

Transformative Vertical Flight 2022

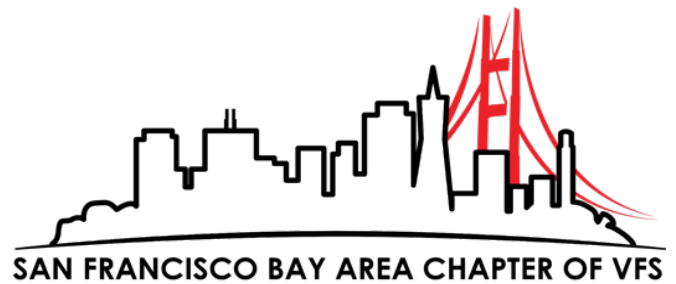
Preliminary Agenda (Subject to Change)



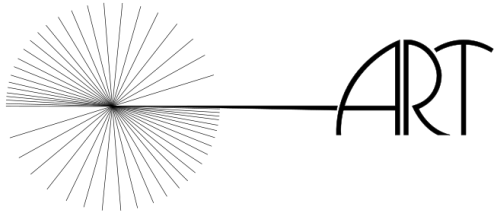
Transformative Vertical Flight 2022
Aeromechanics for Advanced Vertical Flight Technical Meeting
9th Annual Electric VTOL Symposium
Jan. 25-27, 2022 | San Jose, California



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Exhibitors



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Monday, January 24, 2022: Badge Pick-up Hours: 3:00 pm – 5:00 pm (Gateway Foyer)

7:00 am – 9:00 am: Short Course on Electric VTOL Fundamentals, Short Course Badge Pick-up

8:00 am – 5:00 pm: Short Course on Electric VTOL Fundamentals, Dr. James Wang,

Tuesday, January 25, 2022: Badge Pick-up Hours: 7:00 am – 5:00 pm (Gateway Foyer)**Tuesday – Thursday: Exhibits (Bayshore Foyer)****Plenary Presentations****Opening Plenary and eVTOL Symposium Online Q&A:** Please go to bit.ly/tvf2022 to ask and vote on questions for the speakers during the Opening Plenary and eVTOL Symposium. While you're there, please take a minute to answer a few survey questions about what part of the industry you're in, your research priorities, and potential interest in NASA tools and/or collaboration!**Transformative Vertical Flight 2022** Moderator: Colin Theodore, NASA

(8:00 – 8:10)	Welcome and Introductions , Colin Theodore, NASA, and Mike Hirschberg, VFS
(8:10 – 8:30)	Davis Hackenburg, NASA
(8:30 – 8:50)	Jaakko Karras, NASA JPL (invited)
(8:50 – 9:10)	BG Walter Rugen, Director, US Army Future Vertical Lift Cross-Functional Team, US Army (invited)
(9:10 – 9:30)	COL Nathan Diller, Director, AFWERX
(9:30 – 9:50)	Steve Bradford, FAA
(10:00 – 10:30)	Networking Break in Exhibits (Bayshore Foyer)

Transformative Vertical Flight 2022 Moderator: Jim Sherman, VFS

(10:30 – 10:50)	Jonathan Hartman, Sikorsky (tentative)
(10:50 – 11:10)	Diana Marina Cooper, Hyundai Air Mobility (invited)
(11:10 – 11:30)	Bhavesh Mandalia, Lilium (invited)
(11:30 – 11:50)	Dan Dalton, Wisk (invited)
(12:00 – 1:30)	Lunch in Exhibits (Bayshore Foyer)

Electric VTOL Symposium Moderator: Parimal Kopardekar, NASA

(1:30 – 3:00)	Scaling up to AAM Paul Stith, Black And Veatch tba, tba tba, tba tba, tba
(3:00 – 3:30)	Networking Break in Exhibits (Bayshore Foyer)

Electric VTOL Symposium Moderator: tba, tba

(3:30 – 5:00)	eVTOL Industry Updates While 2021 has been a difficult year, it has been marked with great successes in advancing eVTOL technology. eVTOL aircraft developers will share their updates and plans. tba, BETA Technologies (invited) Ben Tigner, Overair tba, Vertical Aerospace (invited) tba, Volocopter (invited) tba, Xpeng (invited)
(5:00 – 5:15)	Certification and event Updates from Europe and China , Willi Tacke, Flying Pages GmbH

