May 17-19, 2016
West Palm Beach, Florida

AHS 72nd Annual Forum & Technology Display

Technical Sessions

Special Sessions schedules are listed on the back cover.

Technical Session A, Tuesday, May 17 – Morning, 8:00 a.m. – 12 noon

	Advanced Vertical Flight I **Room 1F** *Session Chair:* **Dr. Hao Kang,** US Army Research Lab	**Aerodynamics I** **Ballroom A** *Session Chair:* **Dr. Robert Biedron,** NASA Langley Research Center	**Crash Safety** **Room 2A** *Session Chair:* **Dr. Cheng-Ho Tho,** Bell Helicopter	**Dynamics I** **Ballroom C** *Session Chair:* **Dr. Friedrich Straub,** The Boeing Company
0800-0830 *Paper # 1*	**Performance and Controlability Assessment of an Overlapping Quad-Rotor Concept** (14) Michael Avera*, Hao Kang, Rajneesh Singh, U.S. Army Research Lab	**Experiment demonstrating reduction of dynamic stall by a back-flow flap** (48) Anthony D. Gardner*, Steffen Opitz, C. Christian Wolf, Christoph B. Merz, DLR	**Assessment of Memory Cushions in Aircraft Seating for Injury Mitigation through Dynamic Impact Test** (7) John Wang*, Defence Science and Technology Organisation	***This session honors Prof. Robert G. Loewy's 90th Birthday.*** _____ **The Bell 525's Smooth Ride** (103) Matt Hendricks*, Bell Helicopter
0830-0900 *Paper # 2*	***Lichten Competition Winner:*** **Development of the World's Smallest Cyclocopter** (210) Carl Runco*, David Coleman, Moble Benedict, Texas A&M University	**High-resolution CFD Predictions for Static and Dynamic Stall of a Finite-span OA209 Wing** (87) Rohit Jain*, U.S. Army, AFDD ; Arnaud Le Pape, Michel Costes, Francois Richez, ONERA; Marilyn Smith, GeorgiaTech	**Transport Aircraft Seating in Rotorcraft Crash Testing** (25) Joseph Pellettiere, Amanda Taylor*, Federal Aviation Administration	**From EC145 to H145: Validation Program of Major Dynamic Changes** (90) Wouter Houg*, Stefan Dreher, Rainer Heger, Oliver Dieterich, Martijn Priems, Airbus Helicopters Deutschland
0900-0930 *Paper # 3*	**Response Surface Estimation of Trim Controls for a Compound Helicopter with Control Redundancy** (234) Jean-Paul Reddinger*; Farhan Gandhi, Renssealer Polytechnic Institute	**Experimental and Computational Investigation of a Linearly Pitching NACA 0012 in Reverse Flow** (304) Luke Smith*, Andrew Lind, University of Maryland; Kevin Jacobson, Marilyn Smith, Georgia Institute of Technology; Anya Jones, University of Maryland	**Evaluation of Aerospace Seat Belt Webbing Material Under Dynamic Test Conditions** (26) Joseph Pellettiere*, Richard DeWeese, Federal Aviation Administration; Robert Huculak, National Institute for Aviation Research	**Performance and Loads of a Model Coaxial Rotor Part I: Wind Tunnel Measurements** (86) Christopher Cameron*, Jayant Sirohi, University of Texas at Austin
0930-1000	***Refreshment Break***			
1000-1030 *Paper # 4*	**Design and Development of a Scaled Quadrotor Biplane with Variable Pitch Proprotors for Rapid Payload Delivery** (344) Brandyn Phillips*, Vikram Hrishikeshavan, Inderjit Chopra, University of Maryland; Omri Rand, Technion	**Numerical Investigation of the Effect of Shock-Induced Flow Separation on Dynamic Stall in Time-Varying Freestream Conditions** (237) Daniel Gosselin*, Daniel Feszty, Carleton University	**Flight Critical Components: Response to Impact Load** (76) Timothy Fletcher*, Cheng-Ho Tho, Michael Smith, Bell Helicoter Textron Inc.	**Performance and Loads of a Model Coaxial Rotor Part II: Prediction Validations with Measurements** (303) Joseph Schmaus*, Inderjit Chopra, University of Maryland
1030-1100 *Paper # 5*	**Gust Disturbance Rejection Study of a Cyclocopter Micro Air Vehicle** (352) Elena Shrestha*, Derrick Yeo, Vikram Hrishikeshavan, Inderjit Chopra, University of Maryland, College Park; Moble Benedict, Texas A&M University	**Numerical Investigation of Perpendicular Blade-Vortex-Interaction on a Pitching Airfoil in Light Dynamic Stall** (9) Giovanni Droandi, Giuseppe Gibertini, Daniele Zagaglia*, Alex Zanotti, Politecnico di Milano	**Next Generation Smart Crashworthy Crew Seats** (168) Akif Bolukbasi*, Justin Schaub, Terrence Birchette, Boeing; Jin Woodhouse, U.S. Army	**Investigation of Performance, Loads, and Vibration of a Coaxial Helicopter in High-Speed Flight** (378) George Jacobellis*, Farhan Gandhi, Rensselaer Polytechninc Institute
1100-1130 *Paper # 6*	**Analysis Methods for Advanced V/STOL Configurations** (371) Todd Quackenbush*, Jeffery Keller, Glen Whitehouse, Continuum Dynamics, Inc	**A Summary of Flowfield Around a Rotor Blade in Reverse Flow** (255) Nandeesh Hiremath*, Dhwanil Shukla*, Vrishank Raghav*, Narayanan Komerath*, Georgia Institute of Technology	**Development of an Active Spinal Support System for Reducing Lumbar Loading from Body Borne Equipment** (258) Gregory Hiemenz*, Pablo Sztein, Curt Kothera, InnoVital Systems, Inc.; Marv Richards, BAE Systems	**Validation of Comprehensive Modeling of the Wing and Rotor Aeroelastic Test System** (134) Andrew Kreshock*, Robert Thornburgh, Army Research Laboratory; Hyeonsoo Yeo, U.S. Army Aviation Development Directorate
1130-1200 *Paper # 7*	**Experimental Investigation of Fan-in-Wing Aerodynamics in Hover** (337) Anish Sydney*, Naipei Bi, Kevin Kimmel, David Haas, Naval Surface Warfare Center Carderock Division	**Effects of Time-Varying Flow Velocity on Steady Blowing Flow Control for a Pitching Airfoil** (208) Shawn Naigle, Matthew Frankhouser*, James Gregory, Jeffrey Bons, The Ohio State University	**Testing Mobile Aircrew Restraint Systems in a Full-Scale CH-46 Airframe Crash Test – Exploring the Limits** (332) Lindley Bark*, Naval Air Warfare Center Aircraft Division	**Parametric Study of Tiltrotor Whirl Flutter Using Two Rotorcraft Comprehensive Analyses** (372) Jinwei Shen*, University of Alabama Hao Kang, Andrew Kreshock, Army Research Laboratory
12:00-12:30 Paper #8				

Main author is listed first; * denotes presenter.

