

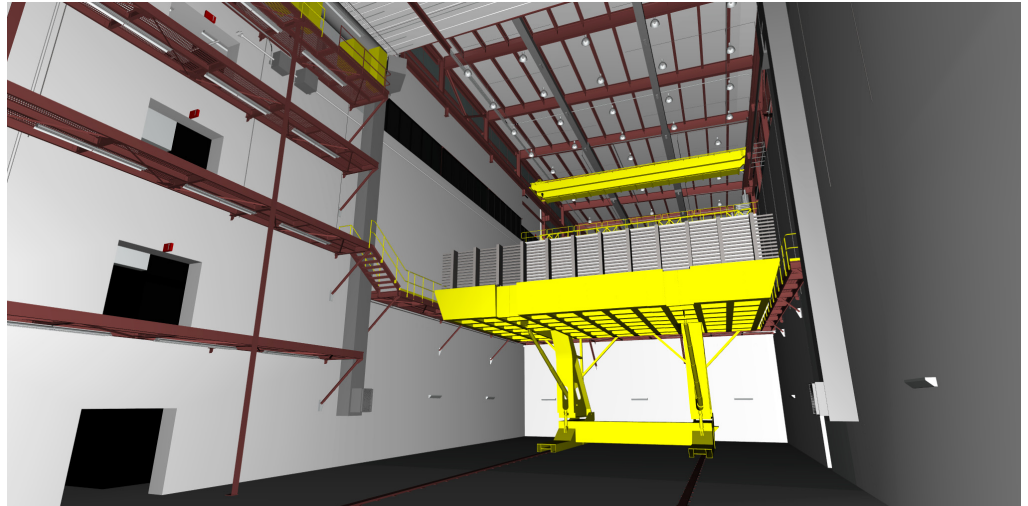
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—Kevin Lind
Virtual Construction Manager
A&P Construction

Origins of the universe.

Autodesk® software aids construction coordination on complex neutrino detection facility.



The NuMI Off-Axis Electron Neutrino Appearance (NOvA) detection facility will house a 15,000-ton particle detector that scientists will use to learn more about the role of neutrinos in the origins of the universe. Designed by Fermilab and funded by the U.S. Department of Energy's Office of Science (including \$20 million in ARRA stimulus funding), the complicated, nearly \$300 million project involves 180 scientists and engineers from 28 institutions. While the University of Minnesota will assemble the neutrino detector, Adolfson & Peterson Construction (A&P) will build the facility's enclosure.

To help avoid problems during construction, A&P uses Autodesk building information modeling (BIM) software to coordinate, analyze, simulate, and plan construction. The firm assembled a coordinated project model in Autodesk® Navisworks® that incorporates 3D models of all equipment and components in the building, including digital prototypes created by manufacturers using Autodesk® Inventor® software. By integrating 3D models into its whole-project model for the NOvA facility, A&P has been able to:

- Show accurate visualizations to its client
- Identify potentially costly and time-consuming problems, such as system clashes, before construction
- Sequence and plan construction activities efficiently
- Demonstrate detector assembly sequences for the client
- Help ensure the safety of construction and lab installation teams

The Challenge

Planning is everything on the complex, physically massive NOvA project. "The more we work out in advance, the better off we'll be when we build," says Bill Miller, NOvA lab manager. "We want to avoid any problems that can delay construction or cost money."

A&P also has an interest in pinpointing problems prior to construction. Kevin Lind, the firm's virtual construction manager on the project, explains: "We are always looking for better ways to reduce errors and field changes to save construction costs. We also want to meet—or beat—our schedule to help the University of Minnesota find answers to questions about neutrinos before other scientists and organizations."

The Solution

Even before A&P won the project, the company knew that leveraging the building information modeling process would be crucial to meeting project deadlines and budget goals. Before winning the project, the team used products based on the Autodesk® Revit® platform to create a 3D model of the building from 2D design documentation and then used the model along with other data to perform construction simulations with Autodesk Navisworks software. They then met with the University of Minnesota team to show how BIM facilitates project understanding. "The A&P team showed us a very detailed model that illustrated exactly how the project would unfold," says Miller. "They convinced us they had considered the project from every angle. This elevated them above other contractors during our construction manager selection process."

A&P finds construction issues early with the help of BIM and 3D models from manufacturers.

Building the Project Model

With help from Autodesk software, A&P is now fine-tuning the project model by incorporating 3D models of products and equipment for the facility, including the detector's installation and assembly equipment, even though some items were designed by their manufacturers using different CAD systems. Several crucial items, such as the assembly glue station and the interior bridge cranes, were designed with Autodesk Inventor software. When models of equipment or components are not available from the manufacturer, Lind creates them himself using Autodesk Inventor software and Autodesk Revit-based software.

