

## Virtually Offshore with Plant Design Engineers

In the shadow of the Petronas Towers in the heart of **Kuala Lumpur, Malaysia**, Plant Design Engineers teams are able to virtually walk around offshore platforms taking measurements and planning alterations. The question of accurate as-built data being made available to engineers and planners has found a new answer.

Petrochemical facilities built in an era before Computer Aided Design often have little or no documentation whatsoever of what was constructed. Even those with detailed plans often underwent changes and restructuring meaning the old plans do not accurately match what exists today. Pipes, valves, reducers may have been moved or replaced to accommodate a change in the facility, storm damage may have caused rework of a particular area. Whatever the reason planned or unplanned changes to offshore facilities mean that any records kept during the initial construction become outdated and refits planned on inaccurate data cause unexpected last minute alterations to be made. In order to plan refits or alterations accurate data of what currently exists (as-built) is necessary to ensure an on time turnaround. Even a day delay during a refit can cost millions of dollars of lost production time.

Ron Bouman from PD Engineers commented *“Scanners have become small enough, fast enough now that we can complete on-site scanning in a fraction of the time making our teams more cost effective and reducing the inconvenience for our clients. Our delivery to our customers has become more comprehensive and the benefits of as-built documentation are being seen by a wider audience”*.

Capturing the virtual world PD Engineers uses the Laser Scanner LS from FARO Technologies, which can be flown out to the platform by helicopter. At a capture rate of 120,000 points per second produces a 360° horizontal and 320° vertical of 27 million points after only 7 minutes. This generates a virtual 3D photograph in black and white or colour. Many scans can be registered together to give a virtual representation of the entire facility which can be walked through virtually.

### How the Laser Scanner Works

“Emitting an infrared beam into the centre of a rotating mirror which deflects the laser around the environment being scanned, the Laser Scanner captures the reflected beam and measures the ‘phase shift’ of the infrared. The difference in the laser phases allows the onboard PC to calculate the distance of the laser from the object, when combined with two encoder readings measuring horizontal and vertical rotation the x,y,z, coordinates of the reflection can be measured. Simply repeating this measurement as the scanner rotates at 120,000 points per second – up to 100 times faster than conventional ‘time of flight’ based technology – a 3D digital image is recorded”, explains James Needham, Marketing Director of FARO Asia Pacific.



Petronas Twin Tower, Kuala Lumpur

The addition of recently improved 'colour option' software enables scans to be coloured with almost zero parallax error, adding another dimension to the realism of the images. Particularly useful where pipe colours denote what is being carried within them.

Once captured the laser scan is shown on a PDA or Laptop inside Faro Scene software, showing the details captured, settings for the scan resolution and speed can be altered and with the click of one button the scanner can proceed with the next scan.



Left: Point cloud scan data. Right: the CAD model produced from the scan data

Faro Scene software allows the user to navigate the scan data in 2D or 3D views as well as enabling cross section cuts (tomography), data filtering and export of the data in different CAD formats such as IGES, DXF and Ascii. A PD Engineers scanning team can perform on site capture in an unprecedented time whilst the facility is in use causing minimal disruption to the daily usage of the platform. Once the Laser Scanning is complete the team returns to the office to begin the modeling. INOVx Solutions, a software partner of FARO Technologies, PlantLINx and RealityLINx are used by PD Engineers to model the captured data. This creates order and intelligence in the data allowing planners, engineers and surveyors easier access to the information they require.

First an asset database is created, this allows pipes, valves, reducers etc. to be matched with standard specifications. Then the scan data is segmented, to allow large quantities to be easily managed, and assisted modeling allows the user to quickly match specified features within the scan data. This accurately fits the correct item from the asset library to the scan data making modeling fast and accurate. If a custom item happens not to be in the database this can simply be constructed in the software and added to the database. Structure and different piping systems are separated allowing the user to highlight or remove sections to give a visual overview of the plant removing clutter and areas which are not of interest. Once the entire facility is modeled the "intelligence" shows exactly what each specific pipe would be carrying including information such as liquid or gas temperature, pressure etc.

*"To be able to document this information in such an accurate, organized manner is a small investment for any petrochemical firm but the returns and the value of such data is enormous which is one reason why PD Engineers are such a success."*  
 Concluded Ron.



3D attributed model from laser scans



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