What is the 3D Toolbox?

The 3D Toolbox is composed of a 3D structured light “camera”, Panasonic “Toughbook” PC controller, software and accessories all in a rugged case that can be easily transported to any jobsite worldwide. The 3D Toolbox is used for Non Destructive Evaluation (NDE) of surface “features” (corrosion, defects, dents, etc.).

Use of the 3D Structured Light Technology was pioneered by Chevron and tested by the Pipeline Research Council International (PRCI) back in August 2012. The technology was put on a very fast track for commercialization and Seikowave the technology IP owner entered into an agreement with Technical Toolboxes to assist in the defect assessment software integration (i.e. ASME B31G, RSTRENG, API 579 FSS, etc.). The first commercial prototypes were demonstrated at the International Pipeline Conference (IPC) in Calgary at the end of September 2012.

Benefits

The benefits of this new technology as stated by the PRCI member companies as well as PHMSA, NTSB, NEB include but are not limited to:

- Highly Repeatable Data Collection
- Delivers the accuracy of laser or better
- Light and portable
- Rugged & reliable
- Low cost

For a complete matrix of the features/benefits between 3D Structured Light and 3D Laser Click Here.
Repeatability - The device will capture the same 3D measurements 100% of the time from any angle by any person using the device.

Calibration - The device is calibrated at the factory and is National Institutes of Standards Testing (NIST) traceable. If the device is NOT calibrated it will NOT operate.

Ease of use - Used just like any standard 2D camera. No special training and images are captured in microseconds.

Speed - The 3D images can be captured in fractions of seconds and stitched together in minutes. Thus a complete corrosion inspection, analysis and final decision can be completed in minutes rather than hours or days.

Accuracy – Equal to or better accuracy than laser technology.

Cost - It is orders of magnitude less expensive than laser scanner (fixed or portable) devices.

Making Measurements

The 3D Pit Gage procedure is the same as in the preparation of the pipe for a conventional pit gage inspection of the coating and is in accordance with NACE ECDA Standards and ASME B38S. Connect camera using a sealed gigabit Ethernet cable to the camera. Connect power cables to computer and camera and then select 3D Camera Icon.

Select 3D Image Icon to begin measuring the pipeline. This will provide a preview of the measurement. If the pipeline section appears in focus in the workspace, the Toolbox 3D pit gauge is appropriately positioned.

Once the Toolbox 3D pit gauge is properly positioned, select the camera icon to acquire a 3D image. Once a 3D image is acquired, the 3D data will be stored automatically in the computer. However, the file should also be saved in your folder Images to verify integrity of the 3D photo to be analyzed.

Select 3D Image Analysis Icon Image Analysis Tool and press Icon as shown below

Load file press and FIT icon to fit image to be analyzed. Select Interaction Rules (Multiples of Wall Thickness) as shown the examples:

- Longitudinal (Example 6t)
- Circumferential (Example 3t)

Press the Apply key and the following results will be calculated as shown in the next image.

The photo above shows two (2) single pits with 1/8” of grid to give finer resolution to do a true Level 2 or 3 analysis.

Final step is to export to B31.G/RSTRENG program for further analysis, repair and record keeping.

3D Toolbox Instructional Walk-Thru

3D Toolbox Quick Start Guide
Measurement Data Analysis

There are four methods for determining the metal loss. All four methods are initiated by selecting an area of corrosion for which a metal loss calculation is desired (see image below).

The user draws a box (shown in blue) using the mouse. Level 4 is the complete volumetric metal loss determined by all of the available data. The user selects a grid size. The grid size selected will determine the grid used to make the Level 1, Level 2, and Level 3 calculations. The methods for these calculations can be found at the end of the document.

Within the blue box drawn by the user, the software determines the area of corrosion. This area is represented by the red box. The grid spacing selected by the user determines the grid cell size inside the red box. Level 1 is calculated by determining the maximum longitudinal distance (L) and circumferential width (W) over which corrosion is present inside the box: this is the length and width of the red box. Within this area, the maximum depth (D) is determined. The metal loss is calculated from the product of L, W, and D. Level 2 is the standard river bottom approach shown below.

\[ \text{Metal loss} = \sum_{i=1}^{n} W_i \times L_i \times D_i \]

* For level 2
  * Depth is checked in each grid cell
  * Deepest point per length segment is determined
  * Red dots at right are the deepest points per line segment and are labeled D1 through Dn
* Level 2 metal loss

Level 3 calculations are performed by calculating the deepest point per each grid cell, determining the metal loss per grid cell, and then summing as shown below. Because Level 4 is the full volumetric metal loss as determined by using each individual 3D data point, when using very fine grid spacing, Level 3 will produce a result that approaches Level 4.
ASME B31G, Modified & RSTRENG®

There is a need in the industry to assess the severity of a particular anomaly (dent, gouge, corrosion pit, etc.) in a pipe as to whether or not repair or removal is warranted. Along with the determination of repair there is also a need for prioritizing in-line-inspection (ILI) data, and for making remaining-life assessments of said pipe. The 3D Toolbox enables the user to quickly and accurately collect repeatable data that can then be used with computational tools including but not limited to ASME B31G, Modified ASME B31G, RSTRENG®, API 579/ASME FFS-1.

Below are the steps for automatic import of the metal loss data for ASME B31G, Modified ASME B31G and RSTRENG® calculations.

**Step 1**
Open RSTRENG and start new project and enter the data

**Step 2**
After proceeding on the new form/screen click “Import” button

**Step 3**
After clicking on “Import” button, it will open file dialog box. Retrieve the (*.rbd) file

**Step 4**
The river bottom corrosion profile will be imported automatically, as below
Step 5 Click “Calculate” button and complete the project.

*The only RISTRENG software approved by PRCI and AGA.

Additional Corrosion Defect Assessment Methods

Click Here for a summary analysis of the methods and computational tools for addressing defects and damage discovered on in-service pipelines.

The complete research report can be purchased from PRCI by Clicking Here.

Pipeline Defect Assessment – A Review & Comparison Of Commonly Used Methods

Catalog #: L52314
Contract: PR-218-05404
Authors: Kiefner and Associates, Inc. - John Kiefner P.E., PhD., Keith Lewis
Date: May 2011
Pages: 238 pages

This report includes example calculations where closed-form algorithms are available in the public domain. It lists and describes solution techniques not available in the public domain, and it provides information so that users can either acquire the relevant software or pursue assistance regarding a particular defect assessment technique.

Price and Availability

The pricing for the system is as follows:

Domestic MSRP (US & Canada) - US$14,995/system (Contents)
International MSRP - US$24,995/system (Contents)

A “system” consists of the 3D Camera (we call it the 3D Pit Gauge or light sabre), system controller cable (25 feet), and a Toughbook PC with all the software preinstalled and tested, all packaged in a heavy-duty Pelican Carrying case.

For more information or to order, please contact us at sales@ttoolboxes.com

3D Toolbox Support

For any support issues or questions please contact Joe Pikas at 713-630-0505 *3201 or send an email to 3D Toolbox Support