

AvioSE'22

4th Workshop on Avionics Systems and Software Engineering

>> AvioSE '22



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Papers & Presentations

Leave a comment or question to our authors

Paper 1: An Anthropomorphic Approach to establish an Additional Layer of Trustworthiness of an AI Pilot - Christoph Regli and Bjoern Annighoefor

What about the aeromedical examination of the AI?
tbd. e.g. a watchdog, or tasking the AI pilot and checking its responses.

ASIL AI has been certified in automotive!
Highly interested in the lessons learned. - Note: "Level 3" in automotive is not the same as "Level 3" according to EASA.

Are there any ideas about legal responsibilities?
This is a major issue, requiring further clarification. Is it the manufacturer, the operator, ... ?

Is it important for examining an AI pilot that the exact tasks are not known ahead of the examination?
A: In analogy to manned aviation: The exact check program is not known to the trainees prior to the check.

Feedback to the AI pilot?
Will most probably a multi-dimensional feedback, for a deep reinforcement learning.

Paper 2: Static Analysis Methodologies for WCET Calculating with Asynchronous IO - Georg Seifert

Information on synchronized access can be incorporated.

Is the WCET bound mathematically guaranteed?
As long as the static, conflict free calculation of the WCET (as it is taken from State of the Art Tools) is trustworthy, the concept is mathematically guaranteed.

What about while loops?
For while-loops with an upper bound, it is no problem. For unbounded while-loops, also no static, conflict free WCET can be calculated.

Are failure condition included in the WCSDF? Fault robustness?
It depends on what "failure condition" and "Fault robustness" means: For external problems, like flooding the bus system, the calculation can be done using the minimum distance of two messages on the bus, by an increase of the WCSF. For breakdown of the DMA-C or an interface, like a configuration error, is not part of the concept and has to be solved on higher level.

Paper 3: A Multi-Platform Small Scale Drone Demonstrator for Technology Maturation of Next Generation Avionic Functions - Michael Pickard, Philipp Ludewig, Jens Halbig and Bernhard Krach

"today's aviation challenges are digital"

Does your platform help with certification issues?
A: No. The key of the platform is technology prototyping with minimal regulatory barriers.

How do you guarantee that added devices/SW cannot manipulate your safe trajectory for example? Is there any kind of usage domain limiting software?
A: Outsourced to pretesting in SIL environment. Also default mode for flight controller (MW)

What about urban environments?
A: permission exists for VLOS

What is the mission you are trying to fulfil with the group of drones? Surveillance?
A: The mission of the drone group is to create a prototyping test bed for swarm applications. These swarm applications could come from a variety of research areas, such as mission group management, trajectory planning for surveillance and detection, coordinated operations, and more.

Q: Are there standards for connected platforms?
A: Communication is realised via ROS DDS

Paper 4: Comparison of Aviation and Automotive Standards and Methods in Terms of Safety and Cybersecurity - Yusuf Akkus and Bjoern Annighoefor

Q: are the conservative methods of aviation really applicable to automotive?
A: In scope of safety there might be no alternative. In other areas it is not possible.

"traffic monitoring and control is an importen area for future security investigations"

Q: Are safety and security in contradiction?
"9/11 vs. Germanwings 9525. Because of the happenings on 9/11, the cockpit doors were reinforced, making it impossible to intrude into the cockpit. This "enabled" the happenings in the course of Germanwings flight 9525."

Q: Does aviation need new agile players?
A: New agile players can also be customers of dinosaurs

Paper 5: Build Your Own Training Data - Synthetic Data for Object Detection In Aerial Images - Lea Laux, Sebastian Schirmer, Simon Schopferer and Johann Dauer

High-resolution satellite data available?
A: No labels available

Virtual training data suitable for real detection?
A: In first tests virtual data degraded the detection accuracy, be cause they tend to be to challenging

Variational auto-encoders?
A: Not known, but will try.

Can also movment or shadows be incorporated into the detection?
A: Not known, but will try.

One issue with image databases is lighting. Can different lighting levels be consideres/generated?
A: Not known, needs to be tested

Generate adversarial images?
A: Not planned.

Paper 6: Extending Behaviour-Driven Development of Avionic Systems to Flight Simulators - Mohamad Ibrahim, Umut Durak and Haseeb Tariq

How can Gherkin be understood by a machine?
A: Currently it is manually translated

Q: Do you see a chance to automatically convert Gherkin to tests in future?
A: That is not very easy. But the progress in NLP front is phenomenal. Who knows, GTP-3 is very capable. It can even design user interfaces from specifications in natural language.

Q: Limited expressiveness of Gherkin? Is this a problem?
A: That is even a very important problem. One approach we are working on is to link gherking to the vocabulary described in an ontology. For the ontology please refer to: <https://arc.aiaa.org/doi/10.2514/6.2017-...>

How do you interact with the pilot through the display?
A: There is no interaction back to the pilot.

