

FORUM⁷⁶

THE FUTURE OF VERTICAL FLIGHT

76th Annual Forum & Technology Display

May 19-21, 2020  Montreal, Quebec, Canada

The Vertical Flight Society's (VFS) Annual Forum & Technology Display is the world's leading international technical event on vertical flight. The Forum is the premier opportunity to present and discuss advances in vertical flight technology, design and its applications.

VFS is pleased to announce that this year's **76th Annual Forum & Technology Display** will take place from May 19-21, 2020, at the Palais des congrés in Montreal. For over 75 years, the Forum has been the world's largest and most important vertical flight technical meeting. It is the only venue where academics, government leaders and researchers, military decision makers, and industry engineers and leaders come together to learn, share and work to advance vertical flight. We invite the world's vertical flight community to join us in Montreal and support the advancement of *The Future of Vertical Flight*.

Vertical flight technology is advancing rapidly, as autonomy, additive manufacturing, electric/hybrid-electric propulsion approaches and other technologies and innovations enable new capabilities for Vertical Take-Off and Landing (VTOL) aircraft. As the US military's Future Vertical Lift (FVL) program progresses and expands, next generation civil tiltrotors and compounds are taking shape under Europe's Clean Sky 2, new commercial rotorcraft near certification, and more electric-VTOL aircraft take to the skies. This coming year will be full of advances in VTOL technology, which will be showcased at the **76th Annual Forum**.

This Call for Papers invites abstracts to be submitted for consideration in any of the technical areas sponsored by the Society's 22 committees:

- Acoustics
- Advanced Vertical Flight
- Aerodynamics
- Aircraft Design
- Avionics & Systems
- Crash Safety
- Crew Stations & Human Factors
- Dynamics
- Electric VTOL (eVTOL)
- Handling Qualities
- History
- HUMS/CBM
- Manufacturing Technology & Processing
- Modeling and Simulation
- Operations
- Product Support Systems Technology
- Propulsion
- Safety
- Structures & Materials
- Systems Engineering Tools/Processes
- Test & Evaluation
- Unmanned VTOL Aircraft & Rotorcraft

The Forum Technical Chair for this event is **Dr. Anubhav Datta, University of Maryland, datta@umd.edu**. The Forum Deputy Technical Chair is **Dr. Hao Kang, U.S. Army Research Lab, hao.kang2.civ@mail.mil**

Abstracts are due by Monday, October 7, 2019 and must be submitted to the Mira website at www.vtol.org/mira. It is the author's responsibility to obtain clearances from their organizations in time to meet the abstract submission deadline date.

The Annual Forum is an international event and therefore it is VFS policy that all final written papers and Forum presentations must be completely unrestricted. Potential authors should make note of this policy BEFORE submitting an abstract.

Abstract acceptance will be based upon the following:

- **Work that represents new vertical flight technology advancements.**
- Abstracts should report significant information and will be judged on technical quality, relevance, importance and timeliness.
- Submitter's prior history in following through with previous commitments.
- Work in progress must be cited appropriately in the abstract, specifying how proposed content differs from prior publication. **Failure to cite prior publications will result in the abstract being ineligible for review.**

Below is a summary of submission information and guidelines:

- Submittal of an abstract is a professional commitment. If an abstract is accepted, the author commits to prepare a final paper, attend the Forum and make a presentation on that final paper.
- One author may present no more than two papers at the Forum.
- The abstract should present the status of the background data to be used, summarize figures and illustrations, and include a summary of important conclusions.
- **Abstracts should be in PDF format, not exceed 5-pages in length and 5MB in file size.** Abstracts exceeding 5-page limit will not be evaluated.
- Formatting guidelines should be followed and templates (Word OR LaTeX) are available on the Mira and Forum 76 sites.

No Paper — No Podium Rule: this policy applies to all papers and all technical sessions. Authors who do not submit their paper by the time the technical schedule is finalized will NOT be scheduled to speak.

Important Dates:

Monday, October 7, 2019 - abstracts must be submitted to the Mira website.

Mid-November 2019 - VFS expects to notify authors of paper selection.

Monday, April 6, 2020 - final written papers are due.

www.vtol.org/mira

Late Paper Submissions: final papers received after the final submission deadline date are not eligible for a Best Paper Award and may not be included in the Proceedings.

