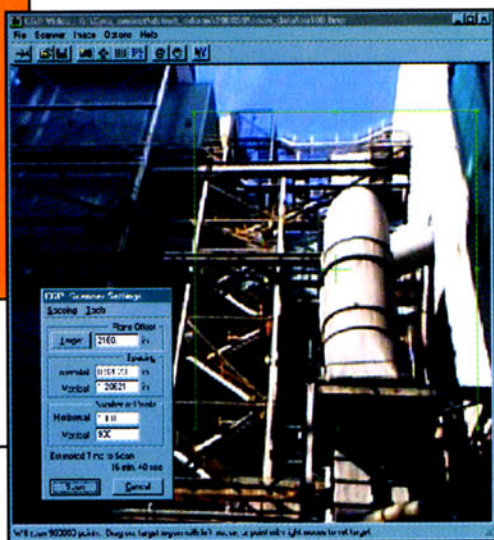
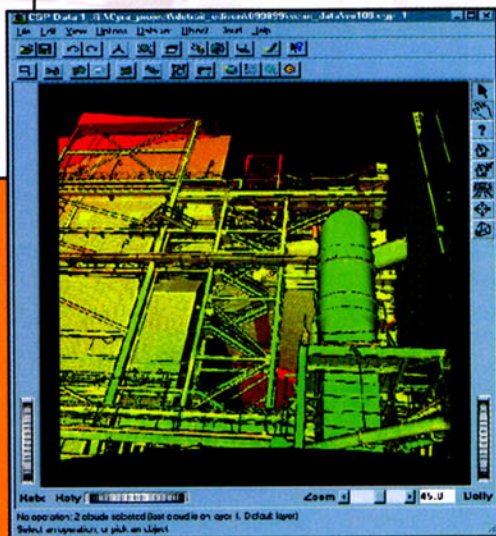


Plant Engineering

Obtaining as-built plant information is always challenging—and sometimes dangerous. Detroit Edison and its subcontractors Raytheon and DB Riley are using MicroStation and the Cyrax 3D laser scanner to automate the task in a revolutionary way.



Views of the data target as seen through the laser scanner and the supporting Cyrax software.

Carving as-built plans with a Laser Cannon

The task Detroit Edison assigned to Raytheon and DB Riley was daunting: Create as-built plans as the first stage of a major redesign of the Monroe Power Plant in southwest Michigan. The engineering team proposed a novel solution. They chose to use the Cyrax 3D laser scanning systems from Cyra Technologies to create the as-built plans, avoiding much of the dangerous task of physically measuring the plant.

The plan worked. Raytheon was able to rapidly create a precise as-built 3D model of the existing plant using 3D data obtained from the Cyrax scanner, ported to MicroStation. Using the Cyrax system, engineers cut down on design time dramatically and reduced the risk of construction errors by obtaining exact measurements without manual data entry.

The existing Monroe Power Plant offered a considerable challenge for this new data collection technology. The boiler building and associated structure with piping that needed to be captured were part of a 10-story-high structure with very restricted access. Traditionally, engineers used to perform either hazardous "walk-downs" of the site to manually gather measurements or use point-to-point surveying equipment that gathers surface geometry measurements one point at the time.

The great advantage of using the Cyrax system became apparent quickly. The Cyrax 2400 was able to capture up to 800 surface geometry measurements per second over a 40-degree x 40-degree field-of-view, with a 50-meter range and 6-mm positional accuracy. With a measurement resolution as fine as 2mm between adjacent points, the system allowed Raytheon to capture an unprecedented level of detail. Raytheon was able to use Cyrax in any lighting conditions and its Class 2, eye-safe laser did not require extra safety precautions.

