Digital mock-up (DMU) has been the automotive industry best practice that for many years has enabled many engineers from different disciplines to collaborate in the virtual world to define future real products better. However, until now this has been static – i.e. it did not take much account of product behaviour. In particular, the dynamic behaviour of embedded systems and software was neither managed nor simulated in DMU. The purpose of MODELISAR is to introduce functional mock-up (FMU), a next generation of methods, standards and tools to support collaborative design, simulation and test of systems and embedded software.

The objectives of MODELISAR are threefold, to:

1. Enable concurrent design of embedded systems and software, leveraging state-of-the-art technologies:
   - The open Modelica language for component-oriented systems modelling and simulation; and
   - The AUTOSAR standard for automotive embedded software.

2. Define advanced runtime interoperability interfaces to enable open co-simulation between virtual product models, especially in Modelica, and the executable embedded software, with various configurations.

3. Deliver a smooth, traceable and integrated process for embedded systems and software across the product life, based on Dassault Systemes V6 Product Life Management (PLM).

**BENEFITS TO THE AUTOMOTIVE INDUSTRY**

MODELISAR will deliver a series of benefits to the automotive industry:

- It will become possible to design the embedded systems and software concurrently in context for the vehicle functional mock-up. This will:
  - Allow early detection of defects in systems and software, which will dramatically reduce the costs of fixing problems and cut the time to market, and
  - Enable collaborative innovation between systems and software teams, instead of the traditional ‘throw over the wall’ process;

- Test will be carried very early on the functional mock-up, instead very late on physical prototypes. This means:
  - Cycles will be reduced, and
  - Huge prototype testing costs will be saved; and

- The workflow between Modelica-based systems modelling and AUTOSAR-based embedded software generation will be seamlessly integrated and controlled. As a result:
The Modelica language

Testing methodologies

AUTOSAR

Function

Logical 

Data will be configured

A new interface standard

Phys.

MODELISAR vision

The overall process will become clear and fully traceable, making it possible to manage product liability, and AUTOSAR data will be configured together with the systems and mechanical configurations, making it possible to foresee the impact of both variety and variability on systems and software management.

DEVELOPING BREAKTHROUGH TECHNOLOGIES

MODELISAR will develop the following breakthrough technologies:

- **At build time:** The Modelica language and compilers will evolve to provide better support for AUTOSAR – for example, support will be provided for the AUTOSAR virtual functional bus;

- **At run time:** A new interface standard – the functional mock-up interface (FMI) – will be developed to ensure run time co-simulation interoperability across all simulation tools contributing to the functional mock-up;

- **At test time:** Testing methodologies will be adapted to the new integrated process; and

- **Throughout the life cycle:** Data will be integrated into the V6 PLM database, and maintained consistently and traceably.

MODELISAR will deliver the following:

- The open FMI standard specification and the specification of the necessary evolutions of Modelica;

- The adaptation of the partners’ Modelica & AUTOSAR compilers to FMI;

- Adaptation of the partners’ tools for modelling, simulation and testing to FMI; and

- The proof of concept of MODELISAR functional mock-up on industrial automotive scenarios such as:
  - Power-lift gate;
  - Cabriolet top;
  - Engine gearbox;
  - Mechatronic shifting;
  - Electronic drive;
  - Chassis control;
  - Combustion and ignition;
  - Climate comfort;
  - Electronics and cardboards;
  - Energy management.

The overall process will be integrated into the ENOVIA V6 PLM database and processes. The overall workflow will be demonstrated.

SINGLE OPEN PLM ENVIRONMENT FOR SYSTEMS AND EMBEDDED SOFTWARE CO-SIMULATION

MODELISAR will make it possible to master the complete design and validation cycle for systems and software in a single open environment. The integration of the state-of-the-art tools for Modelica, AUTOSAR and Dassault Systèmes V6 PLM technology will provide a strong competitive advantage to European MODELISAR early adopters.

Not only will this dramatically simplify the automotive design process, but it will also enable rapid design iterations through multiple hybrid simulations on the functional mock-up, thus leading to better vehicles in a shorter time and without the cost of over-expensive tests.