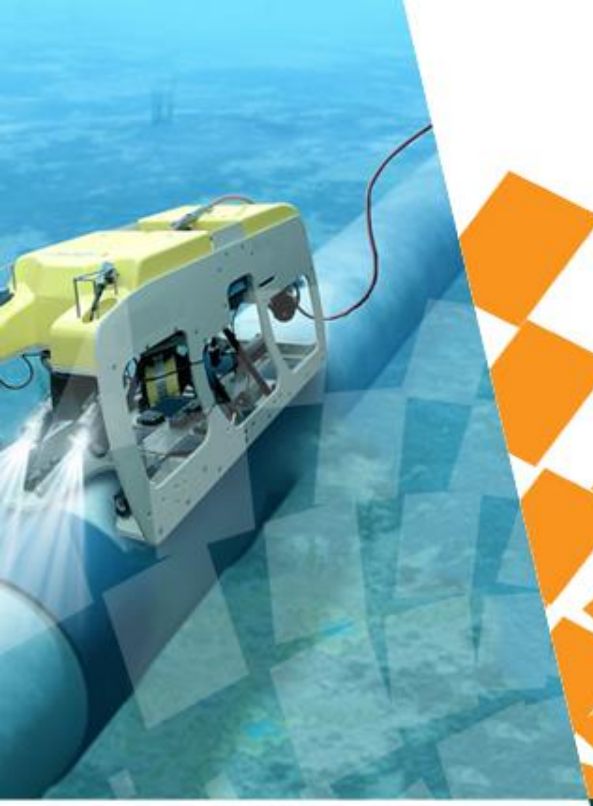

Photo Realistic 3D Cloud of Points (PRC)

Technical Presentation

Introduction

In the oil & Gas industry it is always challenging to visualize a full structure or pipeline section with precise as built dimensions due to the limited visibility underwater and the limited accuracy of underwater positioning.

But, wouldn't it be much easier if you can visualize underwater with the same accuracy as onshore?!

The image is showing a bend in the fishing line in the scanned 3D model and the real live photo on the right.

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Photo Realistic 3D Cloud (PRC)

Photo Realistic 3D Cloud (PRC) is a cutting edge innovative technology to scan complete structures and pipeline sections underwater to create a 3D Cloud of millions of points presenting the as-built of scanned object giving very accurate measurements more than 1/1000 (ex: 1mm accuracy in a 1m measurement).

Using breakthrough advanced optical sensors and mathematical disciplines.

Equipment can be mounted on any size ROV.

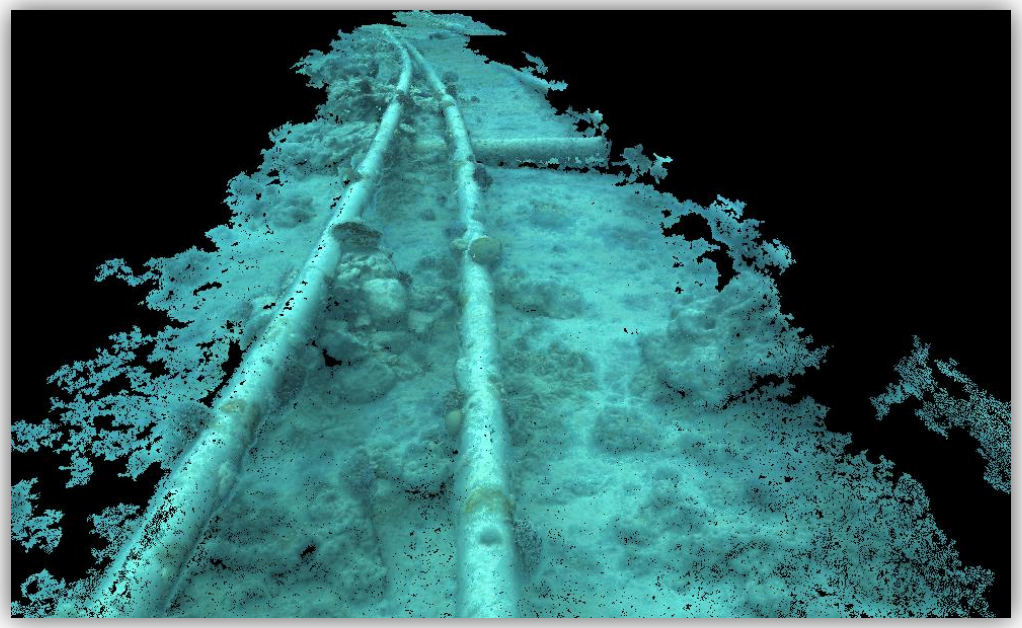

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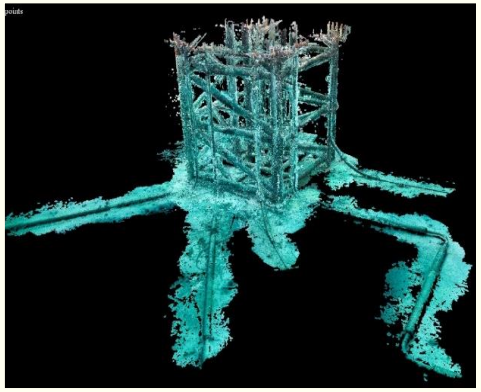
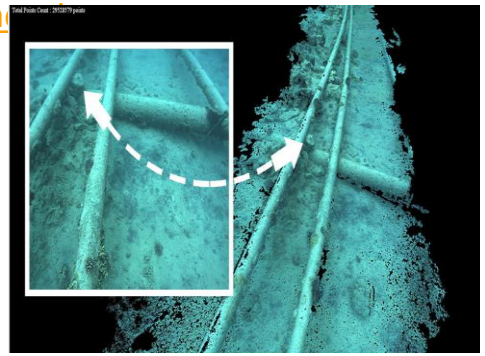
Photo Realistic 3D Cloud (PRC) Applications:

- 3D Subsea Structures As-Laid/As-Built visualization.
  - Subsea installation and Engineering support
  - Anomalies measurements (Scour, Lack of Centralization, Debris)
  - Anode Depletion
  - Riser 3D Metrology
  - Riser Buckling Measurement
  - Life time extension
  - Spud-Can Locations
  - Decommissioning



- Pipeline inspection
  - Out of Straightness Survey in both the vertical and horizontal dim
  - Pipeline Spool measurements
  - Precise measurements for crossing clearance
  - Free span identification



- Onshore 3D Modelling.
- Mooring chain inspection.

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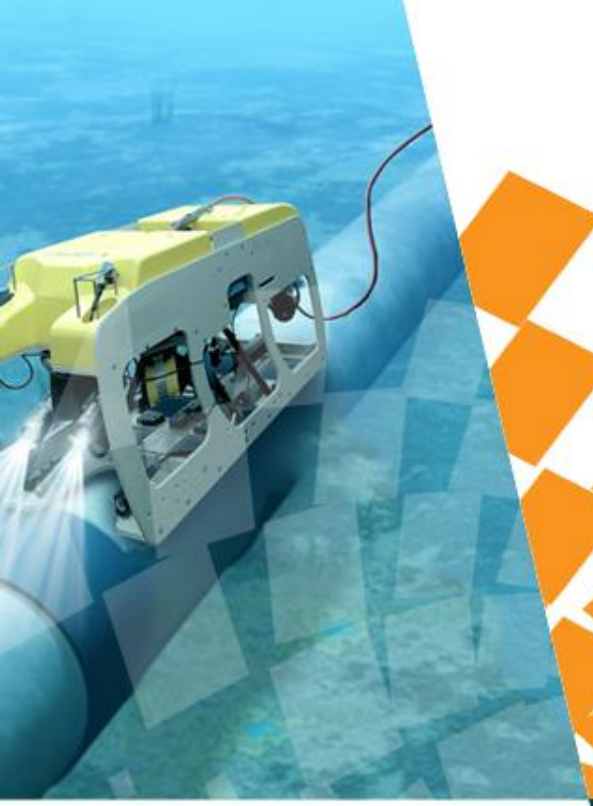


