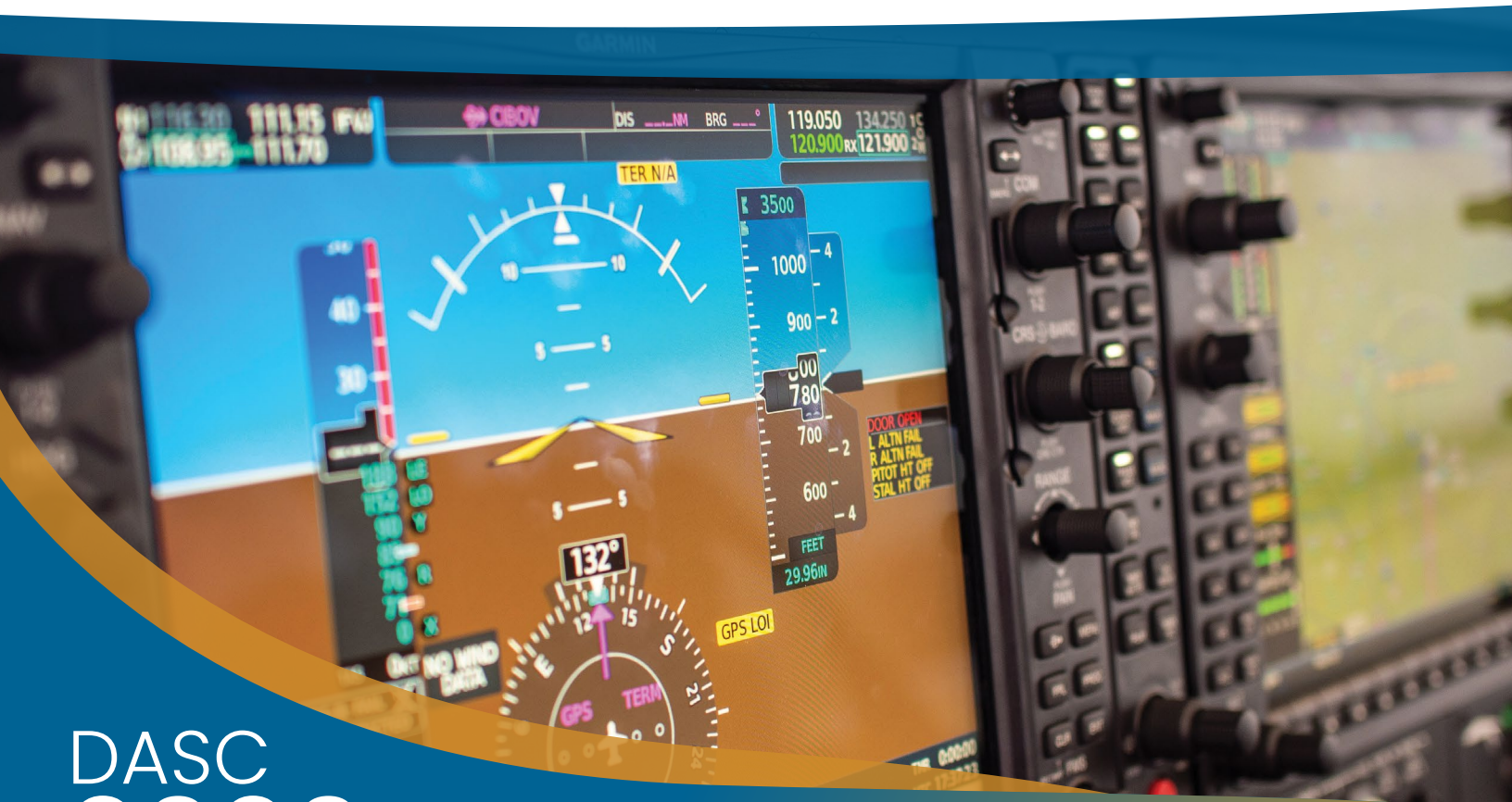
# DASC 39th

## Digital Avionics Systems Conference

Virtual Conference – October 11-16, 2020




# DASC 2020 CONFERENCE PROGRAM

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# Welcome to the 39th (Virtual) Digital Avionics Systems Conference

Greetings! Welcome to the 39th Digital Avionics Systems Conference (DASC). This year's conference is historic, being the first virtual DASC. It seems like yesterday though it was back in July of 2019, when I took up the mantle of leading the 39th Digital Avionics Systems Conference. Although it was originally planned as a live event in San Antonio, Texas, it was and still is, an immense honor for me to have the opportunity to lead this prestigious conference. It is a defining moment in my broad spatio-temporal journey from Ghana, through Sweden, to the USA; and, in my technical journey from Electrical Engineering through Computer Science to Human Factors in Aviation.

A year ago, little did we all know that life as we knew it was about to change due to the global COVID-19 pandemic with its unprecedented and unpredictable impacts. I hope the entire DASC community is doing well under the current circumstances. My sincere condolences to anyone who may have lost a loved one through this pandemic. Nonetheless, we made the decision back in May based on guidance from a Contingency Committee, to conduct a fully virtual conference. Sorry San Antonio, it is always sad saying goodbye (if even for a while) but we shall be back!

The Organizing Committee has worked tirelessly to make this virtual conference a reality without losing any of the traditional in-person experience. There are obvious unique challenges and opportunities associated with the virtual format. Different time zones are a challenge that requires a satisficing solution. Considering the global spread of conference attendees, any time window of activities is bound to be an inconvenience to an attendee somewhere. To address this, we purposefully scheduled all plenary sessions at an optimal time for all time zones. In keeping with our original conference site, San Antonio, Central Daylight Time (CDT) time zone (GMT-5) will be the official time reference for the virtual conference. We also extended the technical sessions through Friday (16th) which was not originally a part of the conference week. Additionally, all technical sessions will be available online, on-demand to all attendees, for four weeks after the end of the conference. We hope these decisions will provide our attendees with an optimal program for all.

The theme of the conference is "Certifiable and Secure Artificial Intelligence in Safety-Critical Air Transportation Systems." It was selected to provide a platform for exploring and discussing the broad application of Artificial Intelligence (AI) in aviation. Despite advances in robust, high performance AI with new capabilities, its application to safety-critical air transportation systems presents unique challenges. Over the week of the 39th DASC, we will explore essentials for AI systems for air transportation systems through the lenses of over two hundred original research papers and posters in nine technical tracks. My Technical Program Chairs, Dr. Michael Dorneich (Iowa State University) and Dr. Terry Morris (NASA Langley Research Center) have done an amazing job putting together a technical program that will engage conference attendees throughout the week.

We have two inspiring keynote speakers on Tuesday: Dr. Nicholas Roy of Massachusetts Institute of Technology (MIT) and Mr. Chris Benson of Lockheed Martin. They are accomplished speakers with depth and breadth in the Artificial Intelligence domain and will bring perspectives from both academia and industry. The second half of Tuesday's program also includes the Students Research Competition (SRC) followed by the opening set of Technical sessions. Please attend to encourage the finalists as they present and answer questions on their research. We will breakout into various tracks for technical sessions after this event.

In these trying times, the role of the aerospace industry in helping address some of the challenges of this pandemic has been amazing. For example, the rapid response of the aerospace sector by making aircraft available for cargo deliveries is one of the actions we can all relate to and be proud of. To expand this theme further, we have scheduled a panel discussion on Wednesday on the topic “UAS and Autonomy Technologies for Pandemic/Humanitarian Crisis.”

Technical sessions continue through the rest of Wednesday, including an hour-long Exhibition event after the mid-day break. Sponsors will showcase products and services, answer questions and present opportunities for collaboration. This event is also scheduled as a stand-alone to encourage participation by the entire conference. Let’s all attend to show appreciation to our generous sponsors for supporting the conference.

Our Awards Ceremony is the first event on Thursday. We will present the Best of Tracks, Best of Conference, and Best Student Paper awards. In addition, AIAA Digital Avionics Technical Committee (DATC) will present the Dr. John C. Ruth Digital Avionics Award and the Distinguished Institution Award. This is the highlight of the conference and you can’t afford to miss it. Poster Sessions are scheduled after midday breaks on both Thursday and Friday. Interspersed with these standalone events are the breakout technical sessions covering all nine tracks.

Despite the limitations of the virtual conference platform, I encourage all attendees to utilize the communication and interaction technologies and tools available to full effect. Let us brainstorm, network and interact as we would have done in-person. There are bound to be issues with this being our first ever virtual conference. Throughout the conference, questions, suggestions and feedback for real-time improvement are welcome.

The fact that we are having this conference is a compliment to the resilience of the DASC Organizing Committee and the entire DASC community. Special thanks to the Session Chairs, Track Chairs, Technical Program Chairs, Conference Organizing Committee and Contingency Committee. My sincere appreciation also goes to our sponsors who in the face of tough economic times in general, and for our industry in particular, chose to support our conference. Thank you!

Finally, on behalf of the AIAA Digital Avionics Technical Committee, the IEEE Aerospace Electronics Systems Society and Conference Organizing Committee, I’ll like to welcome you to a wonderful virtual DASC week. As Nobel Laureate Rita Levi-Montalcini urges us, “Above all, don't fear difficult moments. The best comes from them.” Out of the COVID-19 pandemic has come the ground-breaking first Virtual Digital Avionics Systems Conference. Out of this difficult moment will come the best DASC ever! To quote another Nobel Laureate Albert Szent-Györgyi, “Research is to see what everybody else has seen, and to think what nobody else has thought.” I look forward to a week of groundbreaking research presentations, exceptional innovation and constructive, thought-provoking discussions from diverse perspectives.

Wishing you a week of rich virtual DASC experience. Thank you for your participation.