(5:30 – 6:30) Reception in Exhibits (Bayshore Foyer)**Wednesday, January 26, 2022: Badge Pick-up Hours: 7:00 am – 5:00 pm (Gateway Foyer)****Electric VTOL Symposium** Moderator: Christine Bernat, GAMA

(8:00 – 10:00)	Standards Development The development of industry consensus standards is critical to achieving certification. This session will provide an update on the activities of the key standards development organizations.
(8:00 – 10:00)	Al Lawless, E-VTOL Flight Test Council (invited) David Alexander, SAE International (invited) Rex Alexander, NFPA Yolanka Wulff, CAMI tba, ASTM (invited)
(10:00 – 10:30)	Networking Break in Exhibits (Bayshore Foyer)

Electric VTOL Symposium Moderator: tba, tba

(10:30 – 12:00)	Modelling and Simulation One of the key enabling technologies for eVTOL developing is access to modeling and simulation tools. These tools allow designers the ability to iterate designs and operations at faster than real-time.
(10:30 – 12:00)	Ron du Val, ART tba, Continuum Dynamics tba, Hypersizer tba, CAE Vivek Ahuja, Research in Flight
(12:00 – 1:30)	Lunch in Exhibits (Bayshore Foyer)

Wednesday, January 26, 2022: Badge Pick-up Hours: 7:00 am – 5:00 pm (Gateway Foyer)**Electric VTOL Symposium** Moderator: tba, tba

(1:30 – 3:00)	Advanced Manufacturing Electric VTOL requires very lightweight and strong materials that can be produced inexpensively. This session highlights the latest manufacturing technologies and materials that will enable affordable vehicles and infrastructure.
(1:30 – 3:00)	Stacy Biel/Jeff Cross, Toray tba, Victrex tba, RE:Build tba, Hexcel
(3:00 – 3:30)	Networking Break in Exhibits (Bayshore Foyer)

Electric VTOL Symposium Moderator: Sharon Rossmark, Women & Drones

(3:30 – 5:00)	Diversity in the Workforce, with Women and Drones
(3:30 – 5:00)	Mike Hirschberg, VFS Danielle McLean, Happy Takeoff Anita Sengupta, HydroPlane Paul Eremenko, Universal Hydrogen (invited) Clint Harper, Urban Movement Labs (invited) Jeannie Lam, Wisk (invited)

Thursday, January 27, 2022: Badge Pick-up Hours: 7:00 am – 4:00 pm (Gateway Foyer)**Electric VTOL Symposium** Moderator: Carl Russell, NASA

(8:00 – 10:00)	Cross Agency / Industry Working Groups
(8:00 – 10:00)	Justin Littell, NASA Anna Cavolowsky, NASA Steve Rizzi, NASA (tentative) tba, tba
(10:00 – 10:30)	Networking Break in Exhibits (Bayshore Foyer)

Electric VTOL Symposium Moderator: tba, tba

(10:30 – 12:00)	Enabling Electric Propulsion Systems As eVTOL aircraft progress through flight test toward certification, systems and subsystems suppliers continue to provide more advanced products, such as motors and power systems.
(10:30 – 12:00)	Jia Xu, Honeywell Vance Hilderman, Afuzion tba, tba
(12:00 – 1:15)	Lunch in Exhibits (Bayshore Foyer)

Electric VTOL Symposium Moderator: Danielle McLean, Happy Takeoff

(1:15 – 2:45)	Hydrogen-Electric VTOL (H2eVTOL) As a potential source of power for eVTOL propulsion, hydrogen has the greatest energy-density ratio of any non-nuclear fuel source on Earth (Figure 1). Facing enormous technological challenges in production and storage, hydrogen promises great benefits, including environmental, when it can be made economically and ubiquitously available.
(1:15 – 2:45)	Anubhav Datta, University of Maryland John Piasecki, Piasecki Aircraft Thomas Jones, PlugPower Anita Sengupta, Hydroplane Dave Edlund, Element 1
(2:45 – 3:15)	Networking Break in Exhibits (Bayshore Foyer)

Electric VTOL Symposium Moderator: tba, tba

(3:15 – 4:45)	eVTOL Industry Updates While 2021 has been a difficult year, it has been marked with great successes in advancing eVTOL technology. eVTOL aircraft developers will share their updates and plans.
(3:15 – 4:45)	tba, Joby Aviation Dave Merrill, Elroy Air Martin Peryea, Jaunt tba, Bartini (invited)
(4:45 – 5:00)	Event Wrap-up , Carl Russell, NASA, and Jim Sherman, VFS

