3DS DASSAULT SYSTEMES

ARCHITECTURE, ENGINEERING & CONSTRUCTION
CADMAKERS VIRTUAL CONSTRUCTION

CadMakers
Virtual Construction

Challenge:
CadMakers Virtual Construction seeks to push the envelope for Virtual Design & Construction in the Architecture, Engineering and Construction industry through computational practices, preconstruction simulation and coordination; prefabrication of multiple building systems and optimization of assets through digitized building lifecycle management.

Solution:
CadMakers uses the **3D**EXPERIENCE platform on the cloud, including the CATIA, DELMIA and ENOVIA applications, to create and share an integrated 3D building model.

Benefits:
With the cloud-based **3D**EXPERIENCE platform, CadMakers has gained superior visualization to help identify conflicts in building systems design, while enabling process simulation to shorten construction timelines. CATIA's user-defined features and scripting allows CadMakers to apply manufacturing efficiencies for construction processes.

SMARTER BUILDING

CadMakers Virtual Construction understands that the construction of a building is a small percent of the total cost of ownership, compared to maintenance of the structure. The company thinks it's just as important to efficiently plan for maintenance as it is to build a structure, which is why CadMakers takes a holistic view of the AEC process.

"People have thought that you can't use manufacturing best practices in AEC because everything is different in our industry," explained Javier Glatt, co-founder and CEO of CadMakers, a service company built to streamline the AEC industry and has executed 35 projects worth over US$3 billion in construction value since early 2014. "But new technologies, such as the **3D**EXPERIENCE® platform, are enabling this industry to automate processes and create a lot of value."

CadMakers employs Dassault Systèmes' cloud-based **3D**EXPERIENCE platform to promote collaboration throughout the AEC value chain and enable smarter building. CadMakers uses the **3D**EXPERIENCE platform to assist in three key areas: identifying conflicts in building systems design before construction begins; coordinating on-site sequencing during the construction process, and ultimately, providing a detailed map for maintenance services during the building's lifecycle.

"Virtual design and construction is the idea of taking all of the building systems — architectural, structural, mechanical, electrical and plumbing — and map them virtually," Glatt explained. "That enables us to identify and resolve problems in advance of live construction."

"The future of the construction industry is to effectively manufacture buildings as opposed to stick build on site," Glatt added. "Increasingly, building will be done in a factory floor in a safer and climate-controlled environment only to be assembled on site, similar to how the airplane manufacturing industry has evolved."

VIRTUALLY BUILD IN 3D

Opposed to the typical multi-page set of 2D drawings used by construction project managers, CadMakers shows its clients highly detailed, accurate 3D models early in the building process, which increases efficiency.

"The difference between working in 3D and 2D is powerful," Glatt said. "Roughly 30% of the problems or risks we identify in a given project result entirely from the fact that we're able to view the building and its systems in an integrated, 3D model."

The difference becomes clear to CadMakers' clients when they get to share the 3D building model created with the **3D**EXPERIENCE platform. "The 2D architectural drawing is one page, the structural drawing is another, and various building systems are on subsequent pages," said Ryan Yee, project modeling designer, CadMakers. "But when we use the CATIA application, the 3D building model is right in front of you and that's where the value is. You can be very clear: 'here are the ducts, here is the wall, here is the ceiling, and this is why your duct is below the ceiling.'"

"The recent increase of project teams using Building Information Modeling has created new silos, with an uneven adoption of technology amongst teams, adding complexity to traditional project procurement methods," Glatt said. "Integrated project delivery methods will become more important to drive efficiencies on complex projects. In this new world, prefabrication and manufacturing processes will be critical to maximizing value to owners."

> "New technologies, such as the **3D**EXPERIENCE platform, are enabling the AEC industry to automate processes and create a lot of value."
>
> — Javier Glatt, Co-founder and CEO, CadMakers

SHARING THE 3DEXPERIENCE

The freedom to share the 3D building model throughout a project's team is a key reason that CadMakers chose the **3D**EXPERIENCE platform.

