

2027 AIAA Aviation and Aeronautics Forum and Exposition

2027 AIAA AVIATION Forum

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Modeling and Simulation Technologies

Call for Papers

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Abstract Submission Guidelines

Prospective authors are asked to submit their work electronically through the AIAA AVIATION website prior to the published deadline (<https://aviation.aiaa.org/>). Authors may submit either an extended abstract of 1,000 words or a draft of the paper. Draft papers must include a 100- to 200-word abstract.

The manuscript, whether an extended abstract or draft paper, must include a discussion on the background and motivation for the work, as well as an explanation of the paper's main contributions to the particular areas of interest, including examples of results. The inclusion of the paper in the conference will depend solely on the quality and detail of the submitted manuscript.

The scope of the Modeling and Simulation (M&S) Technologies discipline encompasses M&S of aerospace vehicles in a system or system of systems context (e.g., flight simulators, airspace simulations, space operations simulations, systems analysis). See Topics of Interest below for more details. Except for strategic topics of interest sought jointly with other disciplines (as noted below), a paper that solely covers M&S methods for a single engineering discipline like structures or applied

aerodynamics should be submitted to that discipline. If a paper with a single-discipline M&S topic is submitted to this call, then it will be moved to the appropriate discipline or rejected if the discipline is not represented at AVIATION.

Each submission will be reviewed by at least three members of the Modeling and Simulation Technical Committee. Authors submitting extended abstracts are encouraged to include as many details about their work as possible to help reviewers make informed evaluations.

At each conference, members of the Modeling and Simulation Technical Committee sit in the audience and judge all presentations as the first step in their selection of a best paper at the conference. The papers associated with the best presentations in each session will be evaluated further. The best overall paper will be awarded at the conference the following year. In addition to the best paper award, the Modeling and Simulation Technical Committee will host a Best Student Paper competition.

Topics of Interest

Authors are invited to submit technical papers that address topics either directly in or in support of modeling and simulation of aerospace vehicles, particularly related to flight simulator technologies, including:

1. Modeling and Simulation of Air and Space Vehicle Dynamics, Systems, and Environments

Papers are invited that focus on the modeling and real-time simulation of vehicle dynamics, systems, and the environments in which they operate. This includes fixed-wing aircraft, rotorcraft, UAS, AAM vehicles, and spacecraft. Emphasis is placed on multi-disciplinary approaches that integrate structural dynamics, flight mechanics, and aerodynamics. Preference is given to papers that demonstrate real-time or real-time-capable simulations, human-in-the-loop integration, or cross-domain simulations.

2. Design, Development, Testing, and Validation of X-in-the-Loop Simulations

Papers are invited that explore cutting-edge developments in X-in-the-Loop simulations, encompassing human-in-the-loop, hardware-in-the-loop, and software-in-the-loop configurations. Topics of interest include the design and implementation of these simulations for testing and validation of aerospace systems, with a focus on reducing development time and

increasing model fidelity. Submissions are encouraged to discuss novel methodologies that enhance the integration of various simulation components, improve real-time capabilities, and address regulatory and certification challenges. The role of X-in-the-Loop simulations in advancing autonomous systems and complex aerospace operations is also of particular interest.

3. Simulator Hardware and Facilities

This topic seeks papers that delve into the design, development, and enhancement of simulator hardware and facilities. Topics of interest include the creation and integration of advanced motion systems, visual systems, and image generation technologies that improve simulation fidelity and effectiveness. Papers that discuss novel hardware configurations, motion cueing strategies, and the application of these systems for both research and training are encouraged. Additionally, submissions on the development and optimization of simulator facilities, including considerations for scalability, modularity, and environmental factors, are welcome.

4. Operation and Certification Using Modeling and Simulation

Modeling and simulation have become essential tools in the operation, certification, and qualification processes of aerospace systems, including both traditional aircraft and emerging technologies such as UAS and AAM vehicles. This topic invites papers that explore the use of simulations in the certification process, including the expansion of simulation-based methods for handling quality certification, autonomous aircraft certification, and the validation of operational procedures. Emphasis is placed on innovative simulation approaches that enhance the reliability and efficiency of certification and qualification processes, including the use of digital twins and other advanced modeling techniques.

5. Modeling and Simulation for Multi-Modal Transportation Systems

This subtopic seeks papers that focus on the modeling and simulation of air transportation systems within the broader context of multi-modal transportation. Areas of interest include the development of simulation tools and methods that enhance the performance, safety, and efficiency of air transportation systems as they interact with other modes of transport. Papers are encouraged to discuss the simulation of air traffic management, airport operations, and intermodal connectivity, with a focus on optimizing the integration of air transportation within multi-modal networks.

6. Digital Twins for Aerospace Systems

The concept of Digital Twins (DTs) is transforming the way aerospace systems are designed, monitored, and maintained. This topic invites papers that focus on the development and application of Digital Twins in aerospace. Areas of interest include the creation of high-fidelity DTs for real-time monitoring and control, the integration of DTs with live data streams, and the use of DTs for predictive maintenance, operational optimization, and lifecycle management. Papers that discuss the challenges and solutions associated with scaling DTs for complex aerospace systems, including the integration of multiple DTs across different subsystems, are also encouraged.

7. Advanced Modeling and Simulation Techniques

This topic seeks papers that introduce or explore innovative modeling and simulation techniques applicable to aerospace systems. Areas of interest include, but are not limited to, the development of new algorithms, numerical methods, and simulation frameworks that enhance the accuracy, efficiency, and scalability of simulations. Papers that address the integration of machine learning, artificial intelligence, and data-driven approaches with traditional simulation methods are particularly encouraged. Additionally, submissions that demonstrate the application of these advanced techniques to complex aerospace problems, such as multi-physics simulations, integration of Model-Based Systems Engineering (MBSE) with simulation environments, or large-scale system-of-systems modeling, are welcome.

8. Modeling and Simulation for Aerospace Cybersecurity

As aerospace systems increasingly rely on complex, networked architectures, cybersecurity has become a critical area of focus. This topic invites papers that explore the use of modeling and simulation to assess, enhance, and validate the cybersecurity of aerospace systems. Areas of interest include the development of simulations that model cyber threats and vulnerabilities, the integration of cybersecurity measures into flight and mission simulations, and the use of simulation environments to test and validate cybersecurity protocols. Papers that discuss the application of digital twins, fault injection techniques, or AI-driven methods to predict, detect, and mitigate cyber threats in aerospace systems are particularly encouraged. Additionally, submissions that address the cybersecurity of the simulation tools and environments themselves, ensuring they are secure from exploitation, are also welcome.

9. Advanced Air Mobility Integration within Multi-Modal Transportation Systems (joint GA/MST)

This subtopic invites papers that explore the integration of Advanced Air Mobility (AAM) into existing and emerging multi-modal transportation systems. Areas of interest include the modeling and simulation of interactions between AAM vehicles, such as Urban Air Mobility (UAM) platforms, and other transportation modes like road, rail, and maritime systems. Papers are encouraged that address challenges related to the seamless integration of AAM into complex transportation networks, including airspace management, traffic flow optimization, and the coordination between autonomous vehicles and traditional modes of transport.

10. Emerging design methods, tools, or processes, including model-based design & MBSE (joint DE/DGE/MST)

This subtopic invites papers that explore Model based design and Model based systems engineering. Areas that include the development of novel MBSE methodologies for modeling and simulation processes and applications.

11. Other Modeling and Simulation Topics

Authors may use this subtopic if their work doesn't fit well with other subtopics listed but is applicable to simulation and/or emulation of aerospace systems.