Dr. Emmanuel Letsu-Dake
39th DASC General Chair
Honeywell Aerospace

# Welcome Message from the Technical Program Chairs

Welcome to the 39th DASC meeting – the first “virtual” conference meeting in its history. While the format may be a little different this year, DASC aims to continue its rich tradition of presenting innovative research and state of the art technology in key areas of interest in aviation and space. This year’s theme of “Certifiable and Secure Artificial Intelligence in Safety-Critical Air Transportation Systems” is well represented in our keynote, panels and technical sessions, including a new dedicated track application of machine learning and automation (ATM-ML) on efficient airspace and terminal area operators, advanced data techniques, and trajectory optimization in air traffic management. Technical presentations will address both the promise and the challenges as artificial intelligence techniques are increasingly being introduced in all areas of aviation, with a focus on implications of certification, reliability, and security.

This year’s technical program will present over 170 papers organized into nine tracks: Air Traffic Management Machine Learning & Automation, ATM Airspace & Spectrum management, Unmanned Aircraft Systems, Communications, Navigation, and Surveillance and Information Networks, Human Factors, Special Topics & Space Systems, Cyber Security and Software), and Unmanned Air Systems Traffic Management, and Integrated Modular Avionics and Design Assurance. In addition, we have two poster sessions across the spectrum of topic and a dedicated student research session.

We would like to express our heartfelt appreciation to the track chairs, session chairs, conference staff, and volunteers for their countless hours of service to bring you this outstanding technical program. In this year of COVID-19, they have worked tirelessly to adapt the format while preserving the high standards of the DASC conference. Finally, we want to thank the authors for their contributions to the conference, and their continued support in sharing their excellent work with the community. On behalf of the Technical committee, welcome to the 39th DASC conference.

Michael C. Dorneich, Iowa State University
39th DASC Technical Program Chair

Terry Morris, NASA Langley
39th DASC Technical Program Chair

# Conference Organizing Committee

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Dr. Emmanuel Letsu-Dake
*Honeywell Aerospace, Advanced Technology*

**Technical Program Co-Chair**
Dr. Michael Dorneich
*Iowa State University*

**Technical Program Co-Chair**
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**Student Research Competition Chair**
Dr. Giancarmine Fasano
*University of Naples*

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# 39th DASC Week at a Glance

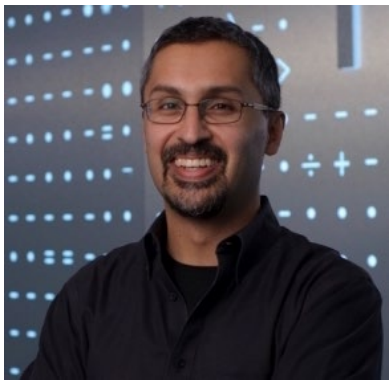
**(All times US CDT; GMT-5)**

| US CDT | Sunday (Oct 11) | Monday (Oct 12) | Tuesday (Oct 13) | Wednesday (Oct 14) | Thursday (Oct 15) | Friday (Oct 16) |
|---|---|---|---|---|---|---|
| **8:00-8:30** | Tutorial (8:00-11:00) | Tutorial (8:00-11:00) | | | | Technical Sessions VI (8:30-10:30) |
| **8:30-9:00** | | | | | | |
| **9:00-9:30** | | | Welcome & Keynote (9:00-11:00) | Panel Session (9:00-10:30) | Awards Ceremony (9:00-10:30) | |
| **9:30-10:00** | | | | | | |
| **10:00-10:30** | | | | | | |
| **10:30-11:00** | | | | Break (10:30-11:00) | Break (10:30-11:00) | Break (10:30-11:00) |
| **11:00-12:00** | Tutorial (11:30-14:30) | Tutorial (11:30-14:30) | Break (11:00-15:00) | Technical Sessions II (11:00-13:00) | Technical Sessions IV (11:00-13:00) | Technical Sessions VII (11:00-13:00) |
| **12:00-13:00** | | | | | | |
| **13:00-14:00** | | | | Break (13:00-15:00) | Break (13:00-15:00) | Break (13:00-15:00) |
| **14:00-15:00** | | | | | | |
| **15:00-16:00** | Tutorial (15:00-18:00) | Tutorial (15:00-18:00) | Student Research (15:00-16:00) | Sponsors (15:00-16:00) | Posters I (15:00-16:00) | Posters II (15:00-16:00) |
| **16:00-17:00** | | | Technical Sessions I (16:00-18:00) | Technical Sessions III (16:00-18:00) | Technical Sessions V (16:00-18:00) | |
| **17:00-18:00** | | | | | | |

# Opening Remarks & Keynotes

*Tuesday, October 13th 9:00-11:00*

Moderator: Aloke Roy (Honeywell)



## Nicholas Roy

Nicholas Roy is the Bisplinghoff Professor of Aeronautics & Astronautics and a member of the Computer Science and Artificial Intelligence Laboratory (CSAIL) at the Massachusetts Institute of Technology. He received his B.Sc. in Physics and Cognitive Science in 1995 and his M.Sc. in Computer Science in 1997, both from McGill University. He received his Ph. D. in Robotics from Carnegie Mellon University in 2003. He has made research contributions to planning under uncertainty, machine learning, human-computer interaction, and aerial robotics. He founded and led Project Wing at Google [X] from 2012-2014. He is currently the director of the Bridge, in MIT's Quest for Intelligence, focused on the science and engineering of intelligence and applying new advances in artificial intelligence broadly to all engineering and science disciplines.

**Title: Autonomous Flight in Urban environments: Challenges for Perception and Planning**

Description: Small UAS have tremendous promise for providing many different services in urban environments, such as inspection or delivery. But, autonomous flight in the urban environment also brings substantial challenges in terms of sensing, perception and decision making. Small UAS need to be able to understand where they are and what is around them to a much greater degree than ever before. I will talk about recent progress in perception and planning for small UAS, and what the next generation of onboard autonomy may look like.

## Chris Benson
## Principal Emerging Technologies Strategist
## Lockheed Martin

Chris Benson is Principal Emerging Technologies Strategist at Lockheed Martin, where he focuses on (or previously focused on) bleeding-edge technologies and topics such as artificial intelligence, autonomy, AI ethics, high-performance computing (AI supercomputers), and containerized DevSecOps. Outside of Lockheed Martin, he is Co-Host of the Practical AI podcast, the Organizer of the Atlanta Deep Learning Meetup, and a prolific international keynote speaker.

**Title: Artificial Intelligence and Autonomy: State of the Union**

Description: Chris Benson has worked in artificial intelligence for Lockheed Martin, Honeywell, and Accenture, and is the organizer of the Atlanta Deep Learning Meetup. He is the cohost of the popular Practical AI podcast, which reaches hundreds of thousands of listeners, and often features luminaries from the global AI community. His diversity of experiences lends him a distinct perspective regarding the advancement of artificial intelligence for autonomy.

Chris will offer a 'state of the union' for AI-driven autonomy that spans industries, tying together the technical underpinnings of both civilian and military use cases. He will explore the capabilities and limitations of existing AI approaches, and address their implications for future generations of autonomous endeavors.

As a case study, DARPA's recent Alphadogfight demonstrated that existing AI architectures are already able to beat highly-proficient human pilots in constrained simulations, which has enormous implications for the future - both military and civilian - including the developing relationship between humans and the AIs we create.

# 2nd Day Panel

## Topic: UAS and Autonomy Technologies for Pandemic/Humanitarian Crisis

*Wednesday, October 14th 9:00-10:30*

Moderator: Dr. Terry Morris (NASA Langley)

### Matt Dunlevy
### CEO, Chairman, and founder of SkySkopes

Matt Dunlevy is the CEO, Chairman, and founder of SkySkopes, a nationally leading unmanned aircraft systems flight operations company based in Grand Forks, ND. SkySkopes is North Dakota's first unmanned aircraft startup certified by the Federal Aviation Administration to fly commercially and offers aerial inspections, energy audits and other services from office locations in Grand Forks, ND, Fargo, ND and Minot, ND. The company also has offices in Minneapolis, MN, Dallas, TX, and Los Angeles, CA. Under Dunlevy's leadership, the business grew from a group of four employees to an organization of national recognition in under three years. Dunlevy studied mechanical engineering and history at the University of North Dakota before ultimately combining a lifelong passion for aviation with his drive for business to form SkySkopes. Dunlevy has taught numerous courses at the University of North Dakota, including UAS in Business, UAS in Engineering, and the Ethics of UAS. Dunlevy's aviation experience includes logging hundreds of flights on powered aircraft, gliders, and hobbyist unmanned aircraft since his teens.

### Dr. Corey A. Ippolito
### NASA Ames Research Center

Dr. Corey A. Ippolito is an Aerospace Scientist at NASA Ames Research Center where he heads the Exploration Aerial Vehicles (EAV) Research Laboratory, which focuses on intelligent control and autonomy for advanced aviation systems evaluated on subscale unmanned vehicle platforms. Dr. Ippolito has a doctoral degree in Electrical and Computer Engineering from Carnegie Mellon University, and an M.S. and B.S. in Aerospace Engineering from Georgia Tech. His doctoral research focused on self-assembling decentralized control constructs for large-scale structurally-adaptive dynamic systems. Dr. Ippolito has led several research projects including safe autonomous UAS flight in high-density low-altitude urban environments, autonomous GNSS-free UAS localization, intelligent UAS swarms for decentralized monitoring of active volcanic systems, intelligent UAS autonomy for autonomous subsurface mapping of earthquake fault lines, the decentralized control project, payload-directed flight control project, the advanced morphing wing project, the Polymorphic Control Systems project, and the Intelligent Integrated Control Systems (IICS) project for smart habitat environments. He has led development of several autonomous vehicle systems, including the Swift UAS, the swarming Dragon Eye UAS, the eXperimental Sensor Controlled Aerial Vehicle (XSCAV), the EAV UAS, the BumbleBee UAS, the Max 5A unmanned ground vehicle variants. He is the primary architect and license holder for several software libraries, including the Reflection Architecture for embedded control of autonomous systems, the Perception Engine for physics-based simulation of multi-body and soft-body systems, the Self-Assembling Brokering Object (SABO) Architecture for automated assembly of large-scale dynamic system simulations, the C3X cross-platform rendering engine, Savant-ML modeling library for fluid-thermal building control and simulation, and the Component Graphics Library (CGL) for cross-platform windowing and rapid design of virtual aircraft control system interfaces.