Technical Session A, Tuesday, May 17 – Morning, 8:00 a.m. – 12 noon

	Modeling & Simulation I **Room 2DE** *Session Chair:* **Dr. Hong Xin,** Sikorsky	**Structures & Materials I** **Room 2BC** *Session Chair:* **Dr. Yuiy Nikishkov,** University of Texas at Arlington	**Test & Evaluation I** **Room 1DE** *Session Chair:* **Philip Alldridge,** Sikorsky	**UAV I** **Room 1BC** *Session Chair:* **Dr. Harshad Sane,** Sikorsky
0800-0830 *Paper # 1*	**A Generic Ground Dynamics Model for Slope Landing Analysis** (93) Kaan Sansal*, Volkan Kargin, Ugur Zengin, Turkish Aerospace Industries	**Probabilistic Rotorcraft Usage Spectrum Development Using Recognized Maneuvers** (24) Suresh Moon*, Mike Stull, Mark Leonard,Technical Data Analysis Inc.; Nam Phan, Structures Division, NAVAIR	**Design and Flight Test of an Adaptive Vehicle Management System on an AH-64 Helicopter Demonstrator** (67) Gary Klein*, Bryan Kashawlic, Russell Enns, The Boeing Company	**Information-Based Analysis of Visual Cues in Human Guidance** (339) Andrew Feit*, Berenice Mettler, University of Minnesota
0830-0900 *Paper # 2*	**Optimizing the Fitness of Motion Cueing for Rotorcraft Flight Simulation** (13) Michael Jones*, German Aerospace Center	**Alternate Characterizations of Fatigue Load Spectra** (30) Robert Benton*, Stephen Howell, U.S. Army Aviation Engineering Directorate	**Certification Flight Testing of the Bell 412EPI Increased Gross Weight Helicopter** (227) John Schillings*, Pat Lindauer, Bell Helicopter; Jason Grogran, Hans Runge, Jeff Newman, Bell Helicopter Textron	**Flight Test Results for a New Mission-Adaptive Autonomy System on the RASCAL JUH-60A Black Hawk** (22) Matthew Whalley*, Marc Takahashi, Hossein Mansur, Carl Ott, Zachariah Morford, Joseph Minor, Marcos Berrios, Ernesto Moralez, U.S. Army ADD; Chad Goerzen, Gregory Schulein, San Jose State University
0900-0930 *Paper # 3*	**Free-Wake Based Dynamic Inflow Model for Hover, Forward and Maneuvering Flight** (72) Omri Rand*, Vladimir Khromov, Technion - Israel Institute of Technology	**Tribological Testing of PEEK for Aerospace Applications** (125) Bryan Allison*, SKF Aeroengine North America	**Bell Model 505 Fatigue Test Loads Derivation using Flight Test Data Reduction and Convex Envelopes** (228) Maxime Lapalme, Guillaume Biron, Marc Ouellet*, Bell Helicopter Textron Canada Limited	**Autonomous Ship-board Landing using Monocular Vision** (209) Jack W. Langelaan, William K. Holmes*, The Pennsylvania State University
0930-1000	***Refreshment Break***			
1000-1030 *Paper # 4*	**Flight Dynamics and Control Modeling with System Identification Validation of the Sikorsky X2 Technology Demonstrator** (216) Cody Fegely*, Hong Xin, Sikorsky; Ondrej Juhasz*, San Jose State University, Mark Tischler, U.S. Army Aviation Development Directorate	**Enhancement of Reliability-Based Probabilistic Solutions for Rotorcraft Structural Analysis and Optimization** (144) Thomas Frewen, Bob LaBarre, Mark Gurvich*, Sergey Shishkin, United Technologies Research Center	**From ERATO Basic Research to the Blue Edge™ Rotor Blade** (88) Berend van der Wall*, Christoph Keßler, DLR (German Aerospace Center); Yves Delrieux, Philippe Beaumier, Pascal Crozier, ONERA; Marc Gervais, Jean-Francois Hirsch, Airbus Helicopters; Kurt Pengel, DNW (German-Dutch Wind Tunnels)	**Vision Based Optimal Landing On a Moving Platform** (106) Takuma Nakamura*, Stephen Haviland, Dmitry Bershadsky, Eric Johnson, Georgia Tech
1030-1100 *Paper # 5*	**Finite State Coaxial Rotor Inflow Model Improvements via System Identification** (191) Yong-Boon Kong*, J.V.R. Prasad, Lakshmi N. Sankar, Georgia Institute of Technology ; Jeewoong Kim, Advanced Rotorcraft Technology, Inc.	**Very-High Cycle Fatigue Testing Under Spectrum Loading for Endurance Limit Structural Design** (189) David Rusk*, Robert Taylor, Bruce Pregger, Luis Sanchez, NAVAIRSYSCOM	**A Computational and Experimental Study of Flexible Insect-based Flapping Wing Aerodynamics and Structural Deformation** (137) James Lankford*, Inderjit Chopra, University of Maryland, College Park	**Effects of vehicle- and task-related motion feedback on operator performance in teleoperation** (36) Johannes Lächele*, Joost Venrooij, Paolo Pretto, Heinrich H. Bülthoff, Max Planck Institute for Biological Cybernetics
1100-1130 *Paper # 6*	**Towards Real-Time Fully Coupled Flight Dynamics and CFD Simulations of the Helicopter/Ship Dynamic Interface** (131) Ilker Oruc*, Joseph F. Horn, Penn State University ; Rajiv Shenoy*, Jeremy Shipman, CRAFT Tech	**Probabilistic Lifing Method for Fatigue Management of Life-Limited Propulsion Components** (197) Michael Shiao*, Tzikang Chen, Anindya Ghoshal, Army Research Laboratory	**Generalized Approach for Slung-Load Aerodynamics** (254) Nandeesh Hiremath*, Nicholas Motahari*, Narayanan Komerath*, Georgia Institute of Technology	**Perception for Safe Autonomous Helicopter Flight and Landing** (141) Sanjiv Singh*, Hugh Cover, Adam Stambler, Benjamin Grocholsky, Jeff Mishler, Bradley Hamner, Kyle Strabala, Gary Sherwin, Marcel Bergerman, Spencer Spiker, Near Earth Autonomy; Michael Kaess, Garrett Hemann, Carnegie Mellon
1130-1200 *Paper # 7*	**Flight Simulation and Control of a Helicopter Undergoing Rotor Chord Extension Morphing** (198) Jayanth Krishnamurthi*, Farhan Gandhi, Rensselaer Polytechnic Institute	**Use of Global and Local Finite Element Analyses to Investigate Peak Stress in Fastened Joints, Validate Structural Repairs, and Design Preventative Structural Modifications** (368) Courtney Solem*, Larry Pilkington, Anna Royce, Columbia Helicopters	**Full Scale Flexible, Passive Stabilization of Helicopter Slung Loads with Comparison to Historical Stabilizers** (325) Daniel Nyren, Marc Tardiff*, U.S. Army (NSRDEC) ; Luigi Cicolani, San Jose State University Research Foundation	**Robust Autonomous Ship Deck Landing for Rotorcraft** (218) Benjamin Grocholsky*, Patrick DeFranco, Hugh Cover, Ayman Singh, Sanjiv Singh, Near Earth Autonomy
1200-1230 Paper #8	**Improving System Identification Results: Combining a Physics-Based Stitched Model with Transfer Function Models Obtained Through Inverse Simulation** (159) Steffen Greiser, Wolfgang von Grünhagen*, DLR			

Technical Session B, Wednesday, May 18 – Morning, 8:00 a.m. – 12:15 p.m.

	Acoustics I **Room 1BC** *Session Chair:* **Dr. Caleb Sargent,** Sikorsky	**Joint Aero/Modeling & Simulation** **Room 2BC** *Session Chairs:* **Dr. Sven Schmitz**, Penn State/**Prof. Gopal Gaonkar**, Florida Atlantic University	**Joint Aero/Test & Evaluation** **Room 2A** *Session Chairs:* **Philippe Beaumier,** ONERA/ **Philip Alldridge,** Sikorsky	**Aircraft Design I** **Ballroom C** *Session Chair:* **Dr. VT Nagaraj,** University of Maryland
0800-0830 *Paper # 1*	**Parametric Investigation of the Effect of Hub Pitching Moment on Blade Vortex Interaction (BVI) Noise of an Isolated Rotor** (326) Carlos Malpica*, Eric Greenwood, NASA Langley Research Center; Ben Sim, U.S. Army Aviation Development Directorate	***This session honors Dr. Robin Gray's 90th Birthday.*** **A Space-Time Accurate Finite-State Inflow Model for Aeroelastic Applications** (222) Massimo Gennaretti, Riccardo Gori, Felice Cardito*, Jacopo Serafini, Giovanni Bernardini, Roma Tre University	**Boundary Layer Transition Characteristics of a Full-Scale Helicopter Rotor in Hover** (118) Kai Richter*, Erich Schülein, Benjamin Ewers, Jochen Raddatz, German Aerospace Center (DLR); Alexander Klein, Airbus Helicopters Deutschland GmbH	**Integrating Flight Dynamics & Control Analysis and Simulation in Rotorcraft Conceptual Design** (277) Ben Lawrence*, Eric Tobias, San Jose State University ; Tom Berger*, Mark Tischler, Joshua Elmore, Andrew Gallaher, U.S. Army; Colin Theodore, NASA
0830-0900 *Paper # 2*	**Analytical Identification of Blade-Vortex Interaction Noise Controller Suited for Miniature Trailing Edge Effectors** (79) Sara Modini*, Giorgio Graziani, University of Rome La Sapienza; Giovanni Bernardini, Massimo Gennaretti, Roma Tre University	**Periodic Free Wake Simulation Using a Numerical Optimization Method** (117) Simon Radler*, Manfred Hajek, Technische Universität München	**Rotor-Obstacle Aerodynamic Interaction in Hovering Flight: An Experimental Survey.** (11) Daniele Zagaglia*, Politecnico di Milano; Michea Giuni, Richard B. Green, University of Glasgow	**Acoustic Assessment for Design and Analysis of Rotorcraft** (307) Kalki Sharma*, Kenneth Brentner, Pennsylvania State University
0900-0930 *Paper # 3*	**Helicopter Community Noise Prediction Methodology for AEDT** (295) Juliet Page*, Volpe, US Dept. of Transportation	**Proprotor-Airframe Interactional Aerodynamics of a Tiltrotor in Airplane Mode** (214) Joon Lim*, Ben Sim, U.S. Army/AFDD	**The 525 Transmission Development Test Stand** (85) David Elliott, Bell Helicopter Textron	**JMR Development** (389) Greg Peterson*, The Boeing Company; Angshuman Saha*, Sikorsky
0930-1015	***Refreshment Break***			
1015-1045 *Paper # 4*	**An Acoustic Investigation of a Coaxial Helicopter in High-Speed Flight** (322) Gregory Walsh*, Kenneth Brentner, The Pennsylvania State University; George Jacobellis, Farhan Gandhi, Rensselaer Polytechnic Institue	**A Simple Analytical Model for Investigation of Fuselage-Rotor Interference** (20) Berend van der Wall*, Marc Wentrup, Jianping Yin, DLR (German Aerospace Center); Ganesh Rajagopalan, Iowa State University; Sung N. Jung, Konkuk University	**High-Speed Experiments on Combustion-Powered Actuation for Dynamic Stall Suppression** (160) Claude Matalanis*, Patrick Bowles, Byung-Young Min, Solkeun Jee, Andrzej Kuczek, Brian Wake, United Technologies Research Center; Peter Lorber, Sikorsky; Tom Crittenden, Ari Glezer, Georgia Institute of Technology; Norman Schaeffler, NASA Langley Research Center	**Range and Endurance Tradeoffs on Personal Rotorcraft Design** (309) Christopher Snyder, NASA Glenn Research Center
1045-1115 *Paper # 5*	**Computational Comparisons between FW-H and Direct Acoustic Predictions** (185) Jeremy Bain*, Bain Aero LLC	**Rotorcraft Simulations with Coupled Flight Dynamics, Free Wake, and Acoustics** (45) Umberto Saetti*, Joseph Horn, Kenneth S. Brentner, Willca Villafana, Penn State University; Dan Wachspress, Continuum Dynamics	**The First Wind Tunnel Test of the DLR's Multiple Swashplate System: Test Procedure and Preliminary Results** (123) Philip Kuefmann*, Rainer Bartels, Berend G. van der Wall, Oliver Schneider, German Aerospace Center - DLR; Hermann Holthusen, Jorge Gomes, Jos Postma, German-Dutch Wind Tunnels	**Parallel Evolutionary Optimization for Rotorcraft Design** (52) Ethan Corle*, Kevin Ferguson, Sven Schmitz, Pennsylvania State University
1115-1145 *Paper # 6*	**Predictions of Transonic Rotor Noise by KFWH Method with A Permeable Self-Adaptive Integration Surface** (206) Siyu Chen, Qijun Zhao*, Zheng Zhu*, Yiyang Ma*, Nanjing University of Aeronautics and Astronautics	**Modeling the Aerodynamic Interaction of Multiple Rotor Vehicles and Compound Rotorcraft with Viscous Vortex Particle Method** (69) Chengjian He*, Advanced Rotorcraft Technology, Inc.	**Overview of S-97 RAIDERTM Scale Model Tests** (143) Peter Lorber*, Gary Law, John O'Neill, Sikorsky; Claude Matalanis, Patrick Bowles, United Technologies Research Center	**Electric Multirotor Propulsion System Optimization for Mission Objectives** (127) Dmitry Bershadsky*, Stephen Haviland, Eric Johnson, Georgia Institute of Technology
1145-1215 *Paper # 7*		**Modeling the Effect of Yawed Flow on Dynamic Stall with Secondary Lift Peak—Experimental Correlation** (18) Ramin Modarres, David Peters*, Washington University in St. Louis		**Reliability-Focused Design of Advanced Rotorcraft Configurations** (43) Robert Scott, U.S. Army Aviation Development Directorate
1215-1245 *Paper # 8*				