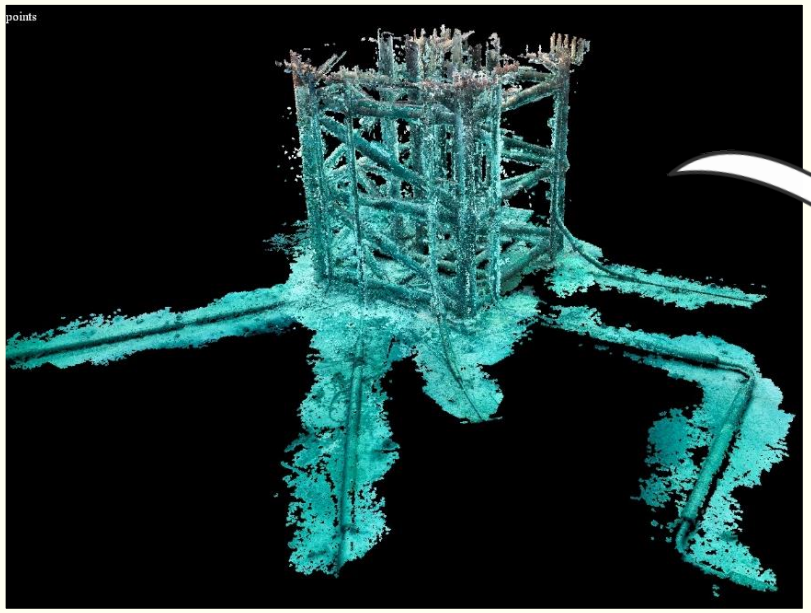
Structures Photo Realistic 3D Cloud of Points (PRC) Applications

3D PRC Application

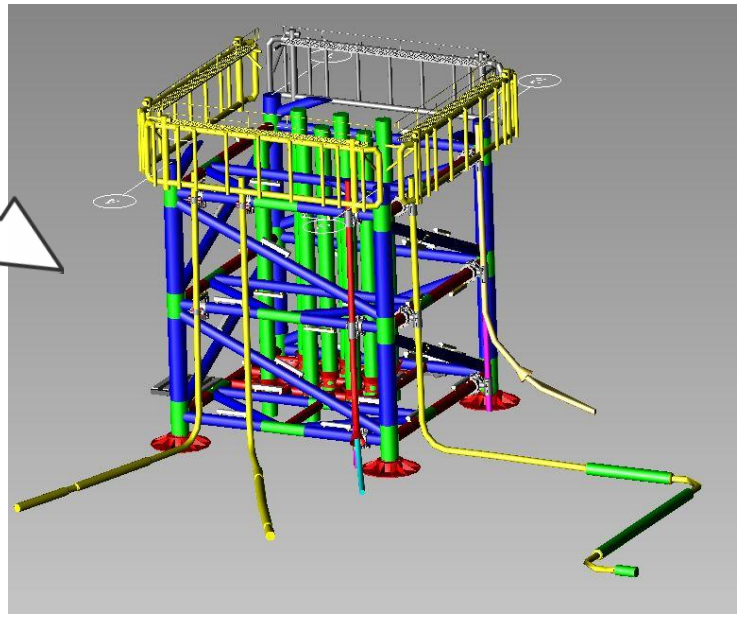
PRC Benefits for Structural Reassessment and Life Extension

Rapid ROV survey technique that creates as built 3D models of current condition.

- Completes Diver less operation avoiding human error.
- Confirms as-built structural dimensions and configuration essential for life extension modeling.
- **Dimensional accuracy for replacement components** (ex: boat landing, riser clamps) assures items fit first time with minimum rework – minimizes installation time/cost.



PRC Viewer



The Whole Platform created as 3D Solid

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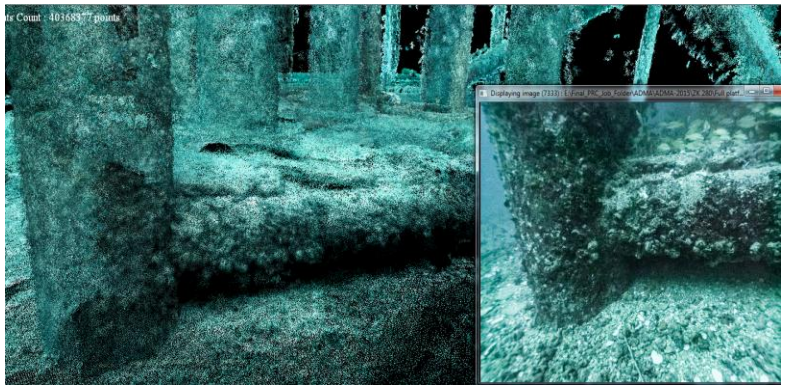
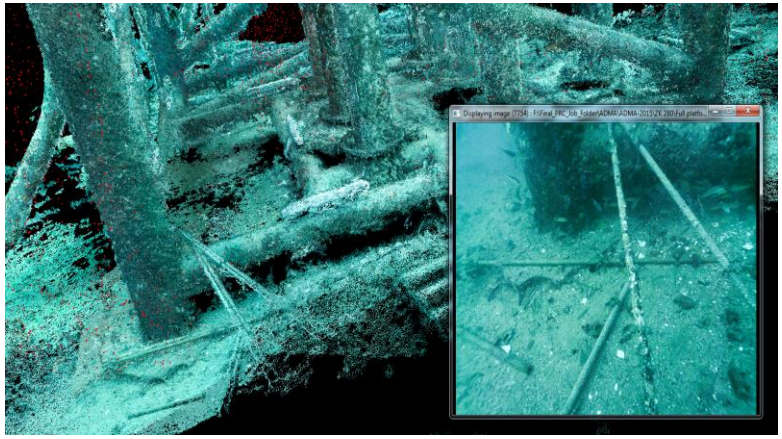
PRC Benefits for Structural Reassessment and Life Extension

- Measure anomalies accurately which allows determination of fitness for service (FFS) and remaining life (RLA).

Conductor lack of Centralization



Scour measurement at seabed level



Debris in contact with the structure

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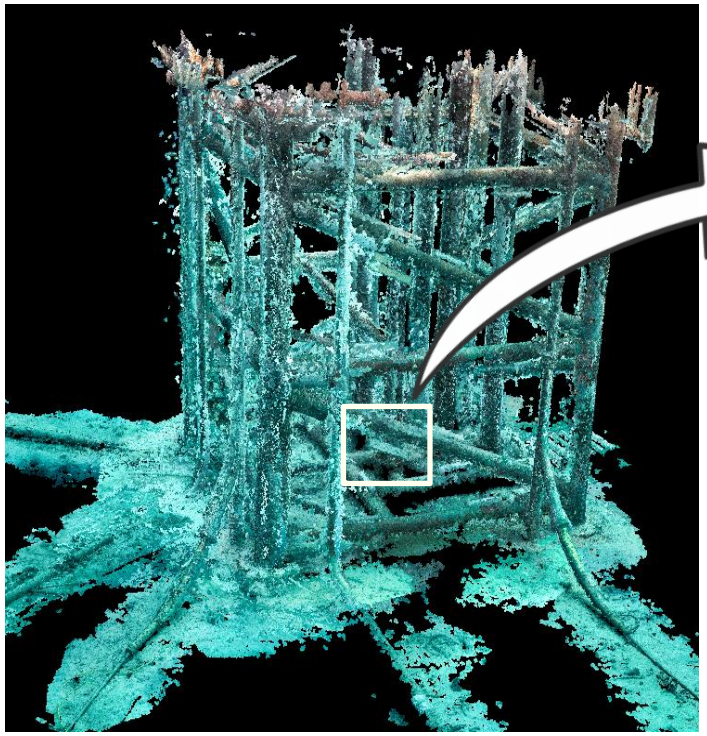
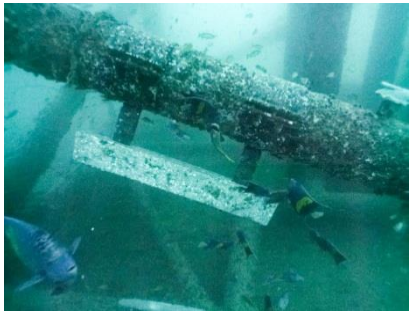
PRC Benefits for Structural Reassessment and Life Extension

Volume Quantification - Anode Depletion Measurements

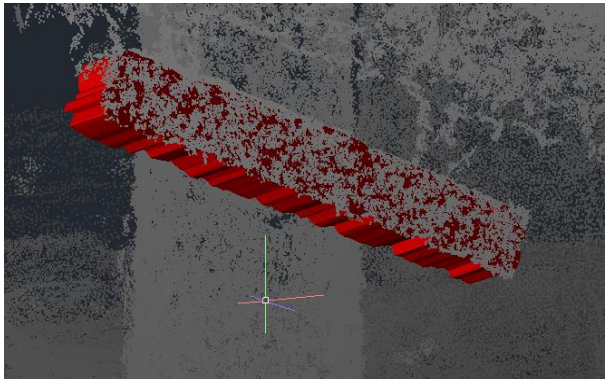
As found shape for the anode will be presented in a 3D solid model to calculate the actual anode depletion in comparison with anode design model.