### Mark Roboff
### Digital Transformation, Aerospace & Defense at DXC

Mark Roboff is General Manager for Digital Transformation, Aerospace & Defense at DXC. Mark has over 15 years' experience in AI and AI related technologies—both as a software engineer and as a business development and technology executive. Mark is a recognized thought leader on AI for the A&D and Travel/Aviation industries, with focus to driving AI solutions in engineering, flight operations, and aftermarket.

Mark is chair of the SAE-G34/EUROCAE WG-114 Joint International Committee for AI in Aviation, and is leading 500+ aerospace engineers, software developers, data scientists, safety experts, and regulators to define a means of compliance for AI certification. Mark is also a member of the S-18 Aircraft System Development and Safety Assessment Committee, the G-31 Electronic Data for Aerospace committee, as well as the SAE Digital and Data Steering Group.

# Tutorial Schedule: Sunday, October 11

| US CDT | Label | Presenter | Title | Topic |
|---|---|---|---|---|
| **11:30-14:30** | SL1 | Tim Etherington | Modern Avionics Architectures | Avionics I |
| **8:00-11:00** | SM2 | Vance Hilderman | Introduction to EVTOL and UAS Avionics Certification | UAS |
| **11:30-14:30** | SL2 | Giancarmine Fasano | Detect and Avoid for Unmanned Aircraft Systems | |
| **15:00-18:00** | SA2 | Maarten Ujit de Haag | Reliable Navigation for Unmanned Aircraft Systems | |
| **8:00-11:00** | SM3 | Carlos Insaurralde | Intelligent Control Architecture for Autonomous Vehicles | Autonomy II |
| **11:30-14:30** | SL3 | Pavel Paces | Artificial Intelligence and Relations to Avionics | |

# Tutorial Schedule: Monday, October 12

| US CDT | Label | Presenter | Title | Topic |
|---|---|---|---|---|
| **8:00-11:00** | MM1 | Aharon David | Aviation Cyber-Security Regulation: Introduction to the DO-326/ED-202-Set | Avionics II |
| **11:30-14:30** | ML1 | Vance Hilderman | Intermediate Essentials for Avionics Certification via DO-178C (software) and DO-254 (Hardware) | |
| **15:00-18:00** | MA1 | Pavel Paces | Machine Learning in Avionics | |

# Tutorial Descriptions: Sunday, October 11

## Avionics I

### Modern Avionics Architectures

This tutorial explores architectures from numerous civil and military aircraft. Key architecture and design challenges are described for legacy as well as the newest aircraft types. Architectures are examined with comparisons of hardware and avionics functions of each are discussed in detail. Civil aircraft investigated include Boeing 787 and Airbus A350. Military aircraft include F-22 and Rafael. IMA 2G and other advanced concepts will be explored. Specific architecture examples are used to represent real word design challenges and solutions. Integrated and connected aircraft concepts are explored in reference to the integrated modular avionics architectures and how they can support integrated digital datalink and future air traffic management. Architectures have been carefully chosen to cover the following:
Broad spectrum of aircraft types, military and civilian
Federated and integrated designs with emphasis on the latest modern commercial and military aircraft
Emphasis on the latest integrated architectures with partitioning and connected aircraft
Line Replaceable Unit (LRU) vis-à-vis modular packaging
Impact of the Modular Open Systems Approach (MOSA) on architecture
Range of non-essential to flight critical applications and the impact on future designs
Connected aircraft and design decisions for integrated designs

**PRESENTER BIO**
Timothy Etherington graduated from North Dakota State University with a Master of Science in Electrical Engineering in 1987. Tim conducts flight deck research at NASA Langley Research Center and is recently retired from Collins Aerospace as a Technical Fellow. Mr. Etherington had worked at Rockwell Collins for over thirty years with extensive experience in military and commercial flight deck design and applied human factors. He helped design the flight decks for the Canadair Regional Jet and other business and regional primary flight display systems. He led the perspective, synthetic and enhanced flight deck research at Rockwell Collins including the flight-testing completed with NASA Langley and Air Force Research labs. He holds an FAA Airline Transport Pilot certificate with a Citation Type Rating and holds commercial fixed wing and private pilot rotorcraft ratings. Mr. Etherington is co-chair for RTCA SC-213 working on standards for enhanced and synthetic vision systems.

## UAS

### Introduction to eVTOL and UAS Avionics Certification

Electric Vertical Takeoff & Landing (eVTOL) and Unmanned Aerial Vehicle (UAV) aircraft and systems are rapidly evolving with over 450 known programs under development. And growing with future Urban Air Mobility (UAM) forecast to be aviation's largest growth area over the next decade. But which certification rules apply? Are eVTOL and UAS systems certified as typical civil aviation, military aviation, general aviation, or a hybrid approach?

eVTOL and UAS systems will need to provide evidence of development processes including Safety, Requirements, Design, Code, Test, Quality Assurance, etc. Many UAV and eVTOL users first-time users of applicable aviation guidelines such as ARP4761 (Safety), ARP4754A (Aircraft & Systems Development), DO-178C (Software) and DO-254 (Hardware) - they often complain of costs and schedules doubling while trying to comply. But are these standards really complex? What are their true meanings for eVTOL and UAS? How can they be understood and applied cost-effectively the first time? What are the top mistakes when starting such certification projects and how to avoid them? All of these topics are explained in this fast-paced introductory eVTOL and UAS avionics certification class.

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| | KEY FEATURES:<br>• Understanding certification basic principles for eVTOL and UAS: explained for the "real world": yours<br>• Understanding the avionics development ecosystem of Safety, Software, Hardware and Certification<br>• Understanding the essential Plans, three Standards, Requirements, Design, Code, Verification, Quality Assurance, and Configuration Management<br>• Common eVTOL and UAS certification initiation mistakes: from beginner to intermediate quickly<br>• Applying traceability, transition criteria, and quality assurance (QA) audits<br>• WHO:<br><br>• Attendees may include engineers, managers, quality assurance or certification personnel; no aviation/avionics certification expertise required.<br><br>**PRESENTER BIO**<br>Mr. Vance Hilderman is Afuzion's director of Avionics Certification. Holding a BSEE and MBA from Gonzaga University, and a Masters in Computer Engineering from USC (Hughes Fellow). Mr. Hilderman was previously the co-founder of TekSci (the world's largest avionics software services company in the '90's), HighRely, and now AFuzion – performing technical avionics software/certification development at companies throughout the world.<br>Mr. Hilderman has focused on safety-critical avionics software, systems, hardware development and related technical products for 25 years. Considered an expert on safety critical software/computer systems and certification, Mr. Hilderman has consulted with ninety five of the world's one hundred largest aerospace companies plus numerous medical, industrial and telecommunications entities Mr. Hilderman has trained over 17,600 avionics engineers and managers in 40 countries on DO-178B, ARP-4754, DO-178C, DO-254, DO-200A, DO-297, and safety/software development.<br>Mr. Hilderman is the principal author of dozens of technical whitepapers and avionics training protocols, plus the world's best-selling book on avionics development/certification, published by Avionics Communications and titled "Avionics Certification – A Complete Guide …"; all royalties are donated to the Boy Scouts of America where Mr. Hilderman and two of his sons are Eagle Scouts.<br>Mr. Hilderman will soon be publishing his next book to be titled "The Avionics Development Ecosystem" published by Afuzion Press. |
| **Detect and Avoid for Unmanned Aircraft Systems** | In the latest years, sense and avoid (SAA), or detect and avoid (DAA), has represented one of the main roadblocks to the integration of unmanned aircraft systems (UAS) operations. This course outlines and reviews architectures, technologies, and algorithms for SAA. First, starting from a discussion about what constitutes a UAS and how it is different than manned aircraft, basic SAA definitions and taxonomies are discussed. Ground-based/airborne and cooperative/non-cooperative architectures are covered. The SAA process is dissected into its fundamental tasks, which are discussed in details. Different sensing algorithms and technologies are presented, including radar and optical systems. Potential and challenges of multi-sensor-based systems and data fusion are pointed out. Techniques for conflict detection, and approaches for remotely operated or autonomous avoidance are introduced. The tutorial ends with an overview of current perspectives and recent progress relevant to SAA for UAS integration in the Air Traffic Management (ATM) system and in the framework of UAS Traffic Management (UTM) / U-Space and Urban Air Mobility.<br><br>**PRESENTER BIO**<br>Giancarmine Fasano is Associate Professor at the University of Naples "Federico II", where he holds courses in "Unmanned Aircraft Systems" and "Space Flight Dynamics". His research activities in the field of aeronautics are focused on UAS, and in particular on sense and avoid and cooperative multi-UAV systems. In the space field he is mainly interested in distributed space systems and proximity operations, with emphasis on relative motion design and control. He is Member of the Avionics Systems Panel of the IEEE Aerospace and Electronic Systems Society and Associate Editor of the IEEE AESS Magazine for the UAS area of specialty. He is also Member of the AIAA Sensor Systems and Information Fusion Technical Committee and of the IAA Committee on Small Satellites. He has co-authored over 110 publications and five book chapters. |

