



**Vertical Flight Society  
76<sup>th</sup> Annual Forum  
& Technology Display**

**October 5–8, 2020  
Virtual**

**Technical Sessions Schedule**

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**Special Session schedules listed on the back cover**

**Technical Session A: Tues. October 6, 2020, 08:00 am to 12:00 pm - US Eastern EDT (UTC-4)**

*Note: the main author is listed first and "\*" denotes the presenting author*

	<b>Acoustics I</b> Session Chair <b>Juliet Page</b> US Dept. of Transportation	<b>Advanced Vertical Flight I</b> Session Chair <b>Matthew Floros</b> US Army CCDC Army Research Laboratory	<b>Aerodynamics I</b> Session Chair <b>Arnaud Le Pape</b> French Aerospace Lab (ONERA)	<b>Dynamics I</b> Session Chair <b>Edward Smith</b> Pennsylvania State University
8:00 AM - 8:30 AM  Paper 1	<b>Medium-Sized Helicopter Noise Abatement Flight Test</b> (200) Kyle Pascioni,* NASA; Michael Watts, Charles Smith, Analytical Mechanics Associates, Inc.; James Stephenson, CCDC AvMC; Eric Greenwood, Pennsylvania State University	<b>Numerical study of distributed variable geometry ducted fans for eVTOLs</b> (180) Francis Marois,* Mathieu Picard, David Rancourt, University of Sherbrooke	<b>An Overview of Wake Breakdown in High-Fidelity Simulations of Rotor-in-Hover</b> (316) Nathan Hariharan,* Jennifer Abras, HPMP CREATE; Robert Narducci, Boeing Co.	<b>From Helicopter Vibrations to Passenger Perceptions: A Closer Look on Standards</b> (46) Süleyman Özkurt,* Walter Fichter, Tobias Rath, University of Stuttgart; Oliver Dieterich, Martijn Priems, Airbus Helicopters; Heinrich Bülthoff, Suzanne Nooij, Max Planck Society
8:30 AM - 9:00 AM  Paper 2	<b>Development and Validation of Generic Maneuvering Flight Noise Abatement Guidance for Helicopters</b> (89) James Stephenson,* CCDC AvMC; Michael Watts, Analytical Mechanics Associates, Inc.; Kyle Pascioni, NASA Langley Research Ctr.; Eric Greenwood, Penn State Univ.	<b>Modeling of Proprotor / Wing / Flap Interaction for Advanced Vertical Lift Aircraft</b> (270) Todd Quackenbush,* Christine Solomon, Daniel Wachspres, Michael Yu, Continuum Dynamics Inc.	<b>Numerical Investigation of Secondary Vortex Structures in a Rotor Wake</b> (341) Andrew Bodling,* Science and Technology Corporation; Mark Potsdam, US Army Combat Capabilities Development Command	<b>Validation of Enhanced Rotorcraft Aeromechanical Simulations: Flow Field, Unsteady Loads, and Vibration</b> (79) Ramin Modarres,* Peter Lorber,* Byung Young Min, Jinggen Zhao, Sikorsky, a Lockheed Martin Co.
9:00 AM - 9:30 AM  Paper 3	<b>A Perceptual Evaluation of the Efficacy of Sound Exposure Level in the Rating of Annoyance to Helicopter Noise</b> (105) Matthew Boucher,* Andrew Christian, Siddhartha Krishnamurthy, Stephen Rizzi, NASA Langley Research Ctr.	<b>Comparing RotCFD Predictions of the Multirotor Test Bed with Experimental Results</b> (357) Sarah Conley,* Kristen Kallstrom, Witold Koning, Ethan Romander, Carl Russell, NASA Ames Research Ctr.	<b>Rotating Wing Dynamic Stall: State of the Art and Future Directions</b> (311) Marilyn Smith,* Georgia Institute of Technology; Anthony Gardner, German Aerospace Center (DLR); Francois Richez, French Aerospace Lab (ONERA); Rohit Jain, US Army CCDC AvMC; David Peters, Washington University	<b>Lichten Runner-Up: A Scalable Time-Parallel Solution of Periodic Rotor Dynamics in X3D</b> (231) Mrinalgouda Patil,* Anubhav Datta, University of Maryland
9:30-10:00	<b>Refreshment Break</b>			
10:00 AM - 10:30 AM  Paper 4	<b>Experimental Acoustic Characterization of Anti-Phase Asymmetric Rotors</b> (24) Raja Akif Raja Zahirudin,* Jose Palacios, Sihong Yan, Pennsylvania State University; Nhan Nguyen, NASA Ames Research Ctr.; Juntao Xiong, Stinger Ghaffarian Technologies Inc.	<b>Design, Development and Flight Testing of a Gun-Launched Rotary-Wing Micro Air Vehicle</b> (107) Hunter Denton,* Moble Benedict, Texas A&M University; Hao Kang, US Army Research Lab; Vikram Hrishikeshavan, University of Maryland	<b>Validation and Analysis of Aeroelastic Simulations of the UH-60A Rotor from Pre to Post-stall Flight Conditions</b> (256) Francois Richez,* Camille Castells, French Aerospace Lab (ONERA); Amanda Grubb, Marilyn Smith, Georgia Institute of Technology; Rohit Jain, US Army Aviation Development Directorate	<b>Sensitivity Study of Helicopter Vibrations and Loads with Elastic Fuselage Coupling and Dynamic Empennage Loads from Free Wake Analysis</b> (253) Willem Rex, Manfred Hajek, Markus Rinker,* Technical University Munich (TUM)
10:30 AM - 11:00 AM  Paper 5	<b>Experimental and Computational Investigation of Stacked Rotor Acoustics in Hover</b> (166) George Jacobellis,* Rajneesh Singh, US Army CCDC Army Research Laboratory; Rob McDonald, Uber; Chloe Johnson,* Jayant Sirohi, University of Texas at Austin	<b>Helicopter Rotor Morphing for Performance Improvement in Reverse Flow Conditions</b> (110) Matthew DiPalma,* Etana Ferede, Farhan Gandhi, Richard Healy, RPI; Zaffir Chaudhry, Raytheon Techn. Research Ctr.; Daniel Camp, US Army Aviation Combat Capabilities Dev. Command Aviation & Missile Ctr.	<b>High Fidelity Code-to-Code Comparison of Rotor Performance in Hover and Forward Flight</b> (208) Joon Lim,* Rohit Jain, Mark Potsdam, US Army; Ronny Widjaja, AU DST Group; George Barakos, Thomas Fitzgibbon, University of Glasgow	<b>Comparisons of Fully Coupled Aeroelastic Fuselage Simulations to UH-60A Airloads Program Data</b> (298) Nicolas Reveles,* Eric Blades, Tyler Pierce, ATA Engineering; Hyeonsoo Yeo, US Army Combat Capabilities Development Command Aviation & Missile Center
11:00 AM - 11:30 AM  Paper 6	<b>Aeroacoustic Analysis of a Side-by-Side Hybrid VTOL Aircraft</b> (141) Zhongqi Jia,* Seongkyu Lee, University of California, Davis		<b>A Numerical Investigation of the Influence of the Blade-Vortex Interaction on the Dynamic Stall Onset in Simplified Rotor Environment</b> (184) Camille Castells,* Michel Costes, François Richez, French Aerospace Lab (ONERA)	<b>Tiltrotor Conversion Maneuver Analysis with RCAS</b> (130) Hyeonsoo Yeo,* US Army Technology Development Directorate; Hossein Saberi, Advanced Rotorcraft Technology
11:30 AM - 12:00 PM  Paper 7			<b>Simulation of step input in collective pitch for a hovering rotor</b> (108) Mark Woodgate,* George Barakos, Thomas Fitzgibbon, University of Glasgow; Pan Li, Yonghie Shi, Nanjing Univ. Aero. & Astro.	