PRC View



Realistic View



As Found Anode 3D Extraction

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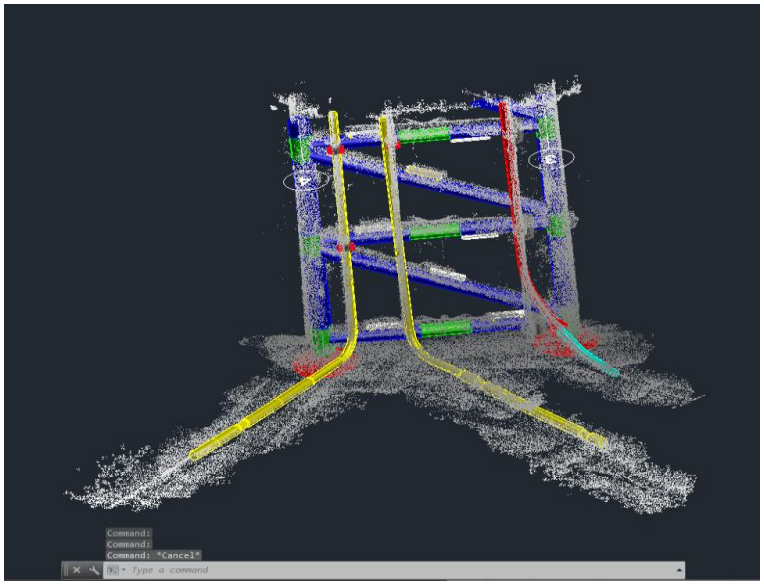
Subsea structure installation and Engineering Support

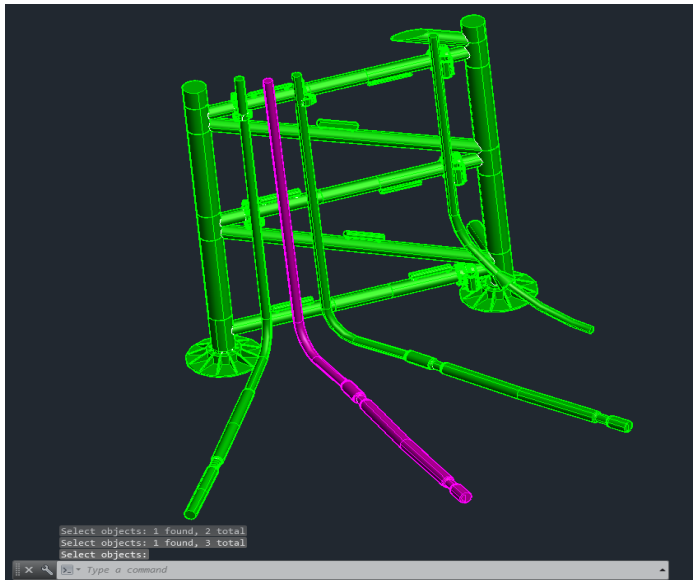
- Dimensional accuracy allows safe installation of new risers and equipment.

Case study: Installing a new riser on existing structure

The actual measurements are taken from as-found model (3D PRC Viewer).
Creating an installation plan for the new riser with exact fixation points.



Creating 3D model for riser Face



Installed new riser on extracted face

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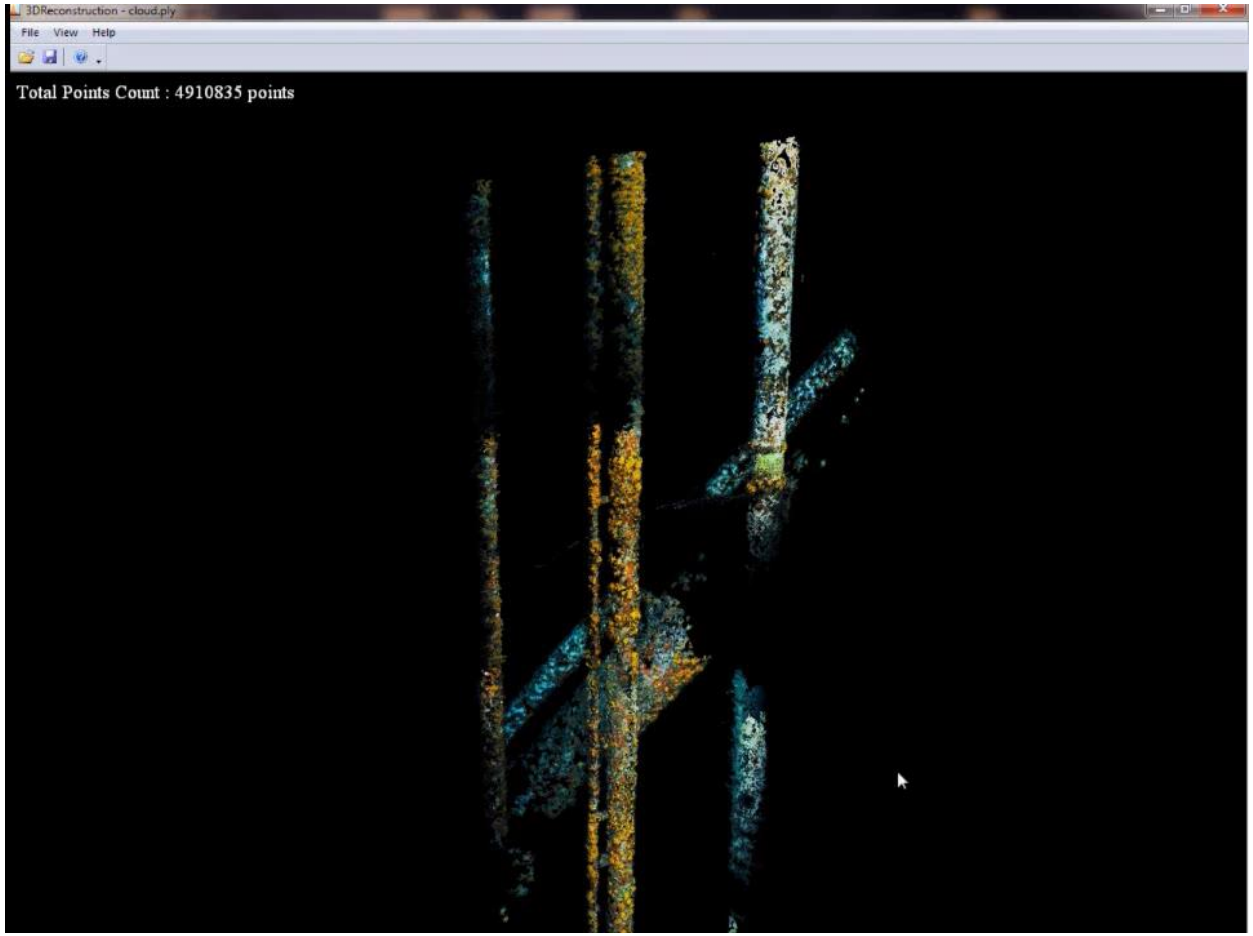
Riser 3D Metrology



