Zhiwei</i>	
<b>Performance of an Airfoil with a Power-saving, Tab-assisted Flap System .....</b>	<b>3276</b>
<i>J. Bottalla, M. Bragg, J. Sheahan, C. Winkler</i>	
<b>Numerical Spoiler Wake Investigations at the Borders of the Flight Envelope .....</b>	<b>3298</b>
<i>Sven Geisbauer</i>	
<b>Compressibility Effects of Extended Formation Flight .....</b>	<b>3318</b>
<i>S. Ning, I. Kroo</i>	
<b>Extensible Rapid Transition Prediction for Aircraft Conceptual Design .....</b>	<b>3342</b>
<i>Dev Rajnarayan, Peter Sturdza</i>	
<b>Analysis and Design of a Wind Turbine with a Wind Accelerator .....</b>	<b>3357</b>
<i>Douglas Bohl, Brian Helenbrook, Benjamin Kanya, Kenneth Visser, Russell Marvin, Brendan Mascarenhas, Michael Parker, Drew Rocky</i>	
<b>An Experimental Investigation on the Wake Characteristics of a Wind Turbine in an Atmospheric Boundary Layer Wind .....</b>	<b>3375</b>
<i>Zifeng Yang, Partha Sarkar, Hui Hu</i>	
<b>Design and Optimization of Tidal Turbine Airfoil .....</b>	<b>3393</b>
<i>Francesco Grasso</i>	
<b>Design, Fabrication, Analysis, and Dynamic Testing of a Micro Air Vehicle Propeller .....</b>	<b>3407</b>
<i>A. Smedresman, D. Yeo, W. Shyy</i>	
<b>Oil-flow Visualization on a SWT-2.3-101 Wind Turbine .....</b>	<b>3423</b>
<i>S. Schreck, L. Fingersh, P. Medina, J. Johansen</i>	
<b>Code-to-Code Comparison of CFD/CSD Simulation for a Helicopter Rotor in Forward Flight.....</b>	<b>3430</b>
<i>Jasim Ahmad, Robert Biedron</i>	
<b>Aerodynamic Investigations on a Helicopter Fuselage.....</b>	<b>3445</b>
<i>F. Vogel, C. Breitsamter, N. Adams</i>	
<b>Deconstructing Hub Drag .....</b>	<b>3453</b>
<i>F. Ortega, R. Shenoy, V. Raghav, N. Komerath, M. Smith</i>	
<b>Time-Accurate CFD Approach to Numerical Simulation of Store Separation Trajectory Prediction.....</b>	<b>3466</b>
<i>T. Berglind, L. Tysell</i>	
<b>Simulation of Trajectories of Cuboid Cargos Released from a Generic Transport Aircraft.....</b>	<b>3484</b>
<i>Niko Schade</i>	
<b>Captive Carry Analyses and Test Results of General Purpose Munition Bomb .....</b>	<b>3495</b>
<i>Osman Basoglu, Hediye Atik, Erdinc Yildiz</i>	
<b>Fourier Analysis of High Speed Shadowgraph Images Around a Mach 1.5 Cavity Flow Field.....</b>	<b>3504</b>
<i>R. Schmit, F. Semmelmayr, M. Haverkamp, J. Grove</i>	
<b>An Experimental Investigation of 2-D Cylinders Affecting Supersonic Cavity Flow .....</b>	<b>3528</b>
<i>G. Givogue, W. Fowler, A. Vakili</i>	
<b>Interference Drag Modeling and Experiments for a High Reynolds Number Transonic Wing .....</b>	<b>3549</b>
<i>Kyle Knight, Eric Braun, Christopher Roy, Frank Lu, J. Schetz</i>	
<b>Effect of Concentrated Roughness on Transition Location at Transonic Speed: From Infrared and High Frequency Pressure Measurements to MDOE Approach.....</b>	<b>3565</b>
<i>A. D'Argenio, F. D'Errico, A. Marino, C. Izzo, C. De Nicola</i>	
<b>SACCON Static and Dynamic Motion Flow Physics Simulations Using COBALT.....</b>	<b>3587</b>
<i>Adam Jirasek, R. Cummings</i>	
<b>Study on Hypersonic Flow over Flat Plate with Channels .....</b>	<b>3598</b>
<i>Yuya Ohmichi, Kojiro Suzuki</i>	
<b>Numerical Study on Supersonic Inlet Buzz Under Various Throttling Conditions and Fluid-Structure Interaction .....</b>	<b>3608</b>
<i>Wooram Hong, Chongam Kim</i>	
<b>Drag Prediction for Supersonic Hydrogen-Fueled Airliners .....</b>	<b>3624</b>
<i>A. Forbes, A. Patel, N. Komerath</i>	

<b>Conceptual Design, Optimization, and Simulation of Tail Surfaces on Actively-Controlled Aircraft for Minimum Weight and Drag Impact</b> .....	3640
<i>Kevin Reynolds, N. Nguyen</i>	
<b>Development of the D8 Transport Configuration</b> .....	3649
<i>Mark Drela</i>	
<b>Multi-Element Airfoil Configurations for Wind Turbines</b> .....	3663
<i>Adam Ragheb, Michael Selig</i>	
<b>Simulations of Separated Flow around an Airfoil with Ice Shape Using Hybrid RANS/LES Models</b> .....	3676
<i>Mohammad Alam, Keith Walters, David Thompson</i>	
<b>Zonal RANS-LES Computation of Transonic Airfoil Flow</b> .....	3688
<i>Benedikt Roidl, Matthias Meinke, Wolfgang Schröder</i>	
<b>Author Index</b>	