In work for UBC Properties Trust, who optimizes the University of British Columbia's land assets, CadMakers uses a 3D model to serve in a quality assurance/quality control capacity. Glatt says the project team at UBC likes to get everyone — the project's architect, engineers and various subcontractors — in a room together to view the model and crowdsource solutions to potential problems.

It doesn't take long for everyone to drill down to their own concerns. "An electrician had us zero-in on one area of the model. 'OK,' he says, 'how much clearance do I have to get through this shaft? If there's a duct there, how am I going to get my conduit in there?' We were solving those problems in real time," Glatt said.

The real value in such reviews, he adds, is combining the hands-on expertise and experience of construction industry veterans with the visualization provided by the **3D**EXPERIENCE model. A veteran electrician or plumber doesn't need to learn to manipulate the model, however. "We'll do the heavy lifting, but we need the construction veterans to be the brains behind it all," Glatt said.

"We ask him, 'how close can we get these pipes together? What about hangers? Flanges? Valves? How are you going to actually install this and in what order?' So we get that veteran expertise and we're capturing it to shape the model in real time."

BENEFITS WITHOUT COMPLEXITY

With the DELMIA application, the **3D**EXPERIENCE platform enables users to move beyond a static model and show clients how the building components will be assembled together.

"When you build the 3D model, you have all of the parts and pieces there, every nut and bolt, but you may not think through the complexity of construction," Yee explained. "Using DELMIA, you can see piece-by-piece, assembly-by-assembly, the sequence and processes of construction."

That has real benefits on a complex job site. It provides informed decisions about when materials and assemblies are delivered to the job site, and where they are placed on the site in relation to the crane, as it can only pick up so many items in a day. Using the **3D**EXPERIENCE platform to connect the value chain through all of the suppliers and subcontractors, the general contractor can optimize deliveries and minimize bottlenecks on the job site.

"Where you put the crane is very important, as it dictates process and flow," Yee said. "With DELMIA, you can visualize which tasks need to be prioritized, and which can be scheduled in conjunction with others. That improves efficiency to shorten the construction timeline."

NEW INSIGHT SOLVES PROBLEMS OFF-SITE

Within the **3D**EXPERIENCE platform, the CATIA application enables users to design piping, tubing and Heating Ventilation and Air Conditioning (HVAC) systems from concept through detailed manufacturing. Moreover, users can build intelligence regarding the new system into the 3D model.

"Let's say you add an elbow to the HVAC system. That changes the friction in the system, which in turn changes the fan specs," Yee explained. "In CATIA, when you add elbows you can link them to the standards of your entire HVAC model, and it will identify what fans or valves you'll need when you change the design."
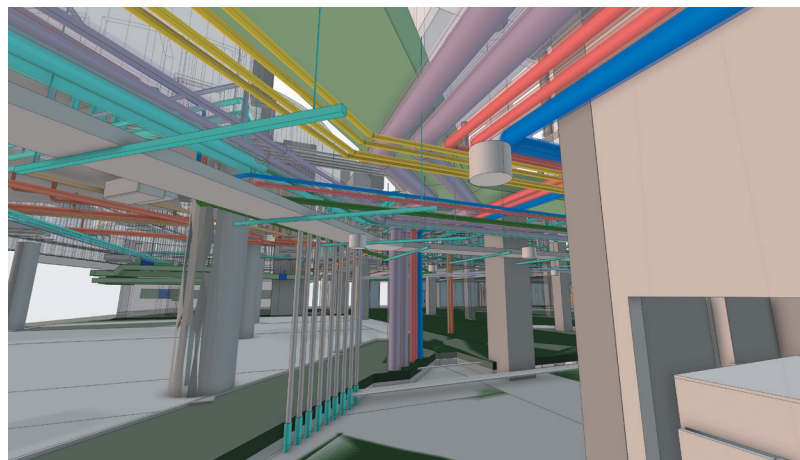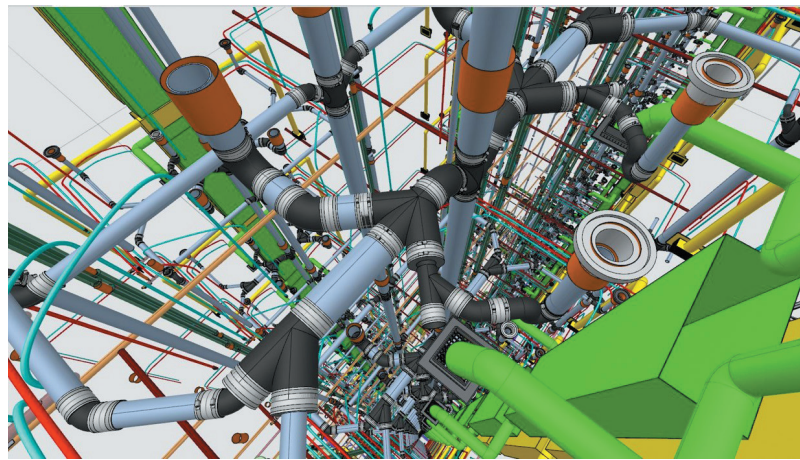
Top image: CATIA Fluid 3D Systems Designer on the **3D**EXPERIENCE platform enables designers to view 18 floors of mechanical, electrical and plumbing (MEP) elements at fabrication level of detail (LOD) 400 on what will be the world's tallest wood building.

