

# **AIAA Atmospheric Flight Mechanics**

## **Call for Papers**

AIAA Science and Technology Forum and Exhibition (SciTech)

6-10 January 2020

Hyatt Regency Orlando, Orlando, FL

[scitech.aiaa.org](http://scitech.aiaa.org)

Atmospheric Flight Mechanics provides an opportunity for presentation and discussion of all technical areas related to atmospheric flight. The topic brings together experts from industry, government, and academia on an international level. Presentations will cover the topics of aircraft dynamics, unsteady and high-angle-of-attack aerodynamics, flying and handling qualities, system identification, aerospace vehicle flight testing, projectile and missile dynamics, UAVs, expendable and reusable launch vehicles, and reentry and aero assist vehicles. Technical sessions consist of formal presentations followed by informal discussions and are intended to serve as a platform to bring together experts and interested people to discuss technical aspects and cultivate professional relationships.

Paper selection will be based on full-length draft manuscripts of proposed technical papers. Papers primarily authored by students are eligible for the Atmospheric Flight Mechanics Student Paper Competition.

Please direct questions to the Atmospheric Flight Mechanics Technical Discipline Chairs:

### **Technical Discipline Chair**

Zachary R. Putnam

University of Illinois at Urbana-Champaign

[zputnam@illinois.edu](mailto:zputnam@illinois.edu)

### **Technical Discipline Co-Chair**

Kamal M. Shweyk

Boeing Global Services

[kamal.m.shweyk@boeing.com](mailto:kamal.m.shweyk@boeing.com)

### **Technical Discipline Co-Chair**

Sarah N. D'Souza

NASA Ames Research Center

[sndsouza@ucdavis.edu](mailto:sndsouza@ucdavis.edu)

## **Draft Manuscript Submission Guidelines**

Paper selection will be based on full-length draft manuscripts of proposed technical papers. Draft manuscripts of proposed papers must be unclassified; authors are responsible for securing approval to publicly release the content in draft. Draft manuscripts must begin with a 100- to 200-word abstract followed by an introduction that provides a brief assessment of prior work by others and an explanation of the paper's main contributions. The body of the draft manuscript must include sufficient detail on the methodology and results to allow an informed evaluation of the paper. Draft manuscripts should use the AIAA conference paper template and should not exceed 25 pages including all figures and references. Submissions not meeting the above criteria will not be accepted. Draft manuscripts must be submitted to AIAA via ScholarOne by 8pm Eastern Time June 11, 2019. Final papers are due on December 2, 2019.

## Technical Areas

The Atmospheric Flight Mechanics Committee solicits papers related to atmospheric flight mechanics across all disciplines (including flight performance, flight and ground test, flying and handling qualities, system identification, modeling and simulation); across all flight regimes and missions (including formation flying, gliding and powered flight, planetary aeroassist); and across all vehicle types and configurations (including conventional aircraft, rotorcraft, vertical and short take-off aircraft, unmanned aerial vehicles, electric aircraft, biomimetic vehicles, hypersonic and aeroassist vehicles, launch vehicles, missiles, projectiles, aerodynamic decelerators). Papers are encouraged that discuss education in atmospheric flight mechanics, multidisciplinary efforts, and projects with international collaboration. The areas of interest above will be organized into the following topics.