Main author is listed first; * denotes presenter.

Technical Session B, Wednesday, May 18 – Morning, 8:00 a.m. – 12:15 p.m.

	Dynamics II **Ballroom A** *Session Chair:* **Dr. Edward Smith,** Pennsylvania State University	**Handling Qualities I** **Room 1DE** *Session Chair:* **David Klyde,** Systems Technology Inc. and **Sean Roark,** , US Navy	**Manufacturing Technologies (1/2) / Test & Evaluation II(1/2)** **Room 1F** *Session Chair:* **Bill C. Harris,** Sikorsky/ **Dr. Jose Palacios,** Pennsylvania State University	**Propulsion I** **Room 2DE** *Session Chair:* **Dr. Zihni Saribay,** Turkish Aerospace Industries
0800-0830 *Paper # 1*	**Multidisciplinary Design and Optimization for High Speed, High Efficiency Tiltrotors with Wing Extensions and Winglets** (312) Sandilya Kambampati*, Taylor Hoover, Edward Smith, Mark Maughmer, Penn State	**Adaptive Vehicle Management Systems Program Phase II Overview** (101) Russell Enns*, James Dryfoos, The Boeing Company; David Segner, Aviation Development Directorate	**Rotor Durability Advanced Technology Demonstration** (136) Louis Centolanza, Aviation Development Directorate; William Harris*, Sikorsky	**Passive Suppression of Planetary Gear Transmission Vibration via Discrete Boundary Struts** (51) Peng Guan*, Hans DeSmidt, University of Tennessee
0830-0900 *Paper # 2*	**An Efficient Approach for the Simulation and On-Blade Control of Helicopter Noise and Vibration** (165) Peretz Friedmann, Miang Chia*, Ashwani Padthe, Karthik Duraisamy, University of Michigan	**Maneuver and Mission Aiding via Tactile Cueing Flight Demonstrations** (105) Bryan Kashawlic*, Russell Enns, Brandon Brown, Rucie Moore, The Boeing Company	**On-Machine Inspection for Rotorcraft Manufacturing** (226) Jeffrey Nissen*, Cody Torno, Bell Helicopter	**State of the Art of Helicopter Hybrid Propulsion** (75) Christian Mercier*, Marc Gazzino, Marc Mugnier, Airbus Helicopters
0900-0930 *Paper # 3*	**RPM Driven Extension-Torsion Coupled Self-Twisting Rotor Blades** (298) Elizabeth Ward*, Inderjit Chopra, Anubhav Datta, University of Maryland College Park	**AVMS APAS H-47 Chinook Tactile Cueing Flight Test Results** (269) Joseph Irwin III*, The Boeing Company; Tony Rich, Redacted; Mark Schwerke, Erik Kocher, Brandon Brown, Boeing		**Performance Investigation of a Full-Scale Hybrid Composite Bull Gear** (96) Kelsen LaBerge*, Army Research Laboratory; Robert Handschuh, Gary Roberts, Scott Thorp, NASA Glenn Research Center
0930-1015	***Refreshment Break***			
1015-1045 *Paper # 4*	**Rotorcraft Ground Resonance Mitigation with Articulated Landing Gear** (343) Jared Langley*, Mark Costello, Georgia Institute of Technology	**Carefree Maneuvering via Tactile Cueing Flight Demonstrations** (288) Bryan Kashawlic*, Russell Enns, Joseph Irwin, Rucie Moore, The Boeing Company	**Application of Casting Technologies to Sikorsky Development Programs** (267) Heather Woodworth*, Sikorsky; Jason Fetty, Treven Baker, Aviation Applied Technology Directorate	**Evaluation of Future Helicopter Powertrain Concepts Regarding Flight Mission and Operational Aspects** (145) Martin Kerler*, Yvonne Heibel, Wolfgang Erhard, Technische Universitaet Muenchen
1045-1115 *Paper # 5*	**Emulation of Whirl Flutter on a Stable Helicopter Using Trailing Edge Flaps** (92) Tobias Rath, Tobias Richter*, Alexander Steinwandel, Walter Fichter, University of Stuttgart	**Flight Test of Explicit and Implicit Rotor-State Feedback Fly-By-Wire Control Laws** (174) Christina Ivler*, M. Hossein Mansur, Zachariah Morford, U.S. Army ; Kevin Kalinowski, Dell Services Federal Government; Marit Knapp, San Jose State Unversity Research Foundation, Santa Clara University	**Experimental Model Validation of a Passive Balancing Device for Supercritical Helicopter Driveshafts** (333) Ahmad Haidar, Jose Palacios, Pennsylvania State University	**Bringing Direct Bolt Preload Measurement to the Aerospace Industry** (243) Andrea Chavez*, Bell Helicopter Textron Inc.; Jason Fetty, Treven Baker, Aviation Development Directorate - Aviation Applied Technology Directorate; Jesse Meisterling, Intellifast
1115-1145 *Paper # 6*	**Application Issues for In-Flight Tracking Control Using Trailing Edge Flaps** (49) Frank A. King, Alexander Steinwandel*, Walter Fichter, University of Stuttgart	**High Order Compensator Augmentation of a Baseline Partial Authority Controller for Rotorcraft** (195) James Spires*, Joseph Horn, Pennsylvania State University	**Designing the Bell 525 Pylon Bipod Mount Test Fixture** (61) Siddhartha Mukherjee*, Bell Helicopter - Textron India Private Limited; Alejandro Barbarin, Bell Helicopter Textron Inc.	**A Physics-based Tribology Model and Parametric Assessments of Loss-of-Lubrication Using Reduced-Order System Level Analysis** (316) Qingtao Yu*, Sean McIntyre, Robert Kunz, Liming Chang, Robert Bill, Penn State University
1145-1215 *Paper #7*	**Optimal Active Twist Deployment Schedule of a Rotor for Performance Improvement and Vibration Reduction** (354) Young You, Sung Jung*, Konkuk University	**L1-based Model Following Control of an Identified Helicopter Model in Hover** (289) Giacomo Picardi, Stefano Geluardi*, Mario Olivari, Heinrich H. Buelthoff, Max Plank Institute for Biological Cybernetics; Lorenzo Pollini, Mario Innocenti, University of Pisa	**Characterization and Analysis of H-53E Lag Damper** (278) Young-Tai Choi, Norman Wereley*, University of Maryland; Ashish Purekar, InnoVital Systems Inc.; Roberto Semidey, Nam Phan, Naval Air Warfare Center	**Advanced Nondestructive Evaluation and Sensing Methods for High Temperature Propulsion Materials** (233) Anindya Ghoshal*, Raymond Brennan, Michael Walock, Muthuvel Murugan, Marc Pepi, Michael Shiao, U.S. Army Research Laboratory; Erik Nykwest, University of Connecticut; Kevin Kerner, ADD-AMRDEC
1215-1245 *Paper #8*	**Adverse Aeroelastic Roll/Lateral Rotorcraft-Pilot Couplings Analysis** (335) Pierangelo Masarati*, Vincenzo Muscarello, Giuseppe Quaranta, Politecnico di Milano; Marilena Pavel, TU Delft; Georges Tod, François Malburet, École Nationale Supérieure d'Arts et Métiers	**Application of Linear Quadratic Estimation (LQE) to Harmonic Analysis of Rotorcraft Vibration** (212) Nathaniel Morgan*, Caitlin Berrigan, Mark Lopez, J.V.R. Prasad, Georgia Institute of Technology		

