



## CALL FOR PAPERS

VFS is pleased to announce the **80th Annual Forum & Technology Display** scheduled for **May 7–9, 2024, at the Palais des Congr s in Montr al**. Forum 80 is the premier opportunity to present and discuss advances in vertical flight technology, developments, and applications.

The **Forum 80 Technical Chair** is **Dr. Hyeonsoo Yeo**, US Army DEVCOM Aviation & Missile Center, [hyeonsoo.yeo.civ@army.mil](mailto:hyeonsoo.yeo.civ@army.mil). The **Forum 80 Deputy Technical Chair** is **Dr. Maryam Khoshlahjeh**, Archer Aviation, [mkhoshlahjeh@archer.com](mailto:mkhoshlahjeh@archer.com).

This **Call for Papers** invites abstracts to be submitted for consideration in any of the Society's 21 technical disciplines or History committee:

- Acoustics
- Advanced Vertical Flight
- Aerodynamics
- Aircraft Design
- Autonomy & UAS
- Avionics & Systems
- Crash Safety
- Crew Stations & Human Factors
- Dynamics
- Electric VTOL (eVTOL)
- Handling Qualities
- History
- Health & Usage
- Management Systems
- Manufacturing Technology & Processing
- Modeling and Simulation
- Operations
- Product Support Systems Technology
- Propulsion
- Safety
- Structures & Materials
- Systems Engineering
- Test & Evaluation

### Abstract submission guidelines:

- *Submittal of an abstract is a professional commitment.* If an abstract is accepted, the author commits to writing a final paper and presenting in person.
- **Abstracts dated extended to October 23, 2023:** Submitted to Mira at [www.vtol.org/mira](http://www.vtol.org/mira).
- The abstract should present the status of the background data to be used, summarize figures and illustrations, and important conclusions.
- Abstracts should not exceed 5 pages in length.
- Abstract templates are to be followed and are available on Mira ([www.vtol.org/mira](http://www.vtol.org/mira)) and the Forum 80 site ([www.vtol.org/forum](http://www.vtol.org/forum)).
- One author should present no more than two papers at the Forum.

### Abstract acceptance will be based upon the following:

- Work that represents new vertical flight technology advancements and/or reports significant new information.
- Technical quality, relevance, importance, and timeliness.
- Work in progress must be cited appropriately, specifying how proposed content differs from prior publication (if any). **Final**

### paper submission information:

- The Forum is an international event and therefore it is *VFS policy that all inal written papers and Forum presentations are completely unrestricted.*
- **Final written papers due April 8, 2024.**
- All technical papers will be published online as part of the Forum Proceedings and in the VFS Library; each paper will be assigned a DOI number.
- Copyright: VFS is assigned copyright ownership of published Forum papers and for US Government employees, to the extent transferable. *Authors also reserve the right to republish or use all or part to their Forum paper in future works.*
- No Paper, No Podium Rule: Authors who do not submit their paper will NOT be scheduled to present.
- Late Paper Submissions: Final papers received after the submission deadline are not eligible for a Best Paper Award and may not be included in the Proceedings.
- Registration: Forum speakers are eligible for reduced speaker registration fees, whether members of VFS or not. Speakers **MUST** register and pay in order to present at the Forum.
- Best Paper Awards: Authors of best papers presented for each technical discipline — as determined by the relevant Technical Committee — will receive a Best Paper Award certificate.
- The overall Forum best paper will receive the *Alfred Gessow Best Paper Award* and be invited to speak at ERF 2024.

### Important Dates:

**October 23, 2023** – Abstract Extended Deadline  
**December 2023** – Author Notification of Paper Selection  
**April 8, 2024** – Final Written Paper Deadline

### Important Links:

**Mira Forum 80 Abstract and Final Paper Submissions:** [www.vtol.org/mira](http://www.vtol.org/mira)  
**VFS Forum 80 Information:** [www.vtol.org/forum](http://www.vtol.org/forum)

### Contact:

**Julie M. Gibbs, VFS Technical Programs Director:** [jmgibbs@vtol.org](mailto:jmgibbs@vtol.org)

## ANNUAL FORUM TECHNICAL SESSIONS

### ACOUSTICS

Papers are sought addressing recent advances in the study of rotorcraft acoustics and their related fields. Research into crewed or uncrewed vehicles that focuses on external and internal noise generation, propagation, control (active and passive), and community impact for rotorcraft, VTOL vehicles and advanced air mobility (AAM), and similar topics in wind turbine noise are also welcome. Other topics of interest include:

