2024 AIAA Aviation and Aeronautics Forum and Exposition
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2024 AIAA Aviation Forum Website

Modeling and Simulation Technologies
Call for Papers

Technical Discipline Chair

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Abstract Submission Guidelines

Prospective authors are asked to submit their work electronically through the AIAA Aviation Forum website prior to the published deadline (www.aiaa.org/Aviation). 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 area(s) 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. A paper that solely covers M&S methods for a single engineering discipline like structures or applied aerodynamics should be submitted to that discipline. The sole exception are papers involving simulation and Computational Fluid Dynamics, which is a joint session this year with other Aviation Forum groups (see item #3 below).

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 of their selection of the 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 and **the winners receive a cash award.**

Topics of Interest

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

1. **Design, Development, Testing, and Validation of Human-in-the-Loop Simulations**

Papers are sought on the design, development, testing, and validation of human-in-theloop simulations. Papers are encouraged to discuss novel tools, techniques, and methods that decrease the development time or increase the capabilities of human-in-the-loop or real-time simulations, and the quality of models. Papers that address testing and validation methodologies for flight simulators, or discuss regulatory issues and experiences are of particular interest.

2. **Design, Development, Test, and Evaluation of simulated/emulated Digital Twins of aviation systems**

Digital Twins (DTs) are having an impact on the way aircraft systems are modeled, designed, monitored, and controlled. DTs are a component of some current and future planned HITL simulations. Papers are sought that discuss the use of simulations and DTs, either federated or integrated, that inform and expand the scope and application of DTs.

3. **CFD Methods for Aerodynamics Applications (joint session APA/CFD/MST)**

Papers are sought on the integration of HITL simulations and CFD methods for the MST component of this track. Computational Fluid Dynamics is widely used in various forms to simulate safer, more efficient, and high-performance aviation systems without relying on physical testing. Within the context of aerospace simulations, CFD results can be used to create realistic aircraft and engine performance. The joint session invites papers on CFD methods in aeronautics, the MST components of this joint session invites papers on the use of CFD data in HITL simulations.

4. **HITL Simulation of Air Traffic Management**

Papers are sought that describe the use of simulations in air traffic management concept development, testing, and analysis. Topics of interest include, but are not limited to, simulation studies that investigate air traffic management automation concepts and decision support tools, airspace and airport traffic modeling methods, and model validation and verification experiences and methods.

5. Simulation of Uninhabited Aerial Systems

Papers are sought on simulations of uninhabited aerial systems. The variety and number of vehicles in this area are ever increasing, as are the missions they perform. This variety offers several new challenges to the field of simulation. Papers are sought on novel simulation techniques and technologies for uninhabited aerial system development, operator training, the development of operational concepts, etc.

6. Model and Simulation Integration

Papers are sought that discuss model and simulation integration. Of particular interest are papers discussing the integration of commercial off-the-shelf tools into existing simulation development and execution processes. Application of networked/distributed simulations and the development of standards that facilitate interaction of diverse simulation environments are encouraged. Papers can discuss the integration of Model Based System Engineering (MBSE) output with simulations, the use of federated networks such as the DoD's High-Level Architecture

7. X-in-the-Loop Simulation and LVC (Live, Virtual, and Constructive)

Papers are sought on the development and use of model-in-the-loop, software-in-theloop, processor-in-the-loop, and hardware-in-the-loop simulations. Topics of interest span from model or software in the loop simulation development to system integration laboratories for hardware-in-the-loop testing of modern fly-by-wire systems, integration and testing of modern avionics and synthetic vision systems, and autonomous flight systems integration and testing. Additionally, combining constructive simulations, virtual simulators, and live vehicles & environments (LVC) permits the blending of engineering, test, training, and operations activities to achieve shortened life cycles, address increasing complexity and scale in system of systems (e.g., the National Airspace System), and improve training outcomes. Topics of interest include but are not limited to LVC architectures, immersing constructive and virtual elements in a live operating environment (shadow mode), immersing live elements in a virtual environment, simultaneous execution of digital twin(s) with live operation, and integration of simulation with ground or flight test.

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

Papers are sought that describe the modeling and real-time simulation of vehicle dynamics and vehicle systems, and the environments in which they operate. This includes, but is not limited to, fixed wing aircraft, rotorcraft, uninhabited aerial systems (UAS), urban air mobility (UAM) vehicles, and spacecraft. Non-real-time simulations will also be considered providing the work is in support of real-time simulation. Furthermore, multi-disciplinary modeling and simulation that spans across domains is increasingly popular. Papers are sought in novel modeling and simulation approaches across domains such as structural dynamics, flight mechanics, and aerodynamics. There is a strong preference for papers which demonstrate integration with real-time, real-time capable, or human-in-the-loop vehicle simulations.

9. Modeling and Simulation for Aerospace Cybersecurity

Network-based architectures are ubiquitous in aviation and space systems, including aerospace vehicles and their command-and-control systems. Securing these systems from unfriendly actors is a significant and growing concern. Papers are sought on modeling and simulation methods and environments that assess robustness of the networked systems to threats and provide methods of protection. Furthermore, papers are sought on the application of modeling and simulation for cybersecurity of aerospace systems. Topics of interest include, but are not limited to, modeling of cyber threats as fault scenarios in flight simulators, and the use of simulators to evaluate prevention, rejection, detection, and mitigation of cyberattacks. A related topic is the cybersecurity of the modeling and simulation environment itself, including information assurance, data protection, and the simulator as a potential attack vector into the system under test.

10. Modeling and Simulation for Certification and Qualification

Modeling and simulation have become essential tools in the qualification and certification processes of new commercial aircraft and the emerging market for commercial crewed spacecraft. In addition, the introduction of autonomous aircraft in civil airspace, such as uninhabited aerial systems (UAS) and urban air mobility (UAM) vehicles, require novel certification approaches based on modeling and simulation. Papers are sought that describe the use of modeling and simulation for the purposes of certification and qualification of new aircraft. Topics of interest include, but are not limited to, expanding the use of simulation for handling quality certification of new and derivative aircraft designs, the use of simulation for the certification of autonomous aircraft, and the design of flight tests to validate these simulations.

11. Simulator Hardware and Facilities

Papers are sought involving all aspects in the design, development, and use of motion systems, visual systems, and other simulator hardware, as well as image generation. Papers that discuss novel motion configurations and hardware as well as the application of motion for research and training are highly encouraged. Papers on motion and visual system technologies that improve simulation fidelity and effectiveness are also highly encouraged. In addition, papers are being sought on the development of new simulator facilities.

12. Simulation-Based Software Development and Verification

Papers are sought that demonstrate the use of simulation for the design, development, and testing of aerospace software systems. This topic also includes simulation-based validation and verification of software solutions.

13. Using AI and Other Technologies within Modeling and Simulation Infrastructure for Aerospace

Papers are sought describing the adaptation or assessment of new technologies to modeling and simulation infrastructure for aerospace. New technologies may include but are not limited to extended reality, cloud technology, new messaging middleware, game engines, social network

platforms (including chat, video conferencing, and 3D virtual worlds), hybrid computing architectures (e.g., CPU-GPU), and artificial intelligence, machine learning, large language models, and generative AI.

14. 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 aviation systems.