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FACILITATING THERMAL ENGINEERING DATA EXCHANGES DURING THE MISSION LIFECYCLE DEMONSTRATED USING A MODEL BASED ENGINEERING HUB

Abstract

The work and recent research towards implementing a Model-Based System Engineering (MBSE) approach throughout the project lifecycle has identified interoperability between tools, models, and domains as being one of the main challenges. A dedicated software and hardware infrastructure is required to support the maintenance of models, especially when these may come from different tools or stakeholders. In this paper, we present the application of the Model Based Engineering Hub in the context of the thermal domain processes and exchanges. In particular, we focus on improving the workflow of some of the core domain processes. The Hub, which had been previously developed to test its applicability to other domains, provides the exchange and storage facilities for all the interdisciplinary data required to maintain the engineering model of the system in question.

The developed use cases are those that were initially identified as having the maximum expected benefit from digitalization. The first use case concerns the heater sizing and data exchange, which is seen as one of the most demanding interface management workflows in the thermal engineering field. The second use case is the automatic mapping of telemetry data received to the thermal model to allow for direct comparison with analysis predictions for correlation purposes or visualization in the form of thermal maps. In order to extend the data model used in the previous Hub applications, we have defined the thermal engineering universe of discourse that fits into the broader scope of the Space System Ontology developments taking place in parallel within the European space industry. The conceptual data model defined using NORMA Pro was translated into a logical data model in SysML2. Finally, both models were translated using custom tooling and templates utilizing RHEA's Kalliope framework into a tangible, operational pilot demonstration, the physical data model, which can be directly plugged into the Hub.

The data used for the demonstration comes from real mission data, like existing heater and thermistor definition tables or measurements from test facilities with time series of temperature readings. By addressing the complexity of the model and data exchanges during the space missions development, the implementation of MBSE methods and tools will ensure that processes are optimized and demonstrate that time and costs can be reduced. The development and demonstration of the proposed solution has been carried out in collaboration with OHB and DEKonsult in the context of an ESA Technology Development Element (TDE) programme.