

**Merck & Co., Inc.
Vaccine Processing Facility Expansion**

success story

Single Source Project Delivery

Advanced Design & Architecture

Collaborative Project Teaming

Innovative Construction



integrated project services



Services Offered:

Consulting and Strategic Planning

Full-Service Design/Engineering

- Architectural
- Civil/mechanical/process
- Electrical/environmental
- Health and safety
- Manufacturing equipment
- Automation

Project Delivery

- Scheduling/estimating
- Construction management
- Owner equipment installation
- Commissioning

Compliance/Validation

Client Benefits:

Guarantees

Minimal financial risk
Functional, compliant facilities

Simplicity

Technical expertise
Single-source project management
Complete, one-stop resource

Speed

"Fastest possible" project delivery
Multi-task capability

Value

Efficiency to meet business needs
Financial accountability

Flexibility

Solutions for tomorrow's needs

Compressing the Critical Path

In the 18th century, an English doctor named Edward Jenner demonstrated that a person exposed to cowpox blisters was not susceptible to smallpox. Today, vaccines play a critical role in preventing a wide range of diseases around the world. One of the leading providers of vaccines is Merck & Co., Inc., with products that include the cervical cancer vaccine, Gardasil®; and Zostavax®, the first and only vaccine for the prevention of shingles; as well as a number of pediatric vaccines to immunize children against measles/mumps/rubella, chickenpox, and rotavirus gastroenteritis.

Demand for Merck vaccines is projected to grow. To meet market needs, In December 2005, Merck kicked off the expansion of Building 12A, its roller bottle vaccine processing facility in West Point, Pennsylvania, in order to meet these growing market needs. The facility also houses a technical laboratory, additional processing suites and warehouse/cold storage space for the aseptic robotic production of the bulk live virus vaccine. The 38,000-square-foot expansion would need to incorporate 14,000 square feet of cGMP space.

Speed to market matters

Speed to market is critical. Merck funded the project at \$52 million and wanted to beat its "historic best"—27 months—for project execution. It called on Integrated Project Services (IPS), an integrated provider of engineering, construction management, commissioning and validation services with extensive experience in cGMP compliant facilities. IPS specializes in providing solutions for the life sciences industry. Noted for its process engineering capabilities, IPS is a pioneer in fast-track design/build and designing to a targeted cost.

"The project posed some interesting challenges," says Stephen Franey, RA, senior project architect with IPS. "The vaccine is produced through aseptic manipulations via robots in restricted access barrier systems. In addition to the tight schedule, we needed to connect the existing building's core functions into the new expansion's core functions while the existing building was operational. Operations needed to function in either area seamlessly."

IPS provided Merck with a range of services, including full architectural/engineering design for the basis of the project design, as well as construction documentation and construction administration services. IPS also consulted on the structural and civil engineering with Mainstay Engineering Group.

IPS and Merck achieved the project goals and completed execution in 24 months, shaving three months off Merck's historical best timeline for similar projects. They did so despite the fact that the construction start was delayed two months due to Pennsylvania Department of Environmental Protection permitting policy changes. The success was a result of an innovative approach to design and construction that included collaborative teaming, pre-fabricated construction elements, and advanced design technology that enables Building Information Modeling (BIM).

The BIM tool is valuable, but it doesn't operate in a vacuum. Experience and insight are critical. For example, designing the correct atmospheric and spatial environment for the robotic equipment requires an understanding of both operational and business needs—a perspective that IPS brings to the table.

Innovation Revealed Knowledge Delivered

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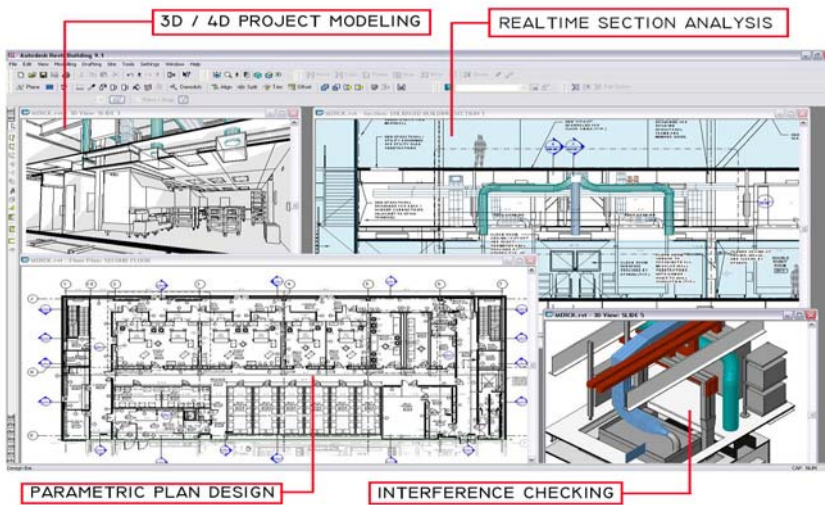


BIM: A new approach to A/E/C design

Building Information Modeling, or BIM, is an innovative technique that facilitates seamless communications within architecture, engineering and construction. It represents a new way of working on projects that allows coordinated, consistent information for faster decision-making; provides better documentation at all levels, from concept to construction documentation; and enables modeled simulations that make it possible to predict performance before the project is constructed.

“I started using BIM in 2002 and have never looked back” Franey says. “I wanted a new approach that would allow me to raise the quality of design to a higher level without increasing the project budget, manpower requirements or schedule significantly. BIM was the answer.”

BIM is both a design approach and a design tool. The BIM process is supported by applications such as REVIT, which combine true three-dimensional visual studies with ongoing construction documents in a single database that connects both elements. It far outstrips the capabilities of two-dimensional CAD systems and even conventional three-dimensional design systems.