	Technical Session C, Wednesday, May 18 – Afternoon, 1:45 p.m. – 6:00 p.m.			
	Aerodynamics II **Ballroom A** *Session Chair:* **Philippe Beaumier,** ONERA	**Aircraft Design II (1/2) / Propulsion II (1/2)** **Ballroom C** *Session Chair* **Dr. VT Nagaraj,** UMD/**Brian Devendorf,** GE	**Dynamics III** **Room 2DE** Session Chair: **Dr. Christoph Kessler,** DLR	**Handling Qualities II** **Room 1DE** *Session Chairs:* **Sean Roark,** US Navy and **David Klyde,** Systems Technology Inc.
1345-1415 *Paper # 1*	**A Hamiltonian-Strand Approach for Aerodynamic Flows Using Overset and Hybrid Meshes** (280) Yong Su Jung*, Bharath Govindarajan, James Baeder, University of Maryland	***Cheeseman Award*** **Bluecopter Demonstrator - An Approach to Eco-Efficient Helicopter Design** Marius Bebesel, Airbus Helicopters Deutschland GmbH	**Measurement and Validation of a Mach-Scale Rotor Performance and Loads at High Advance Ratios** (256) Xing Wang*, Anand Saxena, Inderjit Chopra, University of Maryland	**Development of a Computational Model of Pilot Manual Control and its Application on Mission-Task-Element Evaluation of a Limited Authority Helicopter** (16) Can Onur*, Selahattin Burak Sarsilmaz, Umut Ture, Ismail Hakki Sahin, Ugur Zengin, Turkish Aerospace Industries
1415-1445 *Paper # 2*	**Improvements in the Helios Rotorcraft Simulation Code** (272) Andrew Wissink, Rohit Jain, Mark Potsdam*, Joshua Leffell, U.S. Army; Jayanarayanan Sitaraman, Parallel Geometric Algorithms; Buvana Jayaraman, Beatrice Roget, Vinod Lakshminarayan, Science & Technology Corp.; Andrew Bauer, Kitware Inc.; James Forsythe, U.S. Navy	***Student Design Competition Graduate Presentation:*** **AirEZ** Stacy Sidle, University of Maryland	**Floquet-SSI Methods for Real-Time Stability Monitoring and Correlation** (82) Jason Hull*, Spire Innovations, LLC; Joseph Andrews, Sikorsky Aircraft	**Characterization of Pilot Strategy for Simulated Shipboard Approaches with Realistic Ship Motion** (266) James Pritchard*, Ryan Wallace, NAVAIR; John Tritschler, John O'Connor, David Arteche, USNTPS
1445-1515 *Paper # 3*	**Evaluation of Transitional Effects in Rotorcraft Applications** (265) Philip Cross*, Joachim Hodara, Marilyn Smith, Georgia Institute of Technology	***Student Design Competition Undergraduate Presentation:*** **Air Buzz** Chelsea Fuller and Caitlin Berrigan, Georgia Institute of Technology	**Assessment of Comprehensive Analysis Predictions of Helicopter Rotor Blade Loads in Forward Flight** (102) Jimmy Ho*, Science and Technology Corporation; Hyeonsoo Yeo, U.S. Army Aviation Development Directorate	**Analysis of Pilot Control Activity in ADS-33E Mission Task Elements** (150) John Tritschler*, John O'Connor, U.S. Naval Test Pilot School; David Klyde, Amanda Lampton, Systems Technology, Inc.
1515-1600	***Refreshment Break***			
1600-1630 *Paper # 4*	**Assessment of turbulence model length scales based on Hybrid RANS-LES modeling of unsteady flow over airfoil** (353) Nishan Jain*, James Baeder, University of Maryland	**Load Distribution and Mesh Stiffness Analysis of an Internal-External Bevel Gear Pair in a Pericyclic Drive** (338) Tanmay Mathur*, Edward Smith, Robert Bill, Penn State; Hans DeSmidt, University of Tennessee Knoxville	**Contactless rotor flapping sensor design, implementation and testing** (247) Lorenzo Trainelli*, Alfredo Cigada, Andrea Ferrario, Rui Liu, Stefano Manzoni, Emanuele Zappa, Politecnico di Milano; Attilio Colombo, Matteo Redaelli, Finmeccanica - Helicopter Division; Potito Cordisco, Alberto Rolando, Mauro Terraneo, Edoardo Vigoni, Vicoter; Riccardo Grassetti, Logic	**Disturbance Rejection Handling Qualities Criteria for Rotorcraft** (78) Tom Berger*, Christina Ivler, Marcos Berrios, Mark Tischler, U.S. Army Aviation Development Directorate; David Miller, The Boeing Company
1630-1700 *Paper # 5*	**Assessment of Transition Models in Predicting Skin Frictions and Flow Field of a Full-Scale Tilt Rotor in Hover** (300) Chunhua Sheng*, Qiuying Zhao, The University of Toledo	**Seeded Fault Testing of Hybrid Bearings** (367) Mark Kozachyn*, Mark Robuck, The Boeing Company	**A Convergence Study for a Longitudinal Maneuver by Using Various Tools** (285) Seyhan Gül*, Muhammed Emre Bilen, Murat Şahin, Derya Gürak, Turkish Aerospace Industries; Yavuz Yaman, Middle East Technical University	**Evaluation of ADS-33E Yaw Bandwidth and Attitude Quickness Boundaries** (138) Rhys Lehmann*, Defence Science and Technology Group; Mark Tischler, Chris Blanken, U.S. Army RDECOM - AMRDEC
1700-1730 *Paper # 6*	**Axisymmetric Potential Flow Model of Single or Coaxial Actuator Disks** (321) Eli Giovanetti, Kenneth Hall*, Duke University		**Influence of Dynamic Inflow States on Coupled Rotor Fuselage Modes** (320) Salini S Nair*, Ranjith Mohan, IIT Madras; Gopal Gaonkar, Florida Atlantic University	**Helicopter Main Rotor Hub Load Alleviation Using a Variable Incidence Horizontal Stabilizer** (8) Mark Voskuijl*, Mario Verhagen, Delft University of Technology
1730-1800 *Paper # 7*	**Approximate Transition Prediction for the ONERA 7AD Rotor in Forward Flight using a Structured and Unstructured U/RANS solver** (129) Christoph Heister, German Aerospace Center (DLR)		**Investigation of the structural blade dynamics and aeroelastic behavior of the 7A rotor** (112) Stefan Surrey*, Felix Wienke, German Aerospace Center ; Biel Ortun, Khiem-Van Truong, ONERA	**AW189 Engine Off Landing Certification by Simulation** (182) Riccardo Bianco-Mengotti*, Andrea Ragazzi, Federico del Grande, Gianfranco Cito, Alessandro Brusa Zappellini, Finmeccanica Helicopter Division
1800-1830 *Paper #8*	**Trimmed Simulation of a Complete Helicopter Configuration in Hover Flight** (284) Se Hwan Park, Yeon Bok Chu, Duck Joo Lee, KAIST; Ji Sung Jang, Agency for Defense Development			**Development of Advanced Flight Control Laws for the AH-64 Apache Helicopter - Sketches from the work of TU Delft-Boeing Project in SIMONA Simulator** (360) Marilena Pavel*, Olaf Stroosma, Qiping Chu, Delft University of Technology; Perumal Shanthakumaran, Mike Wolfe, Boeing Mesa; Harm Cazemier, Royal

Main author is listed first; * denotes presenter.

Technical Session C, Wednesday, May 18 – Afternoon, 1:45 p.m. – 6:00 p.m.