Alfred Gessow Forum Best Paper Award: each of the authors of the best paper presented at the Annual Forum for each technical discipline – as determined by the relevant Technical Committee – will receive a Best Technical Paper Award certificate.

- The overall best paper will receive the Alfred Gessow Forum Best Paper award plaque.
- The main winning author will be invited to present his or her paper at the European Rotorcraft Forum (ERF), to be held in September 2020.
- ERF organizers provide complimentary registration and accommodations and VFS covers the winner's travel expenses to ERF.

Registration: scheduled speakers MUST register and pay for the Forum and are eligible for reduced speaker registration fees, whether members or non-members of VFS.

ANNUAL FORUM TECHNICAL SESSIONS

ACOUSTICS

Papers addressing recent advancements in the study of external and internal noise generation, propagation, control (active and passive) and community acceptance for both rotorcraft and other Vertical Take Off and Landing (VTOL) – including Unmanned Aerial Vehicles (UAV) and Urban Air Mobility (UAM) vehicles – are invited. Appropriate *external* noise topics include:

- Vehicle component and full system noise prediction methodology development and validation
- Wind tunnel and full-scale flight test acoustics measurements
- New procedures for acoustic data acquisition or analysis
- Active and passive noise reduction techniques
- Noise abatement flight operations; acoustic propagation models
- Impact of vehicle noise on the community

Appropriate *interior* 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
- Noise reduction concepts, such as concepts for reduction of engine, transmission, and electric motor noise

Additional topics of interest include, but are not limited to:

- Research contributing to a basic understanding of fundamental aerodynamic noise sources
- Interaction between various noise sources for rotorcraft, VTOL UAVs and VTOL UAM vehicles
- Development or implementation of national or international civil noise regulations
- Acoustic aspects of issues that could transform, revolutionize, or facilitate usage of UAM concepts for the future of vertical lift flight

Session Chair: Juliet Page, U.S. Department of Transportation, Volpe Center, +1-617-494-3093, juliet.page@dot.gov

Deputy Session Chair: Dr. Natasha Schatzman, NASA Ames Research Center, +1-650-604-5903, natasha.schatzman@nasa.gov

ADVANCED VERTICAL FLIGHT

Papers are sought that focus on novel, innovative configurations and transformational technologies for vertical flight vehicles. Research on and applications of advanced technologies to enable transformational capabilities beyond that of current state-of-the-art VTOL aircraft are highly desired. Areas of interest include:

- Novel air vehicle configurations
- Autonomy and teaming
- Distributed electric propulsion
- Multi-rotor systems

Advanced propulsion systems, aerodynamic enhancements, and

structural efficiency improvements that enable novel configurations are also of interest. Papers on technology advances in unconventional vehicles are encouraged, such as:

- Ornithopters
- Thrust/lift compounded aircraft
- Slowed/stopped rotor aircraft
- Lift-fan systems
- Ducted fan aircraft
- Hybrid propulsion aircraft and/or all-electric aircraft

Session Chair: Dr. Jayant Sirohi, University of Texas at Austin, +1-512-471-4186, jayant.sirohi@mail.utexas.edu

Deputy Session Chair: Dr. Vikram Hrishikeshavan, University of Maryland, +1-240-383-8379, vikram@umd.edu

AERODYNAMICS

Papers are invited that address 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, but are not limited to

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

Session Chair: Arnaud Le Pape, ONERA, +33-1-8038-6770 arnaud.lepape@onera.fr

Deputy Session Chair: Anthony Gardner, German Aerospace Center (DLR), +49-551-709-2267, tony.gardner@dlr.de

AIRCRAFT DESIGN

Papers are invited on the design of manned and unmanned air platforms, systems and components. Papers discussing the interaction of technology, configuration, and requirements in the design of next generation civil and military rotorcraft are also sought. 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
- Lessons learned from actual design realization
- Development and application of tools and process needed for design

Session Chair: Michael Strauss, Sikorsky Aircraft, a Lockheed Martin Co., +1-203-386-4395, michael.strauss@lmco.com