“Using BIM, we can provide three-dimensional design for the cost of 2D,” Franey says. “It makes it easier for the designer to check for interference and for client and contractors to visualize and understand the design.” It is also easier for contractors to develop shop drawings from the 3D model.

The BIM tool automates many repetitive chore-like tasks, such as completing room or door schedules and drawing annotations, that otherwise would have to be done manually. For example, its bidirectional tracking means that when a designer changes the floor plan, the software automatically changes all the room schedules.

If an exterior door is removed from the project, the software automatically updates each drawing—the floor plan, building sections, elevations and schedules. The software also allows multiple designers to work on the same project file simultaneously. As a result of these efficiencies, Franey says, “the level at which we design projects in our office today wasn’t possible 10 years ago. BIM software makes it possible.”

The multifunctional platform streamlines material takeoffs, provides a repository for information exchange and serves as a facility maintenance turnover tool. BIM even extends into the fourth dimension, integrating the design with the project schedule. Purchasing can be based on real-time data for greater accuracy. BIM gives unprecedented control over project building components, information management, and the graphical effectiveness and control of highly complex, fast-track projects like the Merck expansion.

Good ways to get ahead

The expansion posed multiple design challenges. The design had to accommodate robots and robotic support equipment, prefabricated mechanical/electrical/plumbing elements, and modular walls and ceilings for all clean spaces. Prefabrication saves construction time, but requires greater precision in shop assembly than elements that are assembled on site. BIM modeling provides that precision.

The modular walls came at a cost premium, but greatly reduced time to final finish, saving about a month over drywall construction. They also provided cleaner construction. The ceilings, including HEPA filter housings and lights, could be installed early. The design incorporates HVAC low wall returns and electrical raceways into the wall panels.

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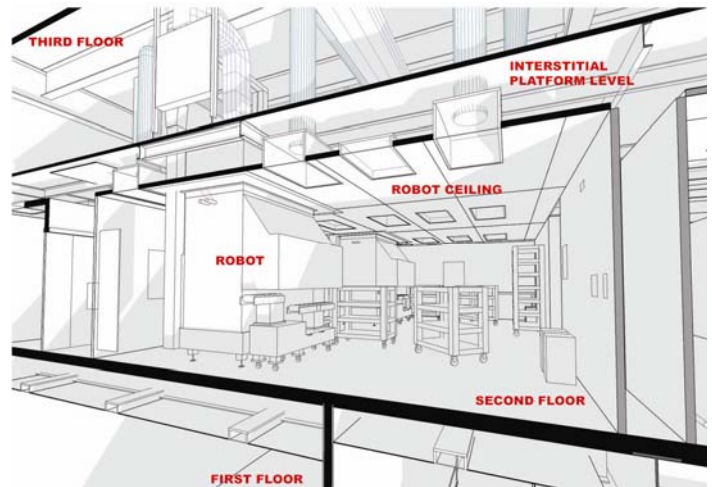
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“The space needs to function efficiently, but at the same time, it can’t be larger than it needs to be due to utility system costs,” Franey says. Vendor equipment CAD drawings were used to create parametric robot models, which can alter their shape, size and proportions in real-time to address a particular design challenge. Robot room portable equipment was created from user input. The resultant BIM model was exported for use by sub-contractors.

The building’s second floor is largely EU Grade A and Grade B space, placing it on the critical path. Key equipment would not arrive for at least seven months after construction began. In order to minimize delays, IPS designed an interstitial level 10 feet above the second floor to enable simultaneous high and low construction.

In the first weeks, prefabricated ceiling panels were hung and terrazzo was installed on the lower level, while Mechanical, Electrical, Piping (MEP) was roughed in on the upper level. Later, the MEP terminations were completed on the upper level, while on the lower level, the pre-fab walls were erected and final finishes put in place. This approach saved eight weeks off the second floor schedule.



Collaboration is key

Another significant advantage that BIM provided for this project was the ability to coordinate all the disciplines involved with the structural and architectural systems. Key subcontractors for HVAC, electrical, instrumentation, plumbing and process piping were selected early and met weekly with the design team. This made it possible to maximize prefabrication and enable subcontractors to “hit the ground running”, and resulted in better cooperation and coordination. As a result, the overall MEP scope came in under budget, and the approach cut eight to 10 weeks off the critical path.

Without BIM, those up-front schedule gains might have been lost to redesign during construction, as various disciplines struggled to coordinate the prefabricated elements.

“Integrating the construction/sub-contracting team earlier allowed for earlier buy-in by all parties,” says Ron Salutric, RA, a design manager and senior associate at IPS. “Through BIM, they gained an earlier understanding of the project, and early constructability review comments gave them partial ownership of the construction documents. That resulted in streamlined documentation and less design rework.”

BIM’s three-dimensional and parametric functionalities facilitated the collaborative effort by enabling the team to coordinate ductwork, piping and other systems to a much greater extent than conventional methods allow. As a result, only a few post-construction field sketches were necessary.

“We lost no time in the field due to problems with discipline coordination,” says Josh Capparella, LEED AP, a mechanical engineer at IPS. “For a job this size, that speaks volumes to the power of BIM modeling.”

IPS adds value

Using innovative design and construction techniques, and drawing on its extensive design/build experience, IPS was able to deliver a fully designed, fully functional, flexible manufacturing facility that met Merck’s requirements—and to accelerate the schedule sufficiently to complete the project faster than the client’s previous “best”. As a result, Merck is well positioned to meet the growing demand for its vaccines.

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