



## Tesla Motors

Changing the automotive paradigm through advanced engineering with Version 6

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**Paul Lomangino**  
Engineering Tools  
Director  
Tesla Motors

### Challenge

As an automotive start-up, Tesla Motors needed to efficiently engineer a vehicle from the ground up with an electric powertrain. Collaborative design is a critical element as Tesla paves the way for market acceptance of electric vehicles while revolutionizing the automotive industry with its vehicle and its approach.

### Solution

Tesla Motors utilized DS software solutions from its inception and is standardizing on Version 6 (V6) PLM as its sole platform.

### Benefits

Having established itself as a successful innovator with the electric Roadster, the company is now using V6 to eliminate data boundaries, compress lead times and reduce costs in development of its second vehicle, Model S.



## Creating a new standard for electric vehicles

Tesla Motors is dedicated to changing the world's view of electric cars. Tesla, which is based in Palo Alto, California, was founded in 2003 by Silicon Valley engineers who set out to prove that electric vehicles did not have to be unattractive, slow econoboxes with limited range. Instead, they could be awesome.

The company proved its point with its very first model, the Tesla Roadster, introduced in 2008. It is arguably one of the most attractive sports cars on the road and boasts performance that few expected from an electric car—288 horsepower, a top speed of 125 miles per hour, and 0-to-60 acceleration in less than four seconds. The Roadster is now sold in more than 30 countries worldwide.

Tesla's mission is to make electricity a viable alternative to petroleum fuel in vehicles. It is already succeeding in making that case with its own electric cars and is also supplying electric powertrains to partner manufacturers including Daimler and Toyota.

## Overcoming start-up challenges

Like any start-up company, Tesla faced special challenges. It worked hard to gain access to automotive industry suppliers and to achieve economies of scale that would make its cars cost-competitive. In 2012, production begins on the Tesla Model S, the world's first premium sedan designed from the ground up as an electric vehicle. Tesla is scaling up to achieve significantly higher production levels for the Model S.

"Tesla has been using DS products almost since its inception," notes Paul Lomangino, Tesla's engineering tools director. Designers started with SolidWorks and other tools to design the Roadster. As its models became more complex, Tesla moved to CATIA for 3D modeling and ICEM Shape Design for Class A surfaces. As the company grew, Tesla also evolved from its prior data management tool, which it used to bring together team members from throughout the company, to the sophisticated ENOVIA Version 6 (V6) collaborative platform. "SolidWorks and ENOVIA SmarTeam helped us start this company and were critical to the success we've had to date," Lomangino said. "V6 is helping us build on that success by managing all of our existing data as well as the increased complexity of our collaborative environment and our product offerings."

## V6 plays central role in Tesla's processes

"V6 PLM is intrinsic to the way Tesla works today," Lomangino says. "It provides the common language we use in collaborative



## SUSTAINABLE INNOVATION\* AT TESLA MOTORS

Tesla uses a sustainable process to develop its vehicles, employing 3D digitization, visualization and virtualization to eliminate waste and bring good ideas to the forefront faster.

Some of the key ways that Dassault Systèmes Version 6 PLM helps Tesla Motors achieve Sustainable Innovation include:

- A powerful collaborative platform facilitates partner and customer input and sharing
- A common 3D "language" eliminates data translation and the errors and waste that come with it
- Virtual 3D models make information actionable, enabling "right-first-time" quality, safety and manufacturability
- A single platform minimizes IT cost-of-ownership, freeing resources for innovation

*\* Sustainable Innovation is a creative, renewable approach to helping businesses simultaneously advance the environmental, health and safety, and financial well-being of their employees, customers, investors and the world at large. Helping its customers achieve Sustainable Innovation is Dassault Systèmes' mission and a core capability of its solutions.*

**We're already working to get supplier access into the V6 system, so there will be one source of design truth in a secure environment. 3DLIVE and 3DVIA will help to open up the design process even further because you don't need to be a CAD expert to work with them.**

Jack Brown, PLM Support Specialist  
Tesla Motors



*Almost 1,700 Tesla Roadsters have collectively driven more than 11 million electric miles in more than 30 countries worldwide.*

product development and production every day. It also helps us achieve the proper program development discipline and keeps our processes organized.”

Going forward, Lomangino says V6 will touch nearly all aspects of Tesla’s operation, from concept development to engineering, manufacturing, quality assurance, sales and marketing—so that everyone in the company, and even Tesla’s suppliers, can participate and contribute more effectively.