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Riser Buckling Measurement

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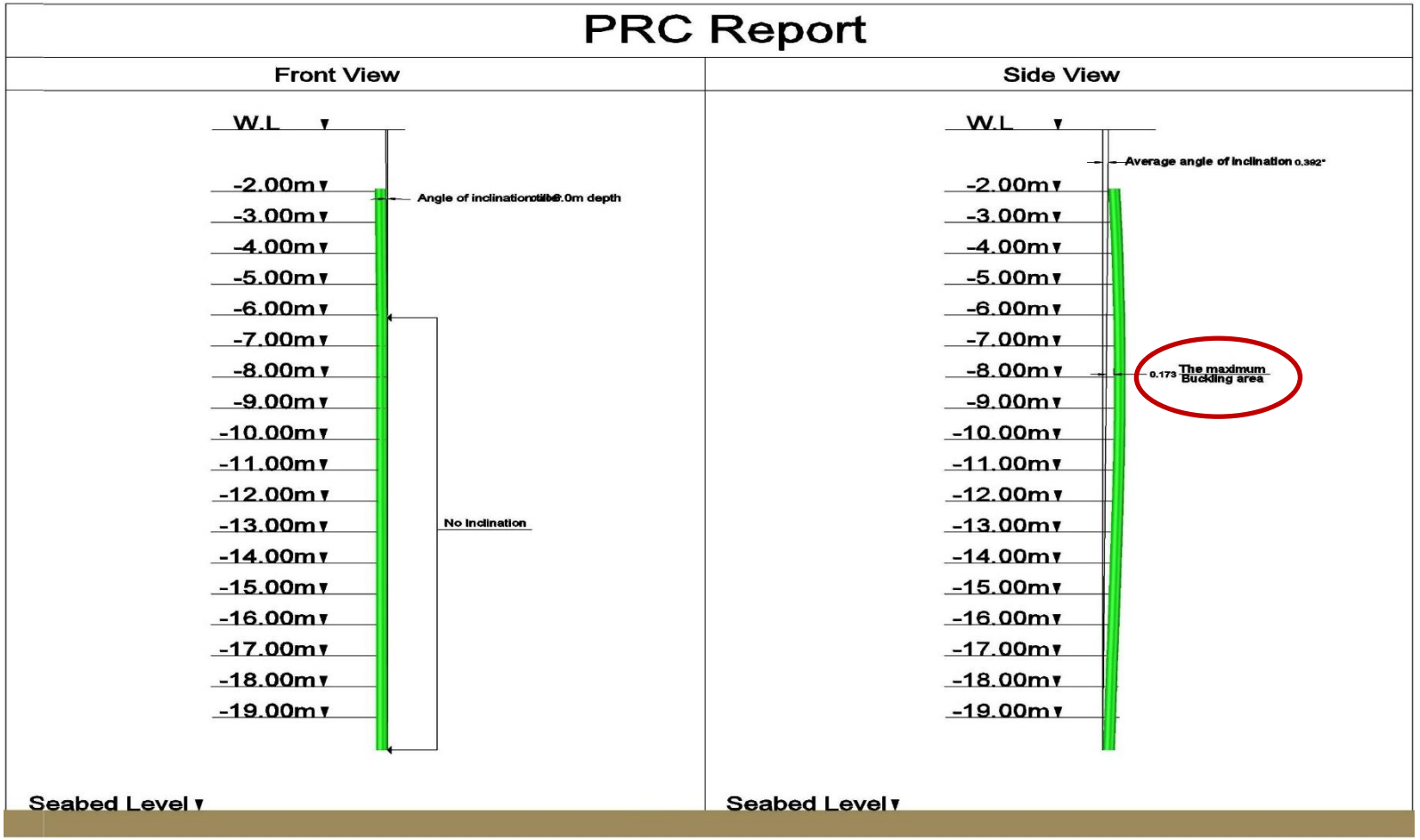
Riser Buckling Measurement



Sample of PRC Report onboard

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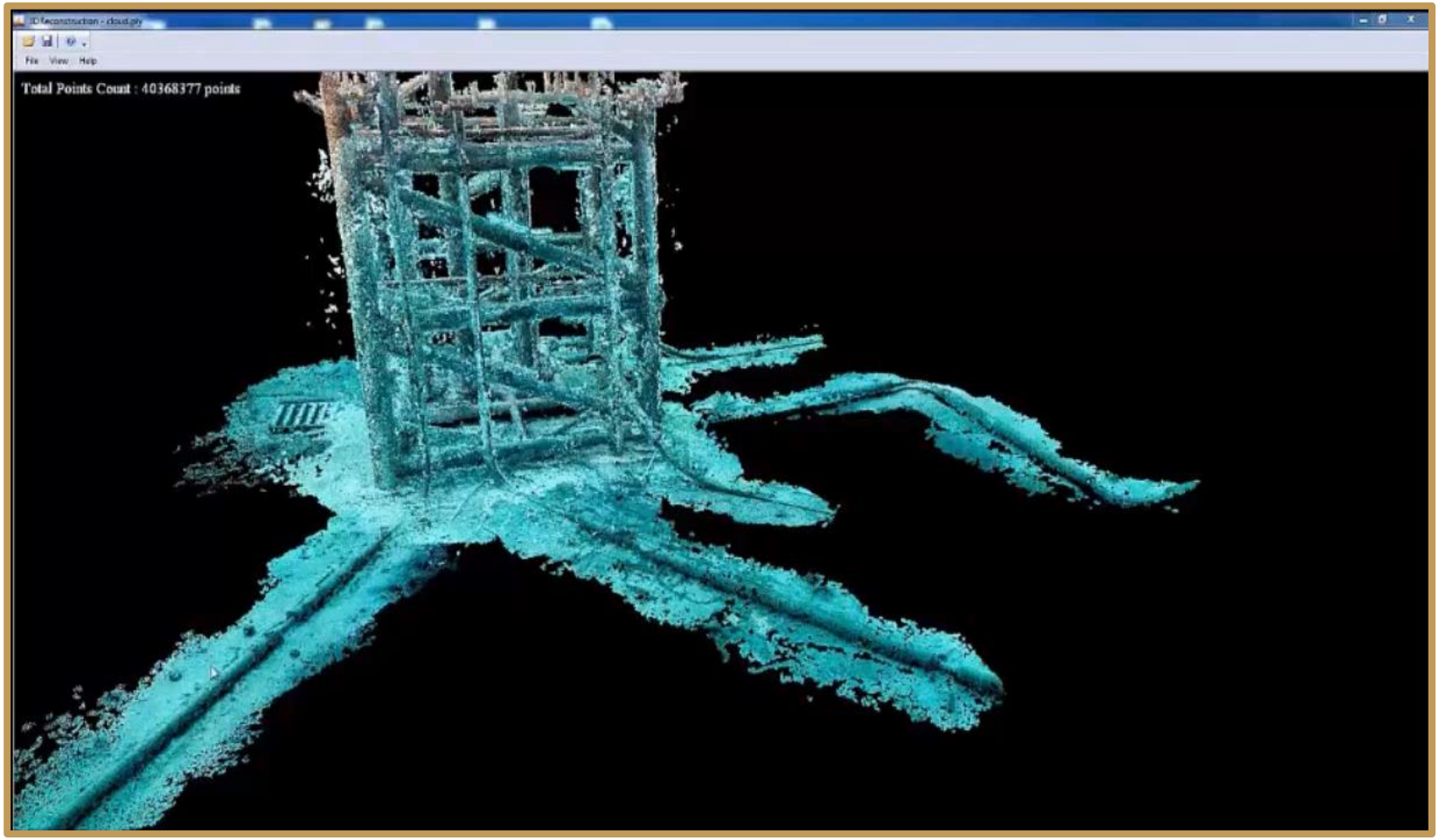
Structure Photo Realistic 3D Cloud of Points (PRC)