Deputy Session Chair: Silvestro Barbarino, Joby Aviation, +1-650-491-4515, silvestro.barbarino@joby.aero

AVIONICS & MISSION SYSTEMS

The committee invites papers that address mission, flight, or avionics systems for manned, unmanned, or optionally manned vertical flight aircraft. Potential topics can include but are not limited to the following:

- 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), or electronic warfare systems
- Open systems architecture initiatives, technologies, and applications within rotorcraft or adjacent airborne aircraft (e.g., fighter) systems, including, but not limited to FACE, OMS, HOST, SOSA and IMA architectures
- Complex software-intensive, partitioned, or multi-core avionics, mission, or flight

CREW STATIONS & HUMAN FACTORS

Papers are invited for all aspects of air vehicle crew stations and/or human factors engineering. Areas of interest include but are not limited to the following:

- New designs facilitating hands on/eyes out operations
- Improved seat comfort and safety, facilitating longer missions
- Flight controls that reduce workload or simplify the pilotage task
- Innovative flight control and/or mission grip design
- Cognitive decision aiding and automation
- Improved situation awareness and information management techniques
- New and innovative visual displays, large area displays, touch interfaces, 3 D displays
- Graphical user interface designs and information management
- Tactile cueing and tactile displays
- Voice recognition and auditory displays, advances in 3 D audio
- Secure and night vision goggle compatible crew station lighting
- Unmanned 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
- Cost control approaches including design processes, test methodologies, and integration of off the shelf technologies
- Methods for minimizing design-related errors by the flight crew / enable flight crew to detect and manage errors that do occur

Session Chair: Andrew P. Smith, Boeing Company, +1-480-239-4984, rootchord@gmail.com

Deputy Session Chair: Dr. Karen Feigh, Georgia Institute of Technology, +1-404-385-7686, karen.feigh@gatech.edu

DYNAMICS

Papers are invited for 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 are of particular interest:

- Development of rotorcraft dynamic or aeroelastic analyses, experimental validation and new experimental results
- Advances in dynamics technology and design methodologies
- Dynamic aspects of technologies such as active controls, adaptive rotors, UAV/MAVs, eVTOL, and unconventional V/STOL aircraft, including multi-state/optimal trim and control approaches for advanced configurations

Other topics include but are not limited to:

- Rotor response and stability
- Dynamics of coupled rotor/airframe systems
- Load prediction
- Vibration reduction
- Analytic modeling techniques
- Experimental measurements as well as computational fluid structure interaction and reduced order models

Session Chair: Dr. Ed Smith, Pennsylvania State University, +1-814-863-0966, ecs5@psu.edu

Deputy Session Chair: Dr. Sesi Kottapalli, NASA Ames Research Center, +1-650-604-3092, sesi.b.kottapalli@nasa.gov

ELECTRIC VERTICAL TAKEOFF AND LANDING (EVTOL)

Papers are invited on the sciences, engineering, and technologies unique to Electric-Vertical Take Off and Landing Aircraft (eVTOL) and Urban Air Mobility (UAM). Particular topics of interest include, but are not limited to:

- Innovative on-board electric power, and energy infrastructure for eVTOL aircraft
- Infrastructure for Urban Air Mobility: vertiports, fast-charging, and airspace insertion
- Economics of Urban Air Mobility: missions, demand modeling, and cost structure
- Problems of safety: crash

systems including cognitive decision aiding, machine learning, automation, and degraded visual environments (DVE) or "all weather operation" including synthetic vision, image or data fusion, use of advanced sights and sensors

- Systems, techniques, and concepts defining assured position, navigation, and timing (A-PNT) information. Threat assessment and mitigation approaches for operations in GPS denied environments
- Cyber security, anti-tamper, information assurance,

airworthiness certification, or other aspects of qualification or certification.

