February 15th WORKSHOP

Javier Pamies

3D Points Cloud

3D Scanner

- Training is required to make the scans.
- Slow data capture (4-10 min per scan)
- Assembly process carried out by hand (20 scans 20h).
- Possibility to export as cloud, mesh, whole scan, part of a scan, 3D viewer, etc.
- The generated 3D points cloud is very accurate (1mm).

Photogrammetry

- It is not neccesary a previous training to use the camera.
- Quickly data capture (30-40 seg per scan)
- Automatic assembly is given by the camera supplier. (20 scans 12h).
- Visual results only. These results can be exported as a points cloud file (.xyz).
- The 3D points cloud is not very accurate as it is generated from photos (a few cm).

LIDAR

- A short training is neccesary to use the scanner.
- Quickly data capture (in 20 minutes it is possible to scan around 250).
- The supplier's software makes assembly automatic.
- A 3D points cloud is obtained.
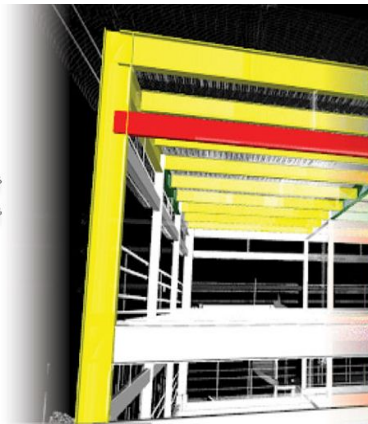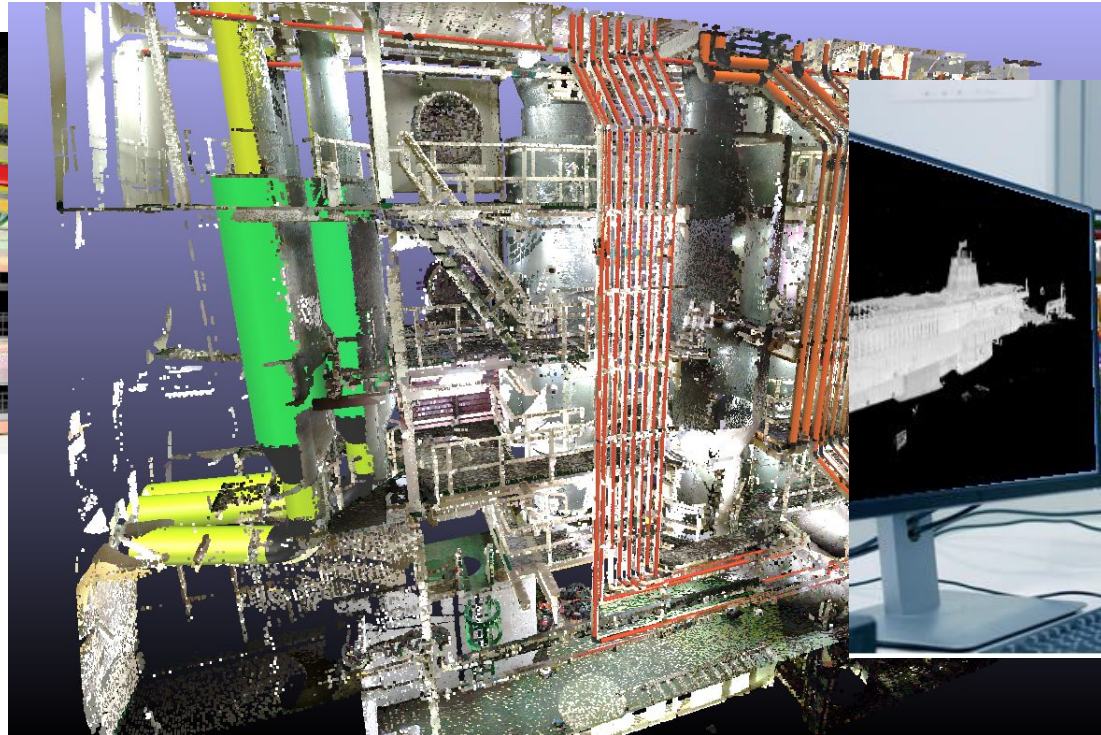- The generated 3D points cloud has an accuracy of 2-3cm.

