DASSAULT SYSTEMES

TRANSPORTATION & MOBILITY

3DEXPERIENCE PLATFORM FOR AUTOMOTIVE SYSTEMS ENGINEERING

Smart, Safe & Connected Industry Solution Experience

TRANSFORM SYSTEMS DEVELOPMENT THROUGH 3DEXPERIENCE

The soul of tomorrow's vehicle innovation originates from an intelligent core of embedded systems and electronics. But while advancing smarter vehicles, innovators must also manage complexity, optimize performance, and ensure vehicle safety. Transportation industry leaders rely on 'Smart, Safe & Connected' solutions from Dassault Systèmes to increase their competitiveness.

The Smart, Safe and Connected solutions accelerate delivery of product innovation to market, fortify your ability to manage complex systems, and provide an integrated platform for mechanical, electronic and software systems development and simulation. Through a virtual 3D experience of real vehicles and their systems it is possible to validate all new vehicle innovations early in the development cycle. With assurance that industry standards for safety and embedded systems are fulfilled you are free to focus on strategic new vehicle innovations.

> **Virtual 3D Experience** – a high fidelity virtual replica of a product, system or system of systems used to accurately predict how the real product or systems will actually behave in real life.

THE CHALLENGE of developing automotive embedded systems has never been greater. During the initial 60% of the development process no physical prototypes exist. Less than 10% of systems engineers get to validate their sub-systems in a complete vehicle, making it impossible to validate and optimize a system's behavior in its environment or its interaction with other systems across all possible vehicle configurations.

In this era of mass customization, new cars can have more than 7,000 orderable features and functions resulting in a huge number of possible vehicle configurations. Many of these features and functions are delivered through embedded systems, the source of 80% of today's automotive innovations. These systems can account for more than 40% of new vehicle development costs and are driven by more than 300,000 market, product and systems requirements.

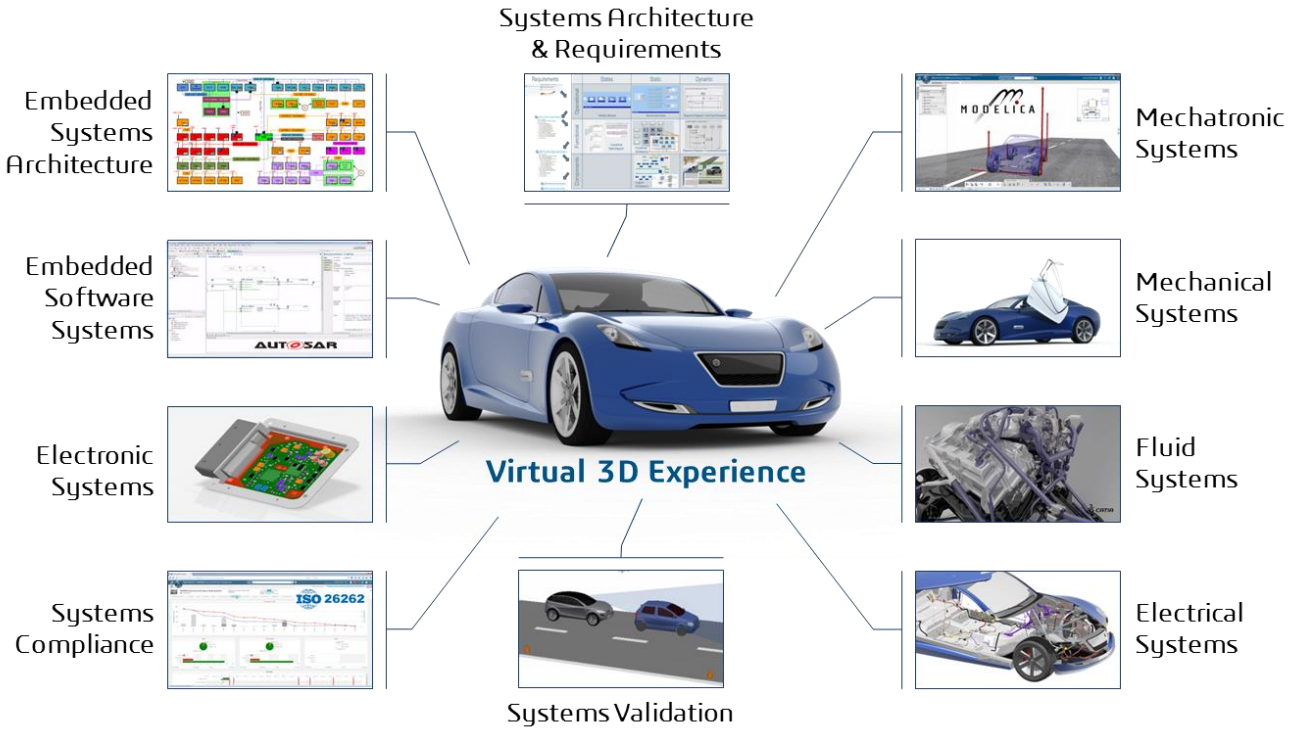
Hundreds of disconnected systems engineering tools and processes are used to model, define, simulate and validate these embedded systems. This disconnected approach makes it difficult to build a holistic systems view that integrates all disciplines. It makes it impossible to model & simulate the behavior of a system in the context of a complete vehicle and its environment or its interaction with other systems. And finally, it limits the ability to reuse system assets across multiple vehicle options and programs.