- Research contributing to a basic understanding of fundamental aerodynamic noise sources
- Noise measurement, modeling, and prediction research that advances the state of science
- Acoustic aspects of issues that could transform, revolutionize or facilitate concepts for the future of vertical flight
- Development or implementation of national or international civil noise regulations

*Exterior* noise topics include:

- Vehicle component and full system noise prediction methodology development and validation
- Wind tunnel and flight test acoustics measurements
- New procedures for acoustic data acquisition and analysis
- Active and passive noise reduction technologies
- Noise abatement flight operations
- Interaction between various noise sources for vertical flight vehicles
- Acoustic propagation models
- Impact of vehicle noise on the community and human response to noise

*Internal* noise topics include:

- Application of numerical techniques to predict noise in vehicle cabins
- Active and passive noise control technologies to reduce cabin noise
- Studies of human response to cabin noise
- Concepts for reduction of engine, transmission, or motor noise

**Session Chair:** Dr. James H. Stephenson, US Army, james.h.stephenson23.civ@army.mil

**Deputy Session Chair:** Lauren Weist, NASA Ames Research Center, lauren.p.weist@nasa.gov

### ADVANCED VERTICAL FLIGHT

Papers are sought addressing novel, innovative configurations, and transformational technologies for vertical flight vehicles. The committee invites research on applications of advanced and emerging technologies to enable transformational capabilities beyond that of current state-of-the-art and production VTOL aircraft. Novel designs to meet unique mission requirements, for example, human-powered, tube-launched, extraterrestrial, or other unconventional applications, are also encouraged. Other topics of interest include:

- Novel air vehicle configurations
- Distributed electric propulsion
- Multi-rotor systems

Advanced propulsion systems, aerodynamic enhancements, and structural efficiency improvements that enable novel configurations are also welcome. In addition, papers on technological advances in unconventional vehicles are encouraged and examples include:

- Flapping wing aircraft
- Cyclocopters
- Thrust/lift compounded aircraft
- Slowed/stopped rotor aircraft
- High-speed VTOL aircraft
- Hybrid propulsion aircraft and/or all-electric aircraft

**Session Chair:** Dr. Jinwei Shen, University of Alabama, jinwei.shen@ua.edu

**Deputy Session Chair:** Steve R. Schafer, Bell, sshafer@bellflight.com

### AERODYNAMICS

Papers are sought addressing recent accomplishments in all areas of rotorcraft and vertical and/or short take-off and landing

(V/STOL) aerodynamics, especially as related to the future of vertical flight. Topics of interest include:

- Computational fluid dynamics techniques
- Analytical methodologies
- Experimental aerodynamics and/or flight test results
- Flow visualization methods
- Correlation and uncertainty quantification
- Aerodynamic design methods
- Unique aerodynamic modeling
- Interactional aerodynamics
- Low Reynolds number aerodynamics
- Aerodynamic flow control
- Unsteady, high angle of attack or vortical flows

*Aerodynamics abstracts exceeding 5 pages will not be evaluated and authors are encouraged to use the full five pages to allow for sufficient detail and increase the chance of acceptance.*

**Session Chair:** Dr. Glen Whitehouse, Continuum Dynamics, glen@continuum-dynamics.com

**Deputy Session Chair:** Dr. Joseph Milluzzo, US Naval Academy, milluzzo@usna.edu

### AIRCRAFT DESIGN

Papers are sought addressing the design of crewed or uncrewed vertical take-off and landing aircraft, their major systems, and components. Papers discussing the application of technologies, or the interaction of technology, configuration, and requirements in the design of next generation aircraft are also welcome.

Specific topics of interest include:

- Conceptual design of whole platforms and systems
- Preliminary and detail design of vehicle, airframe, dynamic components, and major subsystems
- Integration of novel propulsion, control effectors and modular payloads/weapons
- Optimization and trade-off analysis as part of the design
- process using low to high fidelity computational and design tools
- Application of high-fidelity simulation methods to support vehicle or system design
- Lessons learned from actual design realization
- Development and application of tools and process needed for design

**Session Chair:** Michael Strauss, Sikorsky, a Lockheed Martin Co., michael.strauss@lmco.com

**Deputy Session Chair:** Lauren Wolfe, Aurora Flight Sciences, wolfe.lauren@aurora.aero

### AUTONOMY & UNCREWED AIRCRAFT SYSTEMS (UAS)

Papers are sought addressing concepts, design, development, operation, and robotics aspect of VTOL and rotary-wing UAS in the following general areas:

- Autonomy and software architectures
- Reliability and robustness
- Payloads and sensors, including applications such as Intelligence, Surveillance and Reconnaissance (ISR), cargo, etc.
- Agility and performance
- Survivability
- Operability
- Shipboard Environment (deck motion and wind gusts)

Other topics of interest include:

- Guidance, navigation, and control (with and without GPS)
- Alternate navigation methods
- Reinforced learning
- Machine learning for autonomy
- Design concepts, including small uncrewed aircraft systems (sUAS) and micro air vehicles (MAVs)
- Mechatronics integration
- Reasoning, and higher-order decision making
- Swarming, teaming, and multi-vehicle fusion
- Autonomous operation, tasking, and control (C4)
- Manned-unmanned (MUM) teaming
- Flight testing, modeling, and simulation
- Data links and communications
- Airworthiness, safety and certification, operation in civil airspace
- International cooperation and compatibility

**Session Chair:** Dr. Jean Paul Reddinger, US Army Research Lab, jean-paul.f.reddinger.civ@army.mil

**Deputy Session Chair:** Dr. Elena Shrestha, University of Michigan, elena@aeros.me

## AVIONICS & MISSION SYSTEMS

Papers are sought addressing software, mission, flight, or avionics systems for crewed or uncrewed, or optionally crewed vertical flight aircraft. Topics of interest include:

- Aspects of mission, flight, or avionics management systems including hardware, firmware, and software design, testing, development, fielding/deployment, or successes/challenges/lessons learned
- Integration of net-centric operations, sights and sensors, weapons and armament, navigation and communications, aircraft survivability, aircraft management, controls and displays, data management (concentration or collection), data links, or electronic warfare systems
- Complex software intensive, partitioned, or multi core avionics, mission, or flight systems including cognitive decision aiding, machine learning, artificial intelligence, automation/augmentation, and degraded visual environments (DVE) or "all weather operation" including synthetic vision, image or data fusion, use of advanced sights and sensors
- Cyber security, anti tamper, GPS denied environments, information assurance, and aspects of DevSecOps and/or MLOps
- Avionics test or qualification methods, especially as applicable to safety, airworthiness certification, or other aspects of qualification
- Fly by wire and fly by light flight control system architectures including advanced electrical controls, actuators, and emerging technologies
- Innovative technologies from other industries such as automotive, nautical, or internet of things applicable to mission, avionics, flight, ground systems, or software systems that enhance the capabilities of vertical lift aircraft
- Open systems architecture initiatives, technologies, and applications within rotorcraft or adjacent airborne aircraft (e.g., fighter) systems, including, but not limited to MOSA, FACE, OMS, HOST, SOSA and IMA architectures
- Electrical power generation, distribution, and control including eVTOL

**Session Chair:** Daniel Cooper, Sikorsky, a Lockheed Martin Co., dan.m.cooper@lmco.com

**Deputy Session Chair:** Grace Chryzilla, The Boeing Company, grace.chryzilla@boeing.com

## CRASH SAFETY

Papers are sought addressing all aspects of crashworthiness and aviation occupant safety relating to rotorcraft, uncrewed aircraft systems (UAS), and other V/STOL aircraft in applications such as military, civil, offshore transport, advanced air mobility (AAM), mountainous terrain, emergency medical services, and law enforcement. Of key interest are system integration analyses that demonstrate enhanced occupant safety. Emphasis will be given to the recent development of new crash safety concepts and technologies focused on:

- Minimizing human impact injury
- Maximizing post-crash survival
- Development of crash-resistant design criteria
- Addressing chronic injury potential related to crash-protective systems
- Development and application of comprehensive human tolerance and injury criteria
- Development of systems that reduce airframe damage while also reducing injury potential
- Effects of the application of transient dynamic loading on aircraft structure and mission equipment due to impact or crash (e.g., bird strike or cargo system loading)

Additional topics of interest include:

- Advances in energy absorbing systems such as landing gear
- Composite airframe structures, seats, cargo and mass item retention systems, and internal/external inflatable devices
- Crew, troop, and passenger restraint systems
- Multi-terrain impact analysis and testing including ditching and flotation stability
- Impact of crash-resistant fuel systems to include range extension tanks
- Methods of mishap data retrieval, collection and analysis; use of mishap

data to define crash safety technology deficiencies and support system safety analyses

- Numerical techniques for crashworthiness including occupant modeling, simulation of aircraft

