AIAA Intelligent Systems Technical Committee

AIAA Intelligent Systems Call for Papers
AIAA Science and Technology Forum and Exposition (SciTech 2027)

11-15 January 2027
Hyatt Regency, Orlando, FL

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SUBMISSIONS: https://www.aiaa.org/scitech

ORGANIZING COMMITTEE

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Event Synopsis:

Submissions are sought in all areas of application of Intelligent System (IS) technologies and methods to aerospace systems, the verification and validation of these systems, and the education of AIAA membership in the use of IS technologies in aerospace and other technical disciplines. Systems of interest include both military and commercial aerospace systems and those ground systems that are part of the test, development, or operations of aerospace systems. Technologies that enable autonomy (i.e., safe and reliable operation with minimal or no human intervention) as well as collaborative human-machine teaming in complex aerospace systems/subsystems are of interest. These include but are not limited to, autonomous and expert systems; discrete planning/scheduling algorithms; intelligent data/image processing, learning, and adaptation techniques; data fusion and reasoning; and knowledge engineering. The application of such technologies to problems that highlight advanced air mobility, certification, carbon emissions/sustainability, space traffic management, and cislunar operations are of particular interest.

A. Submission Guidelines

Please submit 5-page extended abstracts (note joint GNC/IS papers require full draft manuscript not to exceed 25 pages, formatted in accordance with the AIAA SciTech manuscript template) at https://www.aiaa.org/scitech.

All extended abstracts will be evaluated by qualified individuals from industry, academia or government. Reviews will be single-blind, and authors will be provided with written reviewer feedback. Authors are advised to incorporate reviewer comments into their final manuscripts.

- **The Intelligent Systems Best Paper Award will be given to the best overall IS paper submission** (see Section E for selection criteria).
  - Student authors are encouraged to submit their work to the Best Student Paper Competition. The POC for the Student Paper Competition is Rajnikant Sharma (sharmar7@ucmail.uc.edu and raj.drdo@gmail.com) . Finalists will be invited to present their work before the award committee at a special conference session (see eligibility and submission details in Section B.X and at https://www.aiaa.org/scitech).
- **Authors of the best papers presented at the conference will be invited to submit their work to the AIAA Journal of Aerospace Information Systems (JAIS) (https://arc.aiaa.org/journal/jais).** We also encourage authors who feel their papers are journal quality to simultaneously submit their papers to AIAA JAIS. The AIAA

supports dual conference/journal submission, where the review process for the conference and journal are independent.

To help reviewers provide informed evaluations and constructive comments that will stimulate discussion, each submission should clearly and concisely:

a. State the key research questions being addressed by the submission
b. Explain the specific technical challenges addressed by the submission
c. Provide accurate, relevant, and up-to-date references of previous work/state-of-the-art (please ensure correct formatting/spelling of all works cited and include DOI)
d. State specific innovations, technical contributions, and acknowledgment of published related works
e. Present sufficient initial evidence to support proposed ideas including preliminary data, theorems, illustrations, and examples.
f. Provide a detailed sketch of deliverables for the final full manuscript submission and conference presentation (e.g. simulations, experiments or analyses to be performed, etc.)

B. Core Topic Areas

See below for an additional description of the core IS topic areas and the points of contact for each.

Proposals for special sessions or panel discussions on other important and emerging IS topics of interest are also welcome. Please see https://www.aiaa.org/scitech for instructions on proposing special topic sessions (see Section F for instructions on proposing panel discussions).

I. Adaptive and Intelligent Control Systems

Papers are sought that address innovative approaches to intelligent adaptive control system development. Topics of interest include (alphabetically), but are not limited to, adaptive systems, autonomy, distributed/decentralized adaptive control systems, feedback and feed-forward control systems, hybrid systems, learning systems, linear control systems, model reference adaptive control, multi-agent systems, nonlinear control systems, optimal control systems, parameter estimation, and uncertain dynamical system control, as applied to aerospace systems.