	HUMS/CBM I Room 2BC *Session Chair:* **Douglas Knapp,** The Boeing Company	Modeling & Simulation II Room 1BC *Session Chair:* **Dr. Hong Xin,** Sikorsky	Structures & Materials II Room 2A *Session Chair:* **Dr. Robert Benton,** US Army	UAV II Room 1F *Session Chair:* **Jacquelyn Banas,** Georgia Institute of Technology
1345-1415 *Paper # 1*	**Rotorcraft Turbine Engine applications of Environetix's Wireless High Temperature Surface Acoustic Wave (SAW) Micro Electro-mechanical (MEM) Sensor System** (80) John Moffatt,* U.S. Army, AATD ; Maurice Pereia da Cunha, Robert Lad, Environetix Technologies Corp	**Towards Generalized Certification of Slung Load Flight Envelopes** (241) Nicholas Motahari, Nandeesh Hiremath, Narayanan Komerath*, Georgia Institute of Technology	**Analysis Methods Improving Confidence in Material Qualification for Laminated Composites** (81) Andrew Makeev*, Guillame Seon, Yuri Nikishkov, University of Texas at Arlington; Dean Nguyen, Sikorsky Aircraft; Peter Mathews, Mark Robeson, U.S. Army Aviation Development Directorate	***Lichten Competition Runner-up:*** **Rotor Blade Optimization and Flight Testing of a Small UAV Rotorcraft** (39) Mark Kotwicz Herniczek*, Daniel Feszty, Dustin Jee, Brian Sanders, Carleton University
1415-1445 *Paper # 2*	**Flight Test Preparation of Health Management Technologies** (163) Andrew Brookhart*, Jim Cycon, Mark Davis, Preston Bates, Sikorsky Aircraft; Chris Lyman, Nathaniel Bordick, Paul Pantelis, Treven Baker, Bruce Thompson, U.S. Army ADD-AATD	**A Time-Frequency Domain Approach for PIO/PAO Detection and Analysis** (270) Pierangelo Masarati*, Politecnico di Milano; Denis Franzoni, Giorgio Guglieri, Politecnico di Torino	**Numerical simulation of the load carrying capability of composite rotorcraft airframe structures, taking into account the effect of disbonds in the damage tolerance and fatigue evaluation** (156) Johannes Markmiller*, Christian Reichensperger, Alexander Engleder, Airbus Helicopters	**Study and flight tests of a Drone with OrieNted Thrust (DONuT)** (169) Sebastien Prothin*, François Defay, Luc Lambert, Guillaume Raynaud, ISAE-Supaéro
1445-1515 *Paper # 3*	**Employing Legacy HUMS Data to Support Aging Aircraft ASIP** (224) Aaron Muise*, Anthony Edmonds*, Keith Graham, IMP Aerospace	**Model-Enhanced Analysis of Flight Data for Helicopter Flight Operations Quality Assurance** (250) Alek Gavrilovski*, Kyle Collins, Dimitri Mavris, Georgia Institute of Technology	**Results of a parametric design study to adapt the structural properties and strain distribution of active twist blades** (178) Steffen Kalow*, Steffen Opitz, Johannes Riemenschneider, Frauke Hoffmann, German Aerospace Center (DLR)	**Detection of Forward Flight Limitations of Unmanned Helicopters** (310) Andreas E. Voigt*, Johann C. Dauer, Alex Krenik, Joerg S. Dittrich, German Aerospace Center (DLR)
1515-1600	***Refreshment Break***			
1600-1630 *Paper # 4*	**Tip Displacement Estimation Using Fiber Optic Sensors for X2 Technology¢â Rotor Blades** (240) Seung Bum Kim*, Patrick Bowles, Claude Matalanis, Brian Wake, United Technologies Research Center; Derek Geiger, Sikorsky Aircraft	**The Role of Modeling & Simulation in the Mitigation of V-22 Tiltrotor Formation Flight Wake-Induced Roll-off** (346) Mark Silva*, Donald Gaublomme, Eric Hayden, NAVAIR ; Daniel Wachspress, Continuum Dynamics, Inc.; T. Scott Davis, Tyler Fean, American Systems	**Design for Supportability Considerations** (262) Greg Mellema*, Kimberly Cockrell*, AMRDEC Prototype Integration Facility	**Wind Tunnel and Hover Performance Test Results for Multicopter UAS Vehicles** (374) Carl Russell*, Jaewoo Jung, Gina Willink, NASA Ames Research Center; Brett Glasner, Universities Space Research Association
1630-1700 *Paper #5*	**Integrated Hybrid Structural Management System (IHSMS)** (292) Thomas Cook*, Mark Davis, Jim Cycon, Sikorsky Aircraft; David Rusk, Madan Kittur, NAVAIRSYSCOM	**Vehicle Modeling for Flight Test Measurements of Ship Airwake Disturbances** (297) Jared Cooper*, Barron Associates, Inc.; Venkatasubramani S. R. Pappu, Yande Liu, Joseph Horn, Pennsylvania State University	**Blending Modern Multifunctional Materials with Traditional Structures: An Approach towards Cleaner and Greener Future** (281) Dineshkumar Harursampath, Shashank Agrawal, Sangheetha Ponnusami, Indian Institute of Science; Mohit Gupta*, Georgia Institute of Technology; Sathiskumar Ponnusami, TU Delft; Dhamotharan Veerasamy, City University London	**Effects of Inflow Model on Simulated Aeromechanics of a Quadrotor Helicopter** (370) Robert Niemiec*, Farhan Gandhi, Rensselaer Polytechnic Institute
1700-1730 *Paper # 6*	**A New Acoustic Emission Signal Processing and Feature Extraction Approach for Bearing Fault Diagnosis** (327) Miao He, David He*, University of Illinois at Chicago ; Yongzhi Qu, Wuhan University of Technology; Eric Bechhoefer, GPMS Inc.	**A Python-Based Framework for Real-time Simulation using Comprehensive Analysis** (323) Ananth Sridharan*, Greg Rubenstein, David Moy, Inderjit Chopra, University of Maryland, College Park	**U.S. Army Composite Repair Standardization** (318) Kristina Marshall, David Stone, U.S. Army	**A Model-Based Approach to the Automated Design of Micro-Autonomous Multi-rotor Vehicle Systems** (164) Arthur Cheng, Zachary Fisher, Raphaël Gautier*, K. Daniel Cooksey, Dimitri Mavris, Georgia Institute of Technology; Nathan Beals, Army Research Laboratory
1730-1800 *Paper # 7*	**Improving Gear Fault Detection by Reducing Tachometer Jitter** (146) Eric Bechhoefer*, GPMS Inc ; David He, University of Illinois at Chicago	**Performance Evaluation and Comparison of Dynamic Inflow Models for Rotorcraft Simulation** (364) Feyyaz Guner*, Gonenc Gursoy, Ilkay Yavrucuk, Middle East Technical University	**Dual-Use Structures: Helicopter Structural Composite Wing Antenna** (369) Ronald Lavin*, Courtney Kube, Stacey Tyrell, Dennis McCarthy, Boeing; Mark Robeson, U.S. Army AMRDEC ADD	**Fire Scout MQ-8C Embarked Aviation and Deck Motion Interface Challenges** (187) Dr. Bernard Ferrier*, Hoffman Engineering LLC ; Robert Ernst, Isaiah Kim, NAVAIR U.S. Navy; Ajay Sehgal, Wyle Laboratories Corp
1800-1830 *Paper #8*				