**Technical Session A: Tues. October 6, 2020, 8:00 am to 12:00 pm - US Eastern EDT (UTC-4)**

*Note: the main author is listed first and "\*" denotes the presenting author*

	<b>Modeling and Simulation I</b> Session Chair <b>Robert Niemiec</b> Rensselaer Polytechnic Institute	<b>Propulsion I</b> Session Chair <b>Bruce W. Jensen</b> Sikorsky, a Lockheed Martin Co.	<b>Safety</b> Session Chair <b>David Blair</b> Sikorsky, a Lockheed Martin Co.	<b>Unmanned VTOL I</b> Session Chair <b>Jack Langelaan</b> Pennsylvania State U
8:00 AM - 8:30 AM Paper 1	<b>Comparison of Different Approaches for Modeling Vortex - Rotor Wake Interference on Rotor Trim</b> (56) Berend G. van der Wall,* German Aerospace Center (DLR)	<b>An Empirical Inlet Pressure Recovery Model for Engine Inlet Barrier Filters for Rotorcraft Applications</b> (27) Man Zhang,* Mark Beeman, US Army, CCDC, Aviation and Missile Center	<b>Restoring Practical Single Engine IFR to the Marketplace</b> (58) Erik Oltheten,* Bell	<b>Manned-Unmanned Teaming Challenges in the Maritime Environment</b> (29) Jacquelyn Banas,* Andreas Cords, Tim Mehling, Tobias Paul, ESG
8:30 AM - 9:00 AM Paper 2	<b>Performance of Gradient-Boosted Trees for Prediction of Coaxial Inflow Models with XGBoost</b> (122) Cory Seidel, Ethan Genter,* David Peters, Washington University in St. Louis	<b>Experimental Results of Transient Variable Speed Rotor Performance for Small UAS Propulsion Scalability</b> (53) Kendy Edmonds, Virginia Polytechnic & State University; D Blake Stringer,* Kent State University; Mark Valco, NASA Glenn Research Ctr.	<b>Explainable AI: Rotorcraft Attitude Prediction</b> (97) Hikmat Khan,* Nidhal Bouaynaya, Ghulam Rasool, Rowan University; Charles Johnson, Federal Aviation Administration	<b>Atmospheric Sampling in Urban Areas and Complex Terrain using UAS Swarms</b> (162) Jared Cooper,* David Neal, Barron Associates, Inc.; Alex Andrekanic, Matthew Paulini, Air Force Research Laboratory Information Directorate; Stephan De Wekker, University of VA
9:00 AM - 9:30 AM Paper 3	<b>Enhancement and Validation of VPM-Derived State-Space Inflow Models for Multi-Rotor Simulation</b> (123) Chengjian He, Chongseok Chang, Matthew Gladfelter,* Advanced Rotorcraft Technology; Mark Lopez, Mark Tischler, US ARMY CCDC AvMC; Ondrej Juhasz, US Navy Academy	<b>A Prediction Model of Transient Variable Speed Rotor Performance for Small UAS Propulsion Scalability</b> (55) D Blake Stringer,* Kent State University; Mark Valco, NASA Glenn Research Ctr.; Kendy Edmonds, Virginia Polytechnic & State University	<b>Status and Way Forward on Rotorcraft Lightning Protection</b> (121) Bernard Tagliana*, Marc Meyer, Sonia Zehar,* Airbus Helicopters	<b>Rotor Fault Detection and Identification for a Hexacopter Based on Control and State Signals via Statistical Learning Methods</b> (301) Airin Dutta,* Farhan Gandhi, Fotis Kopsaftopoulos, Michael McKay, Rensselaer Polytechnic Institute
9:30-10:00	<b>Refreshment Break</b>			
10:00 AM - 10:30 AM Paper 4	<b>Linearized Inflow and Interference Models from High Fidelity Free Wake Analysis for Modern Rotorcraft Configurations</b> (145) Jeffrey Keller,* Robert McKillip, Daniel Wachspress, Continuum Dynamics Inc.; Mark Lopez, Mark Tischler, US Army; Ondrej Juhasz, US Naval Academy	<b>Recent Developments of the Arrayed Controlled Turn-less Structures (ACTS) Motor</b> (78) Oved Zucker,* Carl Demolder, Thanh Le, Polarix Corp.	<b>Artificial Intelligence for Helicopter Safety: Head-Pose Detection in the Cockpit</b> (306) Ghulam Rasool, Nidhal Bouaynaya, Eric Feuerstein,* Ramachandran Ravi, Rowan University; Charles C. Johnson, Federal Aviation Administration	<b>A machine-learning approach to time-optimal trajectory generation for UAV's</b> (321) Di Zhao,* Runyu Lai, Sandipan Mishra, Rensselaer Polytechnic Institute
10:30 AM - 11:00 AM Paper 5	<b>Inflow Based Flight Dynamics Modeling Improvements for the Sikorsky, a Lockheed Martin Co. X2 Technology Demonstrator</b> (148) Ondrej Juhasz,* US Naval Academy; Hong Xin,* Sikorsky, a Lockheed Martin Co.; Mark Tischler, US Army CCDC AvMC	<b>Comparison of Variator Technologies for Variable Rotor Speed Drivetrains for Rotorcraft</b> (246) Hanns Amri,* Lorenz Braumann, ZOERKLER GEARS GmbH & Co KG; Florian Donner, Felix Huber, Michael Weigand, Vienna Univ. of Technology	<b>Appropriate Calculation of Risk per Flight Hour for Rotorcraft Safety Risk Management</b> (332) John Hewitt,* Loan (Joan) Pham,* Sikorsky, a Lockheed Martin Co.	<b>A Vision-Based Autonomous Control Method of Vertical Flight Aircraft Landing On a Moving Platform Without Using GPS</b> (196) Bochan Lee,* Moble Benedict, Dileep Kalathil, Vishnu Saj, Texas A&M University
11:00 AM - 11:30 AM Paper 6	<b>Understanding the Effect of Rotor-to-Rotor Interference on CH-47D Helicopter Dynamics</b> (216) Feyyaz Guner,* J. V. R. Prasad, GA Institute of Tech; David G. Miller, Boeing Co.	<b>Development of a Brushless DC Motor Sizing Algorithm for a Small UAS Design Framework</b> (362) Farid Saemi,* Moble Benedict, Texas A&M University; Nathan Beals, ARL	<b>A 25-year Retrospective Analysis of Australia's Previous Defence Aviation Safety Framework</b> (391) James Hood, Arvind Sinha,* Australian Department of Defence; Pier Marzocca, RMIT University	<b>Fuel Cell Application for Small eVTOL UAVs</b> (181) Thomas Seren,* Mirko Hornung, Technical University Munich (TUM)
11:30 AM - 12:00 PM Paper 7	<b>Bell 412 Modeling and Model Fidelity Assessment for Level-D Training Simulators</b> (230) Vincent Myrand-Lapierre,* Michel Nadeau-Beaulieu, CAE; Mark B. Tischler, ADD, CCDC Aviation & Missile Center; Marilena D. Pavel, Olaf Stroosma, Delft Univ. of Tech.; Bill Gubbels, NRC; Mark White, University of Liverpool	<b>Embedded Sensing for Gas Turbine Engine Component Health Monitoring</b> (283) Muthuvel Murugan,* Anindya Ghoshal, Michael Walock, US Army Combat Dev. Command-ARL; Roger Caesley, Robert Knapp, Epsilon Optics Ltd.		<b>Endurance Optimization of a Tandem Helicopter with Variable Speed Rotors and a Spark-Ignition Engine</b> (144) Mathieu Bouchard,* David Rancourt, Université de Sherbrooke; David Laflamme, Enrick Laflamme, Laflamme Aéro Inc.

**Technical Session B: Wed. October 7, 2020, 8:00 am to 12:00 pm - US Eastern EDT (UTC-4)**  
*Note: the main author is listed first and "\*" denotes the presenting author*