Our Targets

1. Progress Monitoring (Task 10.21)

2. Reverse Engineering (Task 13.25)
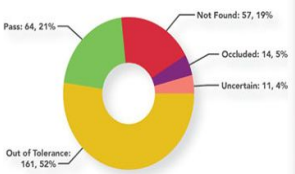
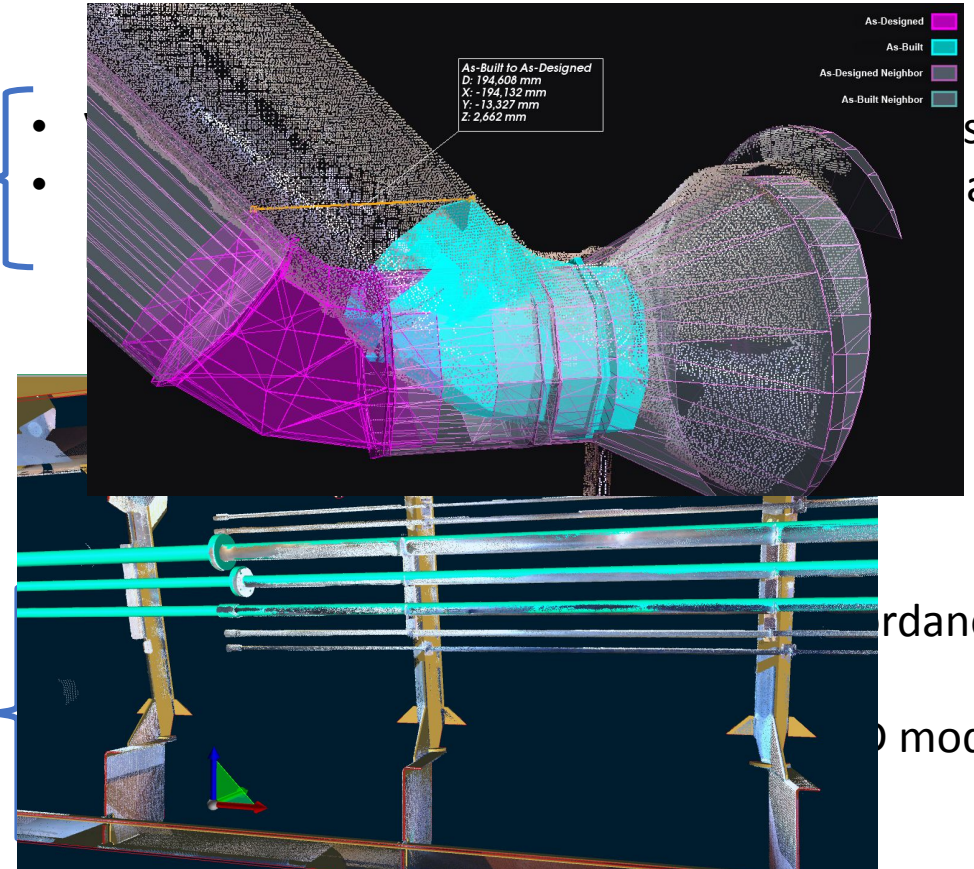3. Project Documentation Updating (Task 14.26)