The importance of an integrated PLM system became clear during development of the Roadster, Lomangino says. As Tesla brought together components that had been developed using a number of CAD tools, program and design reviews became muddled by the need to translate files from one format to another. Engineers spent significant time ensuring that nothing had been lost in translation. The risk of overlooking broken data threatened the company’s commitment to quality. Lomangino resolved to eliminate that challenge in the future. “Quality is absolutely critical to Tesla,” he notes.

### **V6 promises to expand collaboration, improve communication**

“The ability of ENOVIA V6 to handle the complexity, both in our product and our process, as we move forward is very important,” Lomangino notes.” And its ability to unify multiple organizations under one banner and bring them all together within a common tool will help us immeasurably going forward.”

By standardizing on an integrated DS solution, including ENOVIA V6 for collaborative data management, CATIA for integrated product design, and DELMIA for digital manufacturing and production, Tesla will no longer face the need to translate data throughout the design process. ENOVIA V6 – working initially with CATIA and DELMIA V5, with plans to adopt the V6 versions of these solutions in the future – will ensure that accurate, real-time data is available

throughout Tesla, from design to manufacturing and from purchasing to program management.

Jack Brown, PLM support specialist at Tesla, says that because V6 eliminates data translations and other barriers to collaboration, functions throughout Tesla are realizing the benefit of getting involved in projects earlier. Now Tesla can recognize an issue requiring change earlier in the development process to avoid extra cost or delay in development.

“Manufacturing feedback is critical because we are creating a production car,” Brown explains. “To get all departments involved early and get their feedback on the initial releases is a lot better than getting that feedback at the end, when it becomes much more expensive to incorporate those changes.”

### **Scaling up for the Model S**

Having manufacturing feedback earlier in the process not only reduces the risk of cost overruns and errors, but also improves the manufacturability of parts. That is of growing importance as the company scales up for the release of Model S, which will be manufactured in much greater numbers than the Roadster. With each new car the company designs, manufacturability and cost competitiveness become increasingly important to winning mass-market acceptance for electric vehicles.

In developing Model S, Tesla is leveraging much of the engineering work that went into development of the Roadster. This reduces the project risk and speeds development, Lomangino notes. ENOVIA V6 will make it possible to share that information among Tesla employees like never before.

V6 also will allow Tesla to open up the collaborative process even further, Brown says, making it possible to involve partner-suppliers and even customers in the development process. At that point the collaborative and interactive communication capabilities enabled by two other DS solutions, 3DLive and 3DVIA, become even more critical to delivering a detailed view of new product development.

"We're already working to get supplier access into the system, so there will be one source of design truth in a secure environment," Brown says. "3DLIVE and 3DVIA will help to open up the design process even further because you don't need to be a CAD expert to work with them. It opens up the whole paradigm of having a virtual product available for review."

### Easy implementation with low TCO

Brown, who worked as a software consultant prior to joining Tesla, says it requires less time and effort to implement V6 than other PLM products he has worked with, which translates directly to a lower total cost of ownership (TCO). One reason is the out-of-the-box functionality of V6, which eliminates the need to customize the software and the additional work that is inevitably required when upgrades occur.

"My drive is to keep the out-of-the-box as pristine as possible," Brown says. "But it's also a nice benefit with ENOVIA V6 that we can configure and extend the software to put our own spin on it. We do things with it that nobody else would be doing outside our industry, and we can essentially stack those capabilities on it. We're not customizing it per se, so we have something that's easily upgradable, but it's still tailored to our needs."

Brown says the lack of customization also makes V6 quicker and easier to implement than packages he has used in the past. "I was basically the support team for our implementation," he says. "I put everything together, started the pilot on my own and supported it by myself. As we go into production, we've doubled our support staff to two," he says with a grin.

Lomangino says the integration of ENOVIA and CATIA with DELMIA, the DS solution for digital manufacturing and production, makes DELMIA a natural choice to use in planning and simulating the manufacturing facility and process for the Tesla factory where Model S will be built.

"At Tesla Motors, we depend on everybody to be as creative and productive as possible," Lomangino says. "Part of the power of V6 is its ability to allow everybody involved in the product development process to focus on being creative and productive rather than focusing on the process and tools."

3dvia

CATIA

DELMIA

ENOVIA

SOLIDWORKS

*Model S is engineered from the ground up as an electric car. Tesla innovations include integrating the battery pack below the floor and combining the motor and electronics into a single compact module, exploiting the advantage of an electric drive train over a combustion engine.*



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