Blu Homes

Revolutionizes prefab homebuilding with CATIA and 3DVIA

Dennis Michaud
Vice President
Product Development
Blu Homes

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Challenge

Blu Homes needed 3D design and visualization tools that supported its goals of building quality, green, affordable prefabricated homes with a high level of buyer personalization.

Solution

Blu Homes chose CATIA and 3DVIA from Dassault Systèmes to help realize its vision of making the homebuilding process more predictable, affordable and enjoyable.

Benefits

CATIA allows Blu Homes to achieve the level of design precision needed for the complex kinematics of folding its homes. With 3DVIA, the company can deliver an interactive visualization and personalization experience that eliminates unwanted surprises in the process

DASSAULT SYSTEMES

Reinventing prefabricated home architecture with CATIA

Blu Homes is revolutionizing modern homebuilding by combining prefabricated, highly configurable offerings that are eco-friendly, affordable and innovative with marketing tools that give buyers unsurpassed abilities to personalize and visualize their choices. Blu Homes credits its use of CATIA and 3DVIA – 3D design and visualization solutions from Dassault Systèmes (DS) – with allowing the Massachusetts-based startup to completely rethink not only how its homes are designed and built, but also how they are sold.

Dennis Michaud, vice president of product development, first encountered CATIA during his architectural education at MIT, where he recognized its advantages, such as creating the kinematic structures Blu uses in its homes today. Josh Appleman, digital tooling manager at Blu Homes, studied generative design at the University of Michigan, using CATIA to explore how parameters outside an architect's control affected designs. "The CATIA platform was the perfect tool to watch the design evolve," he says. "Today, we're bringing that same advantage of CATIA to use in Blu's homes."

CATIA's kinematic power makes Blu Homes' concept possible

Because Blu's homes are manufactured in a factory – not custom-built on site, where carpenters have the option to cut and trim – design precision is critical. Precision and direct integration between design and manufacturing also helps to ensure that the designed geometries are buildable at a reasonable cost and meet the company's eco-friendly parameters. CATIA allows Blu Homes' designers to analyze their work for machinability and export designs for subsequent downstream processes, maintaining high levels of precision.

Unlike homes constructed board-by-board onsite, which can tolerate variances of as much as 0.5 inches (1.27cm), Blu Homes' unique design, which requires that the homes be folded for shipping, require variances of no more than 0.0625 inches (0.15mm). Typical architectural software cannot manage that level of precision, Michaud says. Thanks to its heritage in the aerospace and automotive industries, however, CATIA can.

CATIA's ability to handle large assemblies is another advantage. "It's necessary for us to be able to work with, manage and visualize assemblies and sub-assemblies with tens of thousands of unique parts," Michaud says. "CATIA is crucial for making that possible. Because of the kinematics we employ for

Left: *The modular design of Blu Homes allows for substantial creativity. In this photograph, three Origin models were combined to create a distinctive home addition.*

Cover: *The interior of an Origin model is rendered in a photorealistic CATIA image. With sophisticated lighting and shading capabilities, distinguishing the virtual from the real becomes nearly impossible.*

> Our designs are constantly changing and improving. We need to ensure that what the customer sees is up-to-date and visible quickly. We simply couldn't do this without the Dassault Systèmes product line.
>
> Joshua Appleman
> *Digital Tooling Manager*
> *Blu Homes*

folding our homes for shipping, our real challenge at Blu Homes is the need for a fairly abnormal level of precision compared to what the building industry is used to."

With Blu Homes' designs, the front half of the house slides into the back half for highway transport, which requires that designers be able to quickly visualize any potential clashes or obstructions. "Maybe there are other software tools that would have allowed us to design the individual sub-assemblies in isolation, but I believe CATIA is the only tool that allows us to design the house in its entirety in full precision," Michaud says. "I can't imagine how we would simulate our folding house designs in 2D CAD, for example."

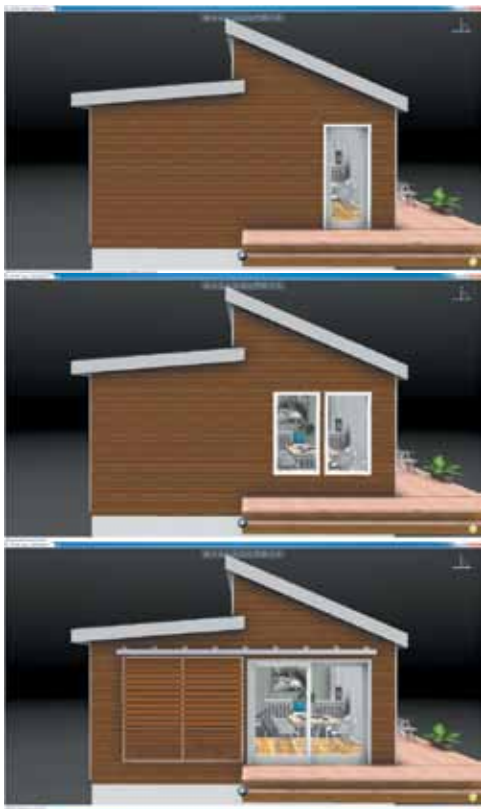
Powering eco-sustainability

CATIA's precision has allowed Blu Homes to design homes that are 40% wider than other prefabricated homes after they're unfolded, but with a transportation footprint comparable to a typical modular home. Once onsite, assembly is accomplished in a matter of hours. "One of our latest innovations is to be able to actually unfold the house such that the ultimate width is greater than double the shipping width," Appleman says. "We're going from a little over eight feet (2.43m) in transit to a little over 18 feet (5.48m) unfolded on site."