New building & retrofit

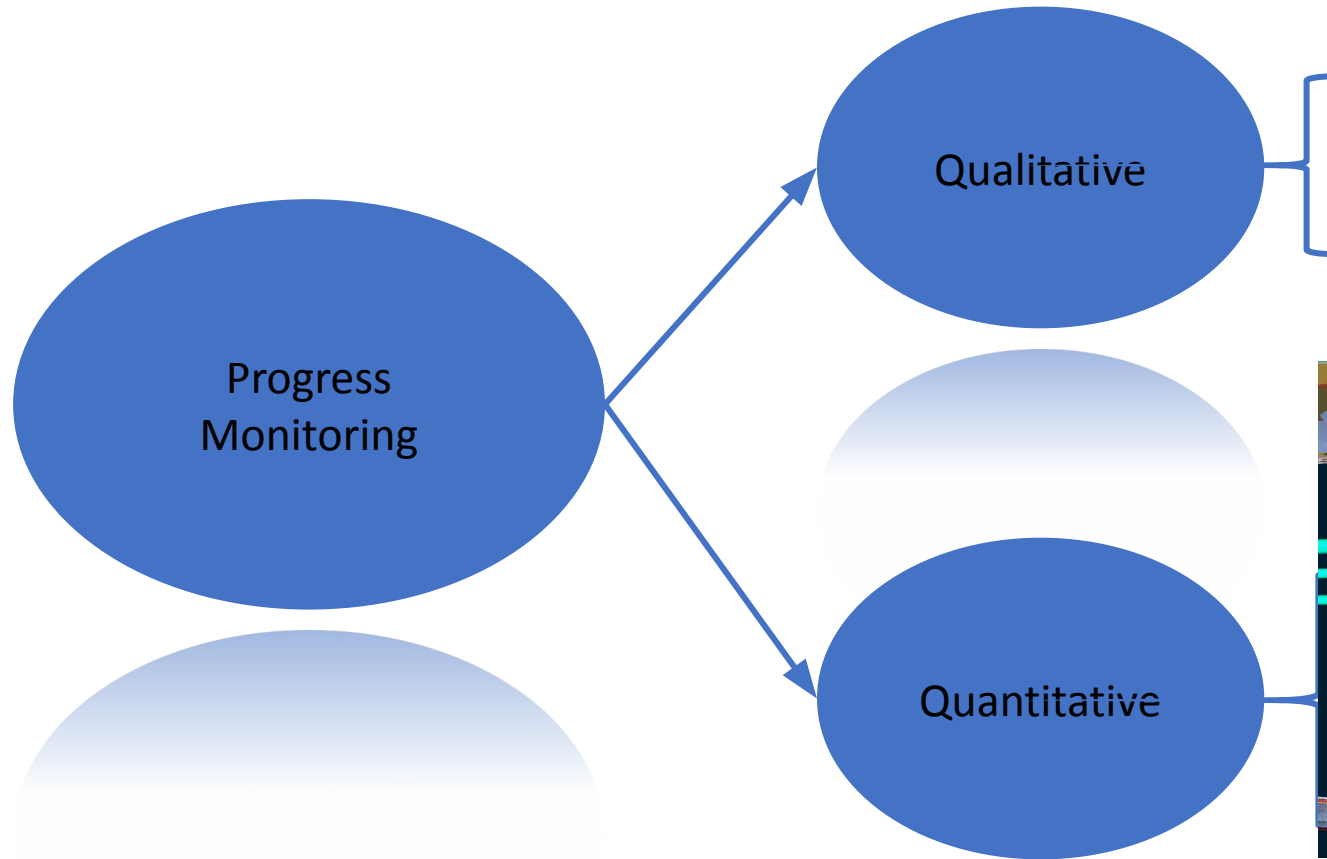New building & retrofit

New building & retrofit

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006798

Progress Monitoring
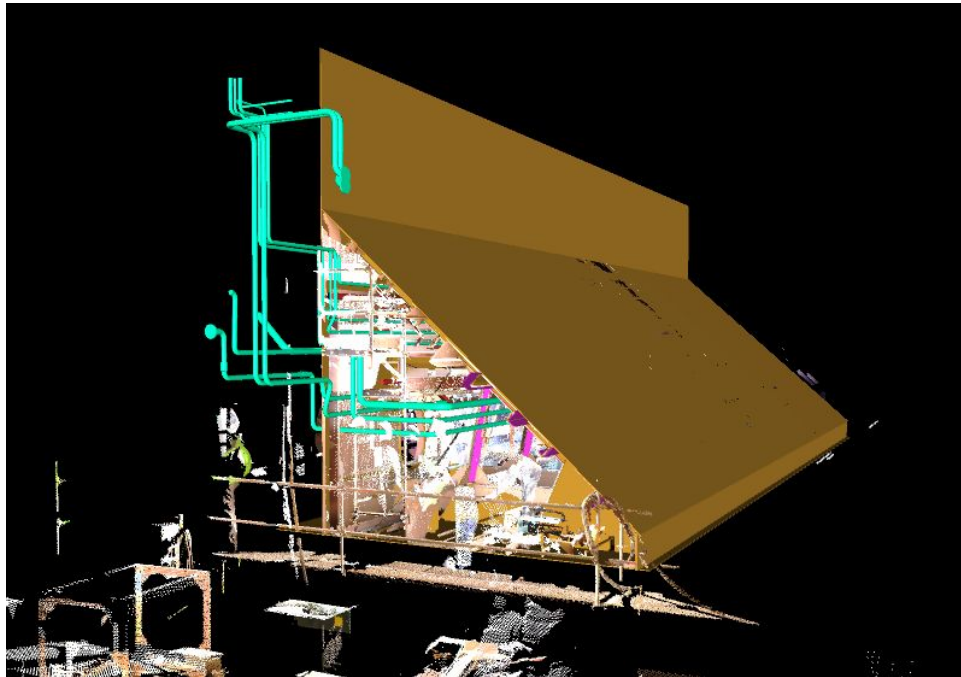
Qualitative

- ...sing.