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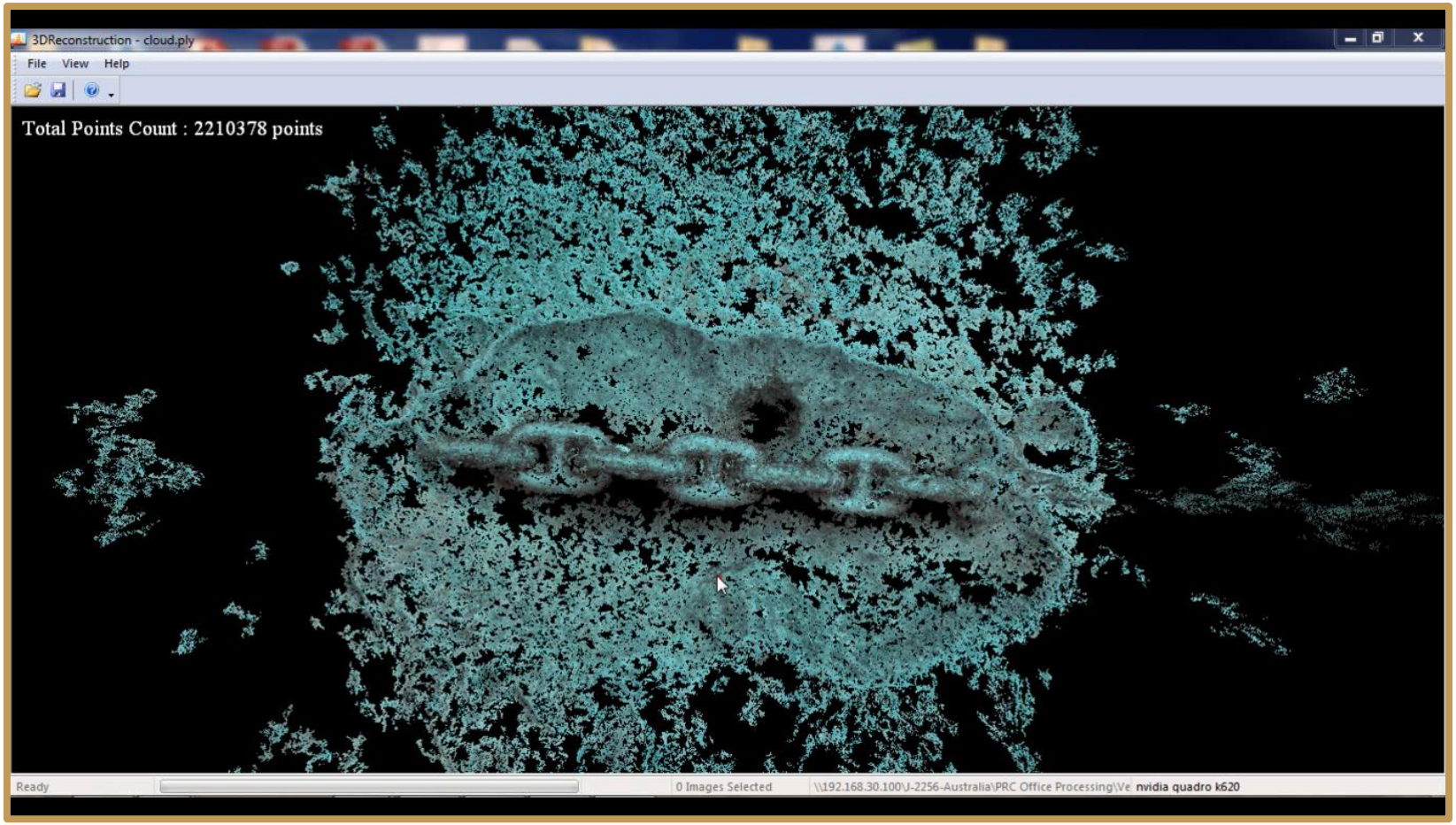
Chain Inspection & 3D Metrology



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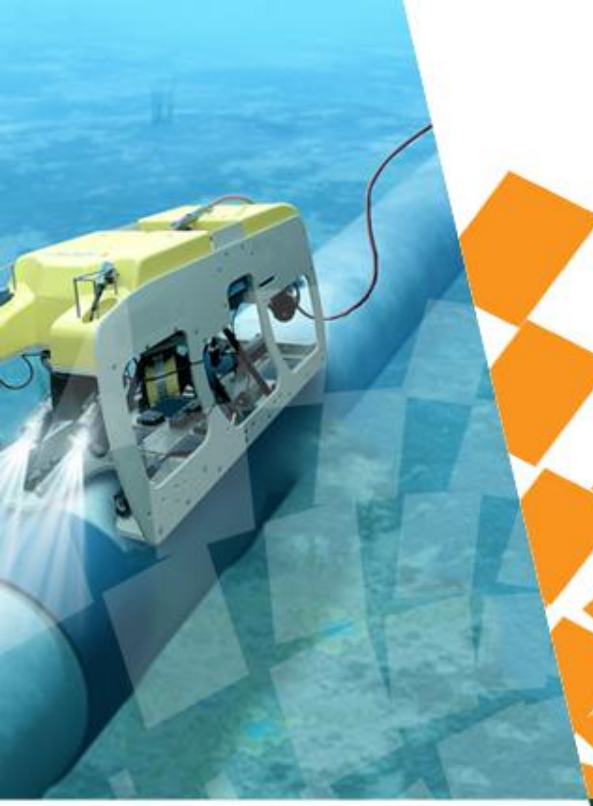
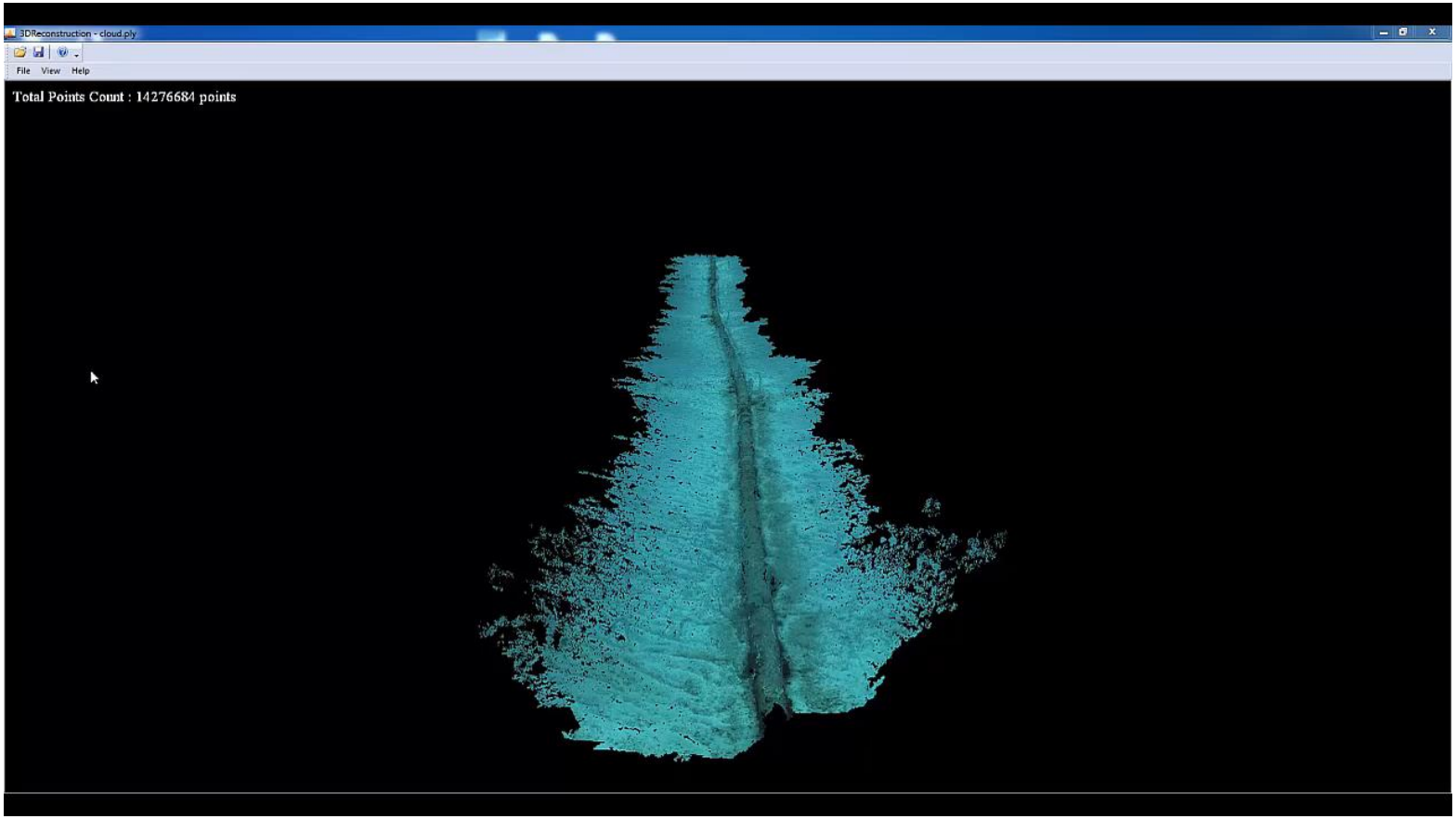


Pipeline Photo Realistic 3D Cloud of Points (PRC) Applications

3D PRC Application

PRC Benefits for Pipeline reassessment & life extension

Out of straightness Survey (OOS) measurement in both vertical and horizontal dimensions to determine the pipeline shape.