- 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, or software systems that enhance the capabilities of vertical lift aircraft

Session Chair: Joe Franiak, Northrop Grumman Company, +1-818-519-1701, joe.franiak@ngc.com

Deputy Session Chair: Harold Tiedemann, Collins Aerospace, +1-319-295-0424, harold.tiedeman@collins.com

CRASH SAFETY

Papers are invited on ALL aspects of crashworthiness and aviation occupant safety relating to rotorcraft, UAVs, and other V/STOL aircraft in applications such as military, civil, offshore transport, Urban Air Mobility, 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 new crash-resistant design criteria
- Development and application of improved and more 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 crashworthiness topics of interest include but are not limited to the following:

- Advances in energy absorbing systems such as landing gear (mountainous)
- Composite airframe structures, seats, cargo and mass item retention systems, and internal/external inflatable devices crew, troop, and passenger restraint systems
- Water ditching and post-impact flotation stability
- Crashworthy fuel systems to include range extension tanks
- Testing and validation; and methods of mishap data retrieval, collection and analysis use of mishap data to define crash safety technology deficiencies and support system safety analyses
- Analytical simulation of aircraft crash impacts on rigid, massively sloped
- Soil and water impact surfaces
- Bird strikes against the canopy and rotor systems
- Impact of crash-resistant fuel systems
- Occupant modeling, and simulation of aircraft crash protective systems such as landing gear, energy-absorbing seats, and inflatable devices
- Validation of analytical methods that will improve the reliability, accuracy, and scope of computer simulations for crash safety
- Numerical techniques for crashworthiness optimization to reduce aircraft weight while improving crash safety performance

Session Chair: Dr. Akif Bolukbasi, Boeing Company, +1-480-891-5111, akif.o.bolukbasi@boeing.com

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- egress, high-voltage, fire, cyber- and physical-vulnerability
- Topics that study the unique aeromechanics and flying qualities of eVTOL aircraft
- Flight- and model- testing of eVTOL aircraft and sub-systems
- Standards, regulatory needs, and certification for eVTOL/ UAM

Session Chair: Michael Ricci, LaunchPoint Technologies, +1-805-683-9659, mricci@launchpnt.com
Deputy Session Chair: LTCOL Rory Feely, U.S. Naval Test Pilot School, +1-301-757-5051, rory.feely@navy.mil

HANDLING QUALITIES

Papers are invited that address all aspects of vertical flight aircraft handling qualities from basic research through engineering design and development to 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 is able to perform tasks required by various aircraft missions. This includes:

- Vehicle stability and control/response characteristics
- Guidance and control systems
- Pilot-vehicle interface

There is also particular interest to investigate and expound on the import and influence these systems have on piloting strategies and pilot workload as driven by task demands. Papers are encouraged 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
- The impact of handling qualities on safety considerations, and work related to handling qualities of unconventional vertical flight configurations
- Handling qualities of remotely-piloted, unmanned, and autonomous systems as defined by mission performance measures, or other relevant metrics

Session Chair: Matthew Rhinehart, U.S. Naval Air Systems Command (NAVAIR), +1-301-757-5613, matthew.rhinehart@navy.mil
Deputy Session Chair: Dr. Christina Ivler, University of Portland, +1-503-943-7140, ivler@up.edu

HEALTH & USAGE MONITORING

Papers are invited on the following topics within the area of rotorcraft health and usage monitoring and management, and condition based maintenance, as they support total lifecycle value (sustainment, operational availability, etc.) of manned and unmanned rotorcraft platforms:

- 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 manned and unmanned rotorcraft platforms.

Session Chair: Christopher Lyman, U.S. Army Aviation Applied Directorate, +1-757-878-5518, christopher.d.lyman2.civ@mail.mil
Deputy Session Chair: Jason Hines, U.S. Navy, +1-301-757-2504, jason.hines1@navy.mil

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 from the no-paper/no-podium policy for first-hand accounts.

Session Chair: Erasmo Pinero, Bell, +1-817-280-5588, bpinero@frontier.com
Deputy Session Chair: Dr. Bruce H. Charnov, Hofstra University, +1-858-598-6284, bruce.h.chnarnov@hofstra.edu

MANUFACTURING TECHNOLOGY

Within the next decade, the US government will be investing in the largest rotary-wing acquisition program ever, Future Vertical Lift, which consists of five capability set missions covering all the Department of Defense fleet requirements. At the same time, the world of Electric Vertical Takeoff and Landing (eVTOL) concepts also continues to grow. High rates are anticipated in both areas (2,000 to 8,000 units per year), which is far greater than historical aircraft procurement rates but not quite as high as automotive rates. New and novel manufacturing approaches are vital to achieving the most cost-effective implementation of technologies to meet industry's needs. Papers are invited on topics that are likely to be employed in the manufacture of FVL aircraft and eVTOL 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 work places 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: Doug Wolfe, Bell, +1-817-280-4615, dwolfe@bellflight.com
Deputy Session Chair: David Misciagna, The Boeing Company, +1-610-591-9922, david.t.misciangna@boeing.com