This allows Blu Homes to ship across the country more economically than other modular home builders can do in-state. "That's a difference of tens of thousands of dollars we can pass on to our customers," Appleman says. "It has allowed our first factory to have a real continental presence."

Much of this savings comes from closely analyzing material weights with CATIA's integrated analysis capabilities, which build some of the analysis capabilities of SIMULIA into the CATIA Analysis module. CATIA's ability to allow designers to quickly create multiple versions and variations of a design, Michaud says, allows Blu Homes to easily substitute "greener" building components without having to re-build an entire CATIA model. "That kind of flexibility helps us stay on top of the latest innovations in green building, and that's a big advantage for us and for our customers." Blu Homes also is using CATIA to help analyze energy use, empowering buyers to choose configurations that maximize their homes' efficiency and keep energy costs down.

The CATIA model feeds all of Blu Homes' downstream processes. This allows any design changes to be reflected in updated renderings and all marketing documentation, which is created with CATIA Photo Studio Optimizer to eliminate the time and expense of physical mockups and custom photography. Bills of material (BOMs) generated directly from the model streamline procurement and allow home buyers to quickly see how their design choices affect the total cost of the home.



The Blu Homes 3DVIA online simulator allows buyers to compare the look of multiple options for virtually every aspect of their home. Here, three CATIA renderings are displayed in 3DVIA showing (top to bottom) a single door, double windows, and a sliding door with sliding screen. Soon, the configurator will also show buyers the affect of different options on their total cost.

Innovating home marketing with 3DVIA

Visualizing design choices is an important – and generally frustrating – part of the home-buying experience. "One of the really important aspects of our business model and our competitive strategy is making the whole process of buying a home much more predictable and much less chaotic," Appleman says.

Blu Homes' online configurator, driven by 3DVIA, helps create a positive experience for buyers from the first moment they land on the Blu Homes website. Starting with a 3D XML model output from CATIA, 3DVIA organizes and presents the assembly in a format that allows homebuyers to virtually "tour" their home before construction. Buyers need only a free download of 3DVIA Viewer.

The tour acts as a virtual walkthrough, allowing buyers to explore every inch of the house to get a sense of space. While on a tour, homebuyers can look up, down, and side-to-

side, view aspects of rooms close up or from a distance, and walk around the perimeter of the house to see it from every angle.

The configurator allows buyers to experiment with tile, cabinets, flooring, window configurations and paint color options until they find their ideal combination. Working in the background, the BOM changes with their selections. Soon buyers will even be able to see the affect of their choices on the home's cost.

When their selections are complete, buyers can solicit input from family and friends by inviting them to take an online virtual tour of their configured virtual house. 3DVIA's iPhone App also allows buyers to superimpose a 3D model of a Blu Home on a photograph of their site, allowing them to experiment with various placements to find the ideal location and orientation.

Blu Homes chose 3DVIA because it works directly with assets output from the CATIA assembly. "3DVIA facilitates the interactivity of the configurator – moving around, navigating, and changing selections – and the pipeline from CATIA into 3DVIA is completely seamless," Appleman says.

Using 3DVIA ensures that Blu Homes customers understand how their house will look before the first board is cut. "It's difficult to make decisions based off 2D floor plans, and even harder off renderings that don't allow you to experience what the space of the home is like," Appleman says. "With the 3DVIA-based configurator, we try to show customers exactly what they're getting before they spend a penny."

Future plans

Blu Homes expects to drive its automated NC machining directly from its CATIA models in the first half of 2011, particularly for nesting parts to make optimal use of high-waste sheet goods such as drywall. The company also is evaluating additional CATIA modules, including the 3D electrical harness workbench, the tubing workbench, and the harness assembly and design workbenches, to further enhance Blu Homes' eco-efficiency, costs, and design productivity.

In the meantime, Michaud hopes that the company's success with CATIA and 3DVIA will inspire other architects to adopt the solutions and deepen the pool of architects with 3D experience. "DS solutions are helping Blu Homes build better quality homes and provide average homebuyers a custom home-buying experience at a reasonable price," he says. "That's something that could benefit the whole industry."

Because Blu Homes are factory constructed, tolerances must be no more than 0.0624 inches (0.15 mm), compared to as much as 0.5 inches (1.27 cm) in stick-built homes. CATIA provides this level of precision and facilitates the homes' unique folding structure, which allows the roof and walls to flatten and create a compact footprint that significantly reduces shipping costs.

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

Images courtesy of Blu Homes.

For more information
Dassault Systèmes
3ds.com

Blu Homes
bluhomes.com