	Technical Session D, Thursday, May 19 – Morning, 8:00 a.m. – 12:15 p.m.			
	Aerodynamics III **Ballroom A** *Session Chair:* **Dr. Sven Schmitz,** Pennsylvania State University	**Aircraft Design III** **Ballroom C** *Session Chair:* **Luigi Ricci Moretti,** Finmeccanica	**Avionics & Systems** **Room 1DE** *Session Chair:* **Andrew Augenstein,** The Boeing Co.	**Handling Qualities III (1/2) / UAV III (1/2)** **Room 2DE** *Session Chair:* **David Klyde,** Systems Technology, Inc./**Dr. Harshad Sane,** Sikorsky
0800-0830 *Paper # 1*	**Compressible Dynamic Stall Alleviation Through High Momentum Blowing** (132) Peter Lorber*, Charles Berezin, Mark Scott, Sikorsky Aircraft ; Patrick Bowles, United Technologies Research Center; James Gregory, Kyle Hird, Matthew Frankhouser, Bons Jeffrey, Ohio State University	**Development of an Electro-Mechanical IBC Actuator** (225) Friedrich Straub, Jeffrey Coffman*, Terry Birchette, Rich Bussom, Boeing; Evan Frank, ThinGap LLC; Louis Centolanza, U.S. Army	**Bell 525 Airspeed Calibration Prior to First Flight** (83) Jonathan Mitchell*, Matthew Hill, Albert Brand, Nathan Wu, Ajay Singh, Bell Helicopter	**Design of an Automatic Load Positioning System for Hoist Operations** (73) Hyun-Min Kim, German Aerospace Center (DLR)
0830-0900 *Paper # 2*	**Adjoint-based Aeroacoustic Design-Optimization of Flexible Rotors in Forward Flight** (263) Enrico Fabiano*, Dimitri Mavriplis, University of Wyoming	**Mlti-Role Rotor – Adaptive Performance (MRRAP)** (41) Edward Brouwers*, Thomas Zientek, Christopher Cline, Richard Bussom, Friedrich Straub, Jeffery Coffman, Boeing; Louis Centolanza, Aviation Development Directorate	**What are the Real Benefits of Applying Open Systems Architecture to Rotorcraft Mission Systems?** (196) Ronald Koontz, The Boeing Company	**Design Refinement and Flight Test of the AVMS Active External Load Stabilization System** (211) Erik Bellandi, Alex Bourreza, Roy Brewer, Russell Enns, Roger Hehr, Boeing; Christina Ivler*, Aviation Development Directorate
0900-0930 *Paper # 3*	**Wind Tunnel Assessment of the Computational Framework for Helicopter Fuselage Drag Reduction Using Vortex Generators** (21) Alex Zanotti, Giovanni Droandi, Giuseppe Gibertini, Franco Auteri, Politecnico di Milano; Jean-Christophe Boniface, Robert Gaveriaux, Arnaud Le Pape*, ONERA	**A Model-Scale Wind-Tunnel Study of Main Rotor/Propeller Interference** (202) Patrick Bowles*, Claude Matalanis, Brian Wake, United Technologies Research Center; Emily Bartz, Mark Scott, Sikorsky; Ben Berry, University of Maryland	**UH-60V – Avionics and Systems** (299) Jonathan Shaddix*, Miranda Oden, Wes Perry, AMRDEC Prototype Integration Facility	**Robust Partial Authority Model Predictive Control in Degraded Visual Environments** (27) Jared Cooper*, Barron Associates, Inc.; Peter Thompson, Chase Schulze, David Klyde, Systems Technology, Inc
0930-1015	***Refreshment Break***			
1015-1045 *Paper # 4*	**Experimental Investigation of Passive and Active Flow Control for X2 Technology™ Hub and Fuselage Drag Reduction** (201) Patrick Bowles*, Byung-Young Min, Barbara Botros, Claude Matalanis, Brian Wake, United Technologies Research Center; Mathew Thomas, Aviation Development Directorate; Derek Geiger, Sikorsky Aircraft	**Bell 525 Hydraulic System Optimization for Fly-By-Wire Control** (257) James Sobel*, Robert Reynolds, Bell Helicopter	**A Rapid and Affordable Approach to Insert the Future Airborne Capability Environment (FACE™)) into Fielded Open System Architecture (OSA) Systems** (341) Tony Johnson*, Stephanie Burns, Joe Dusio, Patrick Gomez, Rockwell Collins	**Outer-Loop Development and DVE Flight Test Assessment of a Partial Authority Model-Following Control System for the UH-60** (84) Brian Fujizawa*, Mark Tischler, Joe Minor, U.S. Army Aviation Development Directorate
1045-1115 *Paper # 5*	**Computations of Combustion-Powered Actuation for Dynamic Stall Suppression** (99) Solkeun Jee*, Patrick Bowles, Claude Matalanis, Byung-Young Min, Brian Wake, United Technologies Research Center; Thomas Crittenden, Ari Glezer, Georgia Institute of Technology	**CFD analysis of tail surface modifications and rudder deflection influence on I-28B gyroplane at high angle of sideslip.** (74) Adam Dziubinski, Instytut Lotnictwa	**Airborne Integrated Voice, Data, and ADS-B in Compliance with the FAA and FCC** (329) Kaydon Stanzione, Praxis Technologies, Inc.	**Flight Control System of a Tiltwing UAV** (382) Tobias Ostermann, RWTH Aachen University
1115-1145 *Paper # 6*	**Performance and Flowfield Measurements of Rotors with Pumping Blades** (315) Joseph Milluzzo*, Scott Drayton, Benjamin Branson, United States Naval Academy	**Servo-Flap Rotor Design for High Density Altitude Operation** (236) Fu-Shang (John) Wei, Central Connecticut State University		**Autonomous Rotorcraft Flight Control with Multi-Level Pilot Interaction in Hover and Forward Flight** (12) Marc Takahashi*, Matthew Whalley, Hossein Mansur, Carl Ott, Joseph Minor, Zachariah Morford, U.S. Army; Chad Goerzen, Greg Schulein, San Jose State University
1145-1215 *Paper # 7*	**Numerical and Experimental Study of Centrifugally-Driven Flow inside a Rotating Duct for Rotorcraft Application** (181) Byung-Young Min*, Daniel Shannon*, Brian E. Wake, United Technologies Research Center; Anand Karpatne, Jayant Sirohi, University of Texas, Austin; D. Caleb Sargent, Sikorsky	**Leveraging Geometry Optimization Tools to Reduce Component Weight, Development Cost, and Design Schedule** (231) Scott Bouwer*, David Bowen*, Boeing		
1215-1245 *Paper #8*	**Influence of the diffuser geometry of shrouded rotors on the aerodynamic footprint of MAVs** (173) David Gomez Ariza*, Thierry Jardin, Sebastien Prothin, ISAE-Supaéro			

Main author is listed first; * denotes presenter.

	Technical Session D, Thursday, May 19 – Morning, 8:00 a.m. – 12:15 p.m.			
	HUMS/CBM II **Room 2BC** *Session Chair:* **Daniel Wade,** US Army	**Safety** **Room 1F** *Session Chair:* **Paul Inguanti,** Sikorsky	**Systems Engineering** **Room 2A** *Session Chair:* **Dr. Joan Pham,** Sikorsky and **Dr. Stephen Felter**, Lockheed Martin	**Wind Energy** **Room 1BC** *Session Chair:* **Prof. Jonathan Naughton,** University of Wyoming
0800-0830 *Paper # 1*	**Health Monitoring Survey of Bell 412EP Transmissions** (32) Brian Tucker*, Bell Helicopter; Paula Dempsey, NASA Glenn Research Center	**Damage Behaviour of Rotorcraft End Plate under High Velocity Bird Impact** (58) Thenarasu D., Vijaya Kumar R.*, Ravindranath R., Chalwade D. B., Rotary Wing R&D Centre, Hindustan Aeronautics Limited	**Safety Enhancement thanks to Real Time Performance Indication** (29) Germanetti Serge, Airbus Helicopters	**An Overset Adaptive High-Order Approach for Blade-Resolved Wind Energy Applications** (311) Andrew Kirby*, Michael Brazell, Dimitri Mavriplis, University of Wyoming; Jay Sitaraman, Parallel Geometric Algorithms LLC
0830-0900 *Paper # 2*	**A modified Tukey Boxplot for Threshold Analysis: Upper Quartile Parameterization** (340) Matthew Watson, QTEC	**Analysis of Human Guidance and Perceptual Behavior in Navigation of Unknown Environments** (62) Abhishek Verma*, Berenice Mettler, University of Minnesota	**Process Improvement for Rotorcraft Tradespace Exploration incorporating Reliability and Availability** (57) Saikath Bhattacharya, Vidhyashree Nagaraju, Lance Fiondella*, University of Massachusetts; Eric Spero, Anindya Ghoshal, U.S. Army Research Laboratory (ARL)	**A Study of Individual Pitch Control of a Horizontal Axis Wind Turbine in Atmospheric Boundary Layer** (283) Yasutada Tanabe*, Takashi Aoyama, Masahiko Sugiura, Japan Aerospace Exploration Agency (JAXA); Harutaka Oe, Makoto Yamamoto, Tokyo University of Science
0900-0930 *Paper # 3*	**Gear Health Algorithm Solution for Drive Systen Design and Operations** (355) Rajasekhar Pulikollu, Sentient Science Corporation	**Implementation of the Product Equipment List to Further Enhance Safety on Sikorsky Aircraft Corporation's Commercial Aircraft Models** (95) Jessica Bufort*, Stephen Hepner*, Sikorsky Aircraft	**Quantitative Methods Improve Rotorcraft Safety Risk Management** (220) John Hewitt*, Joan Pham*, Sikorsky Aircraft	**Numerical Simulation of Oscillating Wind Turbines** (282) Vladimir Leble, George Barakos*, University Glasgow
0930-1015	***Refreshment Break***			
1015-1045 *Paper # 4*	**Measurement of Vibration Transfer Functions to Inform Machine Learning Based HUMS Diagnostics** (249) Daniel Wade*, Jeremy Partain, Andrew Wilson, Matthew Statham, Frances Love, U.S. Army; Hieu Ngo, Perumal Shanthakumaran, Boeing	**Top Causes for Fatal and Non-Fatal Accidents in Helicopter Operations** (167) Arjun Rao*, Karen Marais, Purdue University	**Reconfigurable Discrete Event Simulation of Rotorcraft Maintenance and Operations** (252) Zachary Ernst, Ryan Armstrong*, Kyle Collins, Dimitri Mavris, Georgia Institute of Technology; Eric Spero, U.S. Army Research Laboratory	**Numerical Simulation of Multiple Interacting Wind Turbines on a Complex Terrain** (147) Avinaash Murali*, R. Ganesh Rajagopalan, Iowa State University
1045-1115 *Paper # 5*	**Manoeuvre Recognition Using a Low-Cost Standalone MEMS-IMU System** (40) Catherine Cheung*, Jobin Puthuparampil, Julio Valdes, Shashank Pant, National Research Council Canada	**Standardization of Rotorcraft Guidelines for Quantitative Risk Assessment** (232) Gary Braman*, John Hewitt*, Sikorsky Aircraft	**Closing the Gap between Capability and Affordability for System Upgrades and Major-Modifications** (317) Sylvester Ashok*, Apinut Sirirojvisuth*, Georgia Institute of Technology; Andrew Smith, Georgia Tech	**Wind Farm Performance Improvement by Using Wake Transport** (193) Keye Su*, Donald Bliss, Duke University
1115-1145 *Paper # 6*	**A Virtual Pilot Algorithm for Synthetic HUMS Data Generation** (59) Jonathan Rogers*, Lee Fowler, Georgia Institute of Technology	**Cockpit Alarm Detection and Identification Algorithm for Helicopters** (276) Sanghyun Shin*, Yiqing Ding, Inseok Hwang, Purdue University	**Next-Generation Model-Based Systems Engineering Processes and Tools supporting the Airworthiness efforts of Cyber Physical Systems (CPS)** (345) Stephen Simi*, Sean Mulolland, Tucson Embedded Systems (TES) - System Architecture Virtual Integration (TES-SAVi); Layne Merritt, U.S. Army AMRDEC ADD	
1145-1215 *Paper # 7*	**Establishing Rotorcraft Component Fatigue Lives using SUMS Data and a Partial Usage Spectrum Approach for the MH-47G Chinook** (104) Jeff Finckenor*, Michael Chandler, Vencore Inc; Terry Baker, Scott Engelmeyer, U.S. Army; Christopher Wallace, PeopleTec	**Future Vertical Lift Airworthiness Certification- Should it be based on A Civil Aviation Functional Safety Certification Standard?** (324) Daniel Schrage, Georgia Tech		
1215 - 1245 *Paper #8*	**Improved Load Estimation and Fatigue Life Tracking Demonstrated on Multiple Platforms Using the Signal Approximation Method** (192) Catherine Cheung*, Julio Valdes, Jobin Puthuparampil, National Research Council Canada; Bruno Rocha, Algonquin College			