MODELING & SIMULATION

The Modeling and Simulation technical committee seeks papers on the application of modeling and simulation to the Future of Vertical Lift, VTOL aircrew flight training & rehearsal, flight operations, design, and safety and certification requirements. Papers on the following topics are invited:

- Improving VTOL safety and operations quality assurance through flight simulation
- Rigorous quantification of benefits and Return on Investment of flight modeling and simulation for design, flight-testing, training, and other activities compared to traditional practices
- Application of M&S to improve design, flight test, and

- certification; and to support virtual engineering lifecycle concepts for VTOL aircraft, especially rotorcraft
- Specialized topics in physics-based modeling, system identification, model-based control architectures, and simulation/simulator verification and validation with respect to ADS-33E-PRF, 14 CFR Part 60, CS-FSTD(H) or similar standards
 - Flight modeling and simulation of sling loads, urban mobility, alpine operations, shipboard launch and recovery, Degraded Visual Environments, and other unique operational challenges
 - Application of flight modeling

- and simulation to eVTOL aircraft; advanced lifting mechanism for rotor, wing, or body; and other future vertical lift aircraft configurations
- Rotorcraft simulator fidelity ratings, fidelity metrics, pilot cueing requirements for specific air vehicle configurations or mission tasks, transfer of training, and application of simulation to study pilot-rotorcraft interactions
 - Advanced or novel simulation technologies, including in-flight simulation, parallel computing for real time simulation, and distributed simulation

Session Chair: Todd Smith, Sikorsky Aircraft, a Lockheed Martin Co., +1-561-297-3417, todd.t.smith@lmco.com
Deputy Session Chair: Dr. Robert Niemiec, Rennselaer Polytechnic Institute, +1-413-537-9962, niemir2@rpi.edu

OPERATIONS

Papers are invited that address commercial and military rotorcraft operations (manned or unmanned) on the following topics:

- Concepts of Operations (CONOPS)
- Lessons learned from deployed operations
- Extreme weather, offshore, public safety, emergency medical service, and search and rescue operations
- Vertical lift survivability, vulnerability and operational effectiveness analyses
- Tools, technologies, and methodologies
- Trade study analysis approaches
- Electronic decision-aids/aiding; command, control, and communications
- Intelligence and electronic data gathering applications
- Manned-unmanned teaming operations
- Urban mobility operations

Session Chair: Jordan Kaye, Sikorsky Aircraft, a Lockheed Martin Co., +1-203-386-3917, jordan.kaye@lmco.com

PRODUCT SUPPORT SYSTEMS

The Product Support Systems committee is calling for technical papers that highlight the development or application of technology, processes and innovations that support vertical lift operators and maintainers. Note that many of the technologies that have been presented in previous Forum sessions and have now been successfully fielded are excellent candidates to present in the Product Support sessions going forward. All fielded technology, processes and innovations end up supporting the operator or maintainer. Key product support subjects include:

- Designing for Reliability and Maintainability
- "Ultra High Reliability"
- Platform Maintenance Applications (PMA)
- Maintenance Applications
- UID / IUID Integration, Predictive Maintenance Systems, Development of New Repair Technologies
- 3-D and Augmented Reality Technical Publications, Performance Based Logistics (PBL)
- Condition Based Maintenance (CBM)
- HUMS-Derived Maintenance Management
- Fleet Data Management & Data Analytics
- Increasing the Life of Legacy Systems
- Fleet Information Management (FIM)
- Flight Operations Quality Assurance (FOQA)
- Centralized Automated Flight Records Systems
- Site Activation
- Pre-Operational Support Planning
- Service Center Support, Training & Training Facilities, Lessons Learned from Deployed Operations
- Rapid Prototyping for Legacy

