The Cold Shoe Shuffle in the Heat of the Pilbara – 3D Laser Analysis

In the hot and humid conditions of the Burrup Peninsula, in the Pilbara region of North West Australia, a team of rope access NDT inspectors from Sydney-based laser Inspection Company 4Z, were armed with portable handheld laser scanners and deployed to create detailed 3D surface images of the corrosion underneath 36 cold shoes (pipe supports). The process proved extremely effective, highly accurate and faster than traditional NDT methods. Laser scanning is a new and growing method of inspection within the non-destructive testing industry and forward thinking and entrepreneurial oil and gas companies in Australia are starting to reap the benefits by embracing this emerging service.

The opportunity to run 3D laser analysis occurred during a scheduled maintenance shutdown on a stabiliser unit, which needed to be completed before the cyclone season got into full swing. So 36 cold shoes were removed and inspected, mapped in 3D and reports generated in 'real time'. The entire project was delivered in less than a 2 week period. No other inspection methodologies in the market today are capable of delivering such rich and detailed results in such a short period of time.

The 3D data, once the scanning of a cold shoe was complete, was brought in from the field so it could be analysed and delivered in a detailed report within minutes to asset integrity engineers, who could then direct further maintenance and or coating crews to follow through with required work. The net result for the client was potential savings in the millions of dollars, through reduced down time and minimised production losses.

The high definition scanner deployed for this project produces 3D data (accurate to 0.05 mm), that is perfectly scaled to be representative of the real geometry of the asset being inspected. The realism of the 3D image generated makes for easy visualisation of any surface defects, such as corrosion features.

Further post processing of the 3D data, produces colourful corrosion maps, detailing wall loss data, corrosion feature dimensions, volumetric loss data, cross sectional profiling and files that can be converted and infinitely queried.

Like any visual inspection method, proper surface preparation is essential. Careful cleaning and removal of any coatings, rust and other visual obstructions from the surface of the asset to be inspected is required prior to laser scanning.

Hand-held laser scanners create a 3D image through triangulation, a laser line is projected onto the object from the scanner and a sensor measures the distance to the surface. Data is collected in relation to an internal coordinate system. To collect data where the scanner is in motion the position of the scanner must be determined in relation to the surface. The position is determined by the scanner using reference features on the surface being scanned (retro-reflective targets).

Through continual tri-angulation and the distance measurement process, a polygonal representation of the surface is formed (a polygonal mesh). Thousands of these small faceted flat surfaces are combined to give the detailed 3D model of the corrosion feature.

Laser scanning is a high resolution visual inspection process, and will therefore acquire data on everything within the scanners field of view. Laser scanning should not be confused with radiography or ultrasonics, which are complimentary methods of inspection.

The resulting data generated by 3D laser scanning is invaluable to integrity engineers and plant operators alike, due to its flexibility, and repeatability. It is an archive that can be stored and reused, for future comparisons, and it can be changed into a myriad of formats to be imported or used for numerical modelling, and fitness for service assessments and calculations. It can therefore also be shared with consultants, colleagues and other integrity specialists anywhere and

Figure 1. Cold shoe (pipe support) has been removed and the pipe has been cleaned and is ready for scanning.

Figure 2. 3D data acquisition of the corroded area.

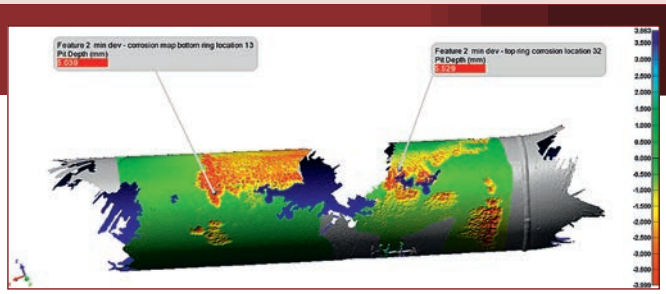

Figure 3. Using wireless technology the scan data can be closely monitored by the technician in real time.

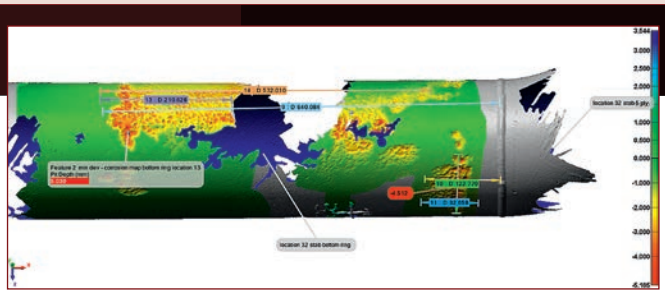

Figure 4. Post processing of the scan data produces deepest pit depths in full colour and 3D.

looked at and reviewed in 'real-time' collaboratively.

The cold shoe inspection using 3D laser technology delivered in the Pilbara was the first of its kind undertaken in Australia, and is a significant development in the evolution of inspection techniques for corroded assets, and data acquisition on material performance. As costs for maintenance continue to increase, and plant operators continue to push their plants and plant materials further, the need for highly accurate data acquisition and inspection results, that only laser scanning produces, will increase.

Submitted by Joel Hicks of 4Z, who are a specialised 3D NDT company, made up of highly skilled rope access NDT inspectors, able to perform inspection services in confined spaces, and difficult to access platforms, elevated areas on and offshore.

Figure 5. Further post processing can go to a level 2 assessment, detailing the geometry of the corrosion feature.