POC: Jay Wilhelm (jwilhelm@ohio.edu) and Benjamin Gruenwald (benjamin.c.gruenwald.civ@army.mil)

Areas of interest include:

- Adaptive systems
- Learning systems
- Adaptive sampling
- Parameter estimation and sensor data fusion
- Analytical and experimental tools for design and validation
- Model Reference Adaptive Control applications
- Distributed/Decentralized adaptive control
- Networked systems adaptive control
- Nonlinear modeling and control
- Model Predictive Control applications
- Optimization and optimal control systems
- Verification and validation of adaptive systems
- Multivariable control in aerospace systems
- Fault Detection and Diagnosis

II. Autonomy

This topic invites papers in the area of autonomy – the quality of a system being self-governing. A system exhibiting autonomy can make decisions and respond to unanticipated conditions without direct human supervision. Aerospace systems with autonomous capabilities may operate more efficiently, reduce human workload, and enable new missions and capabilities. These systems may also exhibit novel failure modes and can be difficult to understand and certify relative to traditional aerospace concepts of reliability and safety. Papers are sought in the general area of aerospace autonomy and in focus topics including decision-making techniques, novel applications of autonomy in aerospace, methods to bound or explain actions taken by an autonomous system, and interactions

between autonomous agents. This session also welcomes papers in the area of Artificial Intelligence, Machine Learning, and Generative AI applied to aerospace autonomy.

POC: Grant Phillips (grantphllps@gmail.com) and Junyi Geng (jgeng@psu.edu).

Areas of interest include:

- Autonomy and autonomous systems in aerospace
- Runtime assurance
- Aerospace systems that learn during operation
- Verification and validation of autonomy and autonomous systems
- Autonomous contingency management
- Multi-agent and collaborative systems
- UAS traffic management (UTM)
- Machine learning-based autonomy

III. Formal Methods in Aerospace Engineering

Modern aircraft contain millions of lines of complex software, much of it performing functions that are critical to safe flight. As an example, the Boeing 787 has over 14 million lines of code! This software must be verified to function correctly with the highest levels of assurance, and aircraft manufacturers must demonstrate evidence of compliance with flight certification requirements like the FAA's DO-178B, DO-178C, DO-333, and DO-254 through a rigorous certification process. Formal methods are being progressively incorporated into the aircraft and spacecraft software design and verification process and are becoming commonplace elements of the aerospace industry. Papers are sought in the field of these formal methods for a wide area of aerospace applications. Additionally, the growing interest in the deployment of increasingly autonomous systems and paths to their verification, validation, and certification for use in safety-critical contexts are of interest to this area.

POC: Natasha Neogi (natasha.a.neogi@nasa.gov) and Cody Fleming (flemingc@iastate.edu)

Areas of interest include:

- Formal methods for verification
- Formal methods for certification
- Model based development
- Automatic translation
- Compositional reasoning
- Assurance of flight critical system

IV. Human – Automation Interaction

This topic seeks papers in the field of human – automation interaction as applied to aerospace systems and vehicle operation and control, robotics, remotely operated vehicles, intelligent agents as teammates, and navigation systems. Topics of interest include research on human trust in automation and how trust affects interactions, how team interactions are affected by automation, and models of effective human-automation interaction/autonomy. Additionally, papers that demonstrate novel applications of human-machine interaction are encouraged.

POC: Nisar Ahmed (nisar.ahmed@colorado.edu) and Amy Ruth Pritchett (apritchett@psu.edu)

Areas of interest include:

- Human trust in automation
- Automation in team interaction
- Effective human-automation systems
- Human-autonomy interaction
- Mixed-initiative intelligent systems
- Intelligent decision support systems
- Pilot and controller mode awareness
- Cockpit decision aids
- Pilot and controller workload
- Air traffic management automation tools
- Dynamic airspace reconfiguration

V. Learning, Reasoning, and Data Driven Systems

This topic seeks papers in the field of intelligent systems as applied to learning, reasoning, and data driven systems. Aerospace applications include pattern recognition, obstacle detection, localization, and intelligent decision making. Specific research activities include training methods, operations on large datasets, and techniques in learning and reasoning.