	<b>Aerodynamics II</b> Session Chair <b>Anthony Gardner</b> German Aerospace Center (DLR)	<b>Aircraft Design I</b> Session Chair <b>Michael Strauss</b> Sikorsky, a Lockheed Martin Co.	<b>Dynamics II</b> Session Chair <b>Sesi Kottapalli</b> NASA Ames Research Center	<b>eVTOL I</b> Session Chair <b>Michael Ricci</b> LaunchPoint Electric Propulsion Solutions
8:00 AM - 8:30 AM Paper 1	<b>Investigation of the Interactional Aerodynamics of the XV-15 Tiltrotor Aircraft</b> (134) Steven Tran,* STC; Joon Lim, CCDC AvMC	<b>More / All Electric Vertical Take-Off and Landing (VTOL) Vehicle Sensitivities to Propulsion and Power Performance</b> (68) Christopher Snyder,* NASA John H. Glenn Research Ctr.	<b>Aeromechanical Behavior and Aeroelastic Stability of Coaxial Rotors in Hover and Forward Flight</b> (75) Puneet Singh,* Peretz Friedmann, University of Michigan	<b>Investigation of Near Ground Effects in Hover Flight for the Multi-Rotor Aircraft Volocopter-2X</b> (263) Sebastian Miesner,* Manuel Keßler, Ewald Krämer, IAG, University of Stuttgart; Ulrich Schäferlein, Volocopter GmbH
8:30 AM - 9:00 AM Paper 2	<b>Comparison of Computational and Experimental Hub Drag Breakdown for A Scaled-Coaxial Counter-Rotating Hub</b> (281) Phurwat Anusonti-inthra,* Army Research Laboratory; Matthew Floros, Army Research Laboratory	<b>VTOL Aerodynamic Configurations Analysis for Urban Air Mobility</b> (83) Maxim Myasnikov,* Sergey Esaulov, Igor Ilyin, Mil Moscow Helicopter Plant	<b>Pretest Flutter Predictions of the Upcoming Aeroelastic Tiltrotor Wind Tunnel Test</b> (93) Andrew Kreshock,* Hao Kang, Robert Thornburgh, Hyeonsoo Yeo, U. S. Army Combat Capabilities Command; Jennifer Baggett, Jinwei Shen, University of Alabama	<b>Wind Tunnel Testing and Analysis of a Rigid, Variable Speed Rotor for eVTOL Applications</b> (333) William Staruk,* Evan Bonny, Lauren Butt, Cody Gray, Garrett Hennig, Diego Represa, Richard Toner, Aurora Flight Sciences, Inc.
9:00 AM - 9:30 AM Paper 3	<b>Aerodynamic Interactions on Airbus Helicopters' Compound Helicopter RACER in Hover</b> (265) Felix Frey,* Manuel Keßler, Ewald Krämer, Jakob Thiemeier, Constantin Öhrle, Institute of Aerodynamics and Gas Dynamics, University of Stuttgart	<b>Evaluation of Sizing Strategies for eVTOL UAV Configurations</b> (242) Ananth Sridharan,* Airbus A3; Bharath Govindarajan, Indian Institute of Technology Madras	<b>Scalable Mesh Partitioning for Large-Scale 3D Finite Element-Multibody Structures</b> (237) Ravi Lumba,* Anubhav Datta, University of Maryland	<b>Use of a High Energy-Dense Li Anode Cell for an eVTOL Application</b> (147) Robert Hess,* Joshua Stewart, BAE Systems; Jeff Britt, Mark Niedzwiecki, Sion Power
9:30-10:00	<b>Refreshment Break</b>			
10:00 AM - 10:30 AM Paper 4	<b>A Computational Investigation of Multi-Rotor Interactional Aerodynamics with Hub Lateral and Longitudinal Canting</b> (323) Richard Healy,* Farhan Gandhi, Rensselaer Polytechnic Institute; Michael Duffy, Mihir Mistry, Boeing Co.	<b>Multicopter Configuration Trades Informed by Handling Qualities for Urban Air Mobility Application</b> (219) Shannah Withrow,* Carlos Malpica, Keiko Nagami, NASA Ames Research Ctr.	<b>An Evaluation of Finite-State Dynamic Inflow for Usage in Design</b> (205) Jimmy Ho,* Science and Technology Corporation; Hyeonsoo Yeo, US Army Combat Capabilities Development Command Aviation & Missile Center	<b>Simulation and Characterization of Variable-Voltage Hybrid-Electric Powertrains</b> (346) Brent Mills,* Anubhav Datta, University of Maryland
10:30 AM - 11:00 AM Paper 5	<b>Towards Full-Scale Fuselage Drag Reduction Computations using Fluidic Oscillators</b> (50) Nicholson Koukpaizan,* Ari Glezer, Marilyn Smith, Georgia Institute of Technology	<b>Demonstration of Prop-Rotor System Development for 52kg MTOW Quad-Tilt Prop UAV</b> (88) Deog-Kwan Kim,* Seong-Wook Choi, Danbi Hong, Hee Jung Kang, Youngjung Kee, Taijoo Kim, Myeong-Gyu Lee, Seong-Yong Wie, Chul Yong Yun, Korea Aerospace Research Institute	<b>Wind Tunnel Test on a slowed Mach-Scaled Hingeless Rotor with Lift Compounding</b> (204) Shashank Maurya,* Inderjit Chopra, Xing Wang, University of Maryland	<b>Electric Propulsion Component Sizing for Optimal Aircraft Configuration</b> (388) Michael Ricci,* Jack Myers, Brad Paden, Ryan Rahn, LaunchPoint Electric Propulsion Solutions
11:00 AM - 11:30 AM Paper 6		<b>Optimal Design of Rotor Blade for a Winged Compound Helicopter at High Advance Ratio</b> (223) Masahiko Sugiura,* Hideaki Sugawara, Yasutada Tanabe, Japan Aerospace Exploration Agency; Takekawa Kuniyuki, Ryoyu Systems Co., Ltd.	<b>Modal Elastic Component Enhancements for RCAS</b> (178) Matthew Hasbun,* Ryan Blumenstein, Hossein Saberi, Advanced Rotorcraft Technology	
11:30 AM - 12:00 PM Paper 7			<b>Relative Rotor Phasing for Multicopter Vibratory Load Minimization</b> (294) Robert Niemiec,* Farhan Gandhi, Nicholas Kopyt, Rensselaer Polytechnic Institute	