**Session Chair:** Tyrone Minton, The Protective Group, tyrone.minton@pbearmorus.com

**Deputy Session Chair:** Dr. Cheng-Ho Tho, Bell, ctho@bellflight.com

## CREW STATIONS & HUMAN FACTORS

Papers are sought addressing all aspects of air vehicle crew stations and/or human factors engineering. Topics of interest include:

- New designs facilitating hands on/eyes out operations
- Cockpit environment for extended mission times, such as air conditioning, noise reduction, vibration reduction, etc.
- Flight controls that reduce workload or simplify the pilotage task
- Innovative flight control and/or mission grip design
- Cognitive decision aiding and automation
- Reducing long-term injury to pilots due to vibration, head-borne weight of goggles, etc.
- Cueing and pilot input needed to transition from autonomous flight to manual control and back
- Improved situation awareness and information management techniques
- New and innovative visual displays, large area displays, touch interfaces, 3D displays
- Graphical user interface designs and information management
- Tactile cueing
- Voice recognition and auditory displays, advances in 3D audio
- Secure and night vision goggle compatible crew station lighting
- Uncrewed air system ground station human machine interface designs
- Workload, stress and fatigue assessment, and impact on crew performance
- Human machine interface design for maintainer
- MIL-STD-1472, MIL-L-85762, MIL-STD-3009 and RTCA DO 275 compliance assessment
- Methods for minimizing design-related errors by the flight crew / enable flight crew to detect and manage errors that do occur

**Session Chair:** Gary D. Klein, The Boeing Co., gary.d.klein@boeing.com

**Deputy Session Chair:** Kathryn Feltman, US Army Aeromedical Research Lab, kathryn.a.feltman.civ@mail.mil

## DYNAMICS

Papers are sought addressing all areas related to rotorcraft dynamics and aeroelasticity. Priority will be given to completed programs where significant conclusions are substantiated and the results contribute to advancing the state-of-the-art. Papers reporting on the following topics are of particular interest:

- Development of rotorcraft dynamic or aeroelastic analyses, experimental validation, and new experimental results
- Advances in dynamics technology and design methodologies
- Advances in active and passive vibration reduction techniques
- Dynamic aspects of technologies such as adaptive rotors, UAS/MAVs, eVTOL, and unconventional V/STOL aircraft, including multi-state/optimal trim and control approaches for advanced configurations
- Prediction of loads, vibration, and stability using coupled CSD/CFD analysis

Other topics include:

- Rotor response and stability
- Dynamics of coupled rotor/airframe system
- Loads prediction
- Analytical modeling techniques
- Experimental measurements
- Reduced order models

**Session Chair:** Dr. Klausdieter G. Pahlke, German Aerospace Center (DLR), klausdieter.pahlke@dlr.de

**Deputy Session Chair:** Dr. Li Liu, The Boeing Co., li.liu2@boeing.com

## ELECTRIC VERTICAL TAKEOFF AND LANDING (EVTOL)

Papers are sought addressing all areas related to the sciences, engineering, and technologies unique to Electric Vertical Takeoff and Landing (eVTOL) aircraft and Advanced Air Mobility (AAM) infrastructure of the future. Topics of interest:

- Advanced on-board electric power systems: batteries, hydrogen fuel cells, hybrid-electric engines, transmission and distribution, heat rejection
- Infrastructure: vertiports, airspace insertion, fast-charging, airspace navigation, hydrogen infrastructure and standards
- Large-scale manufacturing and global supply chain
- Economics: missions, demand modeling, and various costs
- Problems of safety: crash egress, high-voltage, fire, cyber- and physical-vulnerability
- Flight, wind-tunnel and model-testing of eVTOL aircraft and sub-systems
- Standards, regulatory needs, and certification for eVTOL/AAM
- Pilot interface and pilot/crew training including automation and autonomy
- Urban aviation environment, micro-climatology, high wind/gust operations
- Other topics unique to eVTOL aircraft and AAM

**Session Chair:** Dr. John Tritschler, US Naval Test Pilot School, john.tritschler@navy.mil

**Deputy Session Chair:** Dr. Monica Syal, AIBOT, syal.mona@gmail.com

## HANDLING QUALITIES

Papers are sought addressing all aspects of VTOL aircraft handling qualities from basic research through engineering design and development to implementation, verification, qualification, and certification in piloted simulation and flight tests. Handling Qualities comprise all of the aircraft characteristics that govern the ease and precision with which a pilot or uncrewed system is able to perform tasks required by various aircraft missions and under special operational or environmental conditions. This includes vehicle stability and control/response characteristics, flight guidance and control systems, and the pilot vehicle interface.