POC: Tejas Puranik, (tejas.puranik@gmail.com) and Layla Akilan (lakilan@miletwo.us)

Areas of interest include:

- Machine vision
- Computer vision (including image processing)
- Artificial Neural Networks
- Large language models
- Evolutionary algorithms
- Quantum computing
- Machine learning and case-based, formal or qualitative reasoning
- Data intensive systems
- Classification methods
- Optimization using Genetic Algorithms (GA)

VI. Probabilistic and Rule-Based Systems

Papers are sought in the field of probabilistic and rule-based systems as applied to aerospace data, aerospace systems and vehicle operation and control. Probabilistic systems are systems that utilize stochastic processes in the solution and optimization of complex problems, e.g., Recursive Bayesian Estimation (RBE) methods (Kalman, Particle, etc) and Markov Decision Processes. Rule-based systems are systems that utilize crisp and fuzzy logic, biomimicry, and/or self-organization to define adaptive, near-optimal, and robust solutions to complex problems. Motion planning algorithms such as variants of Dijkstra's method are encouraged for publication. Papers that describe novel uses of any combination of the above in aerospace applications are sought. Additionally, papers that demonstrate novel applications of unmanned vehicle systems (including human-vehicle-payload systems) are encouraged.

POC: Liang Sun (liang_sun@baylor.edu) and Junfei Xie (jxie4@sdsu.edu)

Areas of interest include:

- Recursive Bayesian Estimation methods (filtering)
- Markov Decision Processes and decision making
- Motion and path planning algorithms
- Fuzzy Logic applied to Aerospace Operation and Control
- Optimization using Market / Auction methods
- Application of Complex Systems paradigms (e.g. self-organization) to Aerospace Operation and Control
- Expert systems based on Crisp, Fuzzy or Crisp-Fuzzy Hybrid Logic
- Bio-inspired systems
- Swarm Optimization methods, e.g. Particle Swarm and Ant Colony Optimization
- Application of Flocking / Swarming rules to the coordination and control of multiple vehicles

VII. Sensor Fusion and Systems Health Management (SHM)

SHM embodies the development of functional capabilities that enable systems to be self-sufficient in determining their current and future operational states. This is accomplished by integrating disparate information from various sources into an overall understanding of the system's health with respect to available resources and operational demand. SHM embodies enabling capabilities for autonomous and semi-autonomous operation which includes fault management, condition-based maintenance (CBM), mission projection/prognosis, failure recovery/response,

and life-cycle configuration management. SHM capabilities support the overall system goals of safety for the system, payload, passengers, and public; reusability to reduce development costs; fault tolerance to provide operation in the event of system failures; and verification/certification pathways.

POC: Chetan Kulkarni (chetan.s.kulkarni@nasa.gov) and Nhan T. Nguyen (nhan.t.nguyen@nasa.gov)

Areas of interest include:

- Fault and Anomaly Detection, Diagnosis, and Prognosis
- SHM Paradigms and Architectures
- Software Tools to Support the Implementation of SHM Capabilities.
- SHM for Integrated System State and Functional Awareness
- SHM Applications and Test-beds
- SHM Verification and Validation
- SHM as part of a Condition-Based Maintenance Strategy
- SHM and Systems Engineering

VIII. Space Trusted Autonomy

Space trusted autonomy is a rapidly evolving field, with great potential to transform the way we explore and utilize our solar system. This field lies at the intersection of traditional aerospace engineering, computer and data science, human-autonomy interaction, and satellite subsystem integration/interaction. High assurance automation and autonomy will be increasingly important for safety needs such as collision avoidance, as well as emerging missions such as active debris removal, in-space servicing, assembly and manufacturing (ISAM), and cislunar missions such as those in support of the NASA Gateway and Artemis programs. Papers are sought which tackle autonomy, assurance, or interfaces between humans and autonomy, or any other proposed approaches to support trusted space autonomy. The session(s) aims to provide a forum for the exchange of ideas, best practices, and to foster cross-disciplinary collaboration and innovation in the field.