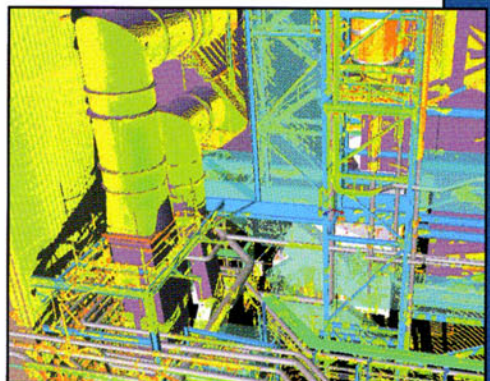
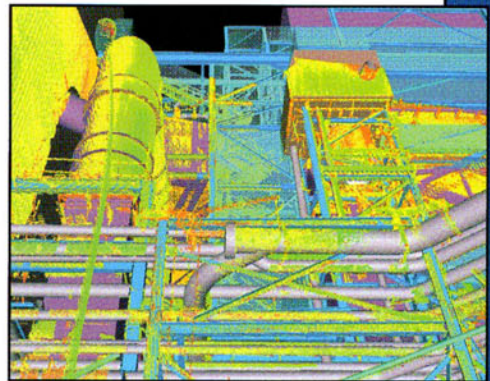
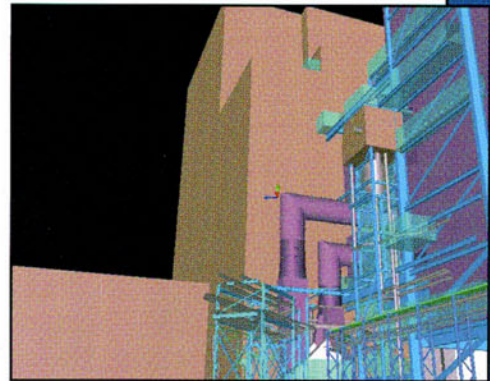
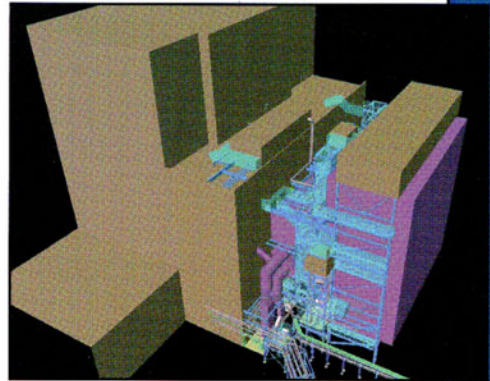
The scanner could be pointed at the boilers from large distances, making it unnecessary to build scaffolding for access and risky manual measurement. Further, due to the unprecedented speed of capturing information, the system was able to cut down the time needed to survey by several orders of magnitude, according to team members.

Capturing 3D point clouds

Raytheon engineer Greg Lawes, who spearheaded Raytheon's use of the system, was able to move the scanner to various locations around the plant and capture portions of it as 3D point clouds. Some of the scans were taken from ground level, looking straight up the full 180 feet of the structure. Even at these distances, Cyrax delivered precise and usable data clouds. Once the scanner captured a location, data representing the location became instantly 3D-viewable with full rotation, fly-around, pan and zoom capability. The valuable 3D geometry information was immediately available for engineering. Raytheon was able to extract point-to-point distances from clouds of points as soon as a scan (typically a 10 minute process) was done.

The contract Detroit Edison awarded to Raytheon Engineers & Constructors Inc. and DB Riley Inc. for the redesign could reach \$250 million, split equally between the two firms. Raytheon, based in Lexington, Mass., acquired its first Cyrax system in early 1998 and has since then deployed it in several projects. The system consists of a portable Cyrax 2400 3D laser scanner, a PC laptop and software that operates the scanner and allows users to convert the laser scans into 3D models and 2D drawings.

Once the data for a model has been gathered using the Cyrax system, MicroStation can utilize it for further viewing and editing. The supporting software for the Cyrax laser scanner directly exports to MicroStation DGN format.



Plant Engineering

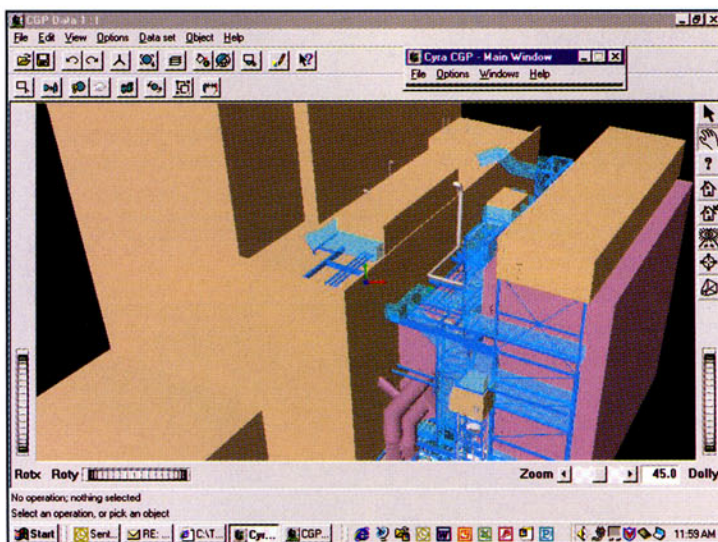
As the data-gathering process continued, individual scans were registered with other scans taken from a different angle, thus giving a complete 3D image of the project. The Raytheon team used over 51 scans to assemble the final 3D point-cloud of the scrubbers. Each scan contained as many as 1 million individual data points. Altogether, it took five working days to finish the scanning process. Once fieldwork was finished, the subsequent modeling took place at two of Raytheon's offices. The inside model was finalized in Philadelphia, the outside model at the Birmingham, Alabama office with Derrel Shaffer as the project leader. In both places, Raytheon engineers used Cyrax Model software to convert the point clouds into solid MicroStation models. The Cyrax software allowed Raytheon Engineers to convert points into geometrical objects such as pipes, steel-beams, valves, flanges and other elements to accurately and intelligently represent plant data.