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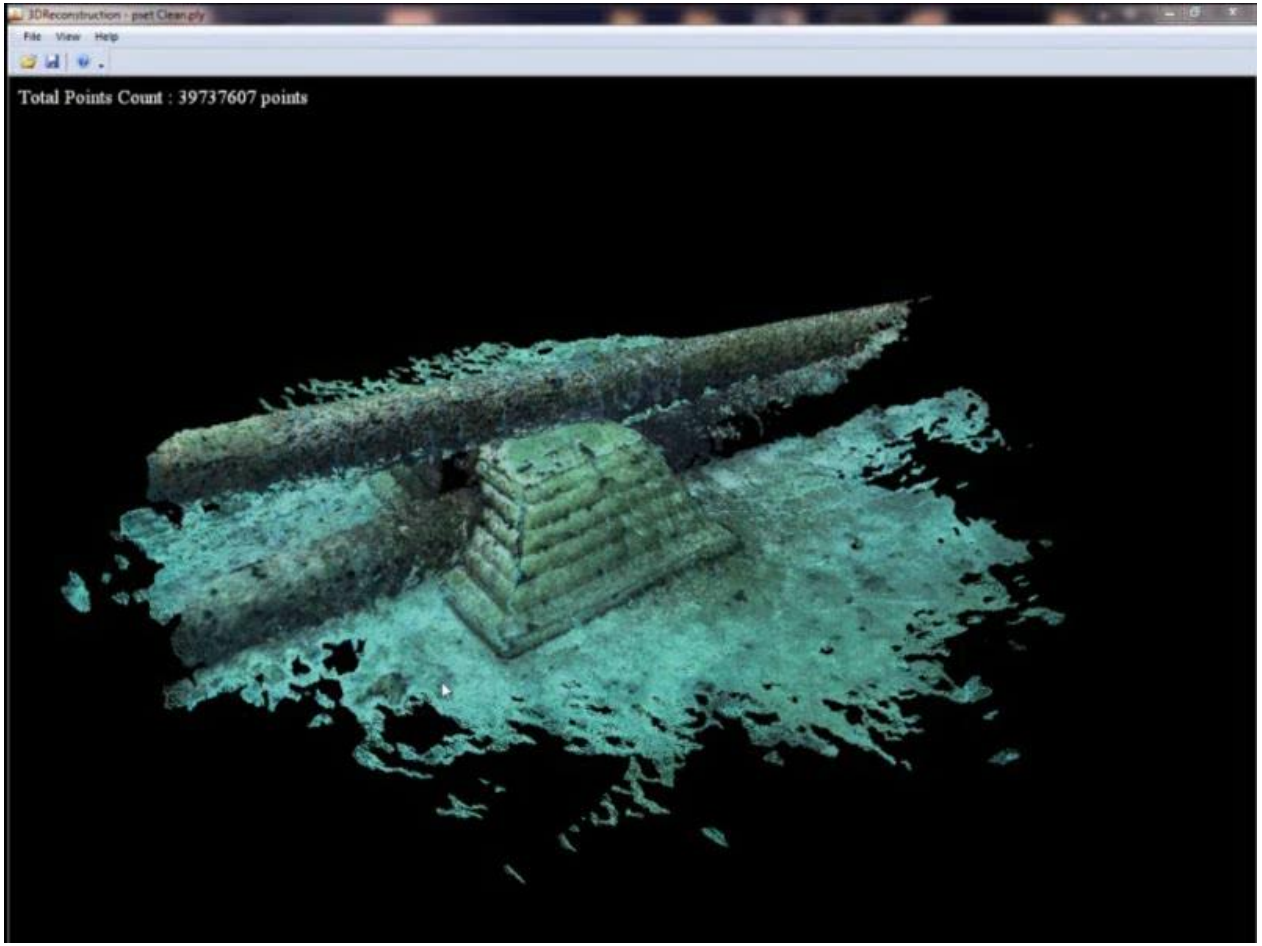
PRC Benefits for Pipeline reassessment & life extension

Clear view and precise measurements for Crossing clearance through Mono Tunnel



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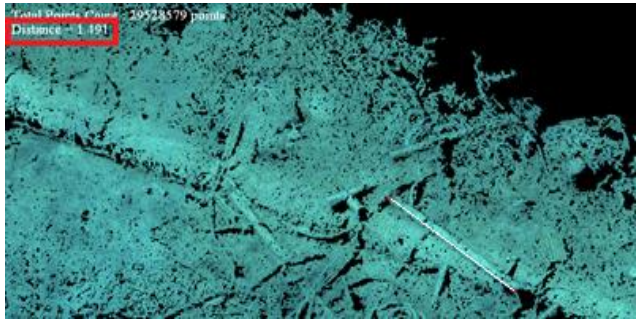
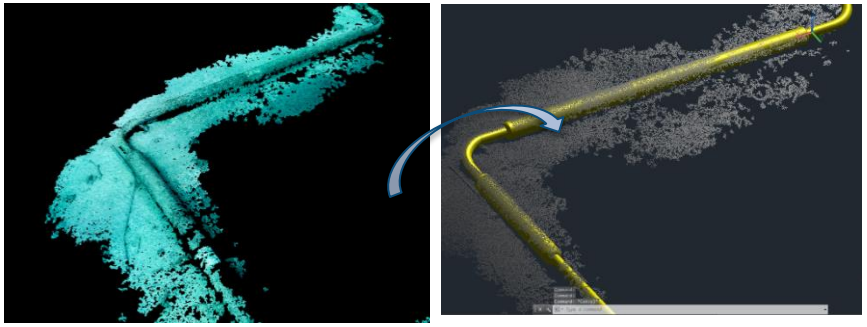
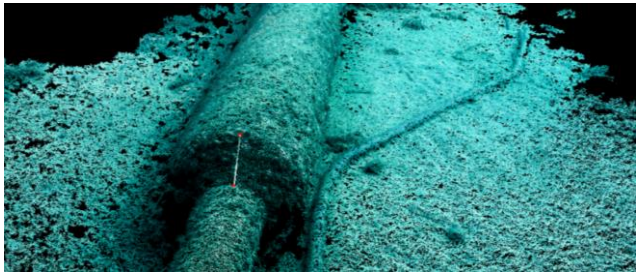
PRC Benefits for Pipeline reassessment & life extension



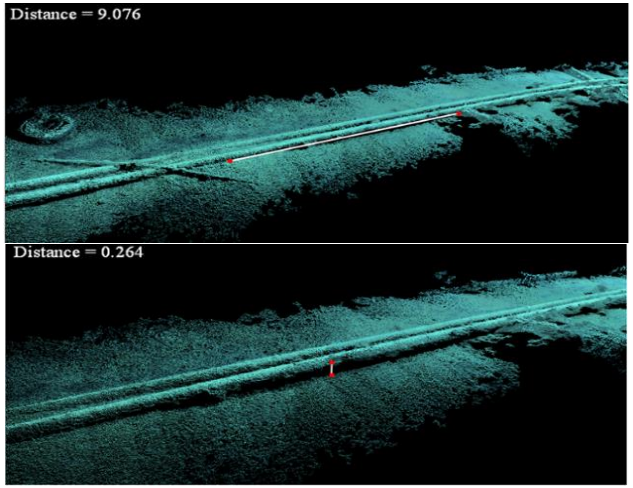
Measure anomalies accurately which allows determination of fitness for service (FFS) and remaining life (RLA).