	Technical Session E, Thursday, May 19 – Afternoon, 1:30 p.m. – 6:00 p.m.			
	Acoustics II **Room 2BC** *Session Chair:* **Dr. Cal Sargent,** Sikorsky	**Advanced Vertical Flight II (1/2)** **Room 1DE** *Session Chair:* **Dr. Hao Kang,** US Army Research Lab	**Aero/Dynamics (1/2) / Aero Safety (1/2)** **Ballroom A** *Session Chairs:* **Dr. Robert Biedron,** NASA Langley and **Dr. James Baeder,** UMD/**Tony Randall,** Bell Helicopter	**Crew Station & Human Factors** **Room 2A** *Session Chair:* **Jeffery Erwin,** Bell Helicopter
1330-1400 *Paper # 1*	**Measurement and Characterization of Helicopter Noise at Different Altitudes** (38) Michael Watts*, Eric Greenwood, NASA Langley Research Center; James Stephenson, U.S. Army Aviation Development Division	**Experimental Measurement of a Blade Section With a Continuous Trailing-Edge Flap** (91) Robert Thornburgh*, Andrew Kreshock, Matthew Wilbur, U.S. Army Research Laboratory	**Rotor Loads Prediction on the ONERA 7A Rotor using Loose Fluid/Structure Coupling** (65) Biel Ortun*, Khiem Van Truong, ONERA; Mark Potsdam, Hyeonsoo Yeo, U.S. Army Aviation Development Directorate	**Helmet Mounted Digital Imaging Systems; Cockpit Compatibility Implications** (274) Tim Robinson*, John Green, Esterline Control and Communication Systems
1400-1430 *Paper # 2*	**The Effects of Ambient Conditions on Helicopter Harmonic Noise Radiation: Theory and Experiment** (37) Eric Greenwood*, D. Douglas Boyd, NASA Langley Research Center; Ben Sim, U.S. Army	**Nonlinear Aeroelastic Model for a Highly Flexible Flapping Wing in Hover** (155) Xuan Yang*, Aswathi Sudhir, Moble Benedict, Texas A&M University	**Improvements to Tandem-Rotor H-47 Helicopter Coupled CFD-CSD Full Aircraft Model** (183) Edward Meadowcroft*, Boeing; Rohit Jain, U.S. Army Aviation Development Directorate – AFDD	**Terrain and Obstacle Avoidance Displays for Low-Level Helicopter Operations in Degraded Visual environments** (308) Martine Godfroy-Cooper*, NASA/SJSU; Zoltan Szoboszlay, U.S. Army Aviation Development Directorate, AMRDEC; Allon Kahana, University of Haifa; Michal Rottem-Hovev, Maof HFE
1430-1500 *Paper # 3*	**Innovative Rotor-State Measurements Enabling Helicopter in-Flight Noise Monitoring and Enhanced Attitude Control** (246) Lorenzo Trainelli*, Marco Lovera, Alberto Rolando, Emanuele Zappa, Politecnico di Milano; Potito Cordisco, Vicoter; Massimo Gennaretti, Università di Roma Tre; Riccardo Grassetti, Logic; Matteo Redaelli, Finmeccanica - Helicopter Division	**System Identification of a Hover-Capable Robotic Hummingbird** (200) David Coleman*, Moble Benedict, Texas A&M University	**Investigation of UH-60A Rotor Structural Loads From Flight and Wind Tunnel Tests** (109) Hyeonsoo Yeo*, Mark Potsdam, U.S. Army Aviation Development Directorate; Thomas Norman, NASA Ames Research Center	**Evaluation of Visual Augmentation Methods for Rotorcraft Pilots in Degraded Visual Environments** (63) Franz Viertler*, Manfred Hajek, Technical University of Munich
1500-1530 *Paper # 4*	**Acoustic Characterization and Prediction of Representative, Small-Scale Rotary-Wing Unmanned Aircraft System Components** (44) Nikolas Zawodny*, D. Douglas Boyd Jr., Casey Burley, NASA Langley Research Center	**Aerial Commuter Architecture Using Slung Loads** (223) Dhwanil Shukla*, Nandeesh Hiremath*, Narayanan Komerath*, Georgia Institute of Technology	**Using Multibody Dynamics for the Aeroelastic Assessment of an Isolated Rotor with Innovative Blade Layout in Hover Flight** (381) Juergen Arnold, DLR German Aerospace Center	**Evaluation of Aircrew Whole-Body Vibration Exposure Levels on a Canadian CH-147F Chinook Helicopter** (10) Yong Chen*, Sebastien Ghinet, Andrew Price, Viresh Wickramasinghe, Anant Grewal, National Research Council Canada
1530-1600	***Refreshment Break***			
1600-1630 *Paper # 5*	**Initial Development of a Quadcopter Simulation Environment for Auralization** (98) Andrew Christian*, NASA Langley Research Center; Joseph Lawrence, Brigham Young University		**Aerodynamic Performance Analysis for Iced Rotor based on New Three-Dimensional Rotor Icing Model** (151) Xi Chen*, Qi-jun Zhao, Nanjing University of Aeronautics and Astronautics	**Evaluation of Aircrew Noise Exposure Levels on a Canadian CH-147F Chinook** (290) Andrew Price*, Sebastian Ghinet, Yong Chen, Viresh Wickramasinghe, Anant Grewal, National Research Council
1630-1700 *Paper # 6*	**Detection and Analysis of Interior and Exterior Noise Sources iIn a MD902 Helicopter** (172) Raphael Hallez, Scott Beebe*, Siemens PLM Software; Arthur Finez, MicrodB		**Rotor Blade Shed Ice Length Prediction** (68) Jared Soltis*, Jose Palacios, Pennsylvania State Universty	**Narrowing of Attention and Functional Field of View For Helicopter Pilots in a Degraded Visual Environment** (186) Joseph Geeseman, Naval Air Systems Command
1700-1730 *Paper # 7*	**Helicopter Drivetrain Noise and Vibration Refinement Through Reduction of Compound Planetary Gear Set Transmission Error** (162) Jose Torres*, Youn Park, Pradeep Deshmane, Romax Technology Limited		**Icing of Ducted Tail Rotor Based on Design of ILX-27 Unmanned Helicopter** (154) Pawel Gula, Adam Dziubiński*, Institute of Aviation; Piotr Neckarz*, PZL Mielec A Sikorsky Company	
1730-1800 *Paper #8*			**Integrated Tools for Rotorcraft Icing Analysis** (238) Lakshmi Sankar, Jeewoong Kim, Georgia Institute of Technology; Jeremy Bain*, Bain Aero LLC ; Andrew Wissink, U.S. Army Aviation Dev Dir – AFDD; Richard Kreeger, NASA Glenn Research Center	

Main author is listed first; * denotes presenter.

