Using Fabrication CADmep to see other building systems improves our ability to make informed decisions about our layout and avoid interferences—helping minimize field rework and delays. And given the unique shape of the hotel and the spatial constraints, the software’s 3D modeling environment help us test whether the actual size of the as-designed systems will fit while allowing adequate access and clearance.

— Jeremy Owen
Project Manager
RK Mechanical, Inc.

The Denver International Airport expansion is one of the largest and more complex building projects in Colorado.

**The project**

Denver International Airport (DIA) is undergoing a multi-year construction program to add a large-scale hotel and transit center complex next to the airport’s south terminal. The project includes a 519-room hotel and conference center, a public transit station that connects the airport and its underground concourse train with Denver’s commuter rail system, and an open-air plaza linking the hotel, conference center, and train station to the existing terminal.

Denver-based contractor RK Mechanical is fabricating and installing the ductwork and mechanical systems for the complex. To better serve its customer, RK Mechanical uses integrated detailing, fabrication, and installation solutions from Autodesk that improve their business and project outcomes – a win-win for the company and their clients.

**The challenge**

“The new complex combines several independent, but physically integrated projects—from the new rail station and hotel with retail stores, restaurants, conference and office spaces, to the extension of the existing concourse and baggage-handling systems,” says Jeremy Owen, RK Mechanical’s project manager. “Fitting our mechanical systems into this integration of dissimilar structures, functions, and spaces is a real challenge.”

In addition to these spatial constraints, the building shape itself poses problems. The architect likens the hotel’s form to a bird with its wings extended. “A conventional hotel or office building has stacked floors, where the layout of each floor and its building systems match the floor below it,” explains Owen. But due to the hotel’s iconic building shape, every level is different and there are many spaces and rooms without floors below them—complicating the location and fit of the building systems.
Make sure productivity gains flow from the shop to the field.

The solution
RK Mechanical is using integrated Autodesk® Fabrication® software and its 3D modeling environment to digitally layout its building systems and coordinate the design with architectural and structural models of the complex’s multi-discipline project elements. Building Information Modeling (BIM) workflows combined with the software’s libraries of real-world, manufacturer-specific content help the firm develop extremely accurate models with a level of detail necessary for precise coordination and fabrication.

Integrated information and workflows
RK Mechanical uses Autodesk® Fabrication CADmep™ software to create 3D models of project’s building systems for coordination and detailing. When the layout and detailing is complete, the firm then uses these models for more efficient production of spool sheets and drawings to support the prefabrication of piping/plumbing systems. For ductwork, RK Mechanical uses the Fabrication CADmep software fabrication-ready models in Autodesk® Fabrication CAMduct™ software to drive ductwork manufacturing.

RK Mechanical’s field personnel at the airport site use Autodesk® Fabrication RemoteEntry to access component library information from the job site to expedite and manage field changes. Workers on the job site also use Autodesk BIM 360™ mobile technologies for cloud-based document management, collaboration, and reporting.

This integrated workflow is helping RK Mechanical provide high-quality building systems while meeting the project’s stringent schedule and budget requirements.

Buildable building systems
“This is one of the largest and the most complex building projects under construction in Colorado,” says Jubel Beren, a BIM technology coordinator for RK Mechanical. “From an MEP point-of-view, the job includes approximately 31 miles of piping and plumbing, 9 miles of PEX piping, almost 430,000 pounds of sheetmetal ductwork, and over 70,000 joints or welds. That’s a lot of mechanical systems to fabricate and install, so we need to make sure that what we’re modeling is what we need and what we’re manufacturing won’t interfere with other trades.”

RK Mechanical is using model-based Fabrication CADmep to virtually plan and coordinate all the building systems. “With Fabrication CADmep, we can work in 3D to layout and model the systems using construction tolerances,” explains Robert Lee, RK Mechanical’s CAD project leader of the DIA project. “The software’s user interface makes it very easy to quickly layout piping or ductwork—complete with manufacturers’ exact dimensions and tolerances, proper flange connections, insulation sizes, and so on.”

In addition, RK Mechanical often downloads 3D models of MEP equipment from manufacturer’s website for more precise coordination. “The accuracy of these equipment models are certified by the manufacturer and contain exact dimensions for the equipment and connection points,” explains Tim Catalano, a BIM technology coordinator for RK Mechanical. “The ability to import and use these models in Fabrication CADmep saves us time and improves the quality of our layout.”

To guide their routing of the building systems, the team imports 3D and 2D information from other disciplines and companies involved in the airport project, from electrical systems and ceiling assemblies to baggage handling systems and structural elements. Moreover, since Fabrication CADmep uses real-world content that contains the level of detail necessary for fabrication, RK Mechanical uses the software and its fabrication models to investigate the constructability of the building systems.
With Fabrication RemoteEntry, our field personnel order components directly from the job site, based on the same Fabrication CADmep component library and database we use in the fabrication shop. We just measure the installed equipment, and then use the software to select the right fitting, input the correct dimensions, and send it off the shop. This cuts our shop time in half.