Automotive Embedded Systems

- 7,000+ Functions
- 50-80 ECU's
- 2 GB of embedded software
- 20,000,000+ lines of software
- 4 Km of electrical wiring
- 1,500+ Individual wires
- 60 Kg of wire harnesses

THE IMPACT of these issues is increasingly serious. Vehicle programs are delayed, products are poorly integrated with sub-optimal systems, and engineering costs are inflated by unsynchronized and duplicated development effort. And it is getting worse. As product complexity and the demand for vehicle variants increases, the resulting demand for systems content and cross discipline collaboration and integration is rising exponentially.

WHAT IS NEEDED to address these challenges is a fully integrated environment that makes it possible to create true high fidelity 3D experiences of a virtual vehicle and its systems, to accurately predict how the real vehicle and its system will actually behave in real life.



To create these 3D experiences an integrated set of capabilities is needed that encompass:

Systems architecture and requirements definition – define and compose system solutions through an integrated set of system requirements and cross-disciple architectural models.

Embedded systems architecture – define, simulate, implement and manage complex embedded systems.

Embedded software development – to develop and validate AUTOSAR compliant embedded systems.

Mechatronic systems modeling and simulation – create realistic high fidelity 3D behavior experiences of future products or systems to accurately predict the behavior and experience of the real vehicle.

Electrical systems design – design the electrical wire harness interconnect between the many Electronic Control Units (ECUs), sensors and actuators within the vehicle and produce all necessary manufacturing data.

Electronic systems design – design rigid and flexible printed circuit boards and therir associated enclosures.

Fluid systems design – design hydraulic, phneumatic and fluid transfer systems.

Systems compliance management – manage, document and demonstrate compliance with system requirements and regulatory standards such as ISO 26262.

Program, lifecycle, configuration & change management of all assets through a rich collaborative framework that supports the creation, sharing and reuse of information.

THE 3DEXPERIENCE PLATFORM FOR SYSTEMS ENGINEERING from Dassault Systèmes delivers a unique and innovative Model Based Systems Engineering development platform. It provides an integrated and powerful set of discipline-specific capabilities to accelerate the development and validation of the most complex products and their embedded systems. Through an open, extensible & integrated system engineering environment that shares a common and consistent set of systems models it transforms the systems development process by integrating all engineering disciplines.

The platform can readily be adapted to complement existing tools and processes and accelerates the development and validation of systems through rich 3D experiences of real products and systems. These 3D experiences begin with the planned usage of the product or system, through to its detailed design, implementation and virtual validation. Throughout the development process, the platform manages and analyzes huge amounts of systems data, enabling this data it to be transformed into real business intelligence and innovative system designs.

The **3D**EXPERIENCE platform for systems engineering makes it possible to:

- *Transform* all aspects of developing complex automotive systems, from defining and developing systems architectures through to their implementation and validation in the context of a virtual 3DEXPERIENCE.

- *Improve* decision-making at the conceptual design stage and reduce the need for physical prototypes through powerful 3D life-like simulation and validation.
- *Collaborate* and share information across all stakeholders through a shared common systems definition.
- *Simulate* the behavior of systems in the context of the complete product and its environment.
- *Reuse* systems assets across multiple vehicle programs and model variants.
- *Manage* the complete product and systems development lifecycle by sharing an open, extendable and common data-model and repository with all stakeholders.