Keynote Presentation

Leave a comment or question to our key note speakers

Maarten Uijt de Haag: Assuring Safe Navigation of UAS Swarms in Challenging Environments

Your comments and questions here:

Toy drone electronics vs. safety?!
A: something must happen.

Modular architectures also for peripherals?
A: Yes that would ease setting up misson-specific UAV

Multi-vehicle compatibility?
A: Not much existing of the shelf in this direction.

What communication links are envisioned for the drone-to-drone communication?

A flexibility in payloads is required, different navigation instrumentation depending on the use case.
A: Absolutely, especially for the operation that operate a fleet of vehicles that must be able to support various operational environments. Furthermore, modularity will also allow for payload or sensor for from different vendors to be used as long as the interface is defined.

Christoph Diesch: Certification Challenge of Increasing complex Software Applications

Your comments and questions here:

Q: would a scaled drone platform helped you in certification issues?
A: If the drone platform fulfills the FHA objectives also for hazard consequences of a large airplane failure: yes However, a system to serve a (small) drone, would probably be overdesigned, if it fulfills such objectives

"real-time != safety-critical"

Q: What type of models are meant when talking about "models to assess hardware behaviour"?
A: Hardware models to calculate execution times from for WCET

Q: What is the hardware platform you would wish for from the perspective of certification?
No way around high-volume COTS!

Stephane Poulain: AvioSE'22 Airbus Cabin systems

Your comments and questions here:

Q: What can avionics contribute to zero emission?
A: No green strategy without a new avionics platform.

Q: How important is to use COTS or Open Source SW in the cabin?

"Zero Cost for Customization"

Q: How to ensure secure separation of flight control and personal services? HW or SW?
A: Both SW and HW diods are already in use, but

Q: Is fusing IMA and cabin electronics still a topic?
A: Fusing IMA and Cabin Electronic is a running (difficult) topic: to get the best of both worlds (Low price and high QoS)

Q: Can the integration of personal devices reduce the complexity of cabin electronics?
Not exactly. It can reduce the footprint of the "IFE" System

Do future cabins have windows?
A: Electronic window has been evaluated. It will be mandatory for a wing Aircraft, but psychological PAX acceptance is still tbd.

Panel Discussion

"Safe and secure avionics architectures (e.g. IMA, platforms, multi-core, networks, clouds, middleware)"

Laurent Meilleur (Vice President @ DDC-I), Matthieu Merckling (IMA Senior Expert @ Diehl Aerospace GmbH), Reinhard Wilhelm (Universität des Saarlandes, Germany), George Romanski (Chief Scientific and Technical Advisor @ FAA), Chris Watkins (Sr. Project Manager @ Gulfstream Aerospace Corporation)

What will be the major technical innovation in the next generation of computing modules currently being developed (IMA)?
A: Multi-core

"We experience on-chip interferences for decades"

"Reconfiguration endangers timing."

"WCET"

"The transition to multi-core is dangerous territory"

"Beware of the illusive measures"

"Decoupling of Data and Processing"

A653

"Dynamic reconfiguration is missing"

"Cache interference is a problem", but there are workin addons"

What are the ways to massively increase computing power for new applications in aerospace domain? I.e. what about GPUs/many cores?
A: no application of AI in the safety-critical is forseen

What amount of applications (maybe even partitions) are expected to be hosted on future avionics platforms?

Driving requirements are multi-core and connectivity

"New vehicles have started totally different architectures."

"There is a connection between timing predictability and security"

"Way forward"

"Current standards are to prescriptive". Overarching properties might be a way out.

Which technology will shape future avionics platforms?

Please vote:

- HW TPM/encryption
- AI-Processors
- multi-GB bus systems
- optical communication
- "always online/connected"
- fusion of different type of sensors
- HMI (touchscreens, speech recognition, AR, ...)
- heterogeneous computing
- large-scale datastores
- wireless communication
- multi-core processing
- complex middleware
- HD graphic generator
- interconnected vehicles
- Flexibility and interoperability
- Ground Connectivity

Topics for next AvioSE and Feedback

What did you like?
Comment here:

- "Congrats on a successful and inspiring AvioSE 2022"
- "Toller Workshop"
- "The discussion was indeed interesting. I am looking forward to AvioSE'23!"
- "Great workshop so far!!"
- The keynotes showed a great variety of avionics platforms in reality, but nevertheless showed common issues.

What could be better?
Comment here:

- Please make Covid end!
- Impossible to Move Airtaxi
- Time limit for the panel discussion was exceeded, but still not all topics could be discussed.
- First half of the workshop is hard to join from the US.
- The opening was interesting, but I missed parts because I was not expecting a presentation, because it was named "dial-in".
- I did not received the AvioSE Webex link from the SE.

What shall be the main theme of AvioSE'23?

Please vote:

- Development Process
- Formal Methods
- Upcoming technologies and demand
- Cyber-Security
- Future Education
- future/smart avionic applications and architectures
- New certification standards required? ...how to contribute to the regulatory process.
- Models and simulation in Avionics to support development and operations.