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| **Reliable Navigation for Unmanned Aircraft Systems** | This course provides a fundamental background in assured navigation for unmanned aircraft systems (UAS). It first introduces the various UAS/RPAS application domains and operational environments, UAS flight management and path planning, required performance parameters, and autonomy at the various levels of the Guidance, Navigation and Control function. Furthermore, it addresses the foundations of Global Navigation Satellite Systems (GNSS) and inertial navigation and discusses the challenges of operating in the various target environments with sole-means GNSS. Next, augmentation methods and alternative navigation methods will be discussed with a focus on guaranteeing required navigation performance in, especially, GNSS-challenged environments. Finally, the course will talk about the role of the navigation function in surveillance, geo-fencing and relative navigation in case of swarms of UAS.<br><br>**PRESENTER BIO**<br>Dr. Uijt de Haag is the Edmund K. Cheng Professor of Electrical Engineering and Computer Science and a Principal Investigator (PI) with the Avionics Engineering Center at Ohio University since 1999. He obtained his M.S.E.E. degree from Delft University in The Netherlands in 1994 and a Ph.D. in Electrical Engineering from Ohio University in Athens, Ohio in 1999. He has authored or co-authored has authored or co-authored over 140 navigation-related publications and seven book chapters. |
| | **Autonomy II** |
| **Artificial Intelligence and Relations to Avionics** | In this course we are going to introduce concepts of decission making conducted by algorithms which led to current term Artificial Intelligence. The course is built around flight planning algorithms, their performance and sutability for different applications. Within our session we will focus on and summarize advantages and disadvantages of Breadth First Search, A*, Iterative Deepening A*, Theta*, and RRT* algorithms. Their reasoning process and path selection methodology with perspective of aerospace requirements are evaluated. Our focus will be on the randomization element and uncertainty of these algorithms. We will also describe selected evaluation parameters required by FAA and EASA Technical Standard Order (TSO) documents on electronic systems and what are the conflicts between these requirements and the natural principle of the existing path-planning algorithms. The influence of the performance of the navigation sensors and expected departure and arrival procedures which use the existing navigation means (INS, VOR, NDB, ILS, GPS) will be discussed. Finally, we describe the Artificial Intelligence phenomena and discuss the determinism of the currently used algorithms for flight-path panning and recovery.<br><br>**PRESENTER BIO**<br>Dr. Pavel Paces works at Artificial Intelligence Center at Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic. He gained MSc and Ph.D. in aerospace engineering. Currently, he leads a group developing solutions for pilot training evaluation and fatigue measurement aiming on human machine interaction, processes and procedures. He received Honeywell Innovator award in 2011, he is member of IEEE Aerospace and Electronic Systems Society and AIAA. |
| **Intelligent Control Architecture for Autonomous Vehicles** | The use of remotely-operated vehicles is ultimately limited by economic support costs, and the presence and skills from human operators (pilots). Unmanned craft have the potential to operate with greatly reduced overhead costs and level of operator intervention. The challenging design is for a system that deploys a team of Unmanned Vehicles (UVs) and can perform complex tasks reliably and with minimal (remote) pilot intervention. A critical issue to achieve this is to develop a system with the ability to deal with internal faults, and changes in the environment as well as their impact on sensor outputs used for the planning phase.<br>The tutorial objective is to present step by step the development process (from requirements to prototyping) of an Intelligent Vehicle Control Architecture (IVCA) that enables multiple collaborating UVs to autonomously carry out missions. The architectural foundation to achieve the IVCA lays on the flexibility of service-oriented computing and agent software technology. An ontological database captures the remote pilot skills, platform capabilities and, changes in the environment. The |

information captured (stored as knowledge) enables reasoning agents to plan missions based on the current situation. The combination of the two above paradigms makes it possible to develop an IVCA that is able to dynamically reconfigure and adapt itself in order to deal with changes in the operation environment. The ability to perform on-the-fly re-planning of activities when needed increases the chance to succeed in a given mission. The IVCA realization is underpinned by the development of fault-tolerant planning and spooling modules (fault diagnosis and recovery) as well as a module called matchmaker to link services with available capabilities.
The IVCA is generic in nature and can be easily adapted to UVs from different domains (i.e. land, water, and air/space). However, the IVCA aims at a case study where Unmanned Marine Vehicles (UMVs) are required to work cooperatively. They are capable of cooperating autonomously towards the execution of complex activities since they have different but complementary capabilities. The above UMV configuration, where the marine robots are tasked to autonomously do mission works before recovery, is possible at a cost of endowing the UMVs with “intelligence” that in former solutions is provided by remote or even in-situ human pilots.
The IVCA development applies the software/systems engineering principles. The tutorial is structured in four parts. Part I (background) consists of a brief review of technologies related to the IVCA and a comparison of control architectures for autonomous UVs. Part II (requirements analysis and design) entails the user and system requirements, and the system architecture specification/design. Part III (implementation and integration) describes the IVCA realization based on Robot Operating System (ROS) for the above case study. Session IV (verification and validation) deals with the evaluation of the IVCA by means a simulation.

**PRESENTER BIO**
Dr. Carlos C. Insaurralde is a Senior Lecturer in Electronic Engineering in the Department of Engineering Design and Mathematics, University of the West of England, UK. His roles are Programme Leader BEng(Hons) Robotics and Module leader for courses from the Electronic Engineering and Robotics programmes. He received the MEng degree in Electronics from the National University of Cordoba, Argentina, in 1999, the MAst and PhD degrees in Computer Engineering (Mention “Doctor Europaeus” accredited by the European University Association) from the Universidad Complutense de Madrid, Spain, in 2005 and 2007 respectively, and the MPhil degree in Electrical Engineering from Heriot-Watt University, UK in 2014. He also received a PgCert in Learning and Teaching in Higher Education from Teesside University, UK in 2017. He is a Fellow of the Higher Education Academy (FHEA), UK and an IEEE Senior Member.
Dr Insaurralde has worked in collaboration with EADS (Airbus and Eurocopter), and BAE Systems as well as in different industrial sectors (aerospace, defense, maritime, and industrial automation). He has over twenty years of hands-on experience in software engineering, including over ten years of engineering research experience in robotics and autonomous systems. He is author of over eighty international publications, including a book and five book chapters. He is also author of fifteen technical project reports. His background is in architectures of intelligent and autonomous systems, multidisciplinary development of high-integrity systems, and metric assessment of systems performance. His research interest mainly focuses on intelligent automation and autonomy, including decision-making support for Air Traffic Management (ATM).

# Tutorial Descriptions: Monday, October 12

## Autonomy and Security – II

### Aviation Cyber-Security Regulation: Introduction to the DO-326/ED-202-Set

The international standards D-326A (U.S.) and ED-202A (Europe) titled "Airworthiness Security Process Specification" are the cornerstones of the "DO-326/ED-202 Set": the only Acceptable Means of Compliance (AMC) by FAA & EASA for aviation cyber-security airworthiness certification, as of 2019. The "DO-326/ED-202 Set" also includes companion documents DO-356A/ED-203A: "Airworthiness Security Methods and Considerations" & DO-355(A)/ED-204(A): "Information Security Guidance for Continuing Airworthiness" (U.S. & Europe) and ED-201: "Aeronautical Information System Security (AISS) Framework Guidance" & ED-205: "Process Standard for Security Certification / Declaration of Air Traffic Management / Air Navigation Services (ATM/ANS) Ground Systems" (Europe only).
This 3-hour fast-paced course will introduce attendees to the background, structure, basic concepts and essential practices of this new, unavoidable set of standards.
WHO SHOULD ATTEND
Attendees may include managers, engineers, quality assurance, certification personnel – as well as aircraft manufacturers, operators, maintainers, service providers and other aviation stakeholders, who need to prepare for Cyber-Security regulatory compliance of their aircraft/systems/organizations.

**PRESENTER BIO**
Aharon David is the Chief WHO (White Hat Officer) of AFuzion-InfoSec, providing Aviation Cyber-Security Certification training & consulting services worldwide.
Since 1981, Mr. Aharon David has worked in engineering of software and systems avionics, including junior-to-senior technical management positions. Among other duties, Mr. David served as the commander of the Israeli Air Force's Avionics & Control Software-development Center (ACSC) and head of System-Engineering & Interoperability of the Israeli Missile Defense Organization (IMDO) – and along the way developed, taught & commanded technical courses in the US and Israel, and was a speaker at international technical conferences.
In recent years, Mr. David has been a senior advisor to the Civil Air Authority of Israel (CAAI), specifically on software certification and Cyber-Security. He is currently a member of both RTCA's SC-216 & EUROCAE's WG-72 "Aeronautical Systems Security", as well as all other aviation cyber-security standard-making committees, such as SAE G-32 and others.
Mr. David holds a BSc in Aerospace Engineering from the Technion – Israel's Institute of Technology, and an MBA from the Tel-Aviv University.

### Machine Learning for Avionics

In this course we will explore the term machine learning and define algorithms to be generally considered as machine learning. The course is built around use cases where machine learning can provide advantage in form of time and cost savings. We are going to link the use of machine learning to existing algorithms used for system diagnostics which include signal processing algorithms, feature extraction and classification methods. The tutorial will begin with Signal to Noise Ratio, variance, Standard Deviation and FFT which can be used for unsupervised, supervised and reinforcement learning where such as regression, k-nearest neighbors and other algorithms are used. The tutorial will also introduce the basics of the neural networks, their design and pros and cons with explanation why certification authorities do not accept systems using neural networks for safety critical applications. The tutorial will be concluded by a use case utilizing machine learning with data classification algorithms for automatic recurrent testing of avionics software modifications.