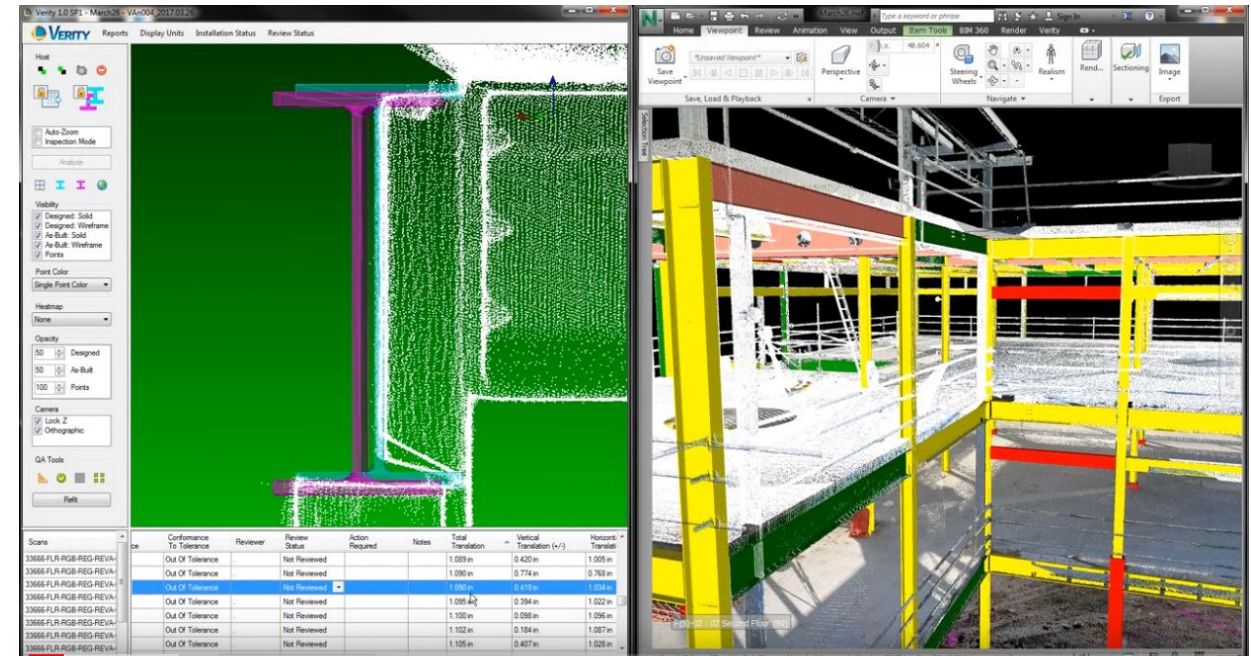- ...a

Quantitative

...rdance with

...model and

1. Progress Monitoring

Compare the real position of equipment with the 3D model by 3D scanning

Visual method (Navisworks)

Automated method (Verity+Navisworks)