Aeromechanics Technical Paper Presentations

Tuesday, January 25, 2022: Badge Pick-up Hours: 7:00 am – 5:00 pm (Gateway Foyer)

Aeromechanics – Urban Air Mobility Session 1 Chair: TBD		Aeromechanics – eVTOL 1 Chair: TBD	
(1:30 – 2:00)	Conceptual Design of a Tiltduct Reference Vehicle for Urban Air Mobility Siena Whiteside and Beau Pollard, NASA Langley Research Center	Characterization and Analysis of Lithium Sulfur Batteries for Electric VTOL Aircraft Emily Fisler and Anubhav Datta, University of Maryland	
(2:00 – 2:30)	Conceptual Design of Tiltrotor Aircraft for Urban Air Mobility Michael Radotich, NASA Ames Research Center	Electrified Aviation Propulsion Batter Challenges and Opportunities Jeffery Belt, Electric Power Systems	
(2:30 – 3:00)	Aeroelastic Analysis of an Urban Air Mobility Rotor in Forward Edgewise Flight Stephen J. Wright, NASA Ames Research Center	Minimum of Electric Propulsion Units (EPU) for Fail-Safe Air-Taxi Vehicles Fuyuan Chang, FSC Engineering Inc.	
(3:00 – 3:30) Networking Break in Exhibits (Bayshore Foyer)			
Aeromechanics – Innovative Rotor Tests Chair: TBD		Aeromechanics – Acoustics Chair: TBD	
(3:30 – 4:00)	Experimental Investigation of the Unsteady Aerodynamics of a Cycloidal Rotor Joseph Heimrel and Moble Benedict, Texas A&M University	Predictions and Validation of Small-Scale Rotor Noise using UCD-QuietFly Sicheng (Kevin) Li and Seongkyu Li, University of California Davis	
(4:00 – 4:30)	Vacuum Chamber Test and Hover Test of Double Anhedral Tip Composite Rotor Blades Cheng Chi, Anubhav Datta, Univ. of Maryland; Brahmananda Panda, The Boeing Company	Rotor-Rotor Interaction Effects on Noise from a Tandem Rotor Configuration Aharon Karon and Michael Mayo, Georgia Tech Research Institute	
(4:30 – 5:00)	An Icing Wind Tunnel Study on the Dynamic Ice Accretion Process over the Surface of Rotating UAV Propeller Blades Nianhong Han, Haiyang Hu, Hui Hu, Iowa State University	Aeroacoustic Analysis of Non-Periodic Propeller Motions Dilhara Jayasundara and James Baeder, University of Maryland	
(5:00 – 5:30)	Revolutionary Flight Vehicle Based on Leonardo da Vinci Aerial Screw: A Paradigm Shift In Aerial Technology Austin Prete, Vengalattore Nagaraj, Inderjit Chopra, University of Maryland	Prediction of Quadcopter Acoustics using RVL Toolchain Sesi Kottapalli and Chris Silva, NASA Ames Research Center	
(5:30 – 6:30) Reception in Exhibits (Bayshore Foyer)			

Wednesday, January 26, 2022: Badge Pick-up Hours: 7:00 am – 5:00 pm (Gateway Foyer)

