

Plasan Carbon Composites

Advances automotive design with Dassault Systèmes composites solutions

Because of the expense of carbon fiber, we can't afford to over-engineer. We have to ensure our designs are the most cost-effective solution. Our PLM solutions for composites allow us to do just that.



Jim Staargaard
President, Plasan
Carbon Composites
USA

Challenge

Plasan Carbon Composites needed to give its automotive customers fast, accurate quotes and deliver high-quality composites parts quickly, with less physical waste and improved material estimates.

Solution

To create accurate-first-time ply lay-up plans, Plasan chose a Dassault Systèmes solutions suite that includes CATIA Composites Design integrated with Simulayt's fiber modeling and linking solutions and SIMULIA Abaqus Finite Element Analysis (FEA) for realistic stress simulations.

Benefits

Plasan can now deliver quotes faster with more accurate estimates of material use, cost and reliability while improving accuracy and reducing waste.



Driving automotive composites use forward

Plasan Carbon Composites USA, a wholly owned subsidiary of Plasan Sasa of Israel, supplies carbon composites parts to leading automotive OEMs worldwide. The company has made body components, including hoods, roofs and fenders, for the Chevy Corvette and Dodge Viper and is leading the charge to bring composites to automotive frame and sub-structural components, increasing strength, passenger safety, and fuel efficiency.

"Carbon fiber requires a paradigm shift in how OEMs build and design cars," says Jim Staargaard, president, Plasan Carbon Composites, USA. "But it's one way they can get to 50 miles per gallon with the extended range they need for electric vehicles."

Plasan is working with partners that include Oak Ridge National Laboratories and Dassault Systèmes to develop the predictive modeling solutions needed to produce the composite structural components of tomorrow's fuel-efficient, long-range cars. But while its sights are firmly set on the future of automotive composites, Plasan also is leading the way in the design and production of state-of-the-art Class A and structural components for today's vehicles.

Streamlining a highly manual process

To create carbon composite parts, carbon fiber pre-impregnated with an epoxy resin matrix must be cut into precise shapes and then layered and treated with high pressure and heat to produce a strong, thin, lightweight part. Craftsmen have traditionally used the "paper doll" method, trimming and splicing the fiber plies to fit them to the underlying shaping tools. But trial-and-error is a slow and expensive process, especially considering the high cost of carbon fiber and labor.

The process is further complicated by the fact that most composites manufacturers use multiple software packages to design and nest plies into a kit to determine a price per piece for parts. If estimates are not accurate – a risk increased by multiple translations of data from one system to another – composites companies can overprice and lose business or under-price, cutting into their margins.

To better serve its customers, its business and the environment, Plasan wanted to produce faster, more accurate quotes, eliminate trial-and-error processes, and reduce wasted composite material. Plasan replaced its three-CAD system with an advanced composite design, manufacturing and simulation solution suite from Dassault Systèmes (DS), which combines CATIA Composites Design, Simulayt solutions for fiber modeling and linking, and Abaqus FEA from SIMULIA for virtual testing of designs' structural integrity. Because CATIA, Simulayt and SIMULIA Abaqus work within a single user interface, Plasan's designers and engineers move seamlessly from one function to another, saving time, eliminating translation errors, and streamlining training.

"CATIA has given us a universal language for design," says Gary Lownsdale, director of Research & Development for Plasan Carbon Composites USA. "Because it is so widely used,



SUSTAINABLE INNOVATION* AT PLASAN CARBON COMPOSITES

With its focus on developing strong, lightweight and durable carbon composites to replace more energy-intensive materials in automotive applications, Sustainable Innovation plays a central role in Plasan's offer to the marketplace. But the processes used to develop Plasan's composite parts are just as sustainable, reducing time and cost and eliminating waste materials.

Some of the key ways that DS composites solutions help Plasan achieve Sustainable Innovation include:

- Eliminating trial-and-error by analyzing ply structures in virtual 3D for right-first-time designs and fewer physical prototypes.
- Supporting the development of an innovative new curing process that has significantly reduced Plasan's power usage.
- Reducing the number of plies in a part design for higher quality and improved performance – especially important in the safety of structural parts.

* Sustainable Innovation is a creative approach to developing products and services that benefit the health and safety of people, the environment, and the economy, while fostering a self-perpetuating climate of innovation.

We're now able to virtually test the strength of our composites in a matter of minutes instead of hours, days or weeks.

Gary Lownsdale, Director of Research & Development, Plasan Carbon Composites USA





**Our customer was absolutely floored during a design review when we could say
'Here are the kits and the material already put into nests so that you can see the efficiency.'**

James Salerno, CAD and FEA Engineer, Plasan Carbon Composites USA

whether we're working with a company in Japan, Europe, Australia or North America, it doesn't matter, while SIMULIA provides us with a universal language for realistic structural performance."

Earlier visibility renders more accurate estimates

Previously, Plasan could not design ply kits for its parts until an OEM's tool molds arrived. But with CATIA Composites Design and the Simulayt Advanced Fiber Modeler, Plasan can quickly provide accurate quotes to its customers based purely on the OEM's part data.

Now, when part data arrives from an OEM – months before a tool is built and delivered – Plasan can estimate the surface area and approximate the tool size. "This first level now takes only about 30 minutes to complete rather than half a day," says James Salerno, CAD and FEA (finite element analysis) engineer at Plasan. "If that looks like a favorable price point, I can take it to the next level and actually start designing the individual plies and nest them into a kit for cutting."