**Technical Session B: Wed. October 7, 2020, 8:00 am to 12:00 pm - US Eastern EDT (UTC-4)**

*Note: the main author is listed first and "\*" denotes the presenting author*

	<b>Handling Qualities I</b> Session Chair <b>Matthew Rhinehart</b> US Navy	<b>Modeling and Simulation II</b> Session Chair <b>Matthew T. Smith</b> Sikorsky, a Lockheed Martin Co.	<b>Propulsion II</b> Session Chair <b>Bruce W. Jensen</b> Sikorsky, a Lockheed Martin Co.	<b>Unmanned VTOL II</b> Session Chair <b>Sandipan Mishra</b> Rensselaer Polytechnic Institute
8:00 AM - 8:30 AM Paper 1	<b>Flight Mechanics of the RACER compound HC (155)</b> Remy HUOT,* Paul Eglin,* Airbus Helicopters	<b>Performance of Recent Large-angle Extensions to Classical Simulator Washout Algorithms (349)</b> Robert Langlois, John Hayes, Rishad Irani, Mikayla Micomonaco,* Carleton University	<b>Computational Thermal Analysis and Testing to Improve Loss of Lubrication Performance of Helicopter Transmissions (62)</b> Kenta Ogasawara,* Hidenori Arisawa, Hironori Hashimoto, Akira Hayasaka, Yuji Shinoda, Hiroki Yamamoto, Kawasaki Heavy Industries, Ltd.	<b>Vision-based Autonomous Guidance Approach for a Nano Unmanned Aerial Vehicle Rotorcraft Towards Indoor Flight Environment (238)</b> Gualin Wang,* Dehui Li, Panpan Xu, Beijing Intelligent Dynamics Rotorcraft Company
8:30 AM - 9:00 AM Paper 2	<b>Exploring Pilot Workload Using Inceptor Time Histories (66)</b> Ryan Paul,* Matthew Rhinehart, NAWCAD	<b>eVTOL Accretion Modeling for Supporting Algorithmic Icing Detection (288)</b> Robert McKillip,* Andrew Kaufman, Todd Quackenbush, Continuum Dynamics Inc.	<b>Contact Pattern Development of the CH-53K MGB with Split-Path Gear-train (101)</b> Shulin He,* Yryiy Gmiyra, Chris Pierce, Sikorsky, a Lockheed Martin Co.; Leslie Leigh, NAVAIRSYSCOM HQ	<b>Concept for an Aeronautical Design Standard (ADS) – Performance Specification for Autonomy Requirements of Military Air Systems (160)</b> John Preston,* US Army CCDC AvMC
9:00 AM - 9:30 AM Paper 3	<b>Estimating Handling Qualities Ratings from Slalom Flight Data: A Psychophysical Perspective (72)</b> Edward Bachelder,* Martine Godfroy-Cooper, San Jose State University Research Foundation; Bimal Aponso, NASA Ames Research Ctr.; Jeffrey Lusardi, US Army Aviation Development Directorate	<b>A turbulence Model for Flight Simulation and Handling Qualities Analysis Based on a Synthetic Eddy Method (168)</b> Sergio Henriquez Huecas,* Mark White, University of Liverpool; George Barakos, University of Glasgow	<b>Static Transmission Error Analysis of a Hybrid Spur Gear Drivetrain (116)</b> Sean Gauntt,* Robert Campbell, Sean McIntyre, Pennsylvania State University	<b>Development of Automatic Controllers and Piloting Aid Functions: Enhancement of UAV/OPV Autorotation Management (146)</b> Laurent Binet, French Aerospace Lab (ONERA); Christian Brackbill,* David Quinn, US Army, Army Futures Command
9:30-10:00	<b>Refreshment Break</b>			
10:00 AM - 10:30 AM Paper 4	<b>Identifying Pilot-Induced Oscillation Tendencies in Advanced Fly-by-Wire Rotorcraft (225)</b> David Klyde,* P. Chase Schulze, Systems Technology, Inc.; David Mitchell, Mitchell Aerospace Research; William Geyer, John Holder, John O'Connor, John Tritschler*, USNTPS	<b>Towards Validation of a Dynamic Interface Simulation using Flight Test Data (291)</b> Tyler Christoffel,* Chris Hendrick, Joseph Horn, Sven Schmitz, Regis Thedin, Pennsylvania State University	<b>Modeling and Design of a Wet Clutch/Offset Compound Gear Transmission for Dual-Speed Rotorcraft Applications (222)</b> Hans DeSmidt,* Xiaowen Su, University of Tennessee; Robert Bill, Edward Smith, Pennsylvania State University	<b>A Contract Based Approach to Collision Avoidance for UAVs (156)</b> Talgat Alimbayev, A. Agung Julius, Sandipan Mishra, Nicholas Moy, Kaushik Nallan,* Rensselaer Polytechnic Institute
10:30 AM - 11:00 AM Paper 5	<b>Development and Flight Validation of Proposed Unmanned Aerial System Handling Qualities Requirements (244)</b> Christina Ivler,* Declan Kerwin, Joel Otomize, Danielle Parmer, Kevin Truong, University of Portland; Norma Gowans, SJSURF; Mark B. Tischler, US Army Combat Capabilities Development Command Aviation & Missile Center	<b>Redistributed Pseudoinverse Control Allocation for Actuator Failure on a Compound Helicopter (159)</b> Praneet Vayalali,* Farhan Gandhi, Michael McKay, Rensselaer Polytechnic Institute	<b>Processing and Property Comparison of High-Temperature Carbon/BMI Composites (307)</b> Matthew Waller,* Kevin Koudela, Sean McIntyre, Pennsylvania State University	<b>Prediction on Nonlinear Flight Dynamics of a Quad-rotor UAV with rotor aerodynamic analysis under Gust under Gust (235)</b> Sun Hoo Park,* Sihun Lee, SangJoon Shin, JeongUk Yoo, Seoul National University; Youngmin Park, Korea Aerospace Research Institute
11:00 AM - 11:30 AM Paper 6	<b>Explicit Uncertainty Quantification for Probabilistic Handling Qualities Assessment (98)</b> Umberto Saetti,* Jonathan Rogers, Georgia Institute of Technology		<b>Low-Order Prediction of Mineral Dust Sticking Probability in Turboshift Engines (251)</b> Matthew Ellis,* Nicholas Bojdo, Antonio Filippone, Merren Jones, Alison Pawley, University of Manchester	<b>Optimal Trajectory Generation for a Quadrotor Biplane Tailsitter (221)</b> Kristoff McIntosh,* Sandipan Mishra, Di Zhao, Rensselaer Polytechnic Institute; Jean Paul Reddinger, CCDC Army Research Laboratory
11:30 AM - 12:00 PM Paper 7	<b>Development and Assessment of Flight Lead Cue for Real-time Guidance and Pilot Workload Reduction in Rotorcraft Shipboard Recovery (241)</b> Vinodhini Comandur,* Karen M. Feigh, J. V. R. Prasad, Robert Walters, Georgia Institute of Technology		<b>Performance Deterioration of Rotorcraft Engines fitted with Particle Separators (187)</b> Nicholas Bojdo,* Wesley Appleton, Matthew Ellis, Antonio Filippone, Jee-Loong Hee, University of Manchester	<b>Coupled Pitch-Lag Hinge for High Inertia Electric Rotors (329)</b> Jean-Paul Reddinger,* CCDC Army Research Laboratory
12:00 PM - 12:30 PM Paper 8			<b>Green House Gas (GHG) Initiative for the Rotorcraft Industry (367)</b> Albertus Tjandra,* Bell; Vincent Routhieau, Airbus Helicopters; Wajid Chishty, NRC; Pierre-Marie Basset, French Aerospace Lab (ONERA); Robert Peluso, Pratt & Whitney Canada; Claude Bérat, Safran Helicopter Engines	

**Technical Session C: Wed. October 7, 2020, 1:00 pm to 5:00 pm - US Eastern EDT (UTC-4)**

*Note: the main author is listed first and "\*" denotes the presenting author*

	<b>Advanced Vertical Flight II</b> Session Chair <b>Jayant Sirohi</b> University of Texas at Austin	<b>Aerodynamics III</b> Session Chair <b>Juergen Rauleder</b> Technology University Munich (TUM)	<b>Aircraft Design II</b> Session Chair <b>Michael Strauss</b> Sikorsky, a Lockheed Martin Co.	<b>Crash Safety</b> Session Chair <b>Akil O. Bolukbasi</b> Boeing Co.
1:00 PM - 1:30 PM  Paper 1	<b>Flight Dynamics and Control of Robotic Boomerang</b> (254) Prashant Singh, Abhishek Abhishek,* Mangal Kothari, Indian Institute of Technology Kanpur	<b>Investigations of Ship Airwakes Using Concurrent Computations and Experiments</b> (202) David Farish,* Sven Schmitz, Regis Thedin, Pennsylvania State University; Dhuree Seth, Embry-Riddle Aeronautical University	<b>Mission Oriented Multi-Prop UAV Analysis using Statistical Design Trends</b> (151) Omri Rand,* Vladimir Khromov, Technion - IIT	<b>Crashworthiness of a Lift plus Cruise eVTOL Vehicle Design within Dynamic Loading Environments</b> (201) Jacob Putnam,* Justin Littell, NASA Langley Research Ctr.
1:30 PM - 2:00 PM  Paper 2	<b>Aerodynamic Investigation of Non-Planar Wing Configurations for Quadrotor Based Tail-Sitters</b> (157) Derek Safieh,* Inderjit Chopra, Vikram Hrishikeshavan, University of Maryland	<b>Single Rotor Inflow and Wake Characterization in Hover with Dynamic Pitch Excitation</b> (354) Patrick Mortimer,* Jayant Sirohi, University of Texas at Austin; Stephan Platzer, Juergen Rauleder, Technical University Munich (TUM)	<b>Conceptual Design of UAS Configurations with Dissimilar Rotors and Wings</b> (269) Nathan Beals,* US Army Research Laboratory; Bharath Govindrajana, Indian Institute of Technology Madras; Rajneesh Singh, US Army Research Laboratory	<b>Development And Validation Of A SPH Bird Model In Abaqus/Explicit. Application To The Design Of The AW609 Tiltrotor Structure</b> (382) Fabrizio Turconi, Riccardo Bay,* Maurizio Tirelli, Leonardo Helicopters; Ryan Miller, Jim Waterman, Agusta Westland Philadelphia Corp.; Marco Anghileri, Politecnico di Milano
2:00 PM - 2:30 PM  Paper 3	<b>Post-Failure Control Reconfiguration for a Lift-Offset Coaxial Helicopter</b> (172) Michael McKay,* Farhan Gandhi, Praneet Vayalali, Rensselaer Polytechnic Institute	<b>Numerical Investigation of Unsteady Boundary Layer Transition on a Dynamically Pitching Rotor</b> (77) Jared Carnes,* James Coder, University of Tennessee	<b>Progress Toward a New Conceptual Assessment Tool for Aircraft Cost</b> (374) Robert Scott,* J. Michael Vegh, US Army	
2:30 PM - 3:00 PM	<b>Refreshment Break</b>			
3:00 PM - 3:30 PM  Paper 4	<b>Handling Qualities Assessment of Large Variable-RPM Multi-Rotor Aircraft for Urban Air Mobility</b> (126) Matthew Bahr,* Farhan Gandhi, Michael McKay, Robert Niemiec, Rensselaer Polytechnic Institute	<b>Numerical and Experimental Investigation into the Aerodynamic Benefits of Rotorcraft Formation Flight</b> (106) Mark Voskuijl,* Jan de Vries, Finbar van der Veen, Netherlands Defence Academy; Ramon Duivenvoorden, Delft University of Technology; Lars Moree, Royal Netherlands Air Force	<b>Active and Passive Camber Morphing for Helicopter Rotors towards Performance Improvements in Hover and Vertical Flight</b> (38) Kushagra Vidyarthi,* Roeland De Breuker, Marilena Pavel, Yasir Zahoor, Delft University of Technology; Mark Voskuijl, Netherlands Defence Academy	
3:30 PM - 4:00 PM  Paper 5	<b>Lichten Award Paper: Experimental Measurements and Low-Order Modeling of Stacked Rotor Performance in Hover</b> (393) Chloe Johnson,* Jayant Sirohi University of Texas at Austin	<b>Reduced-Order Modeling and Analysis of Unsteady Rotor Hub Flows</b> (179) Tristan Wall,* James Coder, University of Tennessee in Knoxville	<b>Helicopter Short Line Underslung Payload Transportation: Exploration of Magneto-Rheological Actuators for payload motion control</b> (342) Etienne Perron,* Universite de Sherbrooke; Jean-Sébastien Plante, Exonetik; Marc Alexander, National Research Council of Canada; David Rancourt, Université de Sherbrooke	
4:00 PM - 4:30 PM  Paper 6			<b>The Innovative Blade Attachment for the new H145 Bearingless Main Rotor</b> (255) Stefan Emmerling,* Gerald Kuntze-Fechner,* Max Wedekind, Airbus Helicopters	
4:30 PM - 5:00 PM  Paper 7			<b>Bell 505 JRX, 250 Aircraft Delivered and Counting</b> (115) Patrick Paquin,* Yann Lavallee,* Bell	