As build 3D models of current condition with ability to import it to 3D CAD Model



3D visualization for pipeline to measure weight coat change



Precise measurements for free span

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Case Study for Spool Metrology

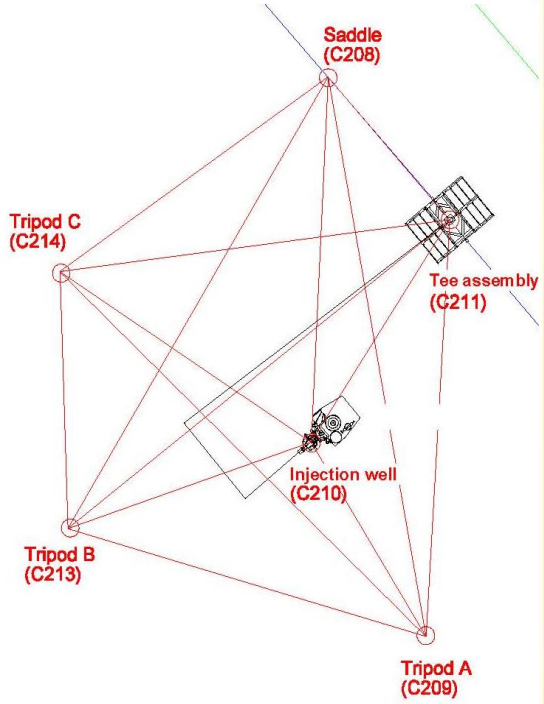
The most common method of collecting metrology measurements is LBL acoustics.
Multiple acoustic ranges are collected between the transponders and then interpolated to determination the relative height, distance and measure the absolute inclinations between the two flanges.

A lot of Equipment are required Such as :

- Seabed tripod stand
- Pipeline saddle tool
- Structures (specific interface tools required)

This tooling adds to the cost, time and also adds to the overall risk

- More than 12 hr. of Survey Vessel time is required , depending on water depth, visibility and number of transponders utilized.
- Accumulated errors due to subsea noise .
- Require 3-4 Personnel onboard .



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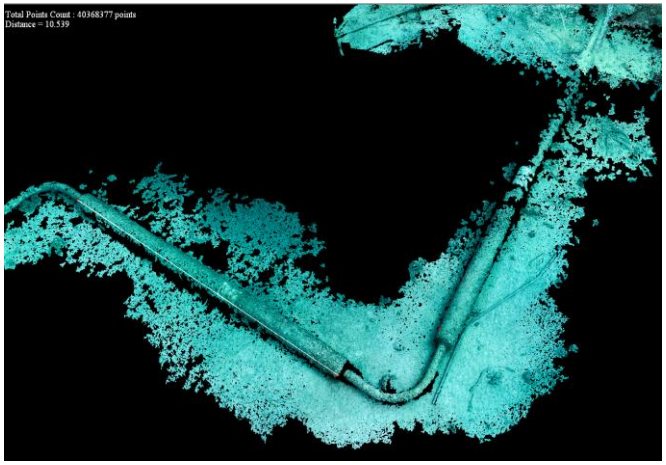
Case Study for Spool Metrology

Using 3D PRC in spool piece metrology is an effective technique in environments with relatively good visibility where ;

- Few hours are needed for data collection and report delivery.
- Provide dimensional accuracy up to mm.
- 1-2 Personnel are required onboard



Conclusion:

- Minimizing the time and cost required for installation by saving significant ROV and vessel time overall metrology campaigns.
- Avoiding human error.

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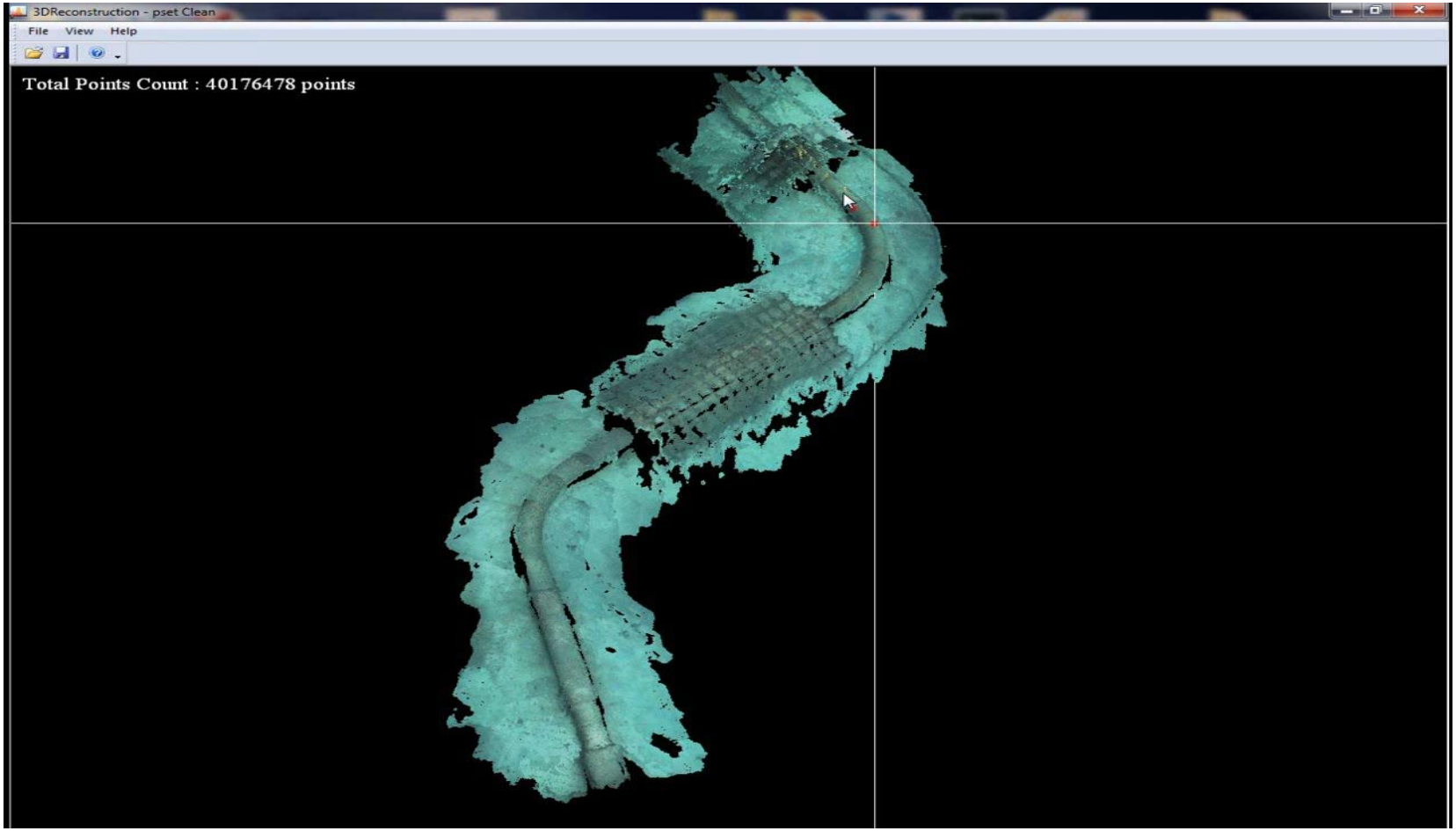
Case Study for Spool Metrology