Aeromechanics – MARS Helicopters Session 1 Chair: TBD		Aeromechanics – Dynamics Session 1 Chair: TBD	
(0800 – 0830)	Overview and Introduction of the Rotor Optimization for the Advancement of Mars eXploration (ROAMX) Project Haley Cummings et al.	Flutter Assessment of a Double-Swept Rotor Blade in Hover Based on Indicial Aerodynamics Considering Blade Profile, Rotor Inflow and Wake Periodicity Jürgen Arnold, DLR German Aerospace Center	
(0830 – 0900)	Aeromechanics of an Advanced Mars Helicopter Ravi Lumba, Cheng Chi, Anubhav Datta, University of Maryland; Haley Cummings NASA Ames Research Center	Individual Blade Control for Component Load Alleviation using Higher Order Linear Time Invariant Methods Chams Eddine Mballo, J.V.R. Prasad, Georgia Institute of Technology	
(0900 – 0930)	Hover and Forward Flight Performance Modeling of Ingenuity Cuyler Dull, Georgia Tech; Lauren Wagner, Larry Young, Wayne Johnson, NASA Ames Research Center	Buoyancy Effects on Trim and Dynamics of a Floating Helicopter , Katie Krohmaly, Roberto Celi, University of Maryland; Jeye Falls	
(0930 – 1030) Networking Break in Exhibits (Bayshore Foyer)			
Aeromechanics – eVTOL Design & Analysis Chair: TBD		Aeromechanics – Dynamics Session 2 Chair: TBD	
(10:30 – 11:00)	A Combined Low and High Fidelity Approach for eVTOL Rotor Modeling and Design Lakshmi N. Sankar and Daniel P. Schrage, Georgia Institute of Technology	Identification of High-Order Linear Time-Invariant Models From Periodic Nonlinear System Responses Mahmoud Hayajnh, J.V.R. Prasad, Georgia Institute of Technology; Umberto Saetti, Auburn University	
(11:00 – 11:30)	An Unstructured Dual-Solver Hybrid Method for Multirotor eVTOL Design and Analysis Henry Schwartz, Marilyn Smith, Georgia Tech; Dan Wachspress, Glenn Whitehouse, Continuum Dynamics	Pre-test Comprehensive Analysis for the Urban Air Mobility Side-by-Side Test Stand Stephen Wright, Haley Cummings, NASA Ames Research Center	
(11:30 – 1200)	Tool for Optimization of Rotorcraft Concepts Applied to an eVTOL Rotor Design Jeffery Sinsay, Ananth Sridharan, Daniel Martinez, Science & Technology Corp.; Jay Sitaraman, Parallel Geometric Algorithms, LLC; Dylan Jude, U.S. Army, CCDC AvMC	Evaluation of a Combined Momentum Theory and Simple Vortex Theory (CMTSVT) Inflow Model for UAM Applications Jahnvi Hariani, Feyyaz Guner, J.V.R. Prasad, Georgia Institute of Technology	
(12:00 – 1:30) Lunch in Exhibits (Bayshore Foyer)			

