2nd Workshop on Avionics Systems and Software Engineering (AVIOSE'20)

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***Abstract*—Companies are struggling with the complexity of avionics systems. A lot of effort is required for the development of such systems. As appropriate tools and methods are supposed to be an effective lever, there is a high demand for increasing their efficiency. The AvioSE workshop continues to be a forum for people working on increasing the efficiency for the development of avionics systems.**

***Index Terms*—avionics, systems engineering, software engineering, formal methods, model-based, requirement, qualification, certification, simulation, process, tool**

I. Introduction

Aerospace applications depend heavily on software and hardware, but complexity, both safety and security demands, and regulations make their development ambitious. Research progress in development efficiency can be observed to be of uttermost significance. AvioSE'19[1] [2] demonstrated successful exchange and collaboration in technological applications and in methodological approaches. For both areas there is still a large gap between the provision of research results and their wide industrial adoption. Fostering the cooperation between industry and research is the main objective for achieving significant technological progress and enable enhancements in the development process.

In addition, AvioSE'20 addresses **tools and their usage in aerospace**. The tools' underlying concepts, e.g., textual, model-based; the process, e. g. V-model, agile; the tool implementation, e. g. qualified, proprietary, in-house development, open source; and the tool ecosystem, e.g., manual conversion, seamless-tool chain, one-tool-for-all, differ. It shall be figured out with the participants, if there is a most promising approach for the usage of tools and how tools for new methods must look like to gain most benefit in the avionics domain.

II. Workshop Goals

The main objective of the workshop is to accelerate the transfer of knowledge between academia and industry. This workshop provides the enabling platform for these stakeholders to discuss technical, but also process, and educational topics.

The objectives of AvioSE'20 are three-fold: (1) It provides a forum for both, academia and industry, to exchange on new methods, tools, and technologies for avionics systems and software engineering, e.g., model-based development, requirements engineering, formal methods, model-based methods, and virtual methods. The contributions are presented in a scientific format, but the atmosphere of openness during the workshop allows and facilitates detailed discussions. (2) **Tools and their usage in avionics** are selected to be the main topic of AvioSE'20. This is addressed interactively by inviting all participants to discuss aspects of the topic in small groups. The breakdown of the complex tool topic into segments like tool properties, tool qualification, tool integration into the development process, tool implementation, and tool ecosystem, enable the groups to focus on an aspect that can be dealt with during a short period of time. Each breakout group figures out the most important issues of their segment and propose ways how to address them. The results are made available to all participants with the presentations of the breakout groups' conclusions. This facilitates collaborations between researchers from academia and professionals from industry and increases the value of the workshop. (3) AvioSE'20 aims the facilitation of common understanding, goal definitions and prioritization as well as the selection of methodology. Keynotes provided in the beginning of the day share their visions and give the workshop the right spirit. The panel debate closing the workshop, however, let reflect past efforts and opens the mind for new directions and explicitly points to still open challenges.

III. Workshop summary

The AvioSE'20 was partially organized as a conference, which provides presentation slots to accepted papers. Out of six submissions four papers were chosen for presentation. The accepted publications are entitled:

1) Approach to Systematic Test Signal Definition for Operation Scenarios of Aircraft Systems

[1] Annighoefer et al., 1st Workshop on Avionics Systems and Software Engineering (AvioSE'19), 2019.

[2] Annighoefer et al., Challenges and Ways Forward for Avionics Platforms and their Development in 2019, in IEEE/AIAA 38th Digital Avionics Systems Conference (DASC), 2019.

2) Towards Using Formal Methods in Prototyping: Advantage or Impediment?
3) An Approach for Logic-based Knowledge Representation and Automated Reasoning over Underspecification and Refinement in Safety-Critical Cyber-Physical Systems
4) Decentralised Avionics and Software Architecture for Sounding Rocket Missions

In addition, two keynotes are given:

1) FH-Prof. Dipl.-Ing. Dr. Holger Flühr from the FH JOANNEUM. He is professor at the University of Applied Sciences in Graz. He shares with us his perspective on "Avionics: Trends for 2030 and Beyond".
2) Detlef Schiron from Airbus Defence and Space shares insights and experience of industrial avionics systems engineering from the Airbus perspective. He is a senior expert for system simulator and virtual engineering and gives us an "Introduction to Virtual Engineering".

The remainder of the day was used to elaborate with the presenters, keynote speakers, and the audience on different aspects of tools in aerospace system and software engineering. This took place in four break-out groups where each focused on identified challenges within the chosen segment, possible solutions, and strategies. Results were shared in short group presentations. A deeper and more critical reflection on moderators and audience questions was provided by the three panel members.

IV. Conclusion

The focus of the AvioSE'20 interactive parts was the closer look at tools. The aspects being most popular in ascending order were tools for upcoming technologies, tools for development strategies, and tool usability.

Currently, most demanding technology is the application of means offered by Artificial Intelligence. The demand lies not more in the technical benefits of the technology, but instead in new tools for the understanding and qualification of AI's products.

In general, it was concluded that inappropriate tools are often the reason for issues in the development of aerospace systems. Potential root causes assigned to tooling range from unavailability over bad usability to bad support. For some root causes, however, the tool is not the main issue, but the methods and processes that are supposed to be supported by tools.

A remarkable collection of solutions is today developed and published by academia and open source communities. However, their transfer to industry need initial development, professionalisation, and adaptations for industrial environment and processes. Due to different reasons, academia is not the partner to resolve the challenges. Those reasons are located in e.g., different motivation of academia's tool development (e.g., proof of concept, evaluations) and resource allocation. Different to academic tools, open source tools could be utilized, but its application is hampered by company policies.

Another lack was identified in the interlocking of tools and the development process. The right balance between tools stiffness and flexible processes is difficult to meet for tool supplier that serve various customers following different processes. Discussed options for alignment were contracts (on handover) between development stages as well as the feasibility of modular tool design.

Considering the usability of a tool it is stated that well accepted tools serve their purpose and often integrate seamlessly an intuitive user interface. In addition, tool acceptance strongly increases if the tool explains what it does and if users influenced the development. Situations like cockpit development, where this seems impossible, are most challenging.

In conclusion, there is a strong demand for improved tool support for system and software engineering activities in the avionics domain that might be addressed with an active working group in future.

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- Detlef Schiron, Airbus Defence and Space GmbH

as well as the members of the panel

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- Dr. Daniel Dreyer, Airbus Defence and Space GmbH and
- Dr. Levi Lúcio, Airbus Defence and Space GmbH.

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- Dr. Andreas Schweiger, Airbus Defence and Space GmbH
- Katja Stecklina, Philotech Systementwicklung und Software GmbH
- Prof. Dr. Matthias Tichy, Universität Ulm

With the engagement of contributors, program committee, and organization team, the expected interest for the workshop is highlighted. The organization committee is encouraged with the provided feedback and plans to repeat the workshop as part of SE'21.