DASSAULT SYSTEMES

Amcor

Consumer Packaged Goods & Retail Case Study

amcor

Challenge
Amcor needed to deliver a wider variety of top-quality, innovative containers to its customers faster and at lower cost while demonstrating corporate and social responsibility.

Solution
With the Dassault Systèmes **3D**EXPERIENCE Platform, including CATIA, ENOVIA and SIMULIA, Amcor has integrated 3D virtual design, finite element analysis, collaborative innovation and workflow management into its product design and production processes.

Benefits
Amcor has reduced design cycle times by 50%, enhanced communication among its teams, reduced physical prototyping, delivered lighter containers that use less plastic and improved time-to-market.

The dynamic, competitive landscape of the consumer packaged goods (CPG) industry demands nimble strategies that can quickly adapt to ever-changing consumer preferences. Manufacturers of PET (polyethylene terephthalate) plastic containers also must juggle business consolidation, increasing government regulation, and the need to demonstrate corporate and social responsibility while delivering a wider variety of top-quality, innovative containers in ever-shorter time periods at lower prices per unit. In short, sustainable innovation is vital.

To meet these challenges, Amcor's Rigid Plastics Division uses Dassault Systèmes' **3D**EXPERIENCE Platform, including CATIA for 3D virtual design, ENOVIA for collaborative innovation and SIMULIA for finite element analysis (FEA).

The results: a 50 percent drop in design cycle times, enhanced communication between designers and engineers, reduced physical prototyping (which translates into lower costs and less waste material), lighter containers that deliver more performance with less plastic, and faster time-to-market.

A few grams shaved means millions saved
At high volumes, saving even a few grams of material per unit has a staggering impact on sustainability. "Too little material can lead to containers failing, and too much can cost us a fortune," Suresh Krishnan, group manager for Amcor Advanced Engineering Services, said. "Lightweighting our products is one of Amcor's key strategies against our competition during these tough times, and computer-aided engineering technologies are critical to achieving that."

The goal of lightweighting resonates with engineers in every industry, from aerospace to cell phones. Saving material is a key component of sustainable innovation because it saves money, delivers the lighter products customers want, and is good for the environment at every stage of a product's lifecycle, from manufacturing to recycling.

In fiscal year 2010, Amcor reduced its total resin use by 60,000 metric tons. The cumulative savings from 2006 to 2010 is close to 160,000 metric tons – enough to fill more than 1,600 rail cars.

Simple product, complicated design challenge
"A PET container is a simple product, but it's a complex design problem to make it right," Krishnan said. For example, the popular two-liter carbonated soft-drink bottle must be custom-designed to individual brand specifications, yet must retain its blow-molded shape during filling, carbonation, sealing, labeling, packing and shipping. Hot-filled containers are even more difficult to design because they must withstand additional temperature and vacuum pressure fluctuations.

To cost-effectively produce such a high-performance container while minimizing waste materials, Amcor Advanced Engineering Services uses computer modeling to simulate – or virtually test – the behavior of a bottle while it still exists only on the computer.

At the core of Amcor's regimen is the 3DS application SIMULIA for realistic simulation, and part of the **3D**EXPERIENCE Platform. Amcor employs SIMULIA to generate simulation data that can guide design modifications, material thickness parameters and manufacturing processes to achieve the lightest possible design with the least possible resin that satisfies both customer and regulatory requirements.

One of our performance metric targets was to reduce the number of design revisions we made by 20 percent in a year. We are well ahead of that goal.

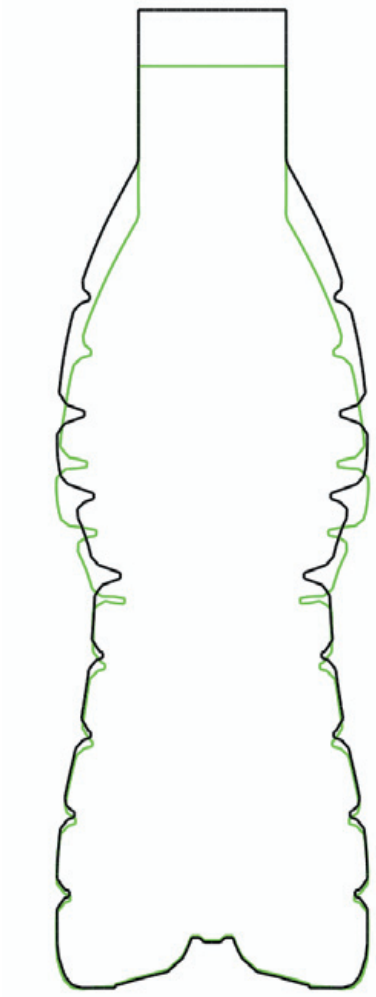
Suresh Krishnan, group manager for advanced engineering services, Amcor

Visualizing the challenges with 3DEXPERIENCE

Based on an initial concept that Amcor's industrial design group has arrived at with the customer, design engineers create a 3D virtual model in CATIA, the 3DS application for integrated product design. They then use customized scripts and knowledge templates within CATIA to accurately determine the critically important surface area, volume and weight for the bottle's final design.