**Technical Session C: Wed. October 7, 2020, 1:00 pm to 5:00 pm - US Eastern EDT (UTC-4)**  
*Note: the main author is listed first and "\*" denotes the presenting author*

	<b>eVTOL II</b> Session Chair <b>Michael Ricci</b> LaunchPoint Electric Propulsion Solutions	<b>Handling Qualities II</b> Session Chair <b>Matthew Rhinehart</b> US Navy	<b>Structures and Materials</b> Session Chair <b>Erik Byrne</b> Sikorsky, a Lockheed Martin Co.
1:00 PM – 1:30 PM  Paper 1	<b>Developing Sustainable Urban Air Mobility Infrastructure that is Efficient, Safe and Regulatory Compliant (194)</b> Rex Alexander,* Five-Alpha LLC; Jonathan Daniels, Praxis Aerospace Concepts International, Inc.	<b>US-German Joint In-flight and Simulator Evaluation of Collective Tactile Cueing for Torque Limit Avoidance – Shaker vs. Soft Stop (271)</b> Mario Müllhäuser,* DLR; Jeff Lusardi, CCDC AvMc Aviation Development Directorate	<b>Gear Rim Failure Prediction Based on Fracture Mechanics (103)</b> Biqiang Xu,* Sikorsky, a Lockheed Martin Co.
1:30 PM – 2:00 PM  Paper 2	<b>Working Group on eVTOL Noise Assessment (109)</b> David Josephson,* Josephson Engineering, Inc.	<b>Bell V-280 System Identification: Application of JIO Methodology for Flight Test Data Analysis (174)</b> Caitlin Berrigan,* Paul Ruckel, Bell; Mark Lopez,* CCDC AvMC Aviation Development Directorate; J.V.R. Prasad, Georgia Institute of Technology	<b>Structural Integrity Challenges for Future Rotorcraft Programs (99)</b> Robert Benton,* US Army
2:00 PM – 2:30 PM  Paper 3	<b>The Integral Approach to Define the Ecosystem for the Aerial Taxi Service in Dubai (185)</b> Denis Heckmann,* Maximilian Fischer, Alexander Nase, FEV Consulting; Ruba Fayez Abdelal, Khaled Al Awadhi, Amair Saleem, Roads and Transport Authority Dubai	<b>Design and Evaluation of Control Laws for the CH-53E Low Speed Precision Control System (95)</b> Matthew Rhinehart,* Robert Brymer, Eric O'Neill, US Navy	<b>Determining TH-1H Tailboom Loads from Measured Strain Gage Data (133)</b> Ken Taylor,* Margaret Gibson, Kathryn Mason, Mercer Engineering Research Center
2:30-3:00	<b>Refreshment Break</b>		
3:00 PM – 3:30 PM  Paper 4	<b>The Influence of the Wiring Harness on the System Performance of eVTOL Aircraft on the Example of Common Reference Models (63)</b> Sebastian Oberschwendtner,* Technical University Munich (TUM)	<b>CH-53K Control Laws: Improved safety and performance in the Degraded Visual Environment (132)</b> David Engel,* NAVAIR; Alex Faynberg, Steven Spoldi,* Sikorsky, a Lockheed Martin Co., a Lockheed Martin Co.	<b>Development of a Rotorcraft Structural Integrity Program Master Plan for Future Vertical Lift (309)</b> Lisa Chiu,* Dennis McCarthy, Boeing Co.; Matthias Krastel, Sikorsky, a Lockheed Martin Co.; Derrell Lorthridge, US Army Combat Capabilities Development Command Aviation & Missile Center
3:30 PM – 4:00 PM  Paper 5	<b>A Life Cycle Economic Study of eVTOL Air Taxi Service in the US Northeast Region (284)</b> Nate Sirojvisuth,* PRICE Systems LLC; Cedric Y. Justin, Georgia Institute of Technology; Simon Briceno, Jaunt Air Mobility LLC	<b>Design and Analysis of a Blended Command Model for Low Speed Flight (319)</b> Geoffrey Jeram,* US Army; Ondrej Juhasz, US Naval Academy	<b>Investigation of Fatigue and Flaw Tolerance Performance of 18CrNiMo7-6 Case Hardening steel (214)</b> Yalin Öztürk,* Ufuk Akcihan, Fazlı Fatih Melemez, Turkish Aerospace
4:00 PM – 4:30 PM  Paper 6		<b>Outer-Loop Control Design and Simulation Handling Qualities Assessment for a Coaxial-Compound Helicopter and Tiltrotor (158)</b> Tom Berger,* Mark Tischler, US Army Aviation Development Directorate; Joseph Horn, Pennsylvania State University	<b>Fatigue Life Improvement in Hierarchically Organized Nanocomposites for Application to Rotorcrafts (368)</b> Mithil Kamble,* Nikhil Koratkar, Aniruddha S Lakhnot, Catain Picu, Rensselaer Polytechnic Institute
4:30 PM – 5:00 PM  Paper 7		<b>Compound Rotorcraft Yaw Control Fault Detection (211)</b> Jeffrey Lewis,*; Venkatakrishnan Iyer, Eric Johnson, Pennsylvania State University	<b>Low AOB Component Loads Derivation to Implement MH-60R HUMS (65)</b> Suresh Moon,* Technical Data Analysis, Inc.; Daniel Liebschutz, NAVAIR

**Technical Session D: Thurs. October 8, 2020, 8:00 am to 12:00 pm - US Eastern EDT (UTC-4)**  
*Note: the main author is listed first and "\*" denotes the presenting author*

