



IMAGE Custom Engineering Solutions, LLC (IMAGE CES), Field Services division (IMAGE Field Services), based in Houston, Texas, USA, has successfully completed the as-built computer modelling of over 70 of approximately 200 gas compression stations owned by CenterPoint Energy Field Services. What is most remarkable about this project is the speed, accuracy and ultimate 'intelligence' of what was produced. IMAGE CES completed this first phase in record time using only two onsite engineers to produce fully intelligent 3D plant, piping and equipment models of each site to an accuracy of 1/8 in. "To do what we have done in six months would have taken us maybe years to do manually,"

explained Don Nuckels, PE, President of IMAGE CES.

LASER Success

GARY CARSON, EQUAMARK, INC., USA,
DISCUSSES THE USE OF NEW
LASER-BASED SCANNING TECHNOLOGY
TO CREATE ACCURATE, INTELLIGENT
PLANT SOFTWARE MODELS.

A global power provider

CenterPoint Energy Field Services operates as a subsidiary of CenterPoint Energy. CenterPoint Energy, once a local Texas utility and now a global power provider with over US\$ 9.6 billion in annual revenue,

distributes natural gas to more than three million customers in the Southwest US and electricity to nearly two million customers on the Texas Gulf Coast. Along with its gas distribution, the company also controls gas gathering and storage operations serviced by 69 000 miles of gas pipeline delivering over 400 billion ft³/yr of gas.

Documenting existing facilities

With such a broad range of facilities designed and installed over many years, CenterPoint Field Services faces the same challenges of any company of its size in maintaining site documentation of existing installations. This is especially true when it comes to the physical design of facilities that may have been built years

ago, with subsequent expansions or additions over the years. The problem is not just in keeping up with updates to these facilities, but also dealing with the various formats in which the original installation and later changes were designed. For example, existing documentation for these sites in question may be in a variety of 2D paper drawings, unintelligent 2D CAD drawings and 3D models, with and without intelligence, and in different file formats.

A decision to update.....

To get documentation current for existing installations, CenterPoint Field Services contracted S&R Technical Services, Inc. (S&R Technical Services) of Tulsa, Oklahoma, USA, to re-document the company's facilities with the most up-to-date information.

This was done partly with an eye to meeting current and possible future US Environmental Protection Agency (EPA) and Department of Transportation (DOT) governmental regulations and also to standardise on the format in which this documentation was to be delivered.

For standardisation of the output, CenterPoint Field Services and S&R Technical Services decided to have the models for the AutoCAD-based deliverables produced using CADWorx Plant Design Suite, a software series from COADE Inc., based in Houston, Texas, that offers both 2D drawing and intelligent 3D modelling and is also easy to use and scalable to match most size project requirements.

The reasoning behind the decision to use CADWorx on this project requires a look at the old way of doing things compared with the demands of a project of this magnitude and with these time constraints. Because of the fast track nature of this job, it was obvious that this project could not be completed in time using traditional methods of capturing site information.

Old methods.....

Typically, the gathering of site information is labour intensive and sometimes dangerous. And, surprisingly, these methods have not changed much in the last 100 years. Of course, the tape measures, plumb bobs and levels have now been replaced by electronic solid state equivalents of the same, but what has not changed is the gruelling work of climbing up and down ladders, clambering along walkways and, in general, risking the chance of injury throughout the process of getting the information.

Another drawback with this method of gathering information is the misinterpretation of the mark-ups and



Figure 1. It took two engineers only six months to create intelligent as-builts of 70 compressor stations.

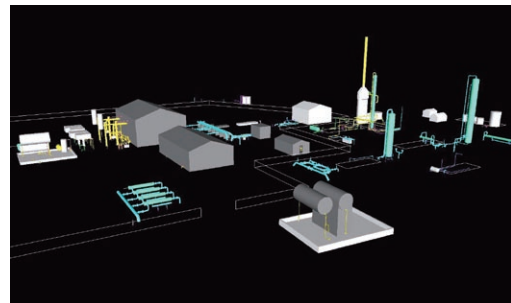


Figure 2. Piping equipment, structures and buildings can be located and modelled with a minimum of effort and with total accuracy.

sketches that are produced onsite once they are being drawn up in the back office. And, because this process is expensive, labour intensive and often dangerous, a skilled operator gathers only what is needed. So, even with the best intentions, things are usually missed. If site photographs do not clearly show the current conditions, additional site revisits are going to be required, adding further to the time and labour involved.

Laser scanning considered but rejected.....

S&R Technical Services had been looking at alternate ways of capturing the onsite information, and laser scanning was one method of doing so.

Laser scans of existing facilities are produced by setting up a scanner at various points of the site and setting the scanner to

document the physical layout. The scanner sends out a laser beam that, when it hits an object, determines the exact 3D position in space at which the beam hit that object. Using this method, the scanner, with associated software, can create a fairly accurate facsimile of the objects it sees. As each area is completed, the scanner is moved to a new location where it repeats the process, capturing objects or views that were not in the previous view's point-of-sight.

The produced scans are then 'stitched' or pieced together to make a single point-cloud model containing millions, or even billions, of points captured by the scanner. Although accurate, what is produced is not an intelligent model. For there to be intelligence, the scans would have to be manually traced over to create a model from which deliverables could be automatically created.

Laser scanning was considered for this project, but S&R Technical Services and the client had not always had positive experiences with this technology. So, this was not the road that the client and S & R Technical Services initially wanted to take because of the fast track nature of this job.

Fortunately, there was an alternative solution available that uses laser technology for accuracy and, in real-time, ties into intelligent plant design systems to produce deliverables in the field.

IMAGE Field Services joins team.....

IMAGE Field Services had gained valuable experience using a new package that uses laser-based technology to

gather site information, quickly and accurately, and then produces intelligent models without the engineer needing to leave the site. It was this experience that led S&R Technical Services to bring IMAGE Field Services into the project to introduce its technology and expertise to the client.

New laser-based tools

The task at hand for IMAGE Field Services was to answer this question: What was different about what IMAGE Field Services was doing compared to traditional ways of using laser technology to gather field information?, an approach that both S&R Technical Services and the client had discounted. The first part of the answer is that IMAGE Field Services uses Leica Total Station technology to pick discreet points to a degree of accuracy far higher than could be done with a scanner. Second, the company uses CADWorx fieldPipe for Leica FieldPro software, jointly developed by Leica Geosystems and COADE Inc., to use the points identified by Leica total Station to produce intelligent plant models. Once the advantages were established, IMAGE Field Services received a go-ahead.

“We found that the CADWorx fieldPipe for Leica FieldPro software was well suited to the challenging and complex task at hand,” added Nuckels. Each site was a different scale, content and size. Sites ranged from as little as a single compressor with a couple of pieces of equipment and some piping, to stations containing 18 compressors with a multitude of supporting equipment and ancillary piping ranging from 0.5 - 30 in. outside diameter.

Flexible and scalable software

An advantage for IMAGE Field Services was that, because the software was so scalable and flexible, it could be used effectively and easily on the smallest and largest facilities.

Set up was easy. As one engineer set up the Total Station, the other set up the work station. The two-man team would then identify and set control points, which are the reference points that the Total Station would use to identify its exact position. The control points ensure that, if the Total Station is moved to capture information at another point in the site, it will continue to provide accurate location information for all items being modelled.

To determine the size, direction and slope of a line, all the software requires is for the operator to pick a few points on any pipe length of a pipe run. Once each pipe length has been selected, the software creates the piping run, including all of its changes of direction, into which inline items can then be inserted. “A big advantage that saves us and the client so much time is that the CADWorx fieldPipe programme creates all of this onsite, in real-time and with complete accuracy,” said Greg Miller, Operations Manager for IMAGE Field Services.

Work carried out with minimal disruption


The benefit of this approach is that, because the engineers are onsite as the scanning is done and models are being generated, they can immediately identify points of interest and confirm that the model is complete. Unlike with a regular scanned model, there is no need to move the scanning equipment to make sure that all information is captured. In this case, the engineer can simply walk over to the piping components and look around the physical layout to determine if the model produced is complete or not. No photographs or extra scans are necessary.

Because CADWorx fieldPipe for Leica FieldPro comes complete with COADE’s AutoCAD-based CADWorx Plant Professional, all model creation is specification driven. This capability allowed IMAGE Field Services to produce full-featured, intelligent models that included piping, steel, equipment, ducting and other items. An extra benefit of using an AutoCAD-based solution like CADWorx Plant Professional is that the model could now be shared and fully interrogated by stakeholders by using CADWorx Design Review, included with CADWorx Plant Professional.

Deliverables done

As soon as each station was completed, the IMAGE Field Services’ two-person team sent the model to S&R Technical Services for the modelling of the underground layout and as-built piping and instrument diagrams in CADWorx Plant Professional and CADWorx P&ID Professional.

As each facility is completed, the customer now has an accurate representation of the site in the form of an intelligent model that anyone can now review or interrogate. This enables designers, managers, supervisors and other stakeholders to get an accurate view, individually or as a collaborative group, of the current conditions of each facility.

“So far, we shot piping spools that totalled over 120 miles of pipe plus hundreds of pieces of equipment, which would have required a lot of pulling of the tape measure, if we were doing it the old way,” Nuckels said. S&R Technical Services and IMAGE Field Services are continuing the task of documenting all of the remaining sites for CenterPoint Field Services in the Oklahoma, Texas, Louisiana and Arkansas area. “To my knowledge, this is the largest project on which CADWorx fieldPipe has been used here and it never missed a beat,” Nuckels concluded. 

Gary Carson is President of Equamark, Inc., Bellaire, Texas, USA, a consulting firm providing strategic planning and marketing services.

IMAGE Custom Engineering Solutions, LLC, based in Houston, Texas, provides a unique and mutually complementary set of products and services focused on meeting the needs of companies in the energy industry.

COADE, Inc. is a provider of software for multiple plant design and engineering disciplines.