- **UAVs and Unmanned Systems**—All aspects of unmanned aerial vehicles, particularly innovative control effectors, operator interface flying qualities throughout the flight envelope, trajectory and flight path optimization, flight test results, and related subjects.
- **Aircraft Dynamics**—Interaction between aerodynamics and aircraft motion across the flight spectrum (subsonic, transonic, supersonic, and hypersonic). Subtopics include effects of configuration changes on aircraft stability, control, and air data systems; store separation; determination of stability and control derivatives and analysis; departure prevention and spin characteristics; effects of aeroservoelasticity on flight dynamics, atmospheric disturbance response and control of such disturbances; trajectory optimization; and flow-field effects. All airframe types and configurations, from general aviation to trans-atmospheric are appropriate topics for consideration.
- **Aircraft Flying Qualities**—Flying and handling qualities of aircraft. Topics of interest include aircraft-pilot coupling phenomena, controllers with associated aerodynamic and feel characteristics, displays with associated lag characteristics/placement/adequacy, and pilot-vehicle interface in general. Because pilot opinion is the final determination of flying qualities, papers are sought on the design of specific simulation and flight test maneuvers for flying-qualities evaluation. Other topics include development and validation of criteria; design tools and procedures to satisfy criteria; techniques to analyze and verify compliance on highly augmented and highly maneuverable aircraft; flying qualities of UAVs, UCAVs, and micro-UAVs; and flying qualities of STOVL aircraft transitioning between powered flight and wing-borne flight and flying qualities guidelines for STOVL mode flight.
- **Aircraft Store Compatibility**—Flight performance and impact of external stores on aircraft. Subtopics include handling qualities of aircraft with stores, store separation dynamics, aircraft-store flutter prediction and testing, and store-aircraft compatibility.
- **Projectile and Missile Dynamics and Aerodynamics**—Dynamics and aerodynamics of missiles and projectiles, both powered and unpowered. Subtopics include bodies with circular and noncircular cross sections; roll-stabilized and spin-stabilized missiles and projectiles; the application of computational methodologies to the prediction of aerodynamic characteristics, especially roll-coupling and high-angle-of-attack effects; launch dynamics of both surface- and air-launched missiles; measurement, numerical computation, and estimation of dynamic stability and control derivatives; incorporation of analysis, experimental results, and computational predictions into six-degree-of-freedom trajectory simulations; and analysis of flight test data.
- **System Identification and Parameter Estimation**—Papers are desired on techniques for extracting aerodynamic data from flight-test, dynamic wind tunnel, or free flight model experiments. Topics of interest include modeling of nonlinear or time-dependent

aerodynamic effects; techniques of model structure determination; the effects of active controls; incorporation of results into simulation and analysis databases; vehicle flexibility; techniques for the high- angle-of-attack flight regime; flight path reconstruction techniques; estimation of air data and flow-field parameters; identifiability issues; experiment design; and results obtained for conventional as well as new or unusual vehicle configurations.

- **Planetary Aeroassist Vehicle Flight Mechanics**—Dynamics of entry, aerocapture, and aerobraking at Earth or in other planetary atmospheres. Subtopics include computational aerothermodynamics, aeroassisted orbit transfer, tethered satellite applications, technology concerning development of high lift-to-drag ratio vehicles, hypervelocity and impact technology, trajectory optimization, maneuvering of reentry vehicles, ablation and erosion effects, and low-density atmospheric flight mechanics.
- **Launch Vehicles and Launch Abort Vehicles/Systems**—Flight dynamics throughout the flight envelope, modeling for flight prediction, trajectory optimization, management of flexible and rigid body modes, requirements for human spaceflight, innovative design concepts, and reusability.
- **Unsteady and High Angle-of-Attack Aerodynamics**—Aerodynamic characteristics of aircraft and missiles operating in a nontraditional part of the flight envelope (e.g., high angles-of-attack or sideslip, large angular rates). Of particular interest are unsteady and nonlinear aerodynamic characteristics, concepts for improved aerodynamic control effectiveness, dynamic lift and super-maneuverability, symmetric and asymmetric vortex wake structures, vortex breakdown, computational fluid dynamics techniques applicable to vortical and separated flows, and math modeling approaches to represent the dynamic characteristics in simulation studies.
- **Linear and Nonlinear Equations of Motion**—Classes of ordinary differential equations; nominal and perturbation solutions; axis systems, Euler angles, rotations, and transformations; integration of nonlinear differential equations; stability and control derivatives; unsteady aerodynamic effects; separation of equations into longitudinal and lateral-directional sets; and numerically implemented qualitative methods, their applications, and the results of these applications.
- **Atmospheric Flight Mechanics Education**—Papers are sought from industry, government agencies, and universities that deal with all aspects of atmospheric flight mechanics education at both undergraduate and graduate levels in aerospace engineering curricula. Topics include the needs of industry and government agencies; support needed to advance the state of the art; techniques for keeping up with the fast pace of research, especially at the undergraduate level; innovative and realistic approaches to education.
- **Vehicle Flight Test**—All aspects of testing atmospheric and exospheric flight vehicles, particularly as they pertain to the vehicle flight mechanics, are of interest. Topics of interest include flight evaluation of novel control systems or vehicle configurations; development and implementation of new maneuvers, methods, or tools for testing that provide new insight into flight mechanics; presentation of data analysis and testing results for important or unique vehicles; and modeling and simulation techniques used in support of flight test.
- **Bio-Inspired Flight Mechanics**—Flight mechanics of bio-inspired flight technologies and concepts, such as micro and nano air vehicles. Such vehicles present unique technological challenges on multiple levels including aerodynamics, performance, endurance, sensors, and flight guidance, navigation, and control. Topics of interest include flight mechanics of birds, insects, and bio- inspired air vehicles as well as modeling of coupled unsteady aerodynamics and flight dynamics for maneuvers such as flapping, hovering, and perching.