"CATIA's capabilities save us a lot of time," Krishnan said. "Instead of starting a new design from scratch, we can begin with an existing design and quickly modify it. And when the SIMULIA analysis shows that we need to make a design change, the CATIA model is adjusted to reflect that."

Krishnan says CATIA has allowed Amcor to reduce mechanical design time from more than two weeks on most projects to an average of just two days. By using Power Copy and knowledge-based templates in CATIA to create definition-based catalogs, Amcor has improved turn-around times and captured best practices that its designers use as their starting point on new projects, rather than designing from scratch. This ensures that advances from previous projects are incorporated into new designs and that all designs conform to Amcor's standards from the outset.



Top loading simulation shows how a PET bottle's original shape (gray line) responds under pressure (green line) during the capping process. Another top load test will also be performed on a bottle design to evaluate the effects of product stacking, in which empty containers can be subjected to anywhere from 50-120 pounds.

Once the team has a design, the engineers mesh the geometry of the virtual bottle. After meshing, physics-based performance simulation is conducted in SIMULIA. A typical FEA model for a top-load analysis such as bottle capping or container stacking has about 150,000 shell elements and about 350,000 degrees of freedom. A more complex coupled Eulerian-Langrangian drop analysis, which simultaneously shows the fluid structure interactions among a container, its contents, and the floor, can have as many as 800,000 degrees of freedom.

Focus on Amcor

Amcor's Michigan-based Rigid Plastics division is the largest manufacturer of PET containers in the world.

Products: Packaging for many of the world's leading brands, from soft drinks and salad dressings to shampoos and healthcare products
Revenue: AUD$12 billion (US$12.5 billion)
Employees: 33,000
Headquarters: Hawthorn, Australia (global headquarters)

For more information
www.amcor.com

Adopting SIMULIA to replace the FEA software Amcor previously used allows the company to explore the full scope of such design challenges. "SIMULIA was the better choice for us because it offered a breadth of simulation disciplines that cover more significant performance requirements for PET containers," Krishnan said.

Kicking the container around with simulation

Creating containers requires a range of disciplines. Amcor Advanced Engineering Services begins with top-loading and vacuum pressure simulations. They then move on to drop-testing, blow molding, conveyance, denting, and leaning. "Being able to simulate multiple load conditions at the same time is very important to us," Krishnan said. "You have to take into account a number of parameters simultaneously, including fluid-structure interaction, temperature, pressure, and material strain rate."

With its FEA results in hand, Krishnan's team has a clear vocabulary for discussing a design's viability with Amcor's industrial designers. Using multiple iterations between CATIA and SIMULIA, both teams can collaborate to arrive at the best solution to deliver the appearance, performance and functionality of a particular container. "One of our performance metric targets was to reduce the number of design revisions we made by 20 percent in a year," Krishnan said. "We are well ahead of that goal."

The benefits from virtual testing also extend into manufacturing. "When we achieve an optimum top-load value via simulation, we can use that data to provide actual section weights to the process engineers in the plant so they can more easily produce the container that gives the desired performance," Krishnan said.

We've cut our design cycle down to nine months from 12 to 18, which has significantly reduced our product development costs.

Suresh Krishnan, group manager for advanced engineering services, Amcor

PET plastic's complex behavior

When highly nonlinear PET containers are filled with a hot liquid, they tend to shrink toward their "remembered" pre-form shape. The bottles also collapse slightly due to the vacuum pressure created by cool-down after hot-filling, so the design for a hot-fill PET bottle includes vacuum panels designed to accommodate this collapse.

"We can now easily model these kinds of physics-based characteristics with SIMULIA, using a customized script for hydrostatic fluid elements that enables us to accurately simulate the behavior," Krishnan said.

The contents of every type of container must also be taken into account in Amcor's simulations, from adjustments in the density and viscosity values of liquids (from pure water to sticky paint) to the internal pressure fluctuations inherent to carbonated soft drinks.

Managing all that data

All these factors and variations result in vast amounts of simulation data. Amcor manages data generated by Advanced Engineering Services with ENOVIA, Dassault Systèmes' **3D**EXPERIENCE application for data and process management. ENOVIA facilitates the organization and easy retrieval of all CATIA and SIMULIA data for each container design while managing all processes to keep data in synch.