POCs: Sean Phillips (sean.phillips.9@afrl.af.mil) and Christopher Hays (christopher.hays.5@spaceforce.mil)

Areas of interest include:

- Safe satellite autonomy to include run time assurance approaches such as barrier control functions or model predictive control (MPC) approaches for assuring safety of autonomous space operations
- Robust/resilience guidance navigation control and decision-making systems
- Autonomous cooperative control strategies
- Computationally efficient on-board satellite autonomy algorithms - to include learning, optimization, or adaptive methods
- Human-autonomy interfaces for operators to interact with autonomy on orbit
- Novel techniques to operate in cislunar space including autonomous rendezvous, proximity operations, and docking or resilient constellation design to provide communication and internet to lunar stations
- Autonomous spacecraft behavior estimation
- Autonomous information and data fusion of interconnected heterogeneous space-based sensors
- Ground-based surrogate platforms for space autonomy development - to include software-in-the-loop, processor-in-the-loop, digital-twin and satellite emulation testing environment
- Space autonomy testing metrics and analysis - operational trust metrics and methodologies, autonomous trust acknowledgment between platforms
- Autonomous fault detection and identification methods

C. Special Topics: Joint Sessions

The Intelligent Systems Technical Committee is collaborating with other technical committees to form joint sessions. Proposals for joint sessions are welcome. Please contact each TC's TDC to propose a joint session. Also, see https://www.aiaa.org/scitech for instructions on proposing special topic sessions.

The following is a list of joint sessions organized for SciTech 2027 Forum:

I. Guidance, Navigation and Control in Intelligent Systems [Joint with GNC]

This joint track co-hosted by the GNC and IS Technical Committees, invites papers in the domain of guidance, navigation and control of intelligent, unmanned aerospace systems. In particular, papers that address interactions in unstructured, uncertain and dynamic environments are encouraged. Advancements in conflict resolution and planning under uncertainty, flight control certification and runtime assurance using classical model-based, data driven, learning-based, or hybrid approaches are sought.

Note that submission to this joint track requires adherence to the GNC requirement of a **full draft manuscript**, which must include sufficient detail to allow informed evaluation by the assigned reviewers. Extended abstracts will be returned without review. Full draft manuscripts must not exceed a total length of 25 pages, formatted in accordance with the AIAA SciTech manuscript template.

POC: Saptarshi Bandyopadhyay (saptarshi.bandyopadhyay@jpl.nasa.gov) and Mike McFarland (michael.b.mcfarland@rtx.com)

Areas of interest include::

- Conflict Detection and Resolution: UAS situational awareness and conflict resolution in hybrid and integrated airspaces (UTM), conflict detection methods, sense-and-avoid under uncertainty, sensor/airspace-class specific methods for conflict resolution and collision avoidance,
- Planning in a Dynamic, Uncertain Environment: Multiagent planning and control, integration of decentralized sensing and computation, GPS-denied planning, planning under sensor conflict, dynamic and/or unstructured obstacles, planning in a three-dimensional environment, resource-constrained planning, real-time trajectory planning, learning-based planning methods, and intelligent decision making/replanning
- Flight Control Certification: Certification of novel control architectures, intelligent systems, hybrid methodologies, safety metrics,
- Validation and Verification: Correlation issues in V&V, model-based testing, flight validation of high-integrity manned/unmanned aerospace vehicle navigation and control in uncertain and GPS-denied environments, and,
- Human/autonomy interaction: teaming between humans and autonomous systems, effect of human-in-the-loop on operation of intelligent systems, methods for control/supervision of intelligent systems.

II. Energy Aware Autonomy for Aircraft Systems [Joint with GNC]

Efficiently managing energy is essential to safe and effective flight of autonomous aerospace systems. Environmental conditions, operational constraints, control strategies, and onboard systems configuration can significantly affect the energy required to complete a mission, and poor energy management can lead to operational or safety failures. This session invites papers on a broad range of energy-aware planning, control, optimization, and system identification areas that enhance the efficiency of uncrewed aircraft systems, urban air mobility vehicles, and transport aircraft.

Note that submission to this joint track requires adherence to the GNC requirement of a **full draft manuscript**, which must include sufficient detail to allow informed evaluation by the assigned reviewers. Extended abstracts will be returned without review. Full draft manuscripts must not exceed a total length of 25 pages, formatted in accordance with the AIAA SciTech manuscript template.