- Out-of-Production Spares
- Austere-Fielded Support Programs

Session Chair: Dan Amodeo, Sikorsky, a Lockheed Martin Co., +1-203-364-7389, amodeo.daniel@gmail.com
Deputy Session Chair: Kevin Rees, U.S. Army Aviation & Missile Research Development & Engineering, +1-361-961-3850, kevin.s.rees.civ@mail.mil

PROPULSION

The Propulsion committee invites papers that present new and innovative information on propulsion for rotorcraft and other vertical flight aircraft, including unique propulsion challenges of UAVs, FVL and V/STOL aircraft configurations with variable/multi-speed propulsion concepts. Please limit abstracts to 2-pages - recommended topics for these configurations include:

- Rotorcraft engines
- Rotorcraft drive systems
- Platform energy requirements
- Propulsion system integration
- Related airframe/engine technologies

Centered around these topics and of specific interest are papers addressing recent approaches or technologies that:

- Enhance safety and improve performance
- Provide methods and design analyses that improve engine and drive system reliability
- Enable a reduction in customer component-repair/replacement burden
- Reduce propulsion contribution to fuel/energy cost and environmental footprint
- Provide a reduction in operations and sustainment costs
- Present weight/noise reduction technologies

Other recommended topics include:

- System integration considerations environmental impacts and requirements
- Integrated/advanced electronic control systems (to include sensors)
- Advanced materials, gear and bearing technology
- Shafting advancements
- Alternative fuels and lubricants
- Demonstrate the use of simulation to enhance propulsion systems and subsystems
- Detail design tools that support the above technologies
- Provide creative validation/testing methods aimed at reductions in development/qualification costs
- Alternatives to conventional rotorcraft propulsion/drive systems, including hybrid/electric drives, batteries, fuel cells and electric motors and their integration

Session Chair: Bruce Jensen, Sikorsky Aircraft, a Lockheed Martin Co., +1-203-381-6486, bruce.w.jensen@lmco.com
Deputy Session Chair: Linnea Taketa, Rolls-Royce Corporation, +1-317-372-6715, linnea.taketa@rolls-royce.com

SAFETY

Papers are invited addressing technologies and processes for the prevention of vertical lift accidents in both new design and legacy fleet aircraft. Topics of particular interest are:

- Application of technology in order to negate the safety critical hazards to commercial, private and military aircraft
- Current or emerging technologies to address specific accident cause factors
- System safety engineering processes that identify and mitigate hazards
- Safety risk management which proactively improves aircraft safety
- Safety risk assessment processes which mitigate accident recurrence
- Operational procedures for accident avoidance such as enhanced pilot training
- Fleet-wide safety lessons learned from the application of advanced flight/crew monitoring technologies
- Current and new accident investigation techniques specifically those techniques which aid in accident investigations when actions in the cockpit are not known
- Safety analyses of transformative VTOL design concepts such as autonomous copiloting/piloting and electric/hybrid distributed propulsion systems

Other topics of interest include off aircraft solutions in other areas such as:

- Certification
- Airspace structure
- Management tools
- Risk assessment tools and techniques
- Simulation and training to include actual accident scenario-based training, and others when particularly related to rotorcraft safety

Session Chair: David Blair, Sikorsky Aircraft, a Lockheed Martin Co. +1-203-386-3984, david.i.blair@lmco.com

Deputy Session Chair: Amanda Taylor, Federal Aviation Administration, +1-405-954-0248, amanda.m.taylor@faa.gov

STRUCTURES & MATERIALS

The Structures and Materials committee invites papers, which address the development, design, analysis, testing, service experiences, or novel application of structures and materials to manned and unmanned rotorcraft, powered lift and fixed-wing V/STOL aircraft. Topics of interest include, but are not limited to the following:

- Durability and damage tolerance
- Fatigue and fracture mechanics
- Impact mechanics
- Advanced metallic and composite materials and structures
- Probabilistic mechanics and structural reliability methods
- Repair concepts and methodology
- Structural integrity assurance
- via health monitoring and non-destructive evaluation and prognosis of remaining useful service life
- Stress and finite element modeling and analysis
- Structural design criteria, loads development, and optimization
- Verification and validation of structural methodologies
- Certification of rotorcraft structural parts

In general, related topics on affordability, weight reduction, material and structural qualification, and stress prediction accuracy improvements are desirable. Papers on practical applications of high strain, high durability, or adaptive materials to advanced structural concepts for improved performance or affordability are also solicited.