## Invited Sessions and Workshops

Invited sessions and workshops are solicited in any of the areas listed above as well as in related and new or emerging technical areas. Invited sessions or workshops should have a cohesive focus on a particular topic. The invited session or workshop organizer is responsible for contacting and confirming all speakers in advance. **Proposals for invited sessions and workshops must be submitted via email to the Atmospheric Flight Mechanics technical discipline chairs by May 10, 2019.** Proposals should include a title for the invited session or workshop and a list of anticipated authors/speakers. Invited session and workshop organizers are encouraged to contact the Atmospheric Flight Mechanics technical discipline chairs well in advance of this deadline.

After an invited session has been approved by the technical discipline chairs, authors of invited papers must submit 200- to 300-word abstracts via ScholarOne by the AIAA abstract submission deadline (June 11, 2019).

Workshops may be conducted on a more informal basis to promote discussion during the session. Workshop presentations may be given without written manuscripts if deemed appropriate by the organizer in consultation with the technical discipline chairs. For presentation-only workshops, no abstracts are required.

Incorporation of the proposed invited session or workshop at the AIAA SciTech 2020 will be at the discretion of the Technical Discipline Chairs. Furthermore, in consultation with the prospective invited session or workshop organizer, individual papers may be removed from the proposed invited session and/or moved to regular sessions. Normal contributed papers may also be moved to an invited session or workshop as necessary.

## Student Paper Competition

The AIAA Atmospheric Flight Mechanics Technical Committee, with the support of [Calspan Corporation](#), is sponsoring the Student Paper Competition at the 2020 AIAA SciTech Forum. Entrants written papers and oral presentations will be judged by members of the Atmospheric Flight Mechanics Technical Committee. The winner of the competition will receive a certificate and \$500 award.

To be eligible for the competition, the entrant must be the primary author of the submitted paper and the work must have been performed while the author was a student. As such, recent graduates are eligible to enter the competition, provided the work was completed while the entrant was a student. Entrants will present their papers in relevant Atmospheric Flight Mechanics technical sessions with judges in attendance.

To enter the competition, the “Student Paper Competition” option must be selected instead of “Technical Manuscript” when submitting a manuscript via ScholarOne. **Entrants must submit a final version of their paper in ScholarOne by November 15, 2020.** While paper revisions may be uploaded to ScholarOne after November 15, the November 15 version of the paper will be used for the student paper competition.

The scoring for the award will be equally based on the written paper and oral presentation. The written paper will be judged on:

- 1) relevance of the topic to atmospheric flight mechanics;
- 2) organization and clarity;
- 3) appreciation of relevant technical issues and sources of error; and
- 4) meaningful conclusions of the research.

The oral presentation will be judged on overall clarity, including:

- 1) background and problem definition statement;

AIAA SciTech 2020 Atmospheric Flight Mechanics Call for Papers

- 2) explanation of technical approach; and
- 3) explanation of research results.

Entrants will be contacted via email after the conference to announce the winner and provide anonymous feedback on the oral presentation and written paper from the judges.

For inquiries regarding the Atmospheric Flight Mechanics Student Paper Competition, please contact the competition co-chairs below.

**Student Paper Competition Co-Chair**

Andrea Da Ronch  
University of Southampton  
a.da-ronch@soton.ac.uk

**Student Paper Competition Co-Chair**

Yunjun Xu  
University of Central Florida  
yunjun.xu@ucf.edu