**PRESENTER BIO**
Dr. Pavel Paces, Czech Technical University in Prague, Czech Republic
Pavel Paces is currently member of Artificial Intelligence Center and Department of Aerospace Technologies at Czech Technical University in Prague, Czech Republic. He graduated from Electrical Engineering in 2005 and got his Ph.D. in Aerospace Engineering in 2011 at the same

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| | university. Pavel has past experience with aerospace sensors development, flight simulators certification and business development. |
| **Intermediate Essentials for Avionics Certification via DO-178C (software) and DO-254 (Hardware)** | DO-178C (ED-12C) and DO-254 (ED-80) are arguably the world's most difficult software and hardware "standards" and many millions of lives rely on it yearly. But software/hardware development has rapidly evolved along with aircraft design: many new technologies must be considered, and certified: VHDL, IP Cores, C++, Model-Based Development, Multi-core, non-CPU based logic, and advanced tools. New techniques for specifying avionics requirements and design must also be understood. But what are detailed and derived DO-178C/254 requirements? How can C++ and OOT be safely used and certified per DO-332? What are DO-178C Model-Based Development best practices in applying DO-331? What are the answers to applying DO-178C's Parameter Data Items? What were the DO-178B weaknesses and how is DO-178C really different from DO-178B? How can DO-178C/254 cost and schedule be reduced by 20-30%?<br>This intermediate DO-178C/254 training is intended for persons with basic familiarity of DO-178 or safety-critical standards or beginners ready for a quick challenge.<br>KEY FEATURES:<br>• Quick refresher on basic DO-178C/254 and "how" they ares applied to advanced avionics<br>• Grasp key differences between DO-178B and DO-178C for more advanced users<br>• Advanced Safety, Derived Requirements, and Detailed DO-178C/254 Requirements<br>• Understanding advanced DO-178C/254 mistakes and best practices to avoid them including model based development, OOT, and C++<br>• Controlling engineering cost/risks with DO-178C/254 Requirements, Design, and Logic<br>• Understanding & applying Aviation Supplements for: DO-330/ED-215 Software Tool Qualification; DO-331/ED-216 Model-Based Development and Verification; DO-332/ED-217 Object-Oriented Technology<br>• Data flow / control flow and Coupling Analysis<br>WHO:<br>Attendees may include engineers, managers, quality assurance or certification personnel with previous knowledge, training, or experience in DO-178/254 or safety-critical engineering.<br><br>**PRESENTER BIO**<br>Mr. Vance Hilderman is Afuzion's director of Avionics Certification. Holding a BSEE and MBA from Gonzaga University, and a Masters in Computer Engineering from USC (Hughes Fellow). Mr. Hilderman was previously the co-founder of TekSci (the world's largest avionics software services company in the '90's), HighRely, and now AFuzion – performing technical avionics software/certification development at companies throughout the world.<br>Mr. Hilderman has focused on safety-critical avionics software, systems, hardware development and related technical products for 25 years. Considered an expert on safety critical software/computer systems and certification, Mr. Hilderman has consulted with ninety five of the world's one hundred largest aerospace companies plus numerous medical, industrial and telecommunications entities Mr. Hilderman has trained over 17,600 avionics engineers and managers in 40 countries on DO-178B, ARP-4754, DO-178C, DO-254, DO-200A, DO-297, and safety/software development.<br>Mr. Hilderman is the principal author of dozens of technical whitepapers and avionics training protocols, plus the world's best-selling book on avionics development/certification, published by Avionics Communications and titled "Avionics Certification – A Complete Guide …"; all royalties are donated to the Boy Scouts of America where Mr. Hilderman and two of his sons are Eagle Scouts. Mr. Hilderman will soon be publishing his next book to be titled "The Avionics Development Ecosystem" published by Afuzion Press. |

# 39th DASC Conference Tracks

**Track 1: Air Traffic Management (ATM) Machine Learning & Automation Chairs**

Rainer Koelle
*Eurocontrol*

Billy Josefsson
*Sweden*

**Track 2: ATM – Airspace & Spectrum Management Chairs**

Jason Glaneuski
*DOT/Volpe Center*

Scott Crawford
*Raytheon*

**Track 3: Unmanned Aircraft Systems (UAS) Chairs**

Steve Young
*NASA Langley*

Brandon Suarez
*General Atomics Aeronautical Systems*

**Track 4: Communications, Navigation, and Surveillance and Information Networks (CNS) Chairs**

Dr. Michael Schnell
*German Aerospace Center (DLR)*

Daniela Kratchounova
*FAA*

**Track 5: Human Factors (HF) Chairs**

Divya Chandra
*Volpe*

Jan Boril
*University of Defence*

**Track 6: Special Topics & Space Systems (STSS) Chairs**

Yemaya Bordain
*Intel Corporation*

Michael McLelland
*SRI*

**Track 7: Cybersecurity and Software (CSS) Chairs**

Steve Vanderleest
*Rapita Systems*

Rafael Apaza
*NASA Glenn Research Center*

**Track 8: UAS Traffic Management Chairs**

Roger Oliva
*US Government Consultant*

Cesar Munoz
*NASA Langley*

**Track 9: Integrated Modular Avionics and Technologies (IMA) Chairs**

Laurence Mutuel
*Honda Aircraft Company*

Paul Miner
*NASA Langley*

# Technical Sessions I: Tuesday, October 13

| | 16:00 | 16:30 | 17:00 | 17:30 |
|---|---|---|---|---|
| **Flow Management – Efficient Airspace Operations (Track 1)**<br>Chair: Hyo-Sang Yoo (NASA) | **National Airspace System (NAS) Traffic Flow Management (TFM) Collaboration: Building Collaboration Into Dashboard Design**<br>Sara Wilkins, MITRE Corporation | **Incorporating User Preferences in Time-Based Flow Management Operations**<br>Sergio Torres, Leidos, Inc. | **Analysis and Modeling of Air Traffic Trajectories Uncertainty in Chinese Airspace**<br>Keyao Yu, Beihang University | |
| **Applications (Track 3)**<br>Chair: Andrew Moore (NASA) | **Autonomous Spacecraft Inspection with Free-Flying Drones**<br>Sami Mian, University of Pittsburgh | **Mask R-CNN Powerline Detector: a Deep Learning Approach with Applications to a UAV**<br>Srikanth Vemula, University of the Incarnate Word | | |
| **DAA/CDR 1 (Track 3)**<br>Chair: Steve Young (NASA) | **Terminal Area Size and Switching Technique Analysis for Unmanned Aircraft Systems Operations**<br>Sagar Kc, NASA Langley Research Center | **Alert Timing Assessment for Unmanned Aircraft System Terminal Area Operations**<br>Devin Jack, Adaptive Aerospace Group | **Vision-Based State Estimation and Collision Alerts Generation for Detect-and-Avoid**<br>Jaehyun Lee, Korea Advanced Institute of Science and Technology | |
| **Future Communications (Track 4)**<br>Chair: Paul Diffenderfer (The MITRE Corporation) | **Advanced Physical-Layer Technologies in VHF Data Link Communications**<br>Hosseinali Jamal, University of South Carolina | **A New Spectrum Management Concept for Future NAS Communications**<br>Eric Knoblock, NASA Glenn Research Center | **Multicarrier Spectral Shaping Performance in Non-White Interference Channels: Experimental Results**<br>Hosseinali Jamal, University of South Carolina | |
| **UTM 1 (Track 8)**<br>Chair: Maria Consiglio (NASA) and Cesar Munoz (NASA) | **The Legal Framework of UTM for UAS**<br>Richard Ryan, Cranfield University | **Unmanned Aircraft Systems Traffic Management: a Comparsion on the FAA UTM and the European CORUS ConOps Based on U-Space**<br>Joonas Lieb, German Aerospace Center | **If You Can't Measure U-Space, You Can't Improve It**<br>Laurence Rognin, European Organisation for the Safety of Air Navigation | **Lessons Learned: Using UTM Paradigm for Urban Air Mobility Operations**<br>Savita Verma, NASA Ames Research Center |
| **Fundamentals of Design Assurance (Track 9)**<br>Chair: Laurence Mutuel (Northrop Grumman Corporation) | **An Analysis of Implementing PVS in SPARK Ada Ashlie Hocking, Jonathan**<br>Ashlie Hocking, Dependable Computing, LLC | **Functional Safety for Braking System Through ISO 26262, Operating System Security and DO 254**<br>Mohini Yadav, Mirabilis Design Inc. | **Bus Network Architecture- and Technology Optimisation for Avionic Systems**<br>Martin Halle, Hamburg University of Technology | |

# Technical Sessions II: Wednesday, October 14

| | 11:00 | 11:30 | 12:00 | 12:30 |
|---|---|---|---|---|
| **Advanced Data Techniques (Track 1)**<br>Chair: Brian Hilburn (Linkoping University) | **Multiclass Geospatial Object Detection Using Machine Learning-Aviation Case Study**<br>Durga Prasad Dhulipudi, International Institute of Information Technology Hyderabad / Honeywell | | | |
| **HMI and ATCO Support (Track 1)**<br>Chair: Carl Westin (Linkoping University) | **Machine Learning of Air Traffic Controller Command Extraction Models for Speech Recognition Applications**<br>Hartmut Helmke, German Aerospace Center | **Precision Four-Dimensional Digital Mapping Teaches Humans and Machines to See in the Dark**<br>Julian Thomson, Performance Software Corporation | **Human-Machine Interactions in Very-Low-Level UAS Operations and Traffic Management**<br>Nichakorn Pongsakornsathien, RMIT University | |
| **GNC 1 (Track 3)**<br>Chair: Maarten Uijt de Haag (TU Berlin) | **Image-Based Guidance of Autonomous Aircraft for Wildfire Surveillance and Prediction**<br>Kyle D. Julian, Stanford University | **Multi-Axis Control for Small UAS VTOL Autopilot**<br>Sherif Ali, General Electric Aviation Systems | **Interferometric Vision-Based Navigation Sensor for Autonomous Proximity Operation**<br>Kookjin Sung, Texas A&M University | |
| **Operations (Track 3)**<br>Chair: Max Friedrich (DLR) | **Security Concept for Unoccupied Aerial Systems**<br>Cora Perner, Airbus Cybersecurity GmbH | **Taking Autonomy Out-of-the-Loop – Novel Methodology for the Development and Automated Operation of UAS in Integrated Airspace**<br>Pranav Nagarajan, Technical University of Munich | **A Concept of Airspace Configuration and Operational Rules for UAS in Current Airspace**<br>Bizhao Pang, Nanyang Technological University | |
| **Navigation (Track 4)**<br>Chair: Nils Maeurer (German Aerospace Center) | **Flight Testing GLS Approaches Using SBAS with the DLR A320 Advanced Technology Research Aircraft**<br>Thomas Dautermann, German Aerospace Center | **Precise UWB-Based Localization for Aircraft Sensor Nodes**<br>Cansu Gözde Karadeniz, Airbus Central R&T | | |
| **Pilot Factors (Track 5)**<br>Chair: Vladimir Socha and Lenka Hanakova (Czech University in Prague) | **BDAM Model for Testing the Resistance of Air Force Pilots to Hypoxia**<br>Jan Boril, University of Defence | **Software Solution for Visualization and Evaluation of Flight Data in Terms of Competency-Based Training**<br>Tomas Malich, Czech Technical University in Prague | | |
| **UTM 2 (Track 8)**<br>Chair: Louis Glaab (NASA) and Anuja Verma (MITRE) | **Small UAS Demand Estimation**<br>Sricharan Ayyalasomayajula, Intelligent Automation, Inc. | **Accessibility Analysis of Unmanned Aerial Vehicles Near Airports with a Four-Dimensional Airspace Management Concept**<br>Wei Dai, Nanyang Technological University | **Lost C2 Link Contingency Procedures for Seoul TMA and Assessment on Safety and Controller Workload**<br>Hyeonwoong Lee, Inha University | |
| **Communication Applications (Track 9)**<br>Chair: Paul Miner (NASA) | **Evaluation of RF Wireless Power Transfer for Low-Power Aircraft Sensors**<br>Jan Tepper, Airbus, Central Research and Technology | **Performance Analysis of the Avionics Power Line Communication by Stochastic Network Calculus**<br>Ruowen Yan, Beihang University | **SDR- and UAV-Based Wireless Avionics Intra-Communication Testbed**<br>Justin Parkhurst, Embry-Riddle Aeronautical University | **Routing Optimization of Time-Triggered Ethernet Based on Genetic Algorithm**<br>Zhong Zheng, Beihang University |