Aeromechanics – Advanced High Speed Rotorcraft Chair: TBD		Aeromechanics – UAM Session 2 Urban Operations Chair: TBD	
(1:30 – 2:00)	Optimum Speed Tiltrotor, Recent Testing and Applications Thomas Berger, Paul Parcell, David Weinstein, Kareem Aircraft	Weather Solutions for VTOL Aircrafts Urban Operations Mounir Chrit, Don Berchoff, TruWeather Solutions	
(2:00 – 2:30)	Variation in Thrust Sharing of a Lift-Offset Coaxial Rotor System Jimmy Ho, Hyeonsoo Yeo, U.S. Army CCDC AvMC	Development of An Experimental Unmanned- Aerial System (UAS) to Study the Effects of Adverse Weathers on its Flight Performance Muhammad A. Siddique, Nianhong Han, Hui Hu, Iowa State University	
(2:30 – 3:00)	Detailed Structural Design for the Co-axial Compound Rotorcraft based on the Physics- based Approach SunHoo Park, ByeongUk Im, Jewan Yeom, TaeYoung Chun, SangJoon Shin, Seoul National University	Rotor Performance Predications for UAM – Single vs Coaxial Rigid Rotors Jason Cornelius, Sven Schmitz, The Pennsylvania State University	
(3:00 – 3:30)	Networking Break in Exhibits (Bayshore Foyer)		
Aeromechanics – MARS Helicopters Session 2 Chair: TBD		Aeromechanics – Rotor Design & Optimization Chair: TBD	
(3:30 – 4:00)	The Effect of Lock Number on the Control of a Mars Rotorcraft Eric Greenbaum, Anubhav Datta, University of Maryland	Development and Validation of Conceptual Design Level Rotorcraft Acoustics Prediction Tools Younghu Wenren, Mark Bodie, Michael Muhlestein U.S. Army ERDC Cold Regions Research and Engineering Laboratory; Michael Avera, George Jacobellis, Mathew Floros, Phuriwat Anusonti-Inthra, U.S. Army DEVCOM Army Research Laboratory	
(4:00 – 4:30)	LILI (Long-term Ice-field Levitating Investigator): Mars Aerial and Ground Explorer for Martian Polar Regions Natasha Schatzman, Micelle Dominguez, NASA Ames Research Center; Pascal Lee, SETI Institute	Incorporation of Airfoil-Interactional Data to Improve the Accuracy of Stacked Rotor Performance Predictions in the Design Stage Miranda Costenoble, James Baeder, University of Maryland; George Jacobellis, CCDC Army Research Lab	
(4:30 – 5:00)	Feasibility Study of a Robotic Science Army on Future Martian Rotorcraft Cole Rutter, Mackenzie Lach, NASA Ames Research Center	Multiobjective Rotor Blade Optimization Framework Advancements Luke Allen, U.S. Army ERDC; Joon Lim, CCDC AvMc; Robert H. Haehnel, Ian Dettwiller	
Thursday, January 27, 2022: Badge Pick-up Hours: 7:00 am – 4:00 pm (Gateway Foyer)			
Aeromechanics – Flow Control Chair: TBD		Aeromechanics – Helios Applications Chair: TBD	
(8:00 – 8:30)	Active Flow Control Simulations and Experiments for Drag Reduction of an External Stores Support System David Schatzman, U.S. Army CCDC AvMC; Ofek Drori, Shai Alexandroni, Avraham Seifert, Tel Aviv University	Performance Predictions of a Small Folding Propeller Using Rotorcraft Comprehensive Analysis and CFD Hao Kang, Phuriwat Anusonti- Inthara, Rajneesh Sing, U.S. Army DEVCOM ARL, Luke Battey U.S. Army DEVCOM, AvMC	
(8:30 – 9:00)	Further Investigation of Fan-In-Wing Aerodynamic Performance Using Active Flow Control Chunhua Sheng, Qiuying Zhao, The University of Toledo	RCAS-Helios Elastic Fuselage Coupling Demonstration for Rotorcraft Jee Woong Kim, Hossein Saberi, Matthew Hasbun, Advanced Rotorcraft Technology; Beatrice Roget, U.S. Army CCDC, AvMC	
(9:00 – 9:30)		An Assessment of XV-15 Tiltrotor Hover Download Predictions Andrew Wissink, Joon Lim, U.S. Army CCDC AvMC; Steven Tran, Science & Technology Corp.	
(9:30 – 1000)			
(10:00 – 10:30)	Networking Break in Exhibits (Bayshore Foyer)		
Aeromechanics – Fast CFD Simulations Chair: TBD		Aeromechanics – Wakes & Airfoils Chair: TBD	
(10:30 – 11:00)	A Data-Driven Reduced Order Model of an Isolated Rotor Nicholas Peters, Chris Silva, NASA Ames Research Center; John Ekaterinaris, Embry-Riddle Aeronautical University	Comparison of CHARM Predictions of the Multirotor Testbed with Wind Tunnel Experimental Results Dorsa Shirazi, NASA Ames Research Center	
(11:00 – 11:30)	Rotor5: Rotor Design Under 5 hours Using Ultra-Fast and High-Fidelity CFD Simulation and Automatic Meshing Runda Ji, Feilin Jia, Zongfu Yu, Flexcompute; QiQi Wang, M.I.T.	RABBIT: A Rapid Low Fidelity BVI Prediction Tool – Comparison and Validation using RVL T Toolchain Lauren Weist, Natasha Schatzman, NASA Ames Research Center	
(11:30 – 12:00)	Initial Assessment of a Real-Time Vorticity Solver for Flight Mechanics of Rotary-Wing and eVTOL Vehicles: A Heterogeneous Computing Approach Diego Hidalgo, John Vargas, Dinamo Systems S.A.S, Colombia	Best Practices for Airfoil Generation using XFOIL and OVERFLOW Kristen Kallstrom, NASA Ames Research Center	
(12:00 – 1:15)	Lunch in Exhibits (Bayshore Foyer)		
Aeromechanics – eVTOL Session 3 Modeling of Propulsion Systems Chair: TBD		Aeromechanics – eVTOL Session 4 Handling Qualities Chair: TBD	
(1:15 – 1:45)	Real-Time Simulation Modeling of Electrical Propulsion Systems Sharare Meredith, Akeem Gidden, Henry Schwartz, Marilyn Smith, Kristina Wayne, Kellen Denny, Georgia Tech	Pilot Workload Rating Predictions Using Image Data and Residual Learning-Based Methods Keiko Nagami, Carlos Malpica, NASA Ames Research Center; Marc Schwager, Stanford University	
(1:45 – 2:15)	Electric Motor Thermal Modeling for Vehicle Conceptual Design Farid Saemi, Moble Benedict, Texas A&M University	Handling Qualities Evaluation of Urban Air Mobility (UAM) eVTOL Disturbance Rejection and Control Response Criteria Using the Vertical Motion Simulator Shannah Withrow- Maser, Jeremy Aires, Carols Malpica, Stefan Schuet, NASA Ames Research Center	
(2:15 – 2:45)	Investigation of Certification Consideration for Distributed Electric Propulsion (DEP) Aircraft Robert McKillip, Daniel Washspress, Continuum Dynamics; John Hansman, M.I.T	Gust Alleviation for a Generic Compound e- VTOL Aircraft Jean-Pierre Theron, Joseph Horn, PennState; Daniel Wachespress, Jefferey Keller, Abhinav Sharma, Continuum Dynamics	
(2:45 – 3:15)	Networking Break in Exhibits (Bayshore Foyer)		

