

## COMPANY

**Tesla Motors**  
teslamotors.com

## LOCATION

Palo Alto, California, United States

## SOFTWARE

Autodesk® Alias® Surface  
Autodesk® Showcase®

# Electric dreams come true

## Tesla Motors reinvents the electric car with help from Autodesk software

Autodesk Alias Surface helped our team deliver incredibly high-quality designs in very short periods of time. Having people who are experienced with such proven software meant we could meet extremely aggressive timelines.

—Paul Lomangino  
Engineering Tools Manager  
Tesla Motors



Image courtesy of Tesla Motors.

### Summary

Once upon a time, the electric car was missing and presumed dead. A documentary film was even made detailing the technology's demise while lamenting its passing. Fortunately, however, the rumors were vastly exaggerated.

While all manner of more environmentally conscious vehicles have been produced and discussed in recent years—from popular gas-electric hybrids to hydrogen fuel cells to biodiesel—the resulting vehicles have typically lacked the speed, styling, and storage space necessary to attract significant numbers of driving consumers. And while hybrid technologies improve the efficiency of the internal combustion engine, they tend to compromise performance for efficiency and sustainability.

That all changes with Tesla Motors, which is using Autodesk® Alias® Surface software to turn heads and change minds. First prototyped in 2006, the Tesla Roadster is the world's first electric supercar. It hits 60 mph in under four seconds, travels up to 245 miles on a single charge, and does it all without any tailpipe emissions, and with far less noise and vibration than traditional cars.

Tesla Motors' vision, however, goes far beyond a need for clean speed. With the more functional and affordable Tesla Model S sedan, the company is intent on nothing less than moving the world to electric transportation. While gasoline-powered cars rely on a single, dwindling resource and grow increasingly inefficient as they age, electric cars promise to grow more efficient as the years pass, especially as more sustainable methods of powering the grid are developed.

Powered by more than 7,000 lithium-ion batteries, the Model S sheds such standard equipment as the internal combustion engine, exhaust pipes, thermal shielding against engine heat, and catalytic converters. The resulting extra space provides room for five adults together with two children, or a surfboard, a 50-inch television, and a mountain bike.

### The Challenge

"The Model S is really about creating a beautiful, efficient product with no compromises," explains Franz von Holzhausen, chief designer at Tesla. "This is not a slower, less-attractive car that compensates by being better for the environment. The Model S is a desirable-looking, supremely functional, and very fast sedan. Oh, and it also happens to be the greenest car on the planet."

The Autodesk Clean Tech Partner Program supports clean technology innovators with design and engineering software they can use to accelerate their development of solutions to the world's most pressing environmental challenges. For more information, visit [autodesk.com/cleantech](http://autodesk.com/cleantech).

The benefits of electric vehicles are many. The most obvious is that electricity trumps oil in almost every way imaginable. It can be generated in a variety of ways, including hydroelectric dams, wind farms, and solar arrays. What's more, the driveshaft, exhaust pipes, and other bulky equipment running along the bottom of the car—all of which make for more noise and vibration, and reduced stiffness—are replaced by rechargeable lithium-ion batteries. The quiet, yet high-performance comfort of the Model S derives in part from its perfectly flat bottom. And just for good measure, the batteries that power the car are bolted into a 9-inch box on the floor of the car, making it stiffer still.

Of course, the most revolutionary ideas can often be the most difficult to design, and Tesla designers soon found that they would have to strike a balance between beautiful, yet familiar styling and industry-changing, yet recognizable technology.

"With the Roadster, we had pretty much proven that the technology could work," says Paul Lomangino, engineering tools manager at Tesla. "People typically thought of electric cars as slow and unattractive. What we had to do was change that perception. We wanted people to be confident that this electric car would be fast, enjoyable, and functional, and would take away problems rather than create new ones. At the same time, we didn't want to overwhelm them with too many changes. The Model S is still meant to be fun and exciting, but it is also meant to broaden the audience through increased functionality and lower pricing."

The result is a lean, powerful car that is also fun for—and can accommodate—the whole family.

"We intentionally maintained a lot of the traditional automotive shape and cues in our exterior design," says von Holzhausen. "It was



Image courtesy of Tesla Motors.

crucial to establish the positive qualities of the design while building customer confidence, and we had to do it quickly."

### The Solution

The company's design and engineering process was significantly streamlined through the use of Alias Surface: "Autodesk Alias Surface software is the best automotive design tool, bar none," says von Holzhausen. "There is simply no other tool that comes close to Alias for visualization, rendering, surfacing, or just drawing. I use Alias to draft lines rather than using pen and paper, and also to replace the traditional tape drawings. I don't know what I'd do without it."

The team uses a combination of rapid prototypes designed in Alias and computer numerical controlled (CNC) milled clay models to perfect designs.

"Many of our best Alias modelers are guys who used to be clay modelers," says von Holzhausen. "We do an iterative process in which we create models in Alias, then mill the data in clay and fine-tune it by hand. We'll then scan the clay model and bring it back into Alias for more polish, then mill it again. Alias is great for visualization and rapid prototyping, and it is as close as you can get to a physical prototype. Alias has streamlined our efforts and made getting to 3D incredibly quick."

"Autodesk Alias Surface helped our team deliver incredibly high-quality designs in very short periods of time," Lomangino agrees. "Having people who are experienced with such proven software meant we could meet extremely aggressive timelines."

### The Results

While the exterior of the Model S is designed to attract discerning drivers, the interior prepares them for a new driving experience. At the car's focal center is a state-of-the-art, 17-inch touch screen, placing all of the car's functions, except steering and acceleration, at the driver's fingertips.

"As much as we wanted to show off our revolutionary power train, we also wanted to give the car awesome technological prowess," says von Holzhausen. "We started thinking about an interactive, updatable, continually relevant interface, much like the smart phones and laptops we all now use. With this large screen, drivers can extend the relevancy of their ownership experience by changing features and apps in the car. Go to the Tesla app store and download a new skin, and your car is fresh again."

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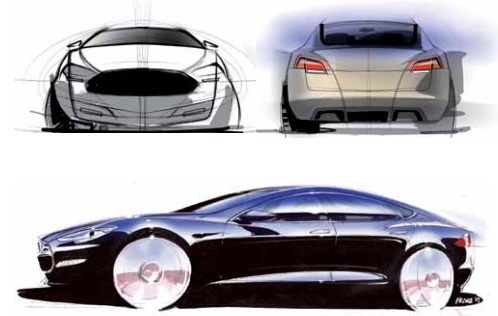


Image courtesy of Tesla Motors.

Just as the Model S promises to take the sleek styling and high performance of the Roadster to a broader audience, there is no doubt that Tesla has plans for more varied and more affordable electric cars. As customers grow more comfortable with the concept of uncompromising electric transportation, increasingly efficient and avant-garde design options will be integrated, all with the help of Autodesk software. The company is currently incorporating Autodesk® Showcase® visualization software into its pipeline.

Von Holzhausen is very bullish on the future: "This is really a whole new experience for drivers. We're confident that after just a few minutes in the Model S, drivers will be wondering why all cars aren't electric and, more than that, why their cars don't have a 17-inch touch screen. We couldn't have done all that without help from Autodesk software."

### For more information

To learn more about the Autodesk Clean Tech Partner Program, visit [autodesk.com/cleantech](http://autodesk.com/cleantech).

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