GHENOVA

MARI4YARD
MARI4ALLIANCE

1. Existing Vessel

2. 3D points cloud of the vessel

3. Model based on the 3D points cloud

4. Modification of existing elements or addition of new ones

Existing vessel
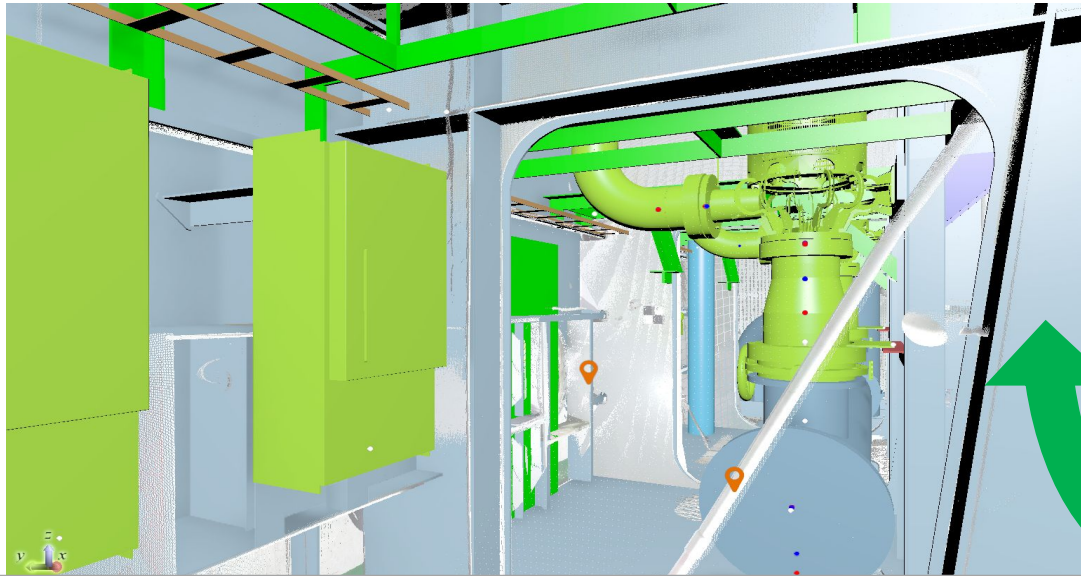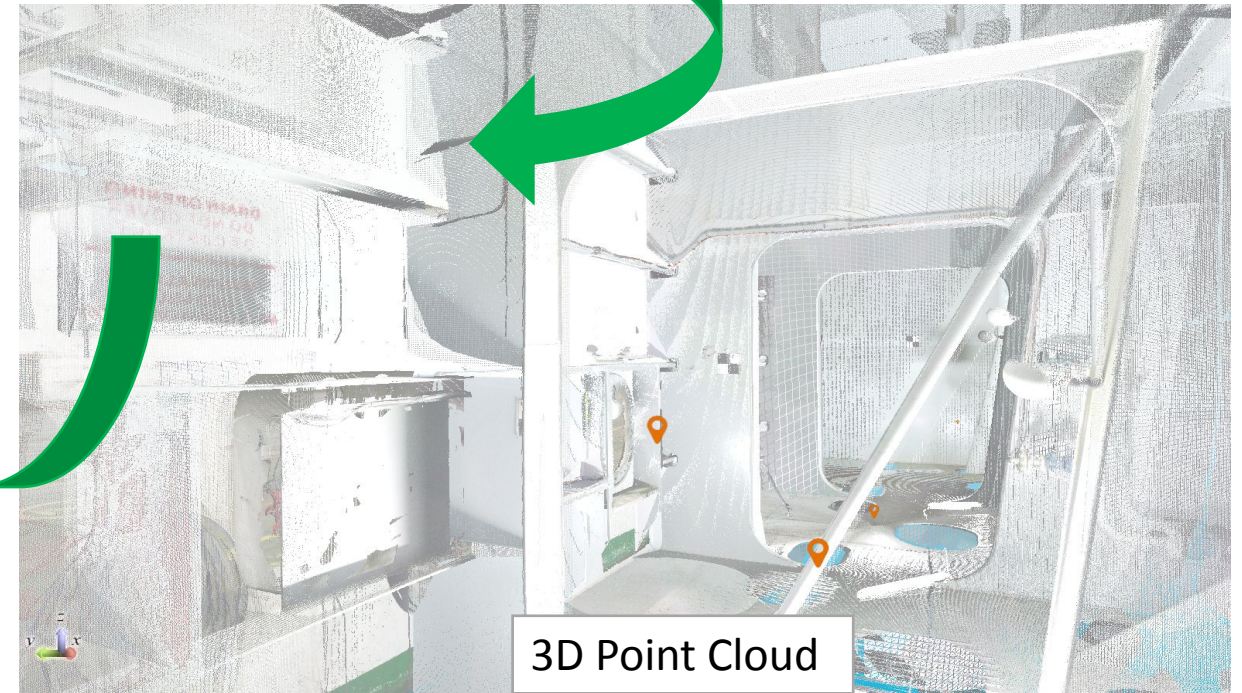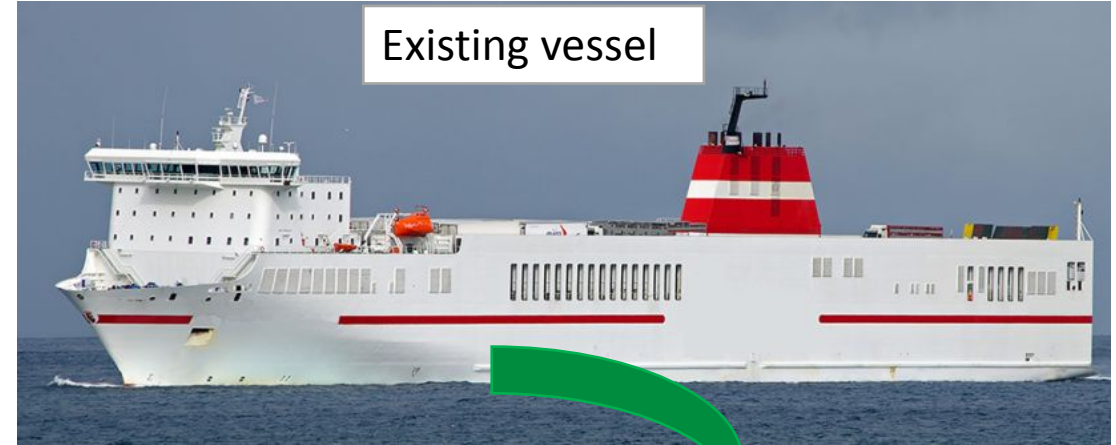
3D model based on the 3D points cloud with modifications