Session Chair: Michael Kiser, U.S. Army Aviation Engineering Directorate, +1-256-313-8423, michael.r.kiser9.civ@mail.mil

Deputy Session Chair: Erik Byrne, Sikorsky, a Lockheed Martin Co., +1-207-692-6912, erik.m.byrne@lmco.com

SYSTEMS ENGINEERING

The Systems Engineering Tools/Processes technical committee invites papers that will promote the advancement of system design, development, integration and management across specialty areas associated with the engineering of helicopter systems. Papers in this session may include topics that span several other helicopter technical subject areas and address problems unique to trade-offs and optimization across those areas. Topics of interest include but are not limited to the following:

- Certification of artificial intelligence
- Cybersecurity – system level security
- Model based system engineering
- Program/project management for system-of-systems
- Risk management
- System architecture measurements and refinements
- Systems engineering education and training
- Systems engineering quality management
- Systems engineering tools, processes and best practice
- System modeling and simulation
- System qualification and certification
- Systems reliability
- “System thinking” benefit
- System verification and validation

Session Chair: Serge Germanetti, AIRBUS, +1-33-442-857-019, serge.germanetti@airbus.com

Deputy Session Chair: James Garman, Sikorsky Aircraft, a Lockheed Martin Co., +1-203-386-5510, jim.garman@lmco.com

TEST & EVALUATION

Abstracts require a minimum of 3 to a maximum of 5-pages and must be less than 5MB. Papers are invited addressing all aspects of legacy and future VTOL aircraft test and evaluation. This includes the evaluation of advanced technologies (components and subsystems) and vehicles (manned and unmanned), both full- and model-scale, in laboratory, ground, and flight-test scenarios. Insightful papers illustrating the applied methodology for testing of advanced technologies and vehicles are highly desirable.

The status, including milestones, of any pending research/work required for the completion of the paper should be included. The abstracts will be evaluated based on the appropriateness of the work to the vertical flight industry, originality, technical quality, availability of (preliminary) results and completion status. The Committee strongly encourages papers covering:

- Research agency, industrial, academic and military activities performed in representative operational and environmental conditions
- Aspects of the complex flight envelopes of conventional and unconventional vertical lift
- vehicles (low-speed, transition, maneuvering, conversion, and high-speed)
- Testing techniques involving vehicle safety in aspects of technological design, scientific evaluation, event investigation, and airworthiness compliance

Session Chair: Berend van der Wall, German Aerospace Center (DLR), +1-49-531-295-2849, berend.vanderwall@dlr.de

Deputy Session Chair: Phil J. Alldridge, Sikorsky, a Lockheed Martin Co., +1-561-775-5179, phil.j.alldridge@lmco.com

UNMANNED VTOL AIRCRAFT & ROTORCRAFT

Papers are invited on the concepts, design, development, operation, and robotics aspect of VTOL and rotary-wing UAVs in the following general areas:

- Autonomy, collaboration and architectures
- Reliability and robustness
- Payloads and sensors, including applications such as Intelligence, Surveillance and Reconnaissance (ISR), weaponization, cargo, etc.
- Agility and performance
- Survivability
- Operability

Other topics of interest include, but are not limited to the following:

- Guidance, navigation and control
- Alternate navigation methods
- Design concepts, including small unmanned aircraft systems (sUAS) and micro air vehicles (MAVs)
- Mechatronics integration
- Reasoning, decision-making, autonomy and multivehicle collaboration architectures
- Embedded perception and data/information 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. Sandipan Mishra, Rennselaer Polytechnic Institute, +1-518-276-2020, mishrs2@rpi.edu

Deputy Session Chair: Dr. Jack Langelaan, Pennsylvania State University, +1-814-863-6817, jlangelaan@psu.edu

Important Dates:

Monday, October 7, 2019 - abstracts must be submitted to the Mira website.

Mid-November 2019 - VFS expects to notify authors of paper selection.

Monday, April 6, 2020 - final written papers are due.

www.vtol.org/mira



Vertical Flight Society