A Perfect Workflow

by Ryan J. Fuselier

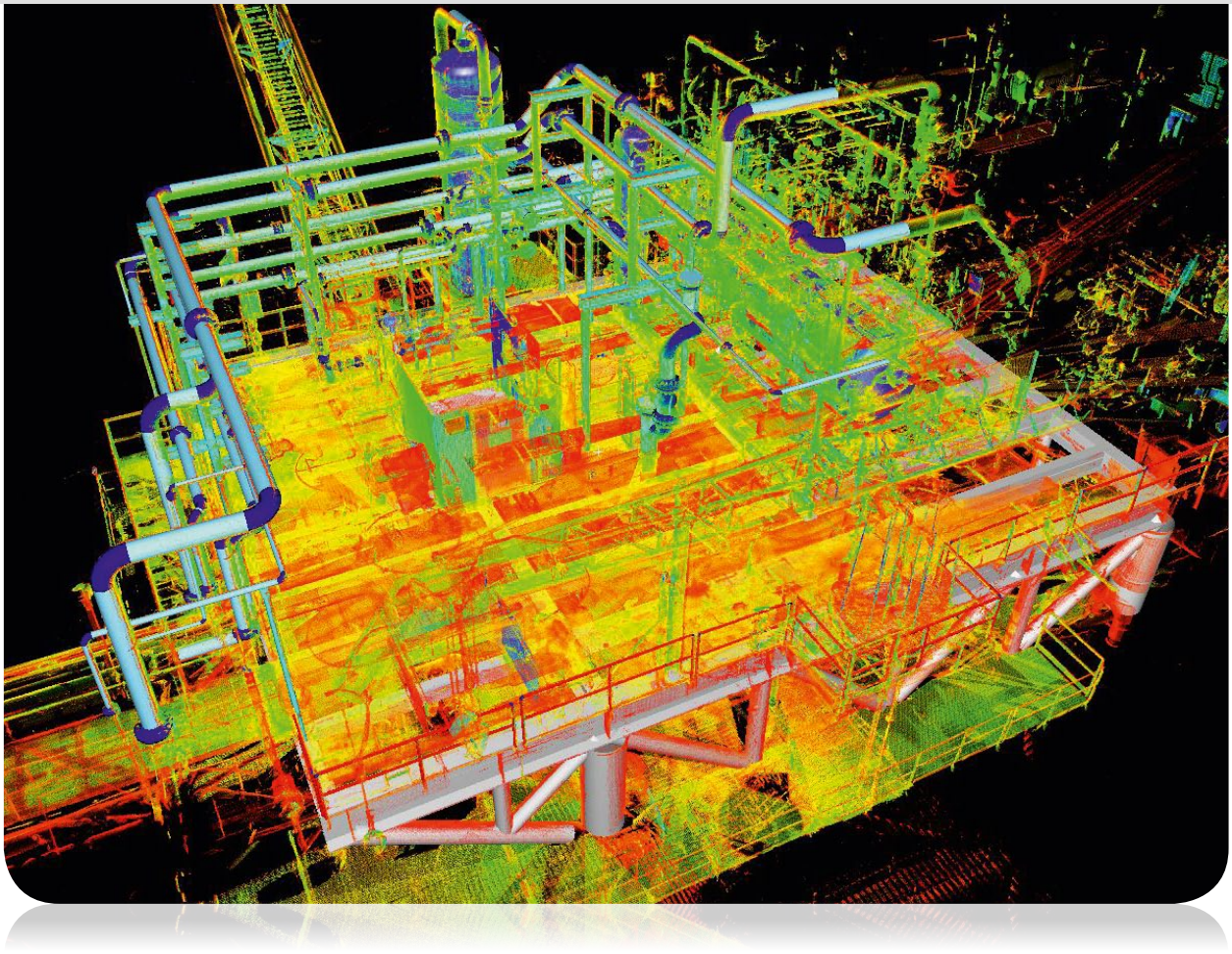
Fenstermaker began as a small, regional surveying company in 1950. It has since become one of the largest surveying and mapping companies in the southern United States, known for its commitment to finding solutions to the most complex mapping and surveying challenges. The Advanced Technologies Division formed in 2008 offers specialized field services, including Underwater Acoustic Imaging (UAI) and High-Definition Surveying (HDS) to provide topside and underwater as-built mapping services to the oil and gas industry. The combination and synergistic working relationship allows Fenstermaker to deliver high-resolution 3D visualization, accuracy, and detail on projects that are not possible using traditional survey methods.

Fenstermaker began laser scanning in 2006, prior to establishing the Advanced Technologies Division, with the help of Joe Lafranca from Leica Geosystems. The first laser scanning project was a Pump Station and 9.6 km (6 mi) topographic survey traversing Lake Shore Drive in New Orleans. At the time, Fenstermaker relied on Leica Cyclone 3D Point Cloud Processing Software, Leica CloudWorx for AutoCAD for 3D Model extraction from point cloud, and other modeling systems.

From this project we understood how the scanning capabilities could be of value to the oil and gas industry. In 2007, we completed a laser scan of a Georgia Gulf facility and implemented the first seat of Intergraph CADWorx plant design suite operating on top of AutoCAD to model and generate 2D spool isometrics for fabrication. Since it was our first chemical facility, we had to address several field and office challenges. In the office, we streamlined our workflow between Leica Cyclone, CloudWorx, and Intergraph CADWorx. Leica Cyclone generated steel, CloudWorx extracted pipe centerlines, and Intergraph CADWorx added the intelligence.