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| **Multicore Processor Assurance and Navigation Applications (Track 9)**<br>Chair: Steve VanderLeest (Rapita Systems) | **Measuring the Impact of Interference Channels on Multicore Avionics**<br>Steven VanderLeest, Rapita Systems, Inc. | **Chip-Level Considerations to Enable Dependability for eVTOL and Urban Air Mobility Systems**<br>Jyotika Athavale, Intel Corporation | **Integrated Guidance, Navigation, and Control System for Tactical Missile Applications**<br>Venugopal Reddy Bogala, Defence Research and Development Organisation | **UAV-Based Measuring System for Terrestrial Navigation and Landing Aid Signals**<br>Justin Parkhurst, Embry-Riddle Aeronautical University |

# Technical Sessions III: Wednesday, October 14

| | 16:00 | 16:30 | 17:00 | 17:30 |
|---|---|---|---|---|
| **Surface Movement Management (Track 1)**<br>Chair: Billy Josefession (LFV) | **3D Modeling of the Airport Environment for Fast and Accurate LiDAR Semantic Segmentation of Apron Operations**<br>Hannes Brassel, Technische Universität Dresden | **Predicting Gate Conflicts at Charlotte Douglas International Airport Using NASA ATD-2 Fused Data Sources**<br>William Jeremy Coupe, NASA Ames Research Center | **Strategic Surface Metering at Charlotte Douglas International Airport**<br>Isaac Robeson, Mosaic ATM, Inc. | |
| **Advanced Concepts – Research and Technologies (Track 2)**<br>Chair: Daniel Finkelsztein (KBR) | **Self-Structuring Route Network for Free Route Traffic**<br>Ingrid Gerdes, German Aerospace Center | **Investigating Effects of Controlled Flights Through Fast-Time Simulation**<br>Zhifan Zhu, KBR Wyle Services, LLC | **Applicability of Current Complexity Metrics in ATM Performance Benchmarking and Potential Benefits of Considering Weather Conditions**<br>Thomas Standfuss, Technische Universität Dresden | |
| **GNC 2 (Track 3)**<br>Chair: Evan Dill (NASA) | **Autonomous UAV Navigation in Dynamic Environments with Double Deep Q-Networks**<br>Yupeng Yang, Embry-Riddle Aeronautical University | **Rule-Based Path Planning for Unmanned Aerial Vehicles in Non-Segregated Air Space Over Congested Areas**<br>Markus Ortlieb, Volocopter GmbH | **Terrain Referenced Integrity Monitor for an Unmanned Aircraft Systems Precision Approach**<br>Andrew Videmsek, General Atomics Aeronautical Systems Inc. | |
| **DAA/CDR 2 (Track 3)**<br>Chair: Brandon Suarez (General Atomics) | **UAS Pilot Performance Comparisons with Different Low Size, Weight and Power Sensor Ranges**<br>Kevin Monk, NASA Ames Research Center | **Real-Time HW and Human-in-the-Loop Simulations for the Validation of Detect and Avoid Advanced Functionalities in ATM Future Scenarios**<br>Gianluca Corraro, Italian Aerospace Research Centre | **A Human-in-the-Loop Evaluation of ACAS Xu**<br>Conrad Rorie, NASA Ames Research Center | **A Distributed Conflict Detection and Resolution Method for Unmanned Aircraft Systems Operation in Integrated Airspace**<br>Ke Shi, Beihang University |
| **Positioning and Collision Avoidance (Track 4)**<br>Chair: Daniela Kratchounova (FAA) | **Communications and High-Precision Positioning (CHP2): Secure Traffic and Resource Management Using Reinforcement Learning**<br>Owen Ma, Arizona State University | **Communications and High-Precision Positioning (CHP2): Enabling Secure CNS and APNT for Safety-Critical Air Transport Systems**<br>Sharanya Srinivas, Arizona State University | **A Neuro-Inspired Approach to Intelligent Collision Avoidance and Navigation**<br>Sami Mian, University of Pittsburgh | **Acoustic Positioning and Navigation System for Micro Aerial Vehicle Navigation**<br>Rohan Kapoor, RMIT University |
| **Displays 1 (Track 5)**<br>Chair: Chiemi Heil (USDOT Volpe Center) and William Penhallegon (MITRE) | **Flight Technical Error in Using Head-Up Display with Localizer Guidance in Lieu of Required Infrastructure for Takeoff**<br>Mark Humphreys, Precision Approaches | **Designing Training Scenarios for Stressful Spaceflight Emergency Procedures**<br>Tor Finseth, Iowa State University | **Impact of ATD-2 Tools on Human Factor Metrics at Charlotte Douglas International Airport**<br>Bonny Parke, San José State University / NASA Ames Research Center | |
| **Conflict Management (Track 8)**<br>Chair: Carlos Varela (Rensselaer Polytechnic Institute) and Roger Oliva (IEEE) | **Onboard Autonomous Sense and Avoid of Non-Conforming Unmanned Aerial Systems**<br>Brendan Duffy, National Institute of Aerospace | **Strategic Deconfliction of Heterogeneous Multiple Unmanned Aerial Vehicles Using Direct Trajectory Optimization**<br>Min-Guk Seo, Cranfield University | **Rule-Based Conflict Management for Unmanned Traffic Management Scenarios**<br>Abdulrahman Alharbi, Cranfield University | **Learning-to-Fly RL: Reinforcement Learning-Based Collision Avoidance for Scalable Urban Air Mobility**<br>Kuk Jin Jang, University of Pennsylvania |

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| **Architecture and Machine Learning (Track 9)**<br>Chair: Paul Meng (GE Research) | **Why CPM Is Not CPM – Enabling Standardized Safety Mechanisms on Off-the-Shelf IMA Modules**<br>Julian Schoepf, University of Stuttgart | **Automatic Synthesis of Information Flow Driven Execution Managers for Embedded Software Applications**<br>Nikita Visnevski, GE Research | **Aircraft Weight Estimation During Take-Off Using Declarative Machine Learning**<br>Sinclair Gurny, Rensselaer Polytechnic Institute | **Latent Dirichlet Allocation (LDA) for Anomaly Detection in Avionics Networks**<br>Adam Thornton, Southwest Research Institute |