3D Point Cloud

GHENOVA

MARI4YARD
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Points cloud viewer + 2D software

| Point Cloud viewer Measure the objects | 2D Software Represent the reallity | 2D Software Add the new items for retrofit | 2D Software Create the construction drawings manually |

Steps:

- Measurements from an scan viewer (3-coordinates X,Y,Z) to place the elements in the different views of the drawing.
- Position the above measurements in the different views to obtain the initial drawing to start the retrofitting.
- Once the existing is represented, the modifications necessary for retrofitting are added and the construction drawings are created manually.

The accuracy of this method is not very high
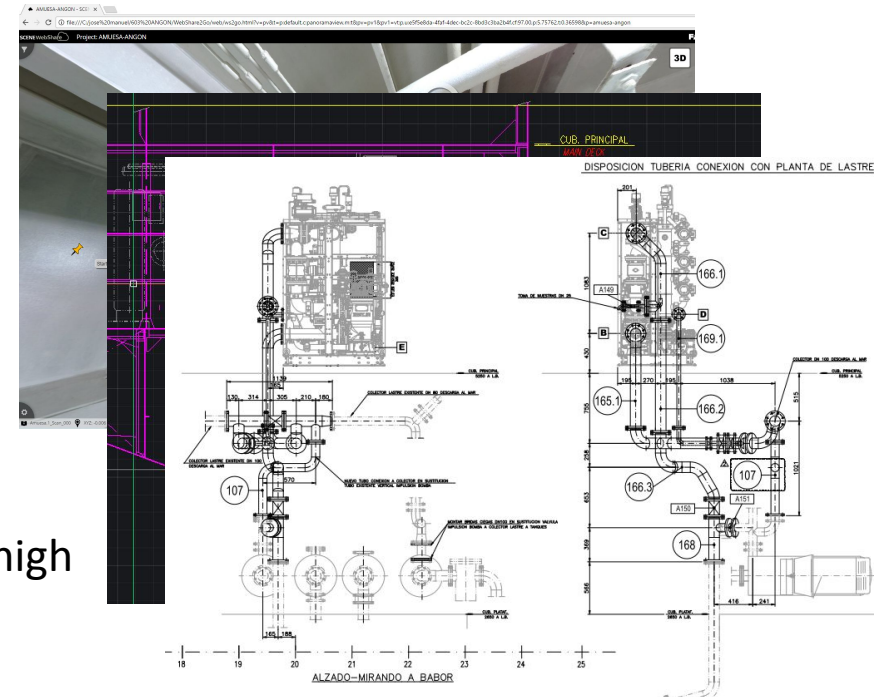
Point cloud viewer + 3D generic software

3D Software	3D Software	3D Software	2D Software
To place the Point Cloud	Adding connection points	Connecting the new elements with the existing	Create the construction drawings manually

Steps:

- Import points cloud into the 3D software.
- Adding new elements needed to begin the work like new equipment or new structures for example.
- Execