Raytheon Raytheon Engineers & Constructors

The RE&C ord

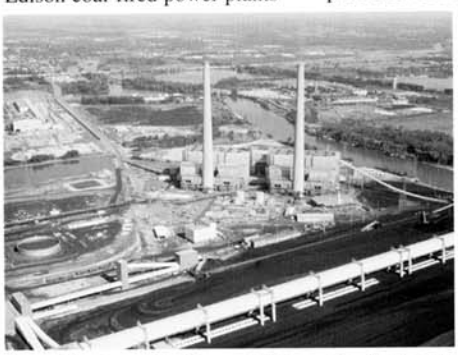
A newsletter for employees of Raytheon Engineers & Constructors

March/April 2000

RE&C Pinpoints Success With Laser System At Detroit Edison

Figuring out how to design a major retrofit of a power plant has traditionally not been an easy job. As RE&C Project Manager Bruce Klein puts it, "The biggest problem is you're always running into existing stuff."

Klein is talking from real-world experience. In the fourth quarter of 1999, an RE&C-led consortium was selected as the contractor for reducing nitrogen oxide emissions at six Detroit Edison coal-fired power plants



in southeastern Michigan. Klein is the project manager.

The first step in such a retrofit project is determining what already exists at the site. The task sounds simple, but it's not. Given that plants such as these have typically been in service for more than 25 years and gone through many modifications during their lifetime, the engineering drawings that exist often are not accurate.

Two methods have historically been used to supplement the existing drawings and gain a more complete picture of what exists. One is close-range photogrammetry, which is the use of photography to produce diagrams or charts. The other has been to walk the site and climb the equipment to take manual measurements.

Both methods are expensive and time consuming. Neither allows three dimensional (3D) designs to be generated economically. In addition, both methods pose a level of physical risk to those performing the tasks. One of the first structures to be measured at Detroit Edision's Monroe Power Plant, for example, is a 13-story boiler house where large selective catalytic reactors need to be added. Measuring such a big structure typically would require scaffolding to be erected.

RE&C chose an entirely different approach for its work – a laser scanning system from Cyra Technologies.

The scanner looks like a large movie camera and weighs about 65 pounds. It can capture up to 800 surface geometry measurements per second over a 40 degree horizontal by 40 degree vertical field of view. A cloud of points is generated from laser hits of objects in the scene.

The point clouds are converted into geometrical objects such as pipes, beams, valves, and flanges. They can immediately be displayed on a laptop as a 3D digital image, which an engineer can manipulate using full rotation, fly-around, pan, and zoom capabilities. The degree of accuracy is plus or minus one quarter of an inch for any discrete point in the cloud and plus or minus one eighth of an inch for combined data points.

According to Klein and Greg Lawes, the RE&C engineer who has led the company's use of the scanner at Detroit Edison, the system has provided multiple benefits.

Saving Time And Money

One is a substantial time savings. Lawes estimates that the system will save more than 50 percent of the required modeling time compared with photogrammetry and manual measurements. In addition, the digital images from the laser scan show a structure's current state with great precision, giving the project team higher confidence that its design can be constructed without problems.

Two is a significant cost savings. Klein estimates that the combination of time savings during modeling and fewer change orders during construction due to the greater accuracy of the design will conservatively save at least $10 million.

"We would have spent a big chunk of the engineering budget on mapping the existing plant in the past," said Klein. "We won't even be at one percent of the engineering budget on this project."

On the construction side, Lawes predicts the laser scanning will result in a big drop in the amount of rework that's needed.

"3D plant design has driven rework on greenfield projects from six percent to less than one percent," said Lawes. "Now that we can apply 3D models to retrofit work, similar levels of improvement are possible in the retrofit area, as well."

Three is increased safety. The scanner can be positioned at significant distances from the structures that are being measured, eliminating the need for activities, such as climbing and crawling, that pose the risk of accident. On the 13-story boiler house at the Monroe plant, for example, no scaffolding had to be erected in order to provide access to the higher parts of the structure.

Raytheon is working in consortium with equipment supplier DB Riley on the nitrogen oxide reduction project for Detroit Edison. The project is scheduled to be completed by May 2003.

Raytheon will perform engineering, select procurement, and all construction for the project. Engineering will be done in the Princeton office. The Philadelphia, Birmingham, and Princeton offices have produced the composite 3D models that incorporate the data from the laser scans.

Lawes has been the project leader for Philadelphia and Princeton. Derrel Shaffer has been the project leader in Birmingham.