Upcoming Events

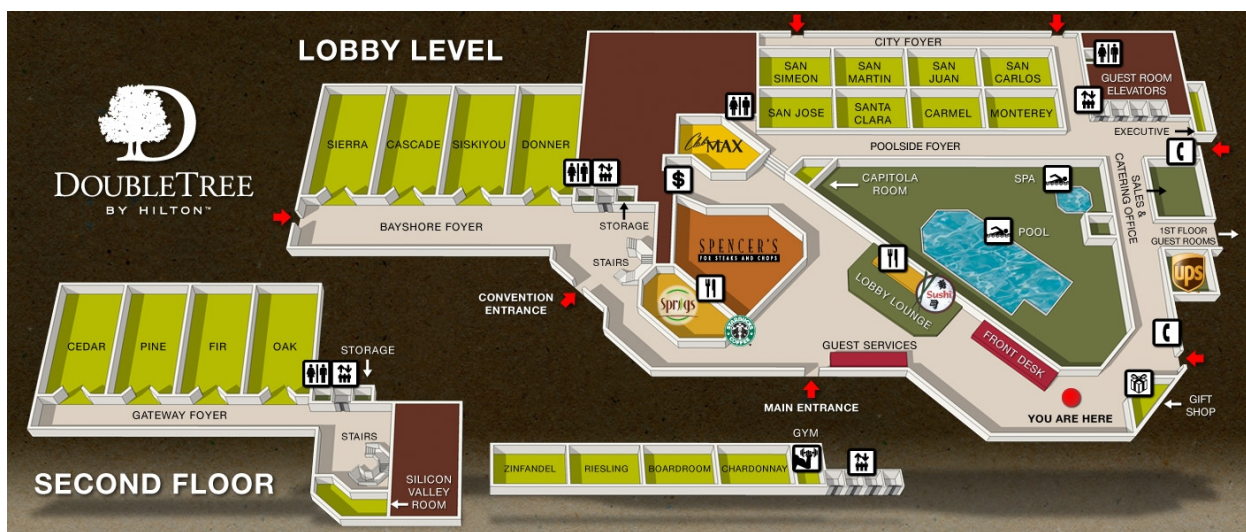


Thank you for joining us here in San Jose for **Transformative Vertical Flight 2022!**
We hope you learn much this week and translate that to your daily work.

Plan now for the VFS **10th Biennial Autonomous VTOL Technical Meeting and 10th Annual eVTOL Symposium**, January 2023 in Mesa, AZ.

Keep up to date with the latest advances in VTOL technology. Our full list of upcoming events is online at www.vtol.org/events

PLACEHOLDER FOR LATEST EXHIBIT MAP



VFS is successful only because of the efforts of our members who dedicate their time, working to advance vertical flight. Many thanks to all our TVF 2022 conference organizers, especially:

- **General Meeting Chair:** Dr. Colin Theodore, NASA Ames Research Center
- **Aeromechanics for Advanced Vertical Flight Technical Chair:** Dr. Buvana Jayaraman, US Army CCDC AvMC
- **9th Annual Electric VTOL Symposium Technical Chair:** Mr. Carl Russell, NASA Ames Research Center