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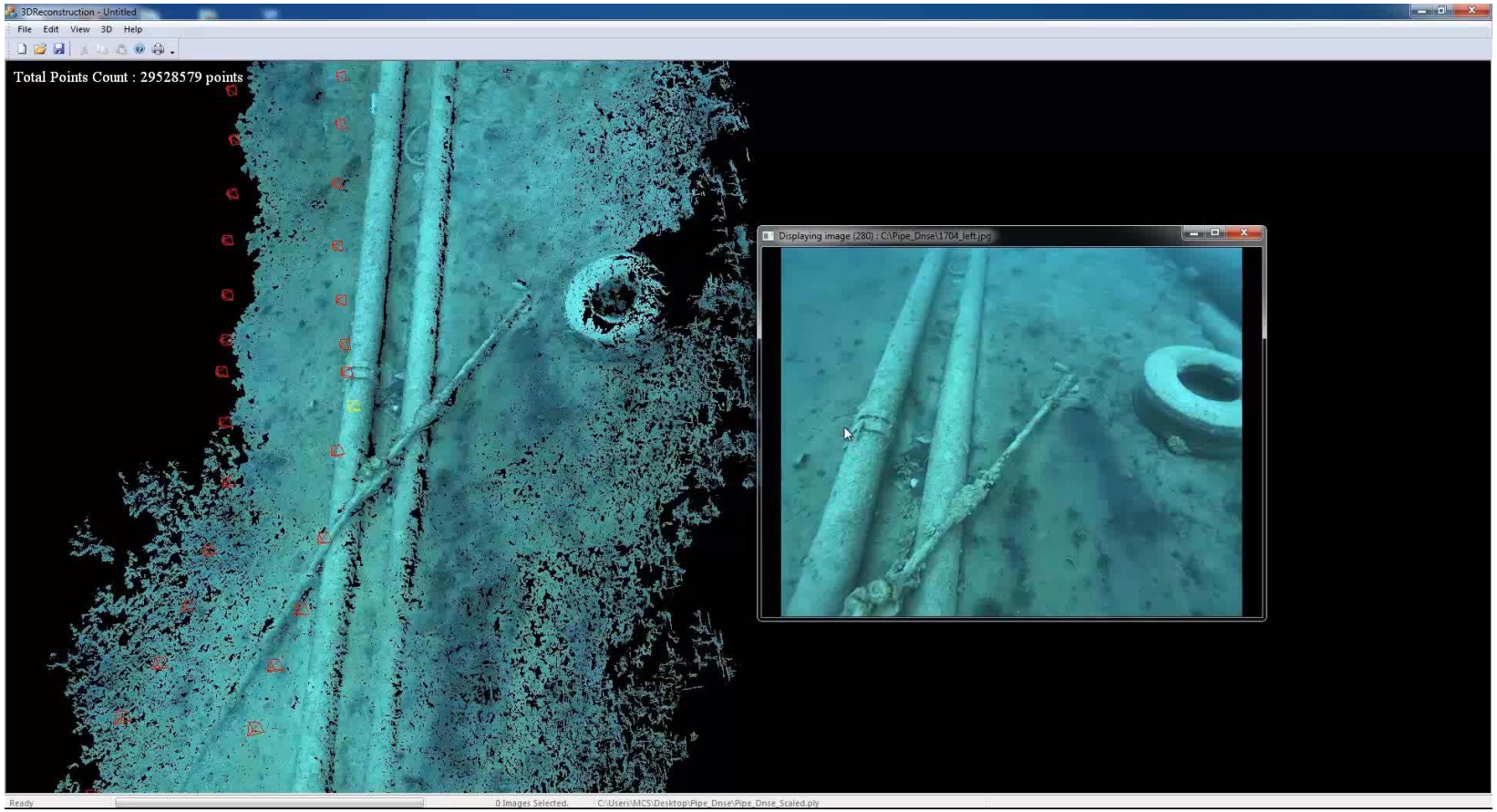
Pipeline Photo Realistic 3D Cloud of Points (PRC)



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MCS PRC with Drones

MCS PRC equipped on Unmanned aerial vehicles (UAV) also known as **drones** is a reliable solution to support operations onshore / offshore oil facilities by accessing areas that would be difficult or impossible without extensive manpower and support without manpower and support, by capturing / collecting enormous amounts of data in a short amount of time.

MCS PRC have a light weight which allows it to fly freely, also environment friendly in hazardous locations; with no need to shutdown to get accurate measurements.

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MCS PRC Noise Enchantement Module

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3D PRC Added Value :-

1. Produce full set of as-found drawing Base line for subsea structures within mm accuracy and precise 3D integrated model with all dimension.
2. Eliminate the need for verification as built visits, whenever new installation needed as it Eliminate the necessity for frequent Vessel visits for physical measurement.
3. Faster, diver-less and more accurate approach than conventional way for collecting as-built/as-found information avoiding any human error.
4. Precise 3D reference for all features position/orientation; convenient for future construction/maintenance (i.e. riser installation, flange/clamps fabrication).
5. Database can integrate within the IDMS.
6. In-depth Integrity assessment & life time extension.
7. PRC equipment can be mounted on ROV or divers .

Concept:

Only one PRC inspection to be executed during normal GVI inspection, is a life time supply for as-built/as-found information.

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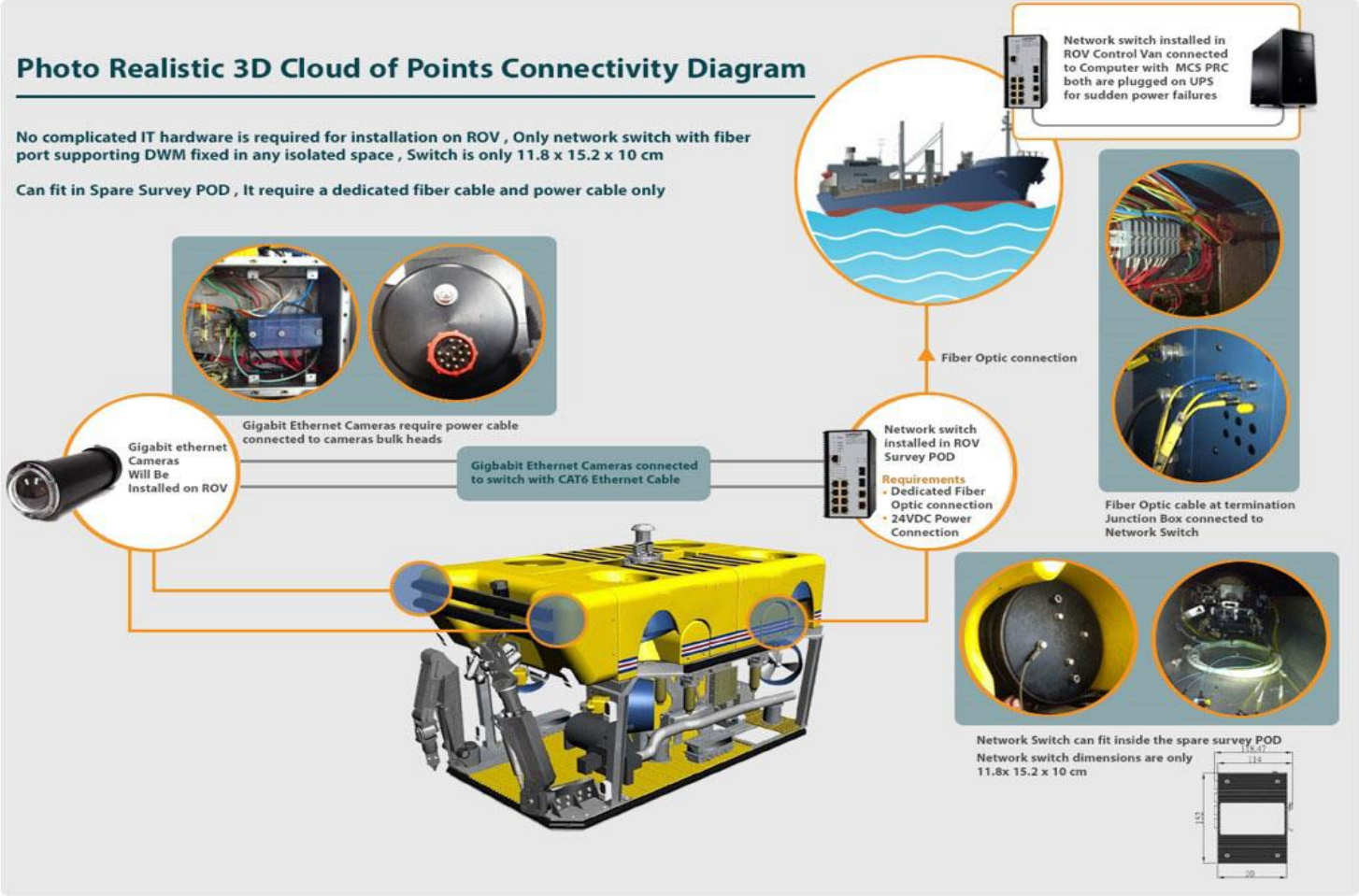
ROV Interface



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