	<b>Acoustics II</b> Session Chair <b>Juliet Page</b> US Dept. of Transportation	<b>Crew Stations I</b> Session Chair <b>Andrew P. Smith</b> Boeing Co.	<b>HUMS I</b> Session Chair <b>Christopher D. Lyman</b> US Army	<b>History</b> Session Chair <b>Erasmus Pinero</b> Bell
8:00 AM - 8:30 AM Paper 1	<b>Coaxial Rotor Broadband Noise Prediction in Hover</b> (198) Seongkyu Lee,* Inbal Shlesinger, University of California, Davis	<b>Flight Simulation Assessment of Autorotation Algorithms and Cues</b> (252) Mushfiqul Alam,* Michael Jump, University of Liverpool; Brian Eberle, Jonathan Rogers, Georgia Institute of Technology	<b>Signal Processing to Reduce the Effect of Gear Dynamics</b> (74) Eric Bechhoefer,* GPMS Inc; Yalin Ozturk, Turkish Aerospace	<b>The Aircraft, the Rotorcraft and the Life of Walter Rieseher 1890-1937</b> (119) Berend G. van der Wall,* German Aerospace Center (DLR)
8:30 AM - 9:00 AM Paper 2	<b>Rotor-on-Rotor Aeroacoustic Interactions of Multirotor in Hover</b> (91) Eduardo Alvarez,* Tyler Critchfield, Andrew Ning, Austin Schenk, Brigham Young University	<b>3D Conformal Pilot Cueing for Rotorcraft Shipboard Landings: A Comparison of Tunnel in the Sky and a Pursuit Guidance Flight Lead Cueing System</b> (217) Robert Walters,* Karen Feigh, Joe McCandless, Georgia Institute of Technology	<b>Bell 525 Relentless: Using Tail Rotor Torque Measurements for Maintenance Credit</b> (26) Brian Tucker,* Ankit Patel, Drew Waller, Bell	<b>The Life and Mysterious Death of Harold F. Pitcairn: Was it Suicide?</b> (5) Bruce Charnov,* Hofstra University
9:00 AM - 9:30 AM Paper 3	<b>Computational Prediction of Broadband Noise from a Representative Small Unmanned Aerial System Rotor</b> (152) Christopher Thurman,* James Baeder, University of Maryland; Nikolas Zawodny, NASA Langley Research Ctr.	<b>Using Augmented Reality to Reduce Workload in Offshore Environments</b> (261) Malte-Jörn Maibach,* Michael Jones, Christian Walko, German Aerospace Center (DLR)	<b>Rotorcraft Lubrication Optimization through Grease Sampling and Analysis</b> (245) Richard Wurzbach,* MRG Labs; Mike Johnson, AMRRI; Tim Singer, Boeing Co.	<b>A Design Worthy of Success: Bernard Szyner, Selma Gottlieb and the Intercity SG-VI</b> (278) Renald Fortier,* Canada Aviation and Space Museum
9:30-10:00	<b>Refreshment Break</b>			
10:00 AM - 10:30 AM Paper 4	<b>A Comparison of Multicopter Noise Characteristics with Increasing Number of Rotors</b> (318) Brendan Smith,* Farhan Gandhi, Robert Niemiec, Rensselaer Polytechnic Institute	<b>Virtual Cockpit Instruments and Visual Conformal Symbology on Head-Worn Displays for Helicopter Offshore Landings</b> (249) Lars Ebrecht,* Johannes Ernst, Sven Schmerwitz, German Aerospace Center (DLR)	<b>Rotor Fault Detection and Identification on a Hexacopter under Varying Flight States Based on Global Stochastic Models</b> (264) Airin Dutta,* Farhan Gandhi, Fotis Kopsaftopoulos, Michael McKay, Rensselaer Polytechnic Institute	
10:30 AM - 11:00 AM Paper 5	<b>Findings in Aero-Acoustic Simulations for Optimizations</b> (195) Gunther Wilke,* German Aerospace Center (DLR)	<b>An Evaluation of Pilot Electroencephalographic Activity during a Helicopter Tracking Task</b> (327) Andrew Law,* Kris Ellis, Sujoy Ghosh Hajra, Sion Jennings, National Research Council Canada	<b>A Motion Primitive Perspective on Rotorcraft Regime Recognition</b> (16) Umberto Saetti,* Jonathan Rogers, Georgia Institute of Technology	<b>Perseverance: Some Reflections on 55 Years of the Canadian Sea King</b> (20) John Orr,* Independent Researcher
11:00 AM - 11:30 AM Paper 6	<b>CFD and Aeroacoustic Analysis of Wingtip-Mounted Propellers</b> (218) Dilhara Jayasundara,* James Baeder, Yong Su Jung, University of Maryland	<b>Pupillometric Workload Measurement in the 360 Degree Integrated Cueing Environment (ICE)</b> (275) Amanda Hayes, Christopher Aura,* Kathryn Feltman, US Army Aeromedical Research Laboratory		<b>Applicable Lessons Learned from AHIP/OH-58D and LHX/RAH-66 Development Programs for the Army's FARA Open Systems Aircraft</b> (240) Daniel Schrage,* Georgia Institute of Technology; William Lewis, Tennessee Technical Test Team
11:30 AM - 12:00 PM Paper 7	<b>Computation and Extraction of Boundary Layer Parameters from Numerical Simulations for Use in Rotor Acoustics Models</b> (189) Miranda Costenoble,* James Baeder, University of Maryland; John Hrynyuk, Rajneesh Singh, US Army	<b>Identifying Operator Workload State through Psychophysiological Metrics in Rotary-wing Simulated Flight</b> (325) Kathryn Feltman,* Kyle Bernhardt, Amanda Kelley, US Army Aeromedical Research Laboratory	<b>Event-Based Regime Recognition Accuracy</b> (118) Jason Hull,* Jeffrey Monaco, Spire Innovations, LLC; Mark Glucksman-Glaser, Roberto Semidey, Naval Air Systems Command	<b>Attack Helicopter Generations</b> (18) Michael Leong,* Boeing Co.



**Technical Session D: Thurs. October 8, 2020, 8:00 am to 12:00 pm - US Eastern EDT (UTC-4)**

*Note: the main author is listed first and "\*" denotes the presenting author*

	<b>Manufacturing and Technology</b> Session Chair <b>Doug Wolfe</b> <b>Bell</b>	<b>Operations</b> Session Chair <b>Jordan Kaye</b> <b>Sikorsky, a Lockheed Martin Co.</b>	<b>Systems Engineering</b> Session Chair <b>Serge Germanetti</b> <b>Airbus</b>	<b>Test and Evaluation I</b> Session Chair <b>Philip J. Alldridge</b> <b>Sikorsky, a Lockheed Martin Co.</b>
8:00 AM - 8:30 AM  Paper 1	<b>Bell 505 Automation at Final Assembly - Project Octopus (54)</b> Cédric Roche,* Sébastien Giroux, Bell	<b>Dynamic Performance Investigation for Tilt-rotor Aircraft (150)</b> ye yuan,* David Anderson, Douglas Thomson, University of Glasgow	<b>Engineering Challenges To Reinvent The Sky (84)</b> Roberto Licata,* Dassault Systèmes	<b>Experimental and Numerical Investigation of Interaction Between Rotor and Wing at High Advance Ratio (87)</b> Yasutada Tanabe,* Noboru Kobiki, Hideaki Sugawara, Japan Aerospace Exploration Agency; Hirotaka Hayashi, Wataru Kobayashi, Ryosuke Satou, SUBARU Corporation
8:30 AM - 9:00 AM  Paper 2	<b>XV-15 Tilt Rotor Research Aircraft Photogrammetry and Metrology Measurement (161)</b> Haley Cummings,* Belen Bowman, Shirley Burek, Michelle Dominguez, Christopher Silva, Eduardo Solis, NASA Ames Research Ctr.	<b>Dragonfly : Defining Environments for Rotorcraft Flight on Titan (81)</b> Ralph Lorenz,* Applied Physics Laboratory	<b>Integration of VTOL Air-taxis into an Existing Infrastructure with the Use of the Model-Based System Engineering (MBSE) Concept CUBE (182)</b> Nicolas Jäckel,* Malte Grotenrath, Philipp Orth, Robert Schaller, FEV Europe GmbH; Maximilian Fischer, FEV Consulting GmbH; Jakob Andert, Christian Granrath, Institute for Combustion Engines	<b>Digital Twin Approach for Structural Property Evaluation of Next Generation Active Twist Blades (167)</b> Hyun Hwang, Jun Ahn, Sehoon Chang, Sung Jung,* Konkuk University; Steffen Kalow, Ralf Keimer, German Aerospace Center (DLR)
9:00 AM - 9:30 AM  Paper 3	<b>Utilizing Casting Technologies on Legacy Parts (164)</b> Heather Woodworth,* Andrew Featheringham,* Sikorsky, a Lockheed Martin Co.	<b>A Concept of Operations for Advanced Manufacturing of Small Unmanned Aircraft Systems for Marine Squads (129)</b> John Gerdes,* Nathan Beals,* Eric Holder, James Humann, CCDC ARL	<b>A Systems Engineering Approach for Enabling Research and Development in the Vertical Lift Autonomy Flight Sciences Domain (364)</b> Marc Alexander,* Derek Gowanlock, Arthur Gubbels, National Research Council of Canada; Mark Spano, Boeing Defense; Fernando Dones,* Glenn Rossi, Boeing Phantom Works	<b>Design of a Lean Avionics Rig for Efficient System Integration Testing and Human Factors (296)</b> Nicolas Callejo Goena,* Pasquale Chiella,* Giovanni Di Meo,* Kopter Group AG
9:30-10:00	<b>Refreshment Break</b>			
10:00 AM - 10:30 AM  Paper 4		<b>Blockchain Applications for Rotorcraft Component Tracking (236)</b> Taavi Tajjala, Raj Bharadwaj,* Honeywell; John Moffatt, US Army, AvMC ADD-E	<b>Is Architecture Measurable? Towards Creating, Managing, and Measuring Architecture and Resulting Product Line Implementations (104)</b> Scott Wigginton,* CCDC AvMC; Paul Jonas, FirePoint; Ronald Towns, RWT Consulting; Gordon Hunt,* Skayl	<b>MH-60 Full Scale Test Rig Loads Development and Analysis (203)</b> Robert McGinty,* Jeffery Brenna, MERC; John Vine, DST Group; Dan Liebschutz, NAVAIR; Philip Conjelko, SAIC
10:30 AM - 11:00 AM  Paper 5	<b>Reducing Risk in 3D Printed Composite Tooling (320)</b> Eric Dunn,* Sikorsky, a Lockheed Martin Co.	<b>Preliminary Insights on Small eVTOL Design Trends from Surrogate Modeling for Operations Research (350)</b> Robert Scott,* Luke Battey, US Army	<b>Advances in Property Model Methodology (PMM) (190)</b> Patrice Micouin, Micouin Consulting; Louis Fabre,* Christian Gaurel, Nicolas Martignago, Pascal Pandolfi, Pascal Paper, Thomas Razafimahefa, Airbus	<b>Development &amp; Testing of a Rotorcraft Engine Transmission Lubrication System (366)</b> Todd Harder,* Boeing Co.
11:00 AM - 11:30 AM  Paper 6	<b>Practical Solutions for Embedding Fiber Optics in Composites (372)</b> Nathaniel Dew,* Sikorsky, a Lockheed Martin Co.		<b>Integration of Model-Based Systems Eng. and a Modular Open System Approach using DevSecOps with Agile Software Methods (188)</b> Thomas DuBois,* Christopher Goebel, Robert Matthews, L3Harris; John Stough, JHNA, Inc.; David Linden, Leidos, Inc.; David Walsh, SigmaTech	<b>Hardware-in-the-Loop Dynamic Wind Tunnel Investigation of Slung Loads Dynamics with Application to Active Cargo Hook Stabilization of an M119 Howitzer (114)</b> A. Rosen, R. Raz Tel Aviv Univ.; S. Nadell*, K. Cheung, Univ. Space Rsch, Assoc.; Z. Chen*, J. Enciu, J. Horn, PSU; L. Cicolani, San Jose State Rsch. Foundation; M. Tischler, US Army
11:30 AM - 12:00 PM  Paper 7	<b>T55 Gas Turbine Engine Bleed Band Actuator Housing Re-Design (331)</b> Wesley Cass,* US Army			

