

# Scanning Beyond Retrofit Design

by Geoff Jacobs

**MegChem Engineering & Drafting Services (Pty) Ltd, South Africa, is a multi-discipline engineering company serving a diverse client base in the oil, gas, power generation, and energy related industries. The company, founded in 1995, is ISO 9001-certified and has more than 300 employees. They also have a Leica HDS6100 scanner, Cyclone, and CloudWorx software as part of their engineering services toolkit.**

Performing plant design for “retrofit” or “revamp” projects at existing plants is a common task for MegChem and for many other plant engineering companies. MegChem originally acquired Leica Geosystems laser scanning technology for the purpose of performing accurate as-built surveys of existing sections of plants intended for modification or expansion. Accurate as-built information of existing plants enables accurate retrofit design, which, in turn, makes retrofit installation and construction go smoothly. This type of application of laser scanning is the very type of application for which high-accuracy laser scanning was first developed; today, it is used this way for hundreds of plant retrofit projects every day, worldwide.

What is especially interesting about MegChem’s use of their Leica High-Definition Surveying™/HDS™ tools is that, over time, MegChem and an Owner/

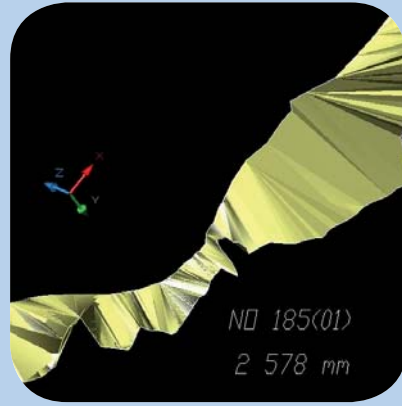
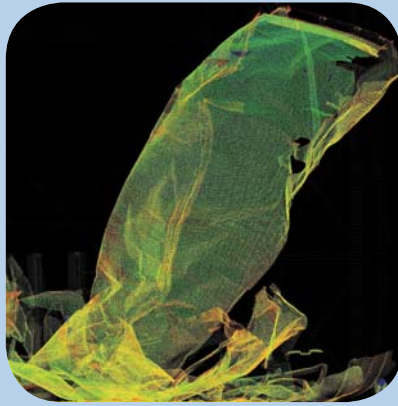
Operator client have also made valuable use of these tools for a variety of applications that are not retrofit design projects, but rather support “Operations & Maintenance” needs of the plant.

## **Accurate plant documentation using intelligent 3D models**

One of MegChem’s clients has begun an initiative to document portions of their existing plant, parts of which are very old, via intelligent 3D computer models using Integraph’s SmartPlant 3D software. (This initiative was the subject of presentations at the Hexagon 2011 International Conference, June 2011 in Orlando, FL.) These models not only contain accurate geometry of key objects in the plant, but also include detailed information about the types of materials, spec ratings, etc. of each object (hence, the term “intelligent” model). From these comprehensive intelligent 3D models, the Owner/Operator can extract accurate, up-to-date information needed for regulatory compliance, as well as 2D and isometric drawings needed by Maintenance and Operations personnel for various tasks.

## **Exact fit replacements**

In many cases, plant maintenance staff simply replaces old equipment or piping with precisely matching new equipment and piping. Although there is no re-design or new design involved, “as-is” geometry information derived from laser scanning has also proven valuable in this application. Accurate



■ **Fragment of a destroyed shipping container – as picture, laser scan and mesh. This way, MegChem's customer can find out the cause of the explosion.**

**Left: Construction of Linc Energy's Gas to Liquids demonstration plant in Chinchilla during 2008.**

laser scan data can uncover slight but very important changes in object geometry, for example in flange orientation and pipe bends, that have occurred over time due to thermal and structural stresses.

#### **Location of a vessel's internal welds for external ultrasonic weld testing**

Periodic testing of welds is regular practice in the highly safety-conscious plant industry. External ultrasonic testing of internal vessel welds used to be subject to the availability of the vessel interior to first locate the welds; however, access to a vessel's interior does not always line up well with weld testing schedules. By scanning the vessel's interior when it's accessible, MegChem was able to precisely locate interior welds for external tests that could be conducted when convenient.

#### **Kiln coating thickness assessments & monitoring**

High-Definition Surveying has proven valuable for assessing and monitoring critical coating thicknesses on the interior surface of kilns. Scanning is performed on the kiln interior and exterior. Geo-referenced concentric scans are overlaid to determine coating thickness. Such evaluations can be done periodically to establish wear trends.

#### **Structural analysis of bulging vessels using Finite Element Analysis (FEA) software**

Although bulging and warping of vessel exteriors may be visible to the naked eye, it is not easy to precisely characterize the extent of such bulging for analysis purposes. Operating staff needs to know if the bulging represents an imminent safety hazard, if remediation is possible and if so, what extent of

remediation is needed, or whether or not the vessel walls need to be replaced. Leica Geosystems scanning tools have proven valuable for producing mesh files that can be fed into FEA software for suitable structural analyses. With accurate as-is information, better informed decisions can be made.

#### **Forensic analysis to establish root causes of incidents or material failures**

When accidents happen at industrial plants, consequences can be severe. So, it's important for Owner/Operators to understand why and how such incidents occur in order to prevent future accidents. MegChem has used their Leica Geosystems scanning tools to precisely analyze fragments of an exploded shipping container. All fragments were scanned, surface areas established, and then analyzed to identify possible causes.

Although MegChem Engineering initially added laser scanning capabilities to aid in the design of plant retrofit (brown-field) projects, MegChem has found over time that they can also provide additional, valuable as-built surveying services to a key Owner/Operator client for a wide variety of Operations & Maintenance applications. These services provide significant added value for the client and represent a significant additional revenue stream for MegChem – a win-win situation for all. ■

*About the author:*

*Geoff Jacobs is Senior Vice President, Strategic Marketing, Leica Geosystems, Inc.  
(geoff.jacobs@hds.leica-geosystems.com)*