The result: faster, more accurate quotes that help Plasan respond more quickly and competitively to customer requests.

Iterations reduced by 50%

On its most recent pre-production program, Salerno says, he was able to arrive at a 100% manufacturable kit for two required parts in just two iterations using CATIA Composites Design. "The first iteration was usable," he says, "but posed some challenges for our manufacturing personnel. The second was dead on." Before CATIA, Salerno says, that same work would have required three to five iterations with paper templates.

Much of the speed at which Plasan can do preliminary analysis comes from the ability to work in a single CATIA platform that is fully integrated with tools from Simulayt, Salerno says. "Using the FEA capabilities of CATIA Analysis, I don't have to change programs," Salerno says. "My plies and boundaries are already in there, and the Advanced Meshing Tools workbench lets you constrain the mesh to the actual ply boundaries, eliminating errors in the elements where they bridge between different thicknesses of the part. Then we use Simulayt Composite Link to port the true fiber orientation and the most accurate material model straight into

Abaqus to run realistic stress simulations."

Simulations help Plasan predict part performance on metrics that include strength, durability and stiffness. If analysis shows that stresses will be too high in any portion of the part, it can be redesigned. Iterating such refinements in the computer eliminates multiple rounds of physical tests, saving time and money and reducing waste materials – important since no recycling process yet exists for composite materials.

Turning days into hours

Since Plasan adopted its new solution, Salerno says its other software packages are "collecting dust."

"Before we had our new solution in place, we were having some problems with cracking in a fender component along a ply line," he says. "With our old software, I had to do all the surface repairs within our old FEA package, and it literally took days just to get the part to



With its advanced CATIA and SIMULIA ply design and analysis solutions, Plasan Carbon Composites' lay-up technicians know they can achieve smooth, clean applications of plies on the first try, eliminating waste and cutting costs.

the point where I could mesh it. Now I can have parts meshed and ready to go in hours."

The new solution also helps engineers easily understand and track fiber direction, Salerno says. "As you wrap fibers around a complex curvature, they're going to deviate," he says. "That's something CATIA can flag so you can take that information into CATIA Analysis for baseline linear structural simulation or Abaqus for more detailed nonlinear and fracture analysis. With different translators you might have to rebuild significant parts of the model."

Eliminating manufacturing errors

Advanced flattening and producibility simulation algorithms in Simulayt allow engineers to understand how fibers in composite materials are deforming around the complex geometries of automotive components. "Our customers are very concerned with inconsistencies in the surface," Salerno says. "Simulayt lets us see how far we can push our materials before they start wrinkling."

Plasan is also using its new solution to develop next-generation processes that create parts faster by replacing autoclave treatments of the composites materials with pressure-based approaches, an innovation the company calls Out-of-Autoclave. "We had to understand what happens to the material chemically and physically," Lowsdale says. "We used CATIA and Abaqus throughout the process to make sure our computational tools were conforming to what we were actually measuring. We would not have been able to have the press equipment in place today, if not for those two solutions."

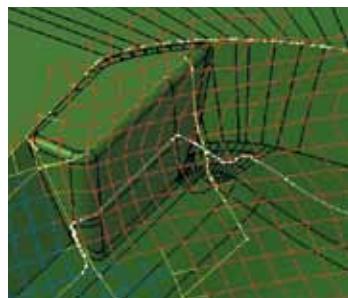
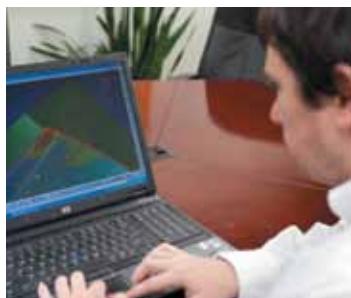
The savings to date from Plasan's Out-of-Autoclave innovation include a 75% reduction in curing times, which translates into significantly lowers energy demand and speeds delivery to customers.

Improved manufacturing processes

Plasan's DS solutions often help it to reduce the number of plies used to produce parts, Salerno says, a Sustainable Innovation that saves lay-up time, improves the strength and durability of the finished part, and reduces waste fiber –good for the environment and the bottom line.

Initially, Salerno says, shop floor workers were skeptical that a single ply could be wrapped in so many directions without wrinkling. Now that they've seen the results, they look forward to receiving new kit designs because they know the results will contribute to improved quality. Manufacturing management also values the ability to produce work instructions directly from the 3D models.

"We can use CATIA Composites Design to generate a ply book while the kit is being cut," Salerno explains. "That's a tremendous help to get out of the gates fast on a new program."



Advanced flattening and producibility algorithms in Simulayt allow Plasan's engineers to perfect ply designs on the computer before sending them to the shop floor, reducing iterations by 50%.



Designing plies that precisely conform to underlying geometries eliminates the need to add manual trims and darts on the shop floor

Plasan used CATIA and SIMULIA to validate physical measurements for its Out-of-Autoclave process, which creates parts faster using pressure instead of heat.

Dassault Systèmes
10, rue Marcel Dassault
78140 Vélizy-Villacoublay
France
Tel: +33 (0) 1 61 62 61

SolidWorks®, CATIA®, DELMIA®, ENOVIA®, SIMULIA®, 3D VIA® and Abaqus® are registered trademarks of Dassault Systèmes or its subsidiaries in the US and/or other countries.

Images courtesy of Plasan USA.

© Copyright Dassault Systèmes 2011.
All Rights Reserved.

For more information
Dassault Systèmes
3ds.com

Plasan Carbon Composites
plasanusa.com