

# AMEC

## Reduces Design Time

Design time reduced 25 percent  
in polymer plant expansion  
with Bentley® AutoPLANT®

**F**aced with expanding the processing capacity of an existing polymer processing plant, the international engineering and services company AMEC sought a 3D plant modeling application—Bentley® AutoPLANT® proved to be the optimum design solution.

It was a medium-sized project, by AMEC's standards, with approximately 600 new lines of piping and 60 new pieces of equipment. The main challenge was that all the new items had to fit into existing buildings. The AMEC engineers in charge of the project expected difficulty in getting pieces to fit through passageways and in interfacing new piping to the existing facility. Because they were so concerned about fit, they ruled out doing the design in 2D and began a search for a suitable 3D plant modeling program.





### The 2D Challenge

Routing pipe in 2D is particularly challenging because it requires piping engineers to imagine elevations and indicate with elbow symbols whether a pipe goes up or down. They must maintain consistency with other drawings as they work, visualizing the z dimension of those other views, as well. Each 2D drawing is actually an exercise in piping design.

“It is difficult to detect interferences when only two dimensions are visible,” says Tim Rothwell, engineering systems development manager at AMEC’s design and engineering arm, Manchester, UK. “Even when designers use plan, section and elevation views to try to spot clashes, if heights on two drawings don’t match perfectly, it is possible for an interference to go unnoticed. It is also difficult to detect interferences between disciplines because they typically do not share drawings early in the design phase.”

### The 3D Solution

Several factors influenced AMEC’s decision to go with Bentley AutoPLANT. In its search for a suitable 3D modeling solution, AMEC ruled out the option of using high-end workstation-based systems (already used by AMEC’s on- and offshore divisions) because of high implementation costs and long learning curves. Knowing it would want to tailor the software, AMEC wanted a

program that was easy enough for its own engineers to customize. An additional requirement was that the software be based on AutoCAD®, as, over time, there had been a considerable amount of investment in AutoCAD, and the majority of the design staff were trained in the use of AutoCAD. Another major factor was that the majority of AMEC’s clients required deliverables in an AutoCAD format. The ease of setting up the software to handle a new project was also a major consideration.

“Sometimes a client comes to us and wants a project up and running in a day,” explains Rothwell. “You can’t do that with all programs.”

Finally, AMEC wanted a suite of integrated applications that would allow the different disciplines to share data seamlessly.

### Integrated Applications for Multidisciplinary Tasks

AMEC chose Bentley AutoPLANT because in addition to its being AutoCAD add-on software with full 3D modeling capabilities, it includes modules for each of the design disciplines. AMEC’s implementation includes seats of AutoPLANT Process and Instrumentation Diagram (P&ID);

AutoPLANT piping; AutoPLANT Equipment; AutoPLANT Structural 3D; AutoPLANT Isogen PLUS, which produces isometric drawings automatically from the 3D mode; AutoPLANT Instrumentation and Wiring Workgroup; and AutoPLANT Explorer and Explorer/ID (Interference Detection), which permit automatic interference detection and walk-through visualization of a 3D model.

**“The software itself was affordable, but we experienced additional cost savings in not having to bring in applications specialists to do the programming.”**

Tim Rothwell, engineering systems development manager, AMEC

For the polymer plant expansion project, AMEC had two preliminary tasks. One was to take measurements of the existing facility so it could be modeled in Bentley 3D software. The other was to set up the software for the project, establishing the tag-numbering scheme in the database, for instance, and setting up a unique symbol library. The actual design

process began with marking up the existing paper P&IDs to reflect the new equipment and then transferring that information into the Bentley AutoPLANT P&ID module. The software maintained an up-to-date database of the information on these drawings, such as the tag numbers for process lines, instruments and equipment.

After the P&IDs were done, datasheets and instrument lists were generated automatically. These documents and the drawings were given to mechanical, structural and piping engineers who began using their respective modules to place items into the 3D model created from measurements of the existing facility. For example, mechanical engineers used the AutoPLANT Equipment module to design and place equipment and tanks. This module automated much of their work by providing a library of parametrically defined components. With the library, the designer simply entered a few values representing the specifications of the equipment and the software drew the model. Structural engineers used the AutoPLANT Structural 3D module, which also has a library of standard shapes. When an engineer wanted to run a beam from one location to another, he simply chose the beam shape he wanted and indicated the desired location. The software drew the 3D model of the beam automatically.

Piping engineers used the AutoPLANT Piping module to route the pipe. To do this, they drew lines indicating where pipes should be placed, as they would in 2D. But rather than geometric representations of the pipes, each digital pipe model was actually an object containing additional information from the database, such as performance and material specifications. And because the engineers were working in 3D, they were able to include the z dimension in the model, routing a pipe 10 meters horizontally, for example, then up five meters, and then horizontally another 10 meters. Having the z dimension visible was easier than trying to imagine elevations on a 2D drawing. Another benefit of building a 3D representation of

the piping was that by panning, zooming and rotating the model, designers could easily detect interferences.