POC: John J. Bird (jjbird@utep.edu) and Jack W. Langelaan (jwl16@psu.edu)

Areas of interest include, but are not limited to:

- Autonomous soaring flight, including thermal, ridge, and wave soaring
- Dynamic soaring and gust soaring
- Adaptation to changes in the environment and uncertainty in weather models
- Detecting and mapping energy availability
- Flight planning in complex weather and terrain conditions
- Flight control in the context of atmospheric energy harvesting and energy optimality
- Learning systems for energy-optimal and soaring flight
- Energy-optimal flight planning

III. Flight Testing Systems with Intelligent Flight Controls [Joint with FT]

This joint session focuses on the methodology, safety, and execution of flight testing aerospace vehicles equipped with intelligent flight controls and autonomous systems. This session specifically seeks papers on the "how" of the test: novel flight test techniques, real-time safety monitoring of adaptive systems, instrumentation requirements, and the transition from simulation to flight for intelligent systems. Papers must provide interpretations on the broader impacts of their work and highlight lessons learned from the planning or execution of testing to provide value to the wider flight test community.

POC: Hever Moncayo (hever.moncayo@erau.edu) and Jessica M. Peterson (jessicapeterson@unr.edu)

Areas of interest include, but are not limited to:

- Application of new flight test techniques or novel approaches to classical techniques for intelligent systems
- Risk mitigation and safety-of-flight processes for non-deterministic or adaptive control laws
- Real-time safety monitoring, run-time assurance (RTA), and envelope protection during test execution
- Methodologies for transitioning from simulation and hardware-in-the-loop (HITL) to the flight environment
- Instrumentation, data acquisition, and high-rate telemetry requirements for learning-based controllers
- Field verification and validation (V&V) of autonomous mission logic and machine learning models

D. Student Competition Submissions

Students are invited to submit extended abstracts by the abstract submission deadline in any broad area of Intelligent Systems to the Intelligent Systems Student Paper Competition. Students must be registered as full-time students in good academic standing at the time of submission and must submit a full draft manuscript by the final paper deadline to be considered. Primary or sole authorship by a single student is required. When submitting your paper, please select “Student Paper Competition” from the “Type” dropdown, then “Intelligent Systems” as the “Topic”; you will then select the most appropriate Sub-Topic for your paper. A student competition paper subcommittee and the chair will review the full draft manuscripts submitted as IS student paper competition papers based on their originality, clarity, and potential impact on practical applications or theoretical foundations, and select 5 or 6 paper finalists. All papers that are not selected will be forwarded to the area chairs for possible inclusion as regular conference papers. A separate student paper competition session is usually held on Monday during SciTech. Students will also present during regular technical sessions. Directly after this session, the subcommittee will decide the winner based on both the paper and the presentation, and the student will be notified by email. The winner will be presented with an award, “Best Student Paper.” All finalists’ papers will be included in the conference proceedings, and you will also be required to present as a regular paper during the standard AIAA SciTech session. (Two presentations will occur, one on Monday and one in the regular conference schedule).

POC: Rajnikant Sharma (sharmar7@ucmail.uc.edu and raj.drdo@gmail.com)

E. Call for Content

The Intelligent Systems Technical Committee is interested in having additional content presented at the AIAA SciTech 2027. Presenters are encouraged to submit talks without paper in topic areas in Section B above. Formats include and are not limited to: tutorials, panel sessions, and oral presentations.

Interested parties should contact: aiaa-istc-scitech@googlegroups.com with a 1-page abstract including authors/presenters by an early deadline of 21st MAY 2026.

F. Intelligent Systems Best Paper Award 2027

The 2027 Intelligent Systems (IS) Best Paper Award is given to recognize the best overall paper, which presents important fundamental contributions to intelligent systems technologies and applications that advance the capabilities of aerospace systems. The best IS paper will be selected from all papers presented during Intelligent Systems sessions at the 2027 SciTech Conference, through an extensive review process, and awarded at the 2027 SciTech Conference.

The IS Best Paper Award is chosen based on the following criteria:

- Long-term relevance to IS technologies
- Technically new, innovative, or a constructive review
- Professional integrity (credits prior work, claims are supported by results and is objective)
- Clear presentation (writing, organization, and graphics)