As-Built Modeling

After the Gulf project, we began testing the use of laser scanning with traditional total stations in dimensional control projects that required high tolerances such as the large-scale fabrication of steel structures or modules, and even jumper and hub



alignments. We've taken all these tools – the scanners and total stations, Cyclone and CloudWorx from Leica Geosystems, and Intergraph CADWorx – and created our own synergistic workflow that is more efficient than conventional methods and allows us to develop high accuracy, intelligent design models for our clients.

In one recent project, a large oil and gas company tasked with making upgrades to their existing infrastructure solicited our group to develop an as-built model of an offshore platform located 50 miles off the Gulf Coast.

Our scope was to map the existing structure on the topside and second sub-level of the platform, with particular attention to pre-identified tie points and general information along potential pipe routes and proposed equipment locations. The data needed to be delivered to within 3 mm (0.12 in) accuracy for tie points and to an as-built model classification Fenstermaker defines as Class A – Level 1. Class A – Level 1 means tie point and fabrication grade accuracy with specification-driven intelligence added to every modeled component. In terms of timeline, the client directed that field data collection on the platform had to be completed in two days, including mobilization.

Traditional methods simply wouldn't have worked. Conventional techniques such as prisms and total stations would have yielded accurate but limited results, while costing the client more time and posing a greater safety risk. Instead, we put in place our entire scanning/modeling workflow – from Leica HDS scanner to Leica Cyclone/Intergraph CADWorx/Leica CloudWorx software – to make this project a success.

Advanced Workflow

Once we had the schedule coordinated with the client, we sent a two-man survey crew in a helicopter with a Leica Geosystems HDS6000 laser scanner to map the 14 x 14 m (45 x 45 ft) portion of the upper and sub-level deck of the platform. On the first day, the crew completed the upper deck in nine scans and set control for the lower deck. The next day the crew completed seven scans on the lower deck and mobilized back to headquarters.

Once back at the office, the survey team post-processed and registered the scan data within Leica Cyclone software. Main structural and pipe supporting steel was modeled and used to set the project coordinate system and Leica TruViews were published.

TruViews allow everyday professionals to easily view and measure laser point cloud data without extensive knowledge of point cloud software. While navigating a Leica TruView, participants can collaborate about project needs, generate markups, manage assets, and acquire 3D coordinate data and measurements.

Modeling Synergy

The model was exported using the Cyclone Object Exchange (COE) format to AutoCAD. Our designers launched Leica CloudWorx within AutoCAD to model the piping elements, flanges, and equipment along with specification-driven intelligence.

Intergraph CADWorx and Leica CloudWorx complement each other well, both being menu driven programs within the native AutoCAD environment. The synergy between these two programs is evident in terms of functionality and our overall workflow efficiency. Used together, we can develop an intelligent asset model of existing conditions from which designers can build the most effective and efficient retrofit and upgrade for the facility. This ensures zero to no rework upon installation.

Because the data from the Leica Geosystems HDS6000 laser scanner was so accurate and comprehensive, underlying structural deformation was uncovered.

During the modeling process, we could see the main deck structural steel deformation and notify the client. We were able to report this vertical deformation in a color relief map of the entire upper section of the platform. With this visual and analytical data, smart decisions could be made by the client concerning corrective measures for reinforcing or replacing the structural components in the area to handle the proposed skid load. These unforeseen deformations could have presented serious installation delays but were able to be addressed prior to equipment mobilization.

As a final deliverable, the client wanted Fenstermaker's SurvDMS (Data Management System) product with a specific interest in an intelligent as-built 3D model. SurvDMS is a portal for serving all project related deliverables to include TruViews, monument data sheets, 3D models, and engineering/construction drawings.

Looking Ahead

Fenstermaker plans to continue to capitalize on their success and work experience to build cutting edge solutions in the oil and gas service sector. So many companies and facilities are only scratching the surface in bridging the gap between data and management. We are in a unique position having extensive knowledge of how a synergistic network exists between the as-built and design world. One day in the near future our clients will enter a feature rich Ecosystem with bi-directional communication between project management, design, construction, asset management, and training all powered by the point cloud engine.

About the author:
Ryan J. Fuselier, P.E., P.L.S., is Director of the Advanced Technologies Division at Fenstermaker.
(ryan@fenstermaker.com)

INTERGRAPH®

Following the acquisition by Hexagon in 2010, Intergraph® is a sister company of Leica Geosystems. Intergraph operates through two divisions: Security, Government & Infrastructure (SG&I) and Process, Power & Marine (PP&M).

Intergraph's Process, Power & Marine division creates solutions that enable the design, construction, and operation of process and power plants, offshore platforms, and ships, and provides the information management capabilities to build and operate those facilities.

The company's leadership position is backed by a proven track record of high-quality product development, a global customer base of industry leaders, and a worldwide sales and support network. Intergraph Process, Power & Marine's business is based on a strong financial foundation and steady growth.

More than two-thirds of the plants built worldwide are designed using Intergraph software.