"For our Autodesk Navisworks project model, we need some representation of space so we can coordinate all elements," says Lind. "It's much easier to receive 3D models from manufacturers because then we don't have to model the components. We simply open the models in Autodesk Inventor software and suppress features we don't need for our project model." Autodesk Inventor and Autodesk Navisworks software let A&P more easily incorporate copious amounts of model data from a variety of sources and platforms—rather than recreating data. As a result, the company can save precious time and reduce the risk of introducing errors.

Coordination and Clash Detection

One construction coordination challenge the project model will help A&P solve involves the detector's massive block of modules, which are comprised of highly reflective PVC cells containing scintillator oil. To assemble the block, the university must stack and glue together 50' x 4' one-thousand-pound modules—12 per plane—on a block pivoter until there are 31 planes. The block pivoter will maneuver the assembled block down the detector enclosure on rails and then pivot the block 180 degrees to stand it in place.

"To verify rail position for the block pivoter, there's a lot of equipment to consider," says Lind. "We have to mount the rails a certain distance from the wall and make sure there won't be any interferences or clashes when we construct all the elements. By visually coordinating the model, we reduce the chance of experiencing hiccups or delays."

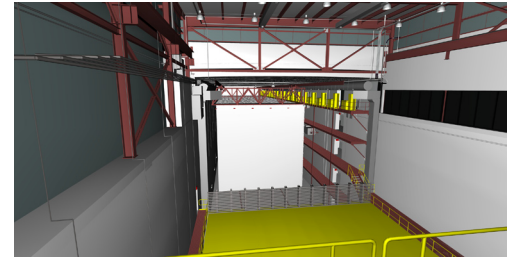
The lab installation team will construct the blocks and the block pivoter with the help of bridge cranes from Skarnes, Inc. Skarnes delivered Autodesk Inventor-created 3D models of its cranes to A&P for incorporation into the whole-project model before the firm had even secured the NOVA contract.

Finding Problems Early

Using the project model, A&P can more precisely coordinate placement of the cranes and sequence installation. In fact, with accurate Autodesk Inventor models of the cranes in place, the contractor has identified problem areas it can address in the planning stage, rather than in the field. "We must coordinate the crane rails precisely with pipes that will pump scintillator oil into the PVC extrusions," explains Lind. "Right now, those pipes are routed up the wall behind the bridge crane rail. But when we added in the Skarnes model, we saw that the space is tight, which will complicate assembly and installation. Now we know we may need to change the installation sequence or reroute the pipes higher on the ceiling."

The Result

By using its detailed project model for construction planning and clash and interference detection, A&P has reduced the possibility it will experience costly, time-consuming problems during construction—and earned the trust of the University of Minnesota. "A&P is helping to prove digitally that everything will fit together on this complex project without issues," says Miller. "Walking through the 3D model



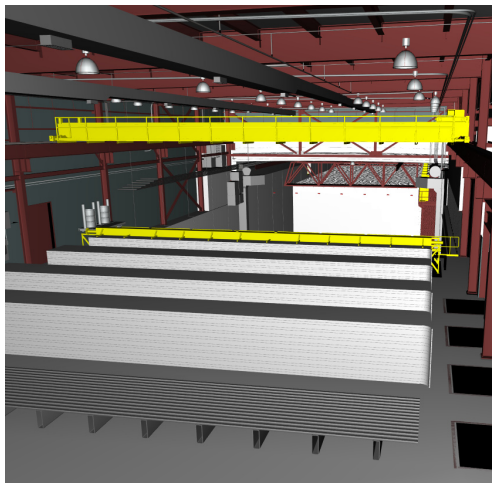
and viewing animations, we're more confident that construction will progress smoothly."

Manufacturers that provide A&P 3D models of their equipment also benefit. "When manufacturers give us models, there is less risk equipment won't fit as planned," explains Lind.

Scott Chelberg, sales engineer at Skarnes, agrees. "By giving our customers 3D models of cranes, we save time and money because obstructions will be less likely during installation. I think this kind of service is the wave of the future. Prices and features being equal, the crane manufacturer that can provide a 3D model of its product will win the business."

For More Information

To learn how you can use digital prototypes and BIM to reduce coordination challenges on projects, visit www.autodesk.com/inventor and www.autodesk.com/BIM.



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—Scott Chelberg
Sales Engineer
Skarnes

Images courtesy of Adolfson & Peterson Construction

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