There is particular interest in investigating and expounding on the influence these systems have on piloting strategies and pilot workload as driven by task demands. Papers that address significant results from:

- Research, development and design of advanced systems and approaches/means to improve handling qualities with respect to operational needs and experience
- Impact of handling qualities on safety considerations, and work related to handling qualities of unconventional vertical flight configurations (e.g., eVTOL)
- Handling qualities of remotely piloted, uncrewed, and autonomous systems of all sizes as defined by mission performance measures, or other relevant metrics

**Session Chair:** Derek Geiger, Sikorsky, a Lockheed Martin Co., derek.h.geiger@lmco.com

**Deputy Session Chair:** Scott Smith, US Army, f.s.smith2.civ@army.mil

## HEALTH & USAGE MANAGEMENT SYSTEMS

Papers are sought addressing rotorcraft health and usage management systems (HUMS), and condition-based maintenance (CBM), as they support total lifecycle value (sustainment, operational availability, etc.) of crewed and uncrewed rotorcraft platforms. Topics of interest include:

- Advanced monitoring technologies to support aircraft health and condition assessment, including sensors, data acquisition and processing, diagnostic and prognostic algorithms, artificial intelligence, machine learning (deep learning), onboard system architecture with HUMS integration, wireless communication and energy harvesting
- Advanced life and usage assessment techniques, including modeling, analysis, and data fusion
- HUMS enabled paradigm shifts in aircraft design (HUMS as a cyber-physical system), maintenance practices, and operations

- planning (logistics)
- Aircraft (onboard) and ground (offboard) decision support system/tools implementation including verification, validation, and certification/qualification including HUMS related cyber security
- Success stories including improvements in operational availability, safety, costs, and maintenance benefits
- The application areas are propulsion, drive systems, structures, rotor systems, vehicle management system/flight control, electrical and electronic systems, as well as cross system integrated solutions.
- Modeling and Simulation that utilizes rotorcraft health and usage monitoring and management, and condition-based maintenance to facilitate realistic total lifecycle value (sustainment, operational availability, etc.) of crewed and uncrewed rotorcraft platforms

**Session Chair:** Dr. Fotis Kopsaftopoulos, Rensselaer Polytechnic Institute, kopsaf@rpi.edu

**Deputy Session Chair:** Dr. Andrew Bellocchio, US Military Academy, andrew.bellocchio@gmail.com

## HISTORY

The History Committee invites scholarly papers and first-hand accounts that facilitate the preservation and understanding of the world's vertical flight history. Of particular interest are papers documenting important but not well-known developments in vertical flight technologies or vehicles, rediscovery of forgotten pioneers, or events involved in understanding specific phenomena. Accounts of early efforts of developing the helicopter industry and/or interactions with the Vertical Flight Society are also encouraged, and personal involvement in the subject matter or extensive research and documentation are highly desirable. Exceptions can be made to the no-paper/no-podium policy for first-hand accounts.

*Proposed technical survey papers should contain a significant historical perspective and be discussed in the abstract. In general, technical survey papers should be submitted to the appropriate technical committee and not the History Committee.*

**Session Chair:** Erasmo Piñero, ATAC, bpinero@frontier.com

**Deputy Session Chair:** Jacques Virasak, R1202, jacques.virasak@yahoo.com

## MANUFACTURING TECHNOLOGY & PROCESSING

The US DoD's rotary-wing, Future Vertical Lift (FVL), consists of multiple mission sets covering requirements across the military services. In addition, the world of eVTOL concepts also continues to grow. High rates are anticipated in both areas, 2,000 to 10,000 units per year, which is far greater than historical aircraft procurement rates. New and novel manufacturing approaches are vital to achieving the most cost-effective implementation of technologies to meet industry's needs.

Papers are sought addressing topics that are to be employed in the FVL program and eVTOL aircraft concepts, such as:

- High-rate automated manufacturing
- Additive manufacturing
- Augmented reality assembly
- Nano- and micro-scale machining
- Adaptive and smart manufacturing equipment and systems
- Manufacturing modeling and simulation
- Resource efficient factory design
- Data management for increased production performance
- Human-centered manufacturing (designing workplaces of the future)
- Networked factories linking supply chains to local production
- Regulatory impacts and environmental issues
- Quality assurance approaches (including non-destructive evaluation/inspection techniques), and applications of innovative process measurements
- Advanced bonding, joining and assembly techniques
- Composite repair
- Accelerating readiness levels

**Session Chair:** Michael Nevinsky, The Boeing Company, michael.d.nevinsky@boeing.com