# Technical Sessions IV: Thursday, October 15

| | 11:00 | 11:30 | 12:00 | 12:30 |
|---|---|---|---|---|
| **Flow Management – Applications (Track 1)**<br>Chair: Bernd Korn (DLR) | **Live Trials with an Innovative Prototype Dedicated to Arrival Flow Management in Paris**<br>Marc Azoulay, Direction des Services de la Navigation Aérienne | **CDO Sensitivity Analysis for Robust Trajectory Planning Under Uncertain Weather Prediction**<br>Shumpei Kamo, Technische Universität Dresden | **OpenSky Report 2020: Analysing in-Flight Emergencies Using Big Data**<br>Xavier Olive, ONERA | |
| **Emerging Trends & Technologies (Track 2)**<br>Chair: Dylan Hasson (USDOT Volpe Center) | **Path Steering Error & Turn Analysis of Multiple Aircraft in the Current ECAC Fleet**<br>Ferdinand Behrend, Lufthansa Aviation Training | **Estimating UAM Network Load with Traffic Data for Munich**<br>Magdalena Peksa, Technical University of Munich | | |
| **GNC 3 (Track 3)**<br>Chair: Evan Dill (NASA) | **Usage of the Domain Specific Languages for Creating UAV Flight Control and Autonomy Systems**<br>Ivan Makarov, Catalyst Aerospace Technologies | **Coordination and Path Planning of Cooperative UAVs in RF Localization and Relay Network**<br>Mary Martin, Georgia Institute of Technology | **Where's WALL-E? a Comparison of the Extended Kalman Filter and Hybrid Inference for Pose Estimation in MAVs**<br>Roger Milroy, Royal Holloway, University of London | |
| **Communications for Drones, UAVs, and GA (Track 4)**<br>Chair: Thomas Dautermann (German Aerospace Center) | **Aviation Scenarios for 5G and Beyond Matti, Johns, Khan,**<br>Andrei Gurtov, Linkoping University | **Quality of Service Study in Synchronized Time-Triggered Aerial Networks**<br>Nahman Tariq, Cranfield University | **Authentication and Authorization Challenges for Controller-Pilot Information Exchange Using Mobile Devices**<br>Paul Diffenderfer, MITRE Corporation | |
| **Displays 2 (Track 5)**<br>Chair: Peter Chudy (Brno University of Technology) and Jonas Lundberg (Linkoping University) | **Controller Initiation and Monitoring of a Relative Spacing Task During Parallel Runway Operations**<br>William Penhallegon, MITRE Corporation | **Virtual Cockpit Instruments on Head-Worn Displays for Helicopter Offshore Operations in Confined Areas**<br>Johannes Maria Ernst, German Aerospace Center | **Flight Crew Conduct of a Relative Spacing Task During Parallel Runway Operations**<br>Bridget Lewis, MITRE Corporation | **Simulation Study of Technology for Predicted Flight Deck Alerting of Energy**<br>Timothy Etherington, NASA Langley Research Center |
| **Modeling and Analyses (Track 6)**<br>Chair: Jyotika Athavale (Intel Corporation) and Rob Atkinson (Mercury Systems) | **Understanding General Aviation Accidents in Terms of Safety Systems**<br>Justin Fuller, University of Tulsa | | | |
| **Model-based Development, Requirements (Track 7)**<br>Chair: Michael Durling (GE Global Research) and Paul Meng (GE Research) | **Model Based Safety Analysis (MBSA) Tool for Avionics Systems Evaluation**<br>Akram Abdellatif, Technical University in Munich / German Aerospace Center | **System Architecture Modeling for Electronic Systems Using MathWorks System Composer and Simulink**<br>Christopher Watkins, Gulfstream Aerospace Corporation | | |
| **Situational Awareness (Track 8)**<br>Chair: Jean-Baptiste (University of Michigan) and Roger Oliva (IEEE) | **Trajectory Flight-Time Prediction Based on Machine Learning for Unmanned Traffic Management**<br>Claudia Conte, University of Naples Federico II | **Flight Test Results of a Distributed Merging Algorithm for Autonomous UAS Operations**<br>Andrew Peters, National Institute of Aerospace | **Impact of Packet Loss to the Motion of Autonomous UAV Swarms**<br>Scott James, Noblis | **Navigation-Aware Path Planning for Multiple UAVs in Urban Environment**<br>Flavia Causa, University of Naples, Federico II |

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| **Fundamentals of IMA Assurance (Track 9)**<br>Chair: Paul Miner (NASA) | **Formal Verification Tool Evaluation for Unmanned Aircraft Containing Complex Functions**<br>Heber Herencia-Zapana, GE Global Research Center | **An Assessment Framework for Development Processes of Safety-Critical System Functions Applied to a Model-Based Safety-Critical Middleware**<br>Darbaz Nawzad Darwesh, University of Stuttgart | **Holistic IMA Platform Configuration Using Web-Technologies and a Domain-Specific Model Query Language**<br>Bjoern Annighoefer, University of Stuttgart | **Using a Model Based System Engineering Approach for Aerospace System Requirements Management**<br>Shana Fliginger, Eaton Corporation |

# Technical Sessions V: Thursday, October 15

| | 16:00 | 16:30 | 17:00 | 17:30 |
|---|---|---|---|---|
| **Terminal Maneuvering Airspace Operations (Track 1)**<br>Chair: Hilton Bateman (MITRE) | **Ground Level Aviation Noise Prediction: a Sequence to Sequence Modeling Approach Using LSTM Recurrent Neural Networks**<br>Adan Ernesto Vela, University of Central Florida | **Expedited Successive Departure Operation Concept and Initial Evaluations**<br>Ralf H. Mayer, MITRE Corporation | **A Data-Driven Probabilistic Trajectory Model for Predicting and Simulating Terminal Airspace Operations**<br>Mayara Condé Rocha Murça, Aeronautics Institute of Technology | |
| **Innovation Operations Demonstrations & Evaluations (Track 2)**<br>Chair: Chiemi Heil (USDOT Volpe Center) | **NASA ATD-2 Trajectory Option Set Prototype Capability for Rerouting Departures in Metroplex Airspace**<br>Eric Chevalley, San José State University / NASA Ames Research Center | **TCAS II and ACAS Xa Traffic and Resolution Advisories During Interval Management Paired Approach Operations**<br>Stephanie Priess, MITRE Corporation | **ATD-2 Phase 3 Scheduling in a Metroplex Environment Incorporating Trajectory Option Sets**<br>William Jeremy Coupe, NASA Ames Research Center | |
| **Hazard and Risk Assessment (Track 3)**<br>Chair: Ersin Ancel (NASA) | **Modular Modelling of Ground and Air Risks for Unmanned Aircraft Operations Over Congested Areas**<br>Markus Ortlieb, Volocopter GmbH | **Hazard Analysis of Verification Supporting Arguments for Assured Autonomy**<br>Kimberly Wasson, Federated Safety, LLC | **Melding System Safety Methodologies for a Structured and Comprehensive Risk Assessment of Optionally Manned Aircraft**<br>Laurence Mutuel, Northrop Grumman Corporation | |
| **Systems Engineering, Software Development, and Security (Track 6)**<br>Chair: Michael Epperly (Southwest Research Institute) and Yemaya Bordain (Intel Corporation) | **The Conception of a Large-Scale Systems Engineering Environment**<br>Leandro Batista, Institut Polytechnique de Paris | **Incorporating Agile Methodologies Into Dod Software Sustainment Operations**<br>Lacey Schley, University of Oklahoma | **Hacking Satellites with Software Defined Radio**<br>Kimberly Lukin, Airbus | |
| **Validation & Verification (Track 7)**<br>Chair: Chris Watkins (Gulfstream Aerospace Corporation) and John Stough (JHNA) | **Verifying Autonomous Air Traffic Algorithms in the Presence of Sensor Error and Flight Perturbation**<br>Allan White, NASA Langley Research Center | **Towards Developing Formalized Assurance Cases**<br>Baoluo Meng, GE Global Research Center | **Adaptive Stress Testing of Trajectory Predictions in Flight Management Systems**<br>Robert Moss, Stanford University | **Continuous Testing and Deployment for Urban Air Mobility**<br>Michael Johnson, Performance Software Corporation |
| **Urban Air Mobility (Track 8)**<br>Chair: Eun Oh and Roger Olivia (IEEE) | **A Novel Navigation Performance-Based Airspace Model for Urban Air Mobility**<br>Nichakorn Pongsakornsathien, RMIT University | **City-ATM – Live Drone Trials with Dynamic Geofencing**<br>Alexander Kuenz, German Aerospace Center | **Machine Learning-Based Traffic Management Model for UAS Instantaneous Density Prediction in an Urban Area**<br>Qinru Qiu, Syracuse University | |
| **Runtime Assurance (Track 9)**<br>Chair: Laurence Mutuel (Northrop Grumman Coporation | **Run-Time Assurance for Learning-Based Aircraft Taxiing**<br>Darren Cofer, Collins Aerospace | **Run-Time Assurance: a Rising Technology**<br>Justin Fuller, University of Tulsa | **Runtime Safety Assurance Using Reinforcement Learning**<br>Christopher Lazarus, Stanford University | **White Paper - Next Generation Graphics GPU Shader and Compute Libraries**<br>Robert Pickles, Core Avionics and Industrial Inc |

# Technical Sessions VI: Friday, October 16

| | 8:30 | 9:00 | 9:30 | 10:00 |
|---|---|---|---|---|
| **Design Assurance 1 (Track 3)**<br>Chair: Florian-Michael Adolf (Volocopter) | **Machine Learning for Drone Operations: Challenge Accepted**<br>Elgiz Baskaya, Ecole Nationale de l'Aviation Civile | **Validation of UAS Command and Control Link Switchover Internetworking and Security Requirements**<br>Todd Kilbourne, Mosaic ATM, Inc. | **Advancing Autonomy in Aviation: a Holistic Approach**<br>Stephen Cook, Northrop Grumman Corporation | **Applicability of UL 4600 to Unmanned Aircraft Systems (UAS) and Urban Air Mobility (UAM)**<br>Alfred Anderegg, MITRE Corporation |
| **DAA/CDR 3 (Track 3)**<br>Chair: Erik Theunissen (Netherlands Defense Academy) | **Towards Robust Certification of Computer-Vision-Based Detect and Avoid in UAS**<br>Michael Murphy, AirMap | **Coupling Consensus Based Tasks with Subsumption Architecture for UAS Swarm Based Intelligence Surveillance and Reconnaissance Operations**<br>Prasanna Kolar, University of Texas at San Antonio | **Cloud Detection System for UAV Sense and Avoid: Cloud Distance Estimation Using Triangulation**<br>Adrian Dudek, Bundeswehr University Munich | |
| **Onboard Communications (Track 4)**<br>Chair: Daniel Mielke (German Aerospace Center) | **Using AI for Optimal Time Sensitive Networking in Avionics**<br>Tom Jose, Mirabilis Design Inc. | **Wireless Avionics Intra-Communication (WAIC) QoS Measurements of an Ultra Wideband (UWB) Device for Low-Data Rate Transmissions**<br>Ankit Dwivedi, MCA Engineering GmbH | **In-Flight Entertainment Datalink Analysis and Simulation**<br>Shahid Ayub, Cranfield University | **Managing Multiple High-Speed Sensor Streams with ARINC 818-3**<br>Tim Keller, Great River Technology |
| **UAS and Future Concepts (Track 5)**<br>Chair: Bill Kaliardos (FAA) and Carlos Insaurralde (Bristol Robotics Laboratory) | **A Multi-UAS Platform to Accelerate Situation Assessment in First Response Missions – Identification of User Needs and System Requirements Using Design Thinking**<br>Max Friedrich, German Aerospace Center | **An Approach to Autonomous Contingency Management in Urban Air Mobility: the Communication Network Awareness Machine System**<br>Vincent Houston, NASA Langley Research Center | **Human-System Interaction Issues and Proposed Solutions to Promote Successful Maturation of the UTM System**<br>Cynthia Wolter, NASA Ames Research Center | |
| **Safety, Certification, and Design Assurance (Track 6)**<br>Chair: Tom Ferrell (Job Aviation) and Larry Kinnan (Kinnan Consulting, LLC) | **A Lean and Highly-Automated Model-Based Software Development Process Based on DO-178C/DO-331**<br>Konstantin Dmitriev, Technical University of Munich | **Challenges in Using Neural Networks in Safety-Critical Applications**<br>Hakan Forsberg, Malardalen University | **Value of Design Assurance in Acquisition – Improvements in Cost, Schedule and Quality**<br>Uma Ferrell, MITRE Corporation | **Survey of Certifiable Air Data Systems for Urban Air Mobility**<br>Angelo Lerro, Politecnico di Torino |
| **Cybersecurity (Track 7)**<br>Chair: Jim Marek (Collision Aerospace) and Dongsong Zeng (The MITRE Corporation) | **Simulating ADS-B Attacks in Air Traffic Management**<br>Andrei Gurtov, Linkoping University | **Comparing Different Diffie-Hellman Key Exchange Flavors for LDACS**<br>Nils Mäurer, German Aerospace Center | **Adversarial Attacks on AI Based Intrusion Detection System for Heterogeneous Wireless Communications Networks**<br>Muhammad Ali, University of Bradford | |
| **Formal Verification (Track 8)**<br>Chair: Swee Balachandran (National Institute of Aerospace) and Cesar Munoz (NASA) | **Collaborative Situational Awareness for Conflict-Aware Flight Planning**<br>Saswata Paul, Rensselaer Polytechnic Institute | **Verification of an Airport Taxiway Path-Finding Algorithm**<br>Siyuan He, University of Michigan | **Towards Verification of Neural Networks for Small Unmanned Aircraft Collision Avoidance**<br>Ahmed Irfan, Stanford University | |