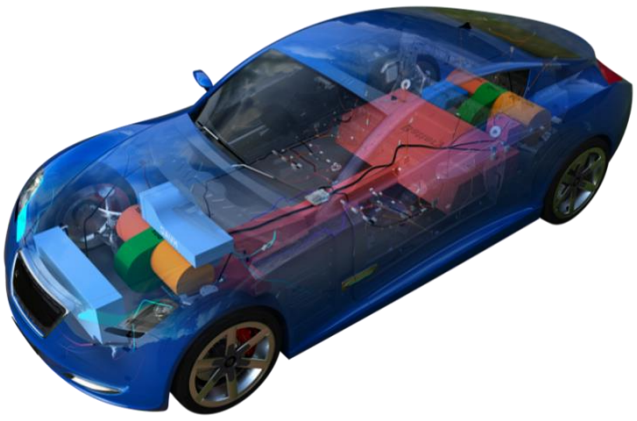
MANAGE THE SYSTEMS DEVELOPMENT PROCESS

By using the power of 3D to accelerate product innovation, the **3D**EXPERIENCE platform fortifies the ability to manage the development of complex systems. It provides a powerful, fully integrated, model based systems engineering solution to architect, define, simulate and validate automotive systems that include embedded software, mechatronic and electrical systems.

Industry leaders rely on these proven solutions to trace customer requirements, validate design options, test the performance of systems and re-use assets across multiple vehicle programs. With the confidence that industry standards for safety and embedded systems are fulfilled, teams can re-focus on strategic new vehicle innovation.

It provides a fully integrated set of lifecycle management capabilities that promotes:

- *Collaboration* through powerful services for real-time social collaboration, dashboarding, visualization and content management. The platform provides a scalable solution capable of supporting systems development from the smallest to the largest and most complex engineering projects.



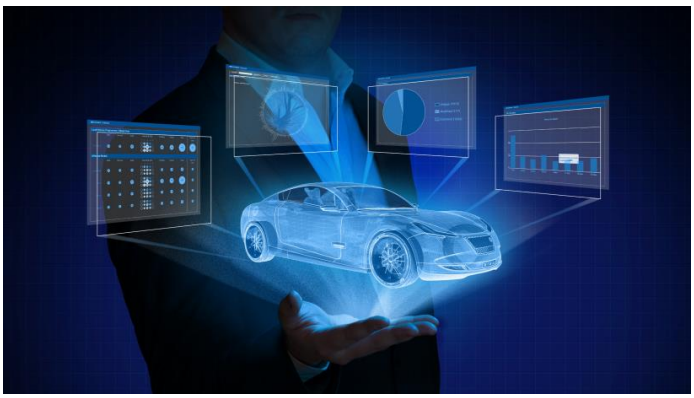
- *Program management* with task status collection becoming a natural part of the design process itself. By collecting information passively throughout the design process it provides decision makers with real-time assessments and gives increased confidence in information.

- *Lifecycle management* through a unified global system engineering development and change management processes that enables early visibility of the change impact to all data consumers - including across the supply chain, all in the context of a configured systems definition.

- *Configuration management* enables the use of a single standardized platform for all product lines with functional variants based on customer & market needs. By reducing the number of explicit system definitions we reduce the number of definition assets, the duplication and number

of tests and increase systems asset re-use across multiple product options and programs.

- *ISO 26262 compliance management* through comprehensive traceability, impact analysis and automated reporting capabilities to satisfy functional safety standards while meeting deadlines. Using powerful dashboarding, traceability and analysis capabilities across more than 60 systems engineering tools, it is possible to assess the completeness of requirements coverage and impact of system changes across all engineering data at both the project and program level.



- *'Big Data' social listening, information federation, dashboarding* and analytic capabilities to quickly and easily get real business intelligence from distributed and fragmented systems information.

- *Extensible data model and shared repository* that provides a unified environment for managing all systems definition, design and simulation data. It provides a single source of truth to ensure all stakeholders always work with a consistent view of the latest information.

- *Open platform* to protect your existing investment in tools & processes through standards based integration and sharing of information across common systems engineering tools.

Support of Open Standards

AUTOSAR: An automotive software architecture that enables the development and reuse of automotive software components.

Codex of PLM Openness: An initiative for establishing openness of IT systems in the context of PLM between end-users, tool vendors and service providers.

Functional Mockup Interface: A tool independent standard to support both model exchange and co-simulation of dynamic systems models.

Modelica: An open language for the object oriented modeling and simulation of multi-domain physical systems.

Open Service for Lifecycle Collaboration: An open community that defines a set of specifications that enable integration of PLM, ALM & IT software.

Requirements Interchange Format (ReqIF): An XML file format that can be used to exchange requirements, along with its associated metadata, between software tools from different vendors.

Our **3D**EXPERIENCE® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes, the **3D**EXPERIENCE® Company, provides business and people with virtual universes to imagine sustainable innovations. Its world-leading solutions transform the way products are designed, produced, and supported. Dassault Systèmes' collaborative solutions foster social innovation, expanding possibilities for the virtual world to improve the real world. The group brings value to over 190,000 customers of all sizes in all industries in more than 140 countries. For more information, visit **www.3ds.com**.

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