**Technical Session E: Thurs. October 8, 2020, 1:00 pm to 5:00 pm - US Eastern EDT (UTC-4)**

*Note: the main author is listed first and "\*" denotes the presenting author*

	<b>Aircraft Design III</b> Session Chair <b>Michael Strauss</b> Sikorsky, a Lockheed Martin Co.	<b>Avionics and Systems</b> Session Chair <b>Joseph W. Franiak</b> Northrop Grumman Corp.	<b>Crew Stations II</b> Session Chair <b>Andrew P. Smith</b> Boeing Co.	<b>Handling Qualities III</b> Session Chair <b>Matthew Rhinehart</b> US Navy
1:00 PM - 1:30 PM  Paper 1	<b>Investigation of BERP-Shape Tip Design on an Apache Rotor Blade</b> (209) Ronny Widjaja,* Defence Science and Technology; Rohit Jain, Joon Lim, Mark Potsdam, US Army Combat Capability Development Command	<b>Chesseman Award Paper: Integration and Test of a Degraded Visual Environment System on H145</b> (392) Tim Waanders,* Airbus Helicopters	<b>The Art of Helicopter EICAS Design</b> (59) Erik Oltheten,* Bell	<b>Real-Time Nonlinear Model Predictive Control of a Helicopter in Autorotation</b> (193) Brian Eberle,* Jonathan Rogers, Georgia Institute of Technology
1:30 PM - 2:00 PM  Paper 2	<b>University of Maryland's "Caladrius" - Graduate Winner 36th Student Design Competition</b> (1234) Seyhan Gul,* Abhishek Shastry, University of Maryland	<b>A Systems Design Approach to Fuel Measurement for Hybrid Aircraft</b> (28) Mark Connors,* Liquid Measurement Systems	<b>Influence of Optical and Gravito-Inertial Cues to Height Perception During Supervisory Control</b> (233) Martine Godfroy-Cooper,* Edward Bachelder, Joel Miller, SJSU/US ARMY/ADD/AvMC/Aviation; Francois Denquin, Jean-Christophe Sarrazin, ICNA/DTIS/ONERA	<b>System Identification and Handling Qualities Predictions of an eVTOL Urban Air Mobility Aircraft Using Modern Flight Control Methods</b> (7) Robert Niemiec,* Farhan Gandhi, Rensselaer Polytechnic Institute; Mark Lopez, Mark Tischler, US Army Combat Capabilities Development Command Aviation and Missile Center
2:00 PM - 2:30 PM  Paper 3	<b>University of Maryland/Universidad de Carlos "Tahr" - Undergraduate Winner 36th Student Design Competition</b> (4321) Benjamin Dobson, John Lewis,* University of Maryland	<b>It is Time for Army Aviation to Move to a Development Assurance Approach for Including Open Integrated Modular Avionics</b> (52) Daniel Schrage,* Georgia Institute of Technology; William Lewis, Tennessee Technical Test Team	<b>Multisensory Cues for Addressing Spatial Orientation</b> (383) Bruce Mortimer,* Engineering Acoustics Inc.; Angus Rupert,* USAARL	<b>Flight Dynamics and Control of an eVTOL Concept with a Propeller-Driven Rotor</b> (17) Umberto Saetti,* Georgia Institute of Technology; Jacob Enciu, Joseph F. Horn, Pennsylvania State University
2:30-3:00	<b>Refreshment Break</b>			
3:00 PM - 3:30 PM  Paper 4		<b>Stability Augmentation System for Coaxial Ultralight Helicopters</b> (9) Tobias Richter,* Walter Fichter, Benjamin Rothaupt, Alexander Steinwandel, University of Stuttgart; Benedikt Grebing, edm aerotec GmbH	<b>Assessment of a Multimodal Cueing Set for Maintaining Aviators' Situational Awareness in a Degraded Visual Environment</b> (334) Kathryn Feltman,* Aaron McAtee, US Army Aeromedical Research Laboratory; Gina Hartnett, US Army Combat Capabilities Development Command; Martine Godfroy-Cooper, Joel Miller, San Jose State Research Foundation	<b>Nonlinear Dynamic Inversion Control for Urban Air Mobility Aircraft with Distributed Electric Propulsion</b> (212) Jean-Pierre Theron,* Jacob Enciu, Joseph Horn, Pennsylvania State University; Daniel Wachspress, Continuum Dynamics Inc.;
3:30 PM - 4:00 PM  Paper 5		<b>Using Deep Learning based Computer Vision in Helicopter Cockpits for Cognitive Decision Aiding</b> (131) Vinay Huddar,* Nitesh Teja Mudapaka,* Collins Aerospace	<b>Multisensory Cueing to Resolve Helicopter Drift Detection in DVE</b> (229) Angus Rupert,* DRIP; Chris Brill, Air Force Research Lab; Braden McGrath, Embry-Riddle Aeronautical University; Bruce Mortimer, Engineering Acoustics Inc.	<b>Hover Handling Qualities of Fixed-Pitch, Variable-RPM Quadcopters with Increasing Rotor Diameter</b> (303) Ariel Walter,* Farhan Gandhi, Michael McKay, Robert Niemiec, Rensselaer Polytechnic Institute; Christina Ivler, Univ. of Portland
4:00 PM - 4:30 PM  Paper 6		<b>Future Vertical Lift Digital Backbone, Navigating Technology and Implementation Details</b> (165) Harold Tiedeman, Branden Sletteland,* Max Taylor, Collins Aerospace		<b>Trade-off between Maneuver Performance and Component Load Limiting</b> (268) Chams Eddine Mballo,* J.V.R. Prasad, Georgia Institute of Tech.
4:30 PM - 5:00 PM  Paper 7		<b>Architecture And Application Of Hypervisor In FACE Environment With Safety Assurance</b> (21) Jason Myren, Mitch Groen,* Collins Avionics		