# Technical Sessions VII: Friday, October 16

| | 11:00 | 11:30 | 12:00 | 12:30 |
|---|---|---|---|---|
| **Trajectory Classification (Track 1)**<br>Chair: Magnus Bang (Linkoping University) | **Predicting Flight Delay Risk Using a Random Forest Classifier Based on Air Traffic Scenarios and Environmental Conditions**<br>Markus Bardach, Vienna University of Technology | **Prediction of the Propagation of Trajectory Uncertainty for Climbing Aircraft**<br>Thomas Zeh, Technische Universität Dresden | **Clustering Aircraft Trajectories According to Air Traffic Controllers' Decisions**<br>Sharmistha Chakrabarti, University of Central Florida | |
| **Design Assurance 2 (Track 3)**<br>Chair: Steve Young (NASA) | **Resilience by Design Is Mandatory to Support the Certification of the Embedded/Artificial Intelligence of an Autonomous Swarm of Drones**<br>Serge Chaumette, Université de Bordeaux | **Real-Time Fault Detection on Small Fixed-Wing UAVs Using Machine Learning**<br>Murat Bronz, Ecole Nationale de l'Aviation Civile | **Scheduling for Offloading Safety-Critical Applications Within Networked Groups of Vehicles**<br>John Mains, Georgia Institute of Technology | **Unmanned Systems Health Analysis Through Evidential Reasoning Networks**<br>Joel Dunham, Georgia Institute of Technology |
| **Aviation Networks and Communication Resiliency (Track 4)**<br>Chair: Hosseinali Jamal (University of South Carolina) | **On the Vulnerability of Random Access Channels in Aeronautical Communications**<br>Daniel Maximilian Mielke, German Aerospace Center | **Dynamic Network Reconfiguration in Safety-Critical Aeronautical Systems**<br>Cora Perner, Airbus Cybersecurity GmbH | **Deep Learning Approach for the Multilink Selection Problem in Avionic Networks**<br>Doanh Kim Luong, University of Bradford | **Digital Interference Mitigation Technique for the Interoperability of Two SatCom Systems for Small Aircraft**<br>Joe Zambrano, LASSENA-Ecole de Technologies Superieure |
| **Automation (Track 5)**<br>Chair: Sherry Chappell (FAA Human Factor Division – Retired) and Tim Etherington (NASA Langley) | **Building Transparent and Personalized AI Support in Air Traffic Control**<br>Carl Westin, Linkoping University | **Human-Automation Teaming: Unintended Consequences of Automation on User Performance**<br>Philip Smith, Ohio State University | **On the Moral Hazard of Autonomy**<br>Terry Morris, NASA Langley Research Center | **Evaluation of Onboard System State and Path Awareness Technologies During Transport Operations**<br>Timothy Etherington, NASA Langley Research Center |
| **Unmanned, Autonomy, and UAM (Track 6)**<br>Chair: Andrea Baldovin (Intel Corporation) and Florian-Michael Adolf (Volocopter) | **Operational Analysis of Vertiport Surface Topology**<br>Shannon Zelinski, NASA Ames Research Center | **Assured Integration of Machine Learning-Based Autonomy on Aviation Platforms**<br>Ganesh Pai, KBR | **Optimal Control Techniques for Heterogeneous UAV Swarms**<br>Sami Mian, University of Pittsburgh | **Human-Machine System Design for Autonomous Distributed Satellite Operations**<br>Samuel Hilton, RMIT University |

# Posters I: Thursday, October 15

| | 15:00 | 15:12 | 15:24 | 15:36 | 15:48 |
|---|---|---|---|---|---|
| **Poster Session 1 (Track 1)** Chair: Omar Garcia Crespillo (DLR) | **Study of Power Electronics Design of the Incapacitating Device Based on the LED Technology** Jan Leuchter, University of Defence | **Avionics Testing with Artificial Intelligence Support** Pavel Paces, Czech Technical University in Prague | **Adaptive Average Exploration in Multi-Agent Reinforcement Learnin** Garrett Hall, Southwest Research Institute / University of Texas at San Antonio | **Initial Control Strategies for Conflicting Automatic Safety Systems in General Aviation** Zack Kirkendoll, University of Tulsa | **Building Trust in Autonomous System Competence – the DiTA Digital Tower Assistant for Multiple Remote Towers, an Early Concept Evaluation** Carl Westin, Linkoping University |

# Posters II: Friday, October 16

| | 15:00 | 15:12 | 15:24 | 15:36 | 15:48 |
|---|---|---|---|---|---|
| **Poster Session 2 (Track 4)** Chair: Dongsong Zheng (The MITRE Corportation) | **Low-Power ADS-B for GA Operating in Low Altitude Airspace** Marketa Palenska, Honeywell | **Natural Language Processing for Autonomous Identification of Impactful Changes to Specification Documents** Somer Falkenstine, Southwest Research Institute | **Flight Procedures Automation: Towards Flight Autonomy in Manned Aircraft** Maria Isabel González, Airbus Defence and Space | **Cognitive Computing Intelligence to Assist Avionics Analytics** Carlos Insaurralde, Bristol Robotics Laboratory | **Artificial Intelligence Engineering for Aerospace Applications** Carlos Insaurralde, Bristol Robotics Laboratory |

# DASC 40th

## Digital Avionics Systems Conference

San Antonio, Texas, USA – September 28-30, 2021

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# CALL FOR PAPERS

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**Mr. Nils Smith**
Southwest Research Institute (SWRI)
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## IMPORTANT DATES

**Submission Deadlines**

**March 19, 2021**
Abstract Submission

**April 9, 2021**
Notification of Acceptance

**May 14, 2021**
Full Paper Submission
(If Editorial Review is Requested)

**July 16, 2021**
Final Paper Submission Deadline

**Conference Dates**

**September 26-27, 2021**
Tutorials

**September 28-30, 2021**
Conference

The 40th Digital Avionics Systems Conference (DASC) promises to continue its rich tradition as the preeminent R&D Conference in the field of digital avionics offered.

In addition to the increasingly diverse background of attendees and relevant technical topics discussed, the conference offers a conducive environment for educational and recreational opportunities for everyone to explore. We are positive that you will have a memorable and educational experience at the 40th DASC.

## CONFERENCE THEME

### Integrating humans and increasingly autonomous systems in air transportation.

There has been much recent emphasis on the application of autonomy in avionics and impacts on safety. As we move to accept automation in flight systems, UAS platforms, and interaction with ground and space-based systems the need to address interaction with humans, be they pilots, controllers, passengers, or users remains of high concern. This is overlaid on top of current safety requirements, increasing security requirements, and the emergence of machine learning in design and operation. The 40th DASC will explore the integration of human and increasingly autonomous systems within the air transportation system. Conference participants are invited to submit cutting edge research papers and exchange diverse perspectives on application of autonomy alongside humans while maintaining safety and security. Original research on technical challenges, gaps and approaches to enhance traditional ATM, UAS, CNS, IMA, security, space systems, and human factors are also invited.

### Areas of emphasis will include:

- Machine Learning in Practice
- Adaptive Networks
- Cognitive Assistants
- Safety Assurance and Human Factors
- Integration of Autonomous Vehicles
- Multi-modal Interaction to support human-autonomy teaming
- Security/Assurance
- Single pilot and reduced crew operations
- Trust in automation
- Certification

### Other Topics

The 40th DASC will continue to offer opportunities to publish and present on a wide range of topics of interest to the avionics technology community (see next page).

### Papers, Panels, Education and Workshops

The Technical and Professional Education Programs will incorporate technical research papers and relevant tutorials from international Researchers, Innovators, Engineers, Users, and Designers. Plenary panel discussions and keynote presentations by Leaders in Industry, Government and Academia will discuss topics that are shaping international developments.

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