"Model as needed" approach

The Cyrax point clouds also allowed a "model as needed" approach. These partial 3D models can be cost-effective data elements for the conceptual design phase in remodeling projects like the Monroe Power Plant. Raytheon chose to do a full, detailed model of the assembly. As a first step, using Cyrax Model, they turned the scan cloud into a shaded polygonal mesh surface for better 3D visualization. Following this, designers used the software to model individual elements within the assembly. When the designer clicks on a portion of the point cloud representing a pipe, the software highlights the areas that it recognizes as part of that pipe. A slider can increase or decrease the point proximity setting (adding or deducting points based on the point's position relative to the object) and thus add or deduct parts of the pipe. Similar semi-automatic procedures exist for identifying steel-beams, wall or floor areas and other common items. The final step in the process was to transfer the model from Cyrax software to



2D views can be extracted from the model data as necessary.



The laser scanner's supporting software is used for initial editing of the data retrieved by the scanner.

MicroStation. Cyrax Model saves in native DGN format, and can launch a MicroStation session within the program, opening the model while maintaining a link with the Cyrax software. Raytheon's Princeton, N.J. office, a major Bentley user, will use these as-built models to implement the required design changes using MicroStation.

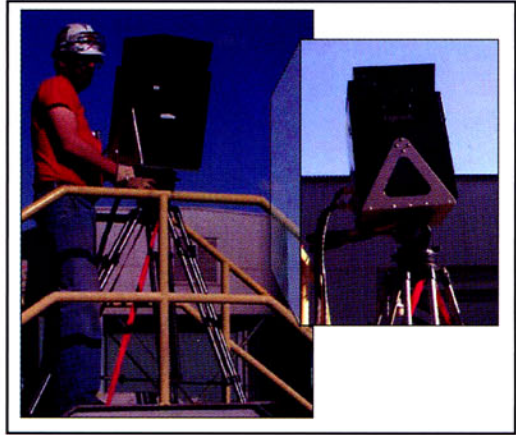
Raytheon's Greg Lawes estimates that using the Cyrax system will save over 50 percent of the required modeling time while providing a much higher value model to the customer. The higher value is represented by the fact that point-clouds are actual historical data that shows the object's current state with great precision. This data can serve archival purposes, it can be queried for precise measurements and compared to the electronic model for verification.

Plant Engineering

"Detroit Edison recognizes the competitive advantage that can come from long-term relationships with contractors and suppliers," said Bob Zaist, senior vice president, Power Group, Raytheon Engineers & Constructors. "We plan to work closely with them to make that competitive advantage happen." Raytheon will perform engineering, select procurement and all construction for the project. Engineering will be done from the company's Princeton, N.J., office, and construction activities will be based out of Detroit Edison's Monroe Power Plant. "The project is a comprehensive review and enhancement of the company's compliance plan using combustion controls to prevent the generation of NOx and post combustion controls to obtain further reductions," said Skiles Boyd, director, Environmental Management and Resources. "What makes this project unique is the consortium's structure that allows members to share in reduced project costs." msm

Cyra Technologies is a privately held corporation based in Oakland, California. The company specializes in the research, development and manufacture of advanced 3D Laser Mapping and Imaging systems. The company is currently offering a special promotion to MicroStation users, combining the purchase of the Cyrax 3D scanning system with two days of scanning conducted by a certified Cyrax Service Provider. For more information about the Cyrax system or the promotion, visit www.cyra.com.

MicroStation Manager thanks Laslo Vespremi for his invaluable assistance in the preparation of this article.



The Cyrax 3D Laser scanner.

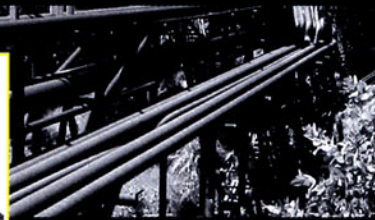
Project : Refinery Piping Documentation

No As-Builts?

Cyrax It!

Step 1

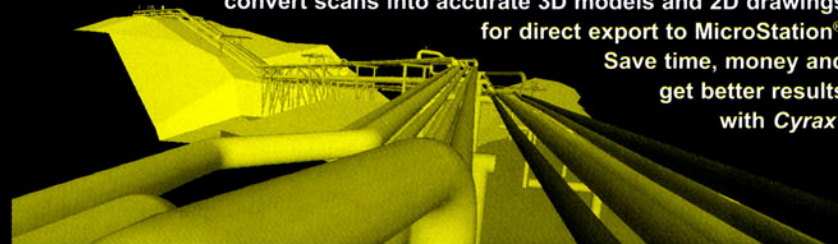
Aim a Cyrax® 3D Laser Scanner at a scene and remotely capture 3D geometry in just minutes. The revolutionary Cyrax® captures very large objects up to 50m away ... with >6mm accuracy and 800 measurements per second!



Step 2

Cyrax® Model software lets you "register" multiple scans together and convert scans into accurate 3D models and 2D drawings for direct export to MicroStation®.

Save time, money and get better results with Cyrax!



Cyrax

Limited time special offer: Cyrax Model software + 2 days of scanning - \$9,995

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