"Whoever in our organization – from our design engineers all the way to our manufacturing plants – needs information about a specific project, they can pull up the report in ENOVIA and find the latest version, completely standardized, which is very helpful," Krishnan said. "ENOVIA also automatically saves the history of every iteration, allowing for easy reference, tracking and communication among our project teams."

Amcor also is using ENOVIA's project management capabilities to manage workflows and processes. "We were a small company that grew through acquisitions," Krishnan explained. "As we did that, we needed to put formal processes in place and a certain sequence of tasks to ensure consistency in our practices. The workflows we've established using ENOVIA allow us to track and manage our projects and make our processes repeatable."

Krishnan says that when a work order is placed, designers and functional group managers can see what time it was assigned, view the workflow, specify approval points and reviewers, and mandate that specific documents be attached to the workflow, including drawings and quality lab requests. Automating and tracking workflows with ENOVIA gives Amcor visibility into the work taking place and allows for the creation of design, pilot plant and quality lab schedules.

"Designers and managers can see how many work orders are at different stages, who is responsible for moving them forward, and how busy the pilot plant is, which helps with estimating completion times for new projects," Krishnan said. "Monitoring and reporting tools in ENOVIA allow us to see how much time design engineers spend on certain work orders, track how many they've completed in a given period of time and get a handle on how many can be completed per day, for instance. Our workflows are now used as project management tools to improve the efficiency of the process and provide insight into the bottlenecks."

For instance, ENOVIA workflows help Amcor's tooling technicians ensure that when a product is ready to go to manufacturing, the tooling has arrived and the necessary 'ingredients' are in place. Before Amcor began using ENOVIA to manage workflows, pilot plants sometimes sat idle because they were scheduled for manufacturing before the tooling arrived. With the **3D**EXPERIENCE Platform, that is no longer a challenge.

Results rise to the top with simulation-driven lightweighting

The growth of Amcor's product lifecycle management capabilities has been a driving force behind the company's lightweighting initiative. For example, advanced simulation with SIMULIA allowed Amcor to reduce an 81-gram container design to 59 grams, a material savings of almost 27%. "Simulation helped us try many more options than we normally would and compare multiple designs with one another. ENOVIA helped us to keep all of those results organized and accessible," Krishnan said.

Although Amcor still validates its virtual tests with physical testing, the ever-increasing accuracy and refinement of its computer predictions have allowed the company to dramatically decrease physical prototyping. "We see a close match between the curves that SIMULIA provides and the test results, so we've got a lot of confidence in simulation now," Krishnan said. "We've cut our design cycle down to nine months from 12 to 18, which has significantly reduced our product development costs. And we've gained a lot of management buy-in to our methodology."

Krishnan says with the large number of projects undertaken by Amcor's engineers each year, the company is seeking to implement stage gate controls to ensure that the most promising projects move forward, and those with lesser results are set aside. To achieve this and other goals, the company is considering adoption of a more comprehensive enterprise-wide PLM system.

ENOVIA Version 6, for example, is a more through-and-through system that can take a product right from idea to commercial launch," he said. "And it can be the planning tool we need for phased implementation. We're really excited about modules like project portfolio planning and innovation and idea management."

Krishnan says that although Amcor has reduced its time to market by more than 50%, it always wants to move even faster to better serve its markets. "Our customers want it and expect it, so we want to make more improvements downstream – in manufacturing and in the supply chain – and upfront in collaborative engineering and project management," he said.

In fiscal year 2010, Amcor reduced its total resin use by 60,000 metric tons. The cumulative savings from 2006 to 2010 is close to 160,000 metric tons – enough to fill more than 1,600 rail cars.

DASSAULT SYSTEMES

Delivering Best-in-Class Products

CATIA
Virtual Product

EXALEAD
Information Intelligence

SOLIDWORKS
3D Design

GEOVIA
Virtual Planet

SIMULIA
Realistic Simulation

NETVIBES
Dashboard Intelligence

DELMIA
Digital Manufacturing

3DSWYM
Social Innovation

ENOVIA
Collaborative Innovation

3DVIA
3D Communication

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 150,000 customers of all sizes, in all industries, in more than 140 countries. For more information, visit www.3ds.com.

Europe/Middle East/Africa
Dassault Systèmes
10, rue Marcel Dassault
CS 40501
78946 Vélizy-Villacoublay Cedex
France

Asia-Pacific
Dassault Systèmes
Pier City Shibaura Bldg 10F
3-18-1 Kaigan, Minato-Ku
Tokyo 108-002
Japan

Americas
Dassault Systèmes
175 Wyman Street
Waltham, Massachusetts
02451-1223
USA

Visit us at
3DS.COM

---

www.3ds.com/solutions/consumer-packaged-goods-retail/overview