**Alternative software platforms for the Concurrent Engineering Lab at TU Darmstadt, a concurrent engineering facility for multidisciplinary applications**

J. Hoffmann*1\*; R. Bertrand2*

*1Institute of Flight Systems and Automatic Control TU Darmstadt, Darmstadt, Germany, \*Primary author contact details:* *hoffmann@fsr.tu-darmstadt.de*

*2Institute of Flight Systems and Automatic Control, Joint Professorship Space Systems, European Space Agency ESA/ ESOC - TU Darmstadt, Darmstadt, Germany,* *reinhold.bertrand@esa.int*

1. **Introduction**

In 2019, the European Space Agency (ESA) and the Technical University of Darmstadt signed a Cooperation Agreement "Memorandum of Collaboration” in which both partners committed on joint academic education and research activities. Within the framework of this agreement, the "ESALab@TU Darmstadt" initiative was established where concurrent engineering has been one of the key topics and led to the build-up of the Concurrent Engineering Lab (CEL) at TU Darmstadt, focusing on conceptual design of complex technical systems.

This established concept for designing complex space systems and missions in the very early design phases with a team of experts of different disciplines in a dedicated audio-visual engineering design environment generates effective and time efficient design conditions. CE is a state-of-the-art method within the space industry, commonly applied in space systems conceptual design. Whereas ESOC in Darmstadt is primarily responsible for the operation of all ESA satellites and the engineering of respective ground segment infrastructures, this domain – due to the increased importance and complexity of ground segments and operations – can largely benefit from CE methods. Therefore, one of the objectives of the cooperation is to research, establish and evaluate CE concepts for ground segment and operations design. While concurrent engineering for the space segment in the majority of the use cases can be focused on a standardised set of expert disciplines (e.g. power, thermal, data handling, communications etc.), the engineering design problem for ground segments are usually much more diverse. It includes engineering aspects and disciplines, involving often non-space aspects such as large scale ground data handling, processing and distribution. Consequently, the design process, the models and tools need to follow diversified requirements in a much more agile way.

At the beginning of this year, the new facility for concurrent engineering was established, the Concurrent Engineering Lab (CEL), located on the Lichtwiese campus of TU Darmstadt. In terms of the cooperation, the focus of the application of the CEL is not limited for the use for conceptual design activities. The other objective is the utilisation for academic purposes such as supporting research projects of different university disciplines as well as the implementation of the CE process in education, allowing students to solve a realistic design task based on this method actively.

1. **Content of the paper**

This paper presents the result of a comparative assessment of alternative software platforms for the specific requirements of the Concurrent Engineering Lab at TU Darmstadt. It describes the findings of the research as well as the analysis and selection of the software platforms. The most optimal solution resulting from the evaluation was implemented in the CEL in order to validate the software platform based on a pilot use case. The results of this validation and optimisation approaches to the software platform are discussed in the paper.