— Scott Pittman
CAD Manager
RK Mechanical, Inc.

“Using Fabrication CADmep to see other building systems improves our ability to make informed decisions about our layout and avoid interferences—helping minimize field rework and delays,” says Owen. “And given the unique shape of the hotel and the spatial constraints, the software’s 3D modeling environment help us test whether the actual size of the as-designed systems will fit while allowing adequate access and clearance.”

For example, the hotel contains several large ballrooms with operable folding partitions, as well as very large chandeliers and other special lighting fixtures. “When we started to virtually layout our mechanical systems in the ceiling above one of the ballrooms, we found complications due to the additional structural supports needed for the lighting and fixtures,” says Lee. “We worked with the structural and MEP consultants to redesign some elements in the area and change some of the routing so that everything would fit above the ceiling.” The team experienced similar challenges when routing systems above the ceiling of the hotel’s corridors. “High corridor ceilings are aesthetically pleasing, but they don’t leave much room for all systems running above them,” says Lee. “Fabrication CADmep and model-based layout let us virtually try out different ideas to successfully minimize the mechanical systems in that space.”

Fabrication CADmep is also helping RK Mechanical coordinate all of its systems around the extension of the airport’s underground subway that will connect the new transit station to the extension of the airport’s underground subway that will connect the new transit station.

“The train’s tube structure goes right under the hotel,” explains Owen. “But due to vibration, we can’t use the structure to support any of our piping or ductwork, so all of our systems have to go below the tube. Fabrication CADmep is helping us successfully coordinate the subway structure with our systems, and the structures needed to support them.”

**Direct to CAM**

As RK Mechanical finalizes the coordination and layout of the building systems, the Fabrication CADmep models drive the firm’s fabrication processes. “With Autodesk Fabrication products, we have a seamless detailing-to-fabrication workflow,” says Lee. “The Fabrication CADmep models help us generate piping spool drawings more efficiently. And for ductwork, it’s a hands-off process. We simply download the models to the Fabrication CAMduct software, which automatically outputs ductwork manufacturing to our production line.”

**Expediting field changes**

RK Mechanical also uses Fabrication RemoteEntry at the airport jobsite to expedite field changes. “To keep ahead of schedule, we sometimes prefabricate ductwork before final submittal,” says RK Mechanical CAD manager, Scott Pittman. “In these situations, we purposely skip connecting fittings, such as an attachment to a piece of equipment. Once the equipment is installed, we use field dimensions for that final connection.” In the past, the field personnel would write the dimensions on a special form or ticket. When the shop received the ticket, they had to decipher the person’s handwriting and then manually input the information into the CAM software. If they misread the numbers or entered them incorrectly, the field would be waiting several weeks for a fitting that is the wrong size.

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**Better access to project data**

RK Mechanical’s field personnel are also using cloud-based Autodesk® BIM 360™ software at the job site. “Instead of carrying paper drawings around, we use mobile devices and BIM 360 Glue to access project models and documentation onsite,” says Craig Edwards, an RK Mechanical sheetmetal project foreman. “It’s a great tool for our field foreman to instantly reference drawings or view the 3D fabrication model—especially when they’re coordinating with other trades. We use it every day to solve issues on-the-spot, in real-time.”

RK Mechanical also uses BIM 360 Field to more efficiently communicate with the contractor about installation issues and checklists.”
Prefabricating quality

To help with the timely delivery of high-quality building systems, RK Mechanical utilizes prefabrication whenever possible. “We preassemble as much as we can in our controlled shop environment,” says Lee. “With the size of this project and the number of welds, off-site preassembly offers a significant cost savings.”

For example, RK Mechanical needed to run 10 and 12-inch carbon-steel piping from the airport’s central utility plant to the hotel and transit center, which is about a mile away. “The accuracy of the Autodesk Fabrication software and models enabled us to prefabricate almost all of this piping—eliminating the cost of onsite logistics and labor for field welding,” says Owen.

The result

RK Mechanical is on target to complete the airport project on schedule and within budget, thanks in part to Autodesk Fabrication software products. “Autodesk Fabrication significantly increases the efficiency and quality of our work,” says Pittman. “Most of our detailers were field personnel, without a lot of computer experience. The software is easy to learn and use—with a graphical user interface that shows them the fittings and components they’ve been using for years, enabling them to quickly and accurately choose parts and pieces for their layouts.”

“The software’s integrated detailing and fabrication—and centralized libraries and databases—means that what we layout on the screen is what’s fabricated,” says Catalano. “And the tight integration between the Autodesk Fabrication products and other Autodesk BIM products makes it much easier to use design and fabrication information from the other companies working on this project.”

“Autodesk’s software products improve our project collaboration and the coordination of our systems with other trades, in the office and at the job site” says Lee. “The ability to combine all that information, and see it in a virtual 3D world gives everyone a better understanding of the project and improves decision-making. At the end of the day, this benefits our company, our project partners, and our client.”

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