“The interference-checking tool is easy to use and runs on the same PC the designers are using. The items in the model are also intelligent, which means you can add or delete pieces of equipment rather than changing individual lines and circles.”

Tim Rothwell, engineering systems development manager, AMEC

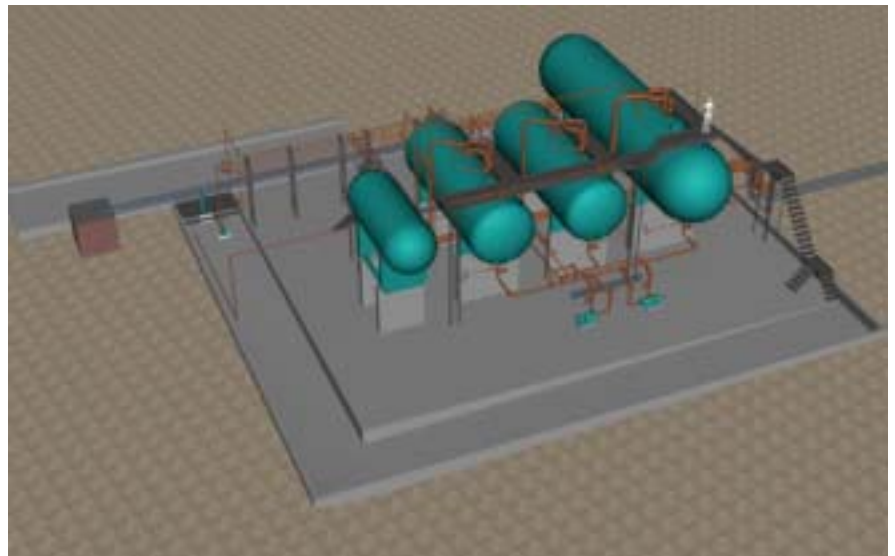
### Fostering Collaboration

One benefit of working this way was that it fostered early collaboration. For example, a structural engineer could import equipment models into his design and a piping designer could route pipes around the structural steel. This helped avoid clashes from the start.

### Interference Checking

In addition, as individual designers worked, they used AutoPLANT Explorer to perform periodic interference checks.

“We encourage the designers to do this themselves. The interference-checking tool is easy to use and runs on the same PC the designers are using. The items in the model are also intelligent, which means you can add or delete pieces of equipment rather than changing individual lines and circles,” explains Rothwell.



### Making Changes and Avoiding Errors

The ease of making changes encouraged engineers to experiment with different layouts to find the best way to integrate the expansion with the existing facility. Another benefit of 3D modeling was that since every item in the 3D model had a corresponding entry in the

database, there was less chance for errors related to wrong part numbers. For example, if a piping designer changed the size of a valve on a drawing, the size was also changed automatically in the database.

“Producing line lists, valve lists and equipment lists for procurement from the database prevented the disordering of expensive components,” Rothwell adds.

When they had completed the 3D model, AMEC used the AutoPLANT Explorer/ID module to perform a thorough evaluation of the entire design for interferences. Engineers fixed any problems that were detected. Once the process had been modeled accurately, instrumentation engineers designed the instrumentation. They entered specifications for instruments directly into the project database. Then the various modules of the Bentley AutoPLANT Instrumentation and Wiring Workgroup used that information, along with information entered previously during the creation of P&IDs, to generate loop diagrams, termination diagrams and data sheets.

### Generating Construction Documents Automatically

At that point, all that was left was producing construction documents. These were generated automatically from the 3D model. For piping

isometrics, engineers simply selected the views they wanted and commanded the AutoPLANT Isogen PLUS to create the drawings. Engineers could produce up to 40 isometrics in 20 minutes in this manner. Some plan and section views were created directly from the plant model.

### The pay-off

By modeling the polymer plant expansion in 3D modeling, AMEC reduced design time by 25 percent compared to manual design methods. Customizing the new software went smoothly and was done in-house,

with all the right materials having been ordered and all new pipes joining perfectly to existing ones.

“The software itself was affordable, but we experienced additional cost savings in not having to bring in applications specialists to do the programming,” says Rothwell. “We knew this project could benefit from 3D modeling. The ability to

create a digital representation of the entire expansion, with geometry linked to specification data, paid off in both design and construction.”



For more information on Bentley please contact us.

1-800-BENTLEY

[www.bentley.com](http://www.bentley.com)



Bentley and the "B" Bentley logo are registered trademarks of Bentley Systems, Incorporated or Bentley Software, Inc. AutoPlant is a registered Trademark of Rebis. AutoCAD is a registered trademark of Autodesk, Incorporated. Rebis is a wholly owned subsidiary of Bentley Systems, Incorporated. All other brands and product names are trademarks of their respective owners. © 2002 Bentley Systems, Incorporated. Bentley Systems, Incorporated believes the information in this publication is accurate as of its publication date. The information is subject to change without notice. BAA012060-1/0001 11/02