	Technical Session E, Thursday, May 19 – Afternoon, 1:30 p.m. – 6:00 p.m.			
	Operations **Room 1BC** *Session Chairs:* **Allen Huber,** US Army and **Lloyd Reaves,** Airbus	**Joint Product Support/HUMS** **Room 1F** *Session Chairs:* **Raymond Beale,** Sikorsky and **Douglas Knapp,** The Boeing Co.	**Structures & Materials III** **Room 2DE** *Session Chair:* **Dr. Yuriy Nikishkov,** University of Texas at Arlington	**Transformative Vertical Flight Special Session** **Ballroom B** *Moderated by:* **Dr. Ashish Baga**i, DARPA and **Mike Duffy**, Boeing
1330-1400 *Paper # 1*	**Improvements in the Rotorcraft Fuel Economy and Environmental Impact through Multiple-Landing Mission Strategy** (66) Fakhre Ali, Chalmers University of Technology	**Leveraging Massively Scalable Data Analytics Technologies to Enable Rapid HUMS-Based Fleet Management Decision Support** (239) Michael Koelemay, Peter Sulcs*, Sikorsky Aircraft Corporation	**Comparative Study of Finite Element Analysis and Geometrically Exact Beam Analysis of a Composite Helicopter Blade** (115) Meryem Nisa Ataç*, Altan Kayran, METU	• Mark Moore, NASA — On-Demand Mobility / Transformative Vertical Flight • Alex Stoll, Joby Aviation — The Joby S4 Tom Gunnarson, Zee.Aero — Civil VTOL Regulations • Dr. Ashish Bagai, DARPA — Transforming Vertical Flight • Carl Schaeffer, Aurora Flight Sciences — The Lightning Strike VTOL X-Plane
1400-1430 *Paper # 2*	**Helicopter Operation at Fukushima Nuclear Disaster** (221) Hajime Sagane, Utah State University	**Visual Exploration of Complex Avionics' Time Series** (375) David Noever*, Dennis Dunaway, PeopleTec	**Isogeometric Analysis based Finite Element Approach for Ductile Failure Prediction of the Second Sandia Fracture Challenge Problem** (171) Eugene Fang, Jim Lua*, Global Engineering and Materials, Inc.; Yicong Lai, Yongjie Jessica Zhang, Carnegie Mellon University; Nam D. Phan, Naval Air Warfare Center (PAX)	
1430-1500 *Paper # 3*	**Humanitarian Operation Packaged Essentials From an Underslung Load** (331) Marc Tardiff, U.S. Army (NSRDEC)	**A Comprehensive Approach for Tracking Helicopter Transmission Power Usage** (373) Harrison Chin*, ACR, INC.; David Green, Starmark Corp.; Richard Barnett, Bristow U.S. LLC ; Marco Macedo, Bell Helicopter	**A Combined Discrete and Continuum Fatigue Damage Characterization of a Hybrid Composite Flexbeam** (175) Jim Lua*, Eugene Fang, Global Engineering and Materials, Inc.; Anisur Rahman, Nam D. Phan, Naval Air Warfare Center (PAX)	
1500-1530 *Paper # 4*	**Development of the Multiple Bundle Sling Load System** (334) Marc Tardiff*, Daniel Nyren, George Matook, U.S. Army (NSRDEC)	**S-92® Main Rotor Blade Life Extension** (296) Raymond Beale*, Mark Davis, Jared Kloda, David Templeton, Sikorsky Aircraft	**Damage Assessment of Rotary Wing Aircraft Cabin Door using Continuum Damage Mechanics Model** (205) Gangadhara Rao T Boyina, Helicopter Division, HAL; Vijaya Kumar R*, Rotary Wing R&D Centre, HAL ; Subba Rao V V, Jawaharlal Nehru Technological University	
1530-1600	***Refreshment Break***			
1600-1630 *Paper # 5*	**The AgustaWestland AW609: Commercial Tiltrotor Operations in the Civil Aviation Environment** (377) Dan Wells, Scott Dubeck*, Don Barbour*, AgustaWestland Philadelphia Corp	**A Training and Educational Demonstration for Improving Maintenance Practices** (301) Travis Edwards*, Rhea McCaslin, Eddie Bell, Abdel E. Bayoumi, Lester Eisner, University of South Carolina	**Analysis of Shockwave Tolerant Features for Small-Volume Composite Rotorcraft Structure** (215) Kenneth Hunziker*, Lisa Chiu, Clark Andrews, Boeing; Mark Robeson, U.S. Army Aviation Development Directorate – AATD	• Perry Ziegenbein, Boeing — The Phantom Swift VTOL X-Plane • Dr. Thomas Berger, Karem Aircraft — The TR36XP VTOL X-Plane • Mark Alber, Sikorsky — The Rotor Blown Wing VTOL X-Plane • John Piasecki, Piasecki Aircraft — ARES Discussion
1630-1700 *Paper # 6*	**Future Unmanned Concept of Operations (CONOPs) – Supporting Future Expeditionary and Joint Forcible Entry Forces** (388) Glenn Tiongson, Sikorsky Aircraft Corporation	**HH-60G Airframe Service Life via Multi-Element Damage Monte Carlo Risk Analysis** (122) Nathan Branch*, Gregory Wood, Mercer Engineering Research Center (MERC); Thomas Brussat, Tom Brussat Engineering, LLC	**Generalized Multifield Variational Sectional Analysis of Composite Blades Considering Nonuniform Torsion** (350) Manoj Dhadwal, Sung Jung, Konkuk University	
1700-1730 *Paper # 7*	**MQ-8 Fire Scout Icing Solution Challenges** (390) Ajay Sehgal*, Wyle Aerospace Group; Robert Ernst, PMA 266, NAWCAD	**Estimation of Economic Effectiveness of HUMS Equipped AH-64 Aircraft: An ROI Approach** (261) Tanzina Zaman*, Abdel E. Bayoumi, University of South Carolina		
1730-1800 *Paper #8*		**Mission Ready – Completing 505 Jet Ranger X Kit Certifications in Time for 1st Deliveries** (28) Thomas Reilly*, Nicholas Ward, Bell Helicopter Textron		

Tuesday, May 17

8:00 a.m. – 12 noon

Special Session:

US Army Aviation Program Manager Briefings

*Moderated by **Ross Guckert,** Acting Deputy PEO for Aviation*

- COL Rob Barrie, PM Cargo
- Mr. Rich Tyler, Apache Deputy PM
- Mr. Steven Kelley, Tech Chief Utility Helicopters
- Mr. Lars Ericsson, Tech Chief Unmanned Aircraft Systems
- COL Matthew Hannah, PM Aviation Systems
- Mr. Bob Sheibley, Deputy PM ITE/FVL

Wednesday, May 18

8:00 a.m. – 12:15 p.m.

Special Session:

International S&T Program Manager Briefings

*Moderated by: **Layne Merritt**, ADD/Redstone*

- COL Steve Braddom, ADD/Ft Eustis
- Jay Fletcher, ADD/Ames
- Ned Chase, ADD/Ft Eustis
- Judah Milgram, ONR
- Susan Gorton, NASA
- Blanche Demaret, ONERA
- Dr. Klausdieter Pahlke, DLR
- Bryan Finlay, Dstl

	Wednesday, May 18 **1:45 p.m. – 6:00 p.m.**
	History Special Session **Ballroom B** *Session Chairs:* **Dr. Berend G. van der Wall**, DLR and **Dr. Bruce Charnov,** Hofstra University
1345-1445 *Paper # 1*	**Advancing Vertical Flight: A Historical Perspective on AHS International and its Times** (271) M.E. Rhett Flater*, L. Kim Smith, M.E. Rhett Flater & Associates
1445-1515 *Paper # 2*	**Historical Contributions to Vertical Flight at the NASA Langley Research Center** (55) Todd Hodges*, Retired; Susan Gorton, Karen Jackson, NASA Langley Research Ctr.
Refreshment Break	
1600-1630 *Paper # 3*	**Göttinger Monograph N: A Historic Document is Back** (4) Berend G. van der Wall, DLR (German Aerospace Center)
1630-1700 *Paper # 4*	**The Unsung Hero of Hurricane Katrina: The Helicopter** (70) Paul Fardink, U.S. ARMY (Retired)
1700-1730 Paper #5	**Chinese First Tandem Helicopter Designed by Major General Chia-Jen Chu of RoCAF** (365) Jacques Virasak, Sikorsky Aircraft Company
1730-1800 Paper #6	**The Good, the Bad and the Ugly: How the Three Revolts Against Igor Bensen's Popular Rotorcraft Association During 1962 – 1976 Failed to Change the Popular Rotorcraft Movement in America** (3) Bruce Charnov, Hofstra University

Thursday, May 19

8:00 a.m. – 12:15 p.m.

Special Session: US Navy/Marine Corps Aviation Program Briefings

(Note: Due to schedule conflicts, these presentations will be conducted remotely)
*Moderated by **Mr. Thomas E. Laux**, Northrop Grumman*
Former Deputy Assistant Secretary of the Navy (Air Programs)

- Greg Drohat, Deputy Program Manager, PMA-261, H-53 Heavy Lift Helicopters
- Larry Pugh, Deputy Program Manager, PMA-274, Presidential Helicopters
- Scott Hite, Deputy Program Manager, PMA-275, V-22 Joint Program
- John Marino, Deputy Program Manager, PMA-276, USMC Light/Attach Helicopters
- Holli Galletti, Deputy Program Manager, PMA-299, H-60 Multi-Mission Helicopters