THALES

MES MODEL ENGINEERING SOLUTIONS

A Roadmap for Model-based Design of Railway Systems

Thales Deutschland – Transportation Systems Division contracted MES to boost model-based system development of rail signalling and safety equipment

Thales is one of the world's leading suppliers of cutting-edge railway signalling solutions for mainline and urban rail, which guarantee the safe, reliable, convenient and efficient transport of passengers and freight. The Thales Deutschland – Transportation Systems Division includes the development centre for innovative solutions for railway signalling and safety systems.

Model-based system development in the railway sector

An extensive regulatory framework combined with an ever-growing complexity of rail systems make traditional, document-centric system development laborious, inflexible and expensive. The automotive sector has predominantly already risen to this challenge by establishing model-based development of safety-critical systems as the most effective solution. Model-based system development should in future also prove to be the best solution in the highly competitive railway sector. Model-based design can increase system development productivity by 40 percent compared to document-centric approaches. Moreover, it significantly reduces the incidence of design flaws and eases the bid process. Thereby it helps master complexity and reduce lead time.

Thales Deutschland – Transportation Systems Division has already begun shifting from document-centric system design to model-based system development in some pilot projects. Thales Deutschland - Transportation Systems contracted Model Engineering Solutions GmbH as proven experts in model-based design processes for safety-critical systems to analyse the capabilities of Transportation Systems with regard to model-based system development of rail signalling and safety equipment. An analysis was carried out with a special focus on the following:

- The Transportation Systems-specific system development process
- The Thales-wide system development methodology ARCADIA
- System modelling with Melody Advance, the Thales system modelling tool

Transportation Systems sought to learn from the expertise and experience of MES in the automotive sector, and to adapt techniques and processes from this domain to ensure a quick ramp-up of its model-based system design capabilities.

Analysis of the Transportation Systems system development process

In the first step, MES interviewed key Transportation Systems staff and analysed existing documentation and process descriptions. A deeper investigation then sought to clarify whether the Thales system development methodology and its

system modelling tool were suitable and implementation-ready in the railway sector. An accompanying study was designed to show how model-based design of railway systems can contribute to fulfilling the railway sector-specific requirements of the CENELEC development framework. Finally, model-based design guidelines from the automotive sector were analysed and assessed as to their applicability as modelling guidelines for system models in the railway sector.

A solution for Thales Transportation Systems

MES was able to prove that Transportation Systems already fulfils many requirements for a successful introduction of model-based design. There is already a high commitment on the part of its management and engineers to moving to model-based system development. The effectiveness of model-based system design has already been shown in pilot projects. The general ARCADIA methodology for system development is available, as well as the general-purpose Melody Advance system modelling tool. However, both ARCADIA and Melody Advance would need to be adapted to the requirements and development approaches of the railway sector. The MES analysis showed that model-based system design has the potential to significantly increase the productivity of system development, simplifying collaboration and contributing to CENELEC compliance. On the basis of these results, MES developed a roadmap that allows Transportation Systems to quickly ramp up its model-based system development capabilities over a short time period.

A roadmap for model-based design of CENELEC-compliant railway systems

The Transportation Systems-specific roadmap for model-based system design consists of different phases and steps of which the most important ones are as follows:

- Domain-specific adaptation of the system design methodology and system modelling tool to the railway sector
- Best practices guide for modelling safety-critical railway systems
- Design guidelines for Transportation Systems system models
- Best practices guide for transforming textual requirements into system models
- Guidelines for safeguarding system models
- Test case generation from system models
- Automatic compliance checking of system models
- Automatic generation of product requirements from systems models

Further planning and next steps

With the analysis results and the roadmap from MES, Transportation Systems will now be able to implement a highly efficient and productive model-based system design process in a relatively short time.

Markus Schwab, Systems Engineering Manager at Thales Deutschland - Transportation Systems, remarks:

"One of our major challenges is the high level of competitiveness in the railway and systems engineering sector. Our goal is to significantly improve our competitiveness in all our projects. Model-based system development is key to achieving this goal. We really appreciated the excellent collaboration with MES. Their expertise and dedication to model-based development was second to none."

About Model Engineering Solutions: Läuft die Software, fährt das Auto

Model Engineering Solutions (MES) specializes in integrated quality assurance of embedded software in vehicles. MES supports its clients with consulting services and customized training programs for the introduction and improvement of model-based development processes, the deployment of new standards such as AUTOSAR, or the fulfilment of new requirements such as ISO 26262 or CENELEC. The MES Quality Commander® is a dynamic management and reporting tool for software development and delivers key data throughout the software life cycle, providing an optimal basis for decision-making. The MES Model Examiner® (MXAM) is the market-leading tool for checking quality guideline compliancy of Simulink®, TargetLink®, and ASCET models as well as Excel sheets. MES Test Manager® implements the requirements-based approach in model-based development perfectly. Amongst MES`s clients are major OEMs and suppliers from the automotive and transportation industry. MES is a TargetLink Strategic Partner of dSPACE GmbH and a Product Partner of MathWorks, Inc. and ETAS GmbH.

For further information and contact, please visit our website www.model-engineers.com