Bottom image: Architectural, structural and MEP coordination of a complex project using Industry Foundation Classes and the **3D**EXPERIENCE platform.

"When the project is turned over to operations and maintenance staff, are they going to have the expertise and know-how to manage new wastewater systems and complex mechanical systems in a building?" Glatt asked rhetorically. "We can design new technologies into buildings, but can we operate them for the next 50 years? That's where the ENOVIA architecture of the **3D**EXPERIENCE platform can be extremely powerful."

The metadata behind a **3D**EXPERIENCE model, Glatt explains, includes every pump, filter and substructure in an easily searchable form. It can even include warranties and maintenance schedules for all of the building systems.

As a result, high quality building maintenance and operation can be built into the project from the start, rather than relying exclusively on the skills of a maintenance staff that learns a building's idiosyncrasies over time. Sooner or later, members of that maintenance staff will retire, so their experience and specific building knowledge will be lost; but content in the data-driven, model-based ENOVIA architecture will remain forever.

A new piping interface and platform lets users place specific elements in defined locations. Users select the equipment, supports, hangers and more; then CATIA creates the route. "You know the pipe is going from point A to point B, so why should you do all the leg work to route it when the software will do it for you — and probably do it better?" Yee asked.

The bottom line, he continues, is that CATIA enables users to identify issues in a plumbing or HVAC design and resolve them before the system gets to the worksite.

HOLDING ONTO THE KNOWLEDGE
Glatt believes the **3D**EXPERIENCE platform has a definitive competitive advantage: its data-driven, model-based architecture delivered by ENOVIA applications seamlessly connect business processes. This architecture, he argues, enables users to leverage the 3D model in new ways. One prime example is the long-term facility maintenance and management that occurs long after architects, engineers and construction crews leave the site.

SOLVING COMPLEX PROBLEMS WITH TECHNOLOGY
Combining their technological expertise with the **3D**EXPERIENCE platform to power its virtual design and construction business has been the crux of CadMaker's success.

"We believe in solving problems using technology, and we believe the **3D**EXPERIENCE platform may be the most powerful software available to our industry today," Glatt said. "It's an excellent match for very large, complex projects. You don't just have an architectural model, or a single building system. You have every mechanical, electrical and plumbing system right in front of you.

"In the **3D**EXPERIENCE platform, Dassault Systèmes has created an amazing technical solution. It's up to us to leverage its capabilities to solve real problems on the front lines of architecture, engineering and construction for our customers."

Our **3D**EXPERIENCE® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

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 190,000 customers of all sizes in all industries in more than 140 countries. For more information, visit **www.3ds.com**.

3DEXPERIENCE®

DASSAULT SYSTEMES | The **3D**EXPERIENCE® Company