**Technical Session E: Thurs. October 8, 2020, 1:00 to 5:00 PM - US Eastern EDT (UTC-4)**

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	<b>HUMS II</b> Session Chair <b>Jason Hines</b> US Navy	<b>Modeling and Simulation III</b> Session Chair <b>Matthew T. Smith</b> Sikorsky, a Lockheed Martin Co.	<b>Product Support</b> Session Chair <b>Daniel Amodeo</b> Sikorsky, a Lockheed Martin Co.	<b>Test and Evaluation II</b> Session Chair <b>Berend G. van der Wall</b> German Aerospace Center (DLR)
1:00 PM - 1:30 PM  Paper 1	<b>Modeling a Maintenance Free Operating Period Strategy for Future Vertical Lift (128)</b> Andrew Belloccchio,* Matthew Beigh,* United States Military Academy; James Burgess, CCDC AvMC ADD; Daniel Schrage, Georgia Institute of Technology	<b>System Identification of a Coaxial Ultralight Helicopter (125)</b> Tobias Richter, Walter Fichter, Benjamin Rothaupt,* University of Stuttgart; Benedikt Grebing, edm aerotec GmbH	<b>Leveraging Additive Manufacturing for Low-Volume, Out-of-Production Spare Parts (42)</b> Thomas Reilly,* Bell	<b>GPS-Based Airspeed Calibration for Rotorcraft: Generalized Application for All Flight Regimes (69)</b> Denis Hamel,* Alexander Kolarich,* Airbus Helicopters
1:30 PM - 2:00 PM  Paper 2	<b>Health-Aware Digital Enterprise: A Blueprint for Digital Thread Integration for FVL Sustainment (135)</b> Mark Thomson,* Logan Caraway, Brian Tucker, Bell	<b>Guidelines for System Identification of Multirotor Vehicles with Highly Correlated Inputs (210)</b> Tom Berger,* Mark Lopez, Mark Tischler, CCDC Aviation & Missile Center; Aaron Wagner, San Jose State University	<b>U.S. Army Rotary-wing Airframe Defect Trending, Modeling, and Analysis (96)</b> Jared Peltier,* Prasant Chhotu, US Army Combat Capabilities Development Command Aviation & Missile Center	<b>Cold Weather Testing of the Bell 525 Relentless (57)</b> Bradley Regnier,* Joel Baden, Albert Brand, Patrick Lindauer, Joshua O'Neil, John Schillings, Bell
2:00 PM - 2:30 PM  Paper 3	<b>Automated Component Tracking Technologies for Future Vertical Lift (232)</b> Raj Bharadwaj,* Honeywell; Hayley Borck, Honeywell Aerospace; John Moffatt, US Army, AvMC ADD-E	<b>Methodology Correlation for Coaxial Rotor and Blade Load Prediction (102)</b> Jinggen Zhao,* Mikel Brigley, Ramin Modarres, Hong Xin*, Sikorsky, A Lockheed Martin Company	<b>Additive Manufacturing Implementation in Rotorcraft Sustainment (80)</b> William Harris,* Sikorsky	<b>The Multirotor Test Bed - A New NASA Test Capability for Advanced VTOL Rotorcraft Configurations (356)</b> Carl Russell,* Sarah Conley, NASA Ames Research Ctr.
2:30-3:00	<b>Refreshment Break</b>			
3:00 PM - 3:30 PM  Paper 4	<b>Monitoring Gross Weight and Center of Gravity Position: A Review of the Challenges and Current Estimation Approaches (177)</b> Catherine Cheung,* Davis To, National Research Council	<b>Visual Augmentation for Personal Air Vehicles During Flight Control System Degradation (3)</b> Tim Mehling,* Manfred Hajek, Omark Halbe, Matthias Heller, Technical University Munich (TUM); Milan Vrdoljak, University of Zagreb	<b>Holistic Life Management of Damage Tolerant Airframes (64)</b> Darryl Toni,* Avinash Sarlashkar, Sikorsky	<b>Experimental Measurement of Sectional Stiffness Properties of Composite Rotor Blades (173)</b> Tyler Sinotte,* Olivier Bauchau, University of Maryland
3:30 PM - 4:00 PM  Paper 5	<b>Towards Unified Probabilistic Rotorcraft Damage Detection and Quantification via Non-parametric Time Series and Gaussian Process Regression Models (351)</b> Ahmad Amer,* Fotis Kopsaftopoulos, Rensselaer Polytechnic Institute	<b>A Virtual Reality Approach to Piloted Flight Simulation (379)</b> Pierangelo Masarati, Matteo Daniele,* Giuseppe Quaranta, Andrea Zanoni, Politecnico di Milano		<b>Wind Tunnel Testing a Small Isolated Folding Propeller (377)</b> Luke Battay,* US Army Technology Development Directorate; Carl Russell, NASA Ames Research Ctr.
4:00 PM - 4:30 PM  Paper 6		<b>UAV Dynamics and Electric Power System Modeling and Visualization using Modelica and FMI (138)</b> Meaghan Podlaski,* Hao Chang, Hamed Nademi, Luigi Vanfretti, Rensselaer Polytechnic Institute		<b>Helicopter Flight Test Evaluation of an Actively Stabilized External Slung Load (361)</b> Marc Alexander,* Gregory Craig, David Rancourt, National Research Council of Canada; Eiteene Perron, Sherbrooke University
4:30 PM - 5:00 PM  Paper 7				

## Forum 76 Special Session Schedule

**Monday, October 5, 2020: 9:00 to 11:00 AM**

**Opening General Session** — Sponsored by



**Welcome:**

- **Mike Hirschberg**, Executive Director, Vertical Flight Society
- **Glenn E. Isbell**, 2019-2020 Chair of the VFS Board of Directors and Bell VP of Rapid Prototyping & Manufacturing Innovation

**Keynote Address:** [LtGen Mark R. Wise, US Marine Corps](#), Deputy Commandant For Aviation (confirmed)

***Straight Talk from the Top***

Moderated by **Graham Warwick**, Managing Editor, Technology, *Aviation Week & Space Technology*

- **Tomasz Kryszynski**, VP Research & Innovation, Airbus
- **Michael Thacker**, Executive VP, Technology & Innovation, Bell
- **Steve Parker**, VP/GM, Boeing Vertical Lift
- **Roberto Gavaraglia**, Senior VP Innovation, Leonardo Helicopters
- **Dan Schultz**, President, Sikorsky, a Lockheed Martin Company

**Special Sessions Sponsored by Pratt & Whitney Canada**



**GO BEYOND**

**Tuesday, October 6, 2020: 10:00 AM to 12:00 PM**

**Special Session 1: Military VTOL R&D Leaders**

*Moderator: John Lindsay, Textron*

- **Maj Gen Greg Masiello**, US Marine Corps, USN/USMC PEO(A) (invited)
- **BGEN Wally Rugen**, US Army, FVL CFT lead
- **BGEN Rob Barrie**, US Army, Army PEO-Aviation
- **Col Paul Morris**, British Army, NATO JCG Vertical Lift (invited)

**Thursday, October 8, 2020**

**Special Session 2: Civil VTOL R&D Leaders (10:00 AM to 12:00 PM)** —

*Moderator: Nicolas Chabée, Pratt & Whitney Canada*

- **Antonello Marino**, European Union Clean Sky 2 Fast Rotorcraft IADP
- **Klausdieter Pahlke and Arnaud LePape**, ONERA, and, DLR: *Franco-German Rotorcraft Research*
- **Derek Gowanlock**, National Research Council (NRC) Canada
- **Susan Gorton**, NASA Revolutionary Vertical Lift Technology (RVLT) project

**Special Session 3: Electric VTOL Testing & Certification (1:00 PM to 2:30 PM)**

*Moderator: Brian Garrett-Glaser, Access Intelligence*

- **Col Nate Diller**, US Air Force, AFWERX Commander
- **Mark Moore**, Uber Elevate
- **Wes Ryan**, Federal Aviation Administration, Unmanned and Pilotless Aircraft Technology Lead
- **David Solar**, EASA, SC-VTOL Lead
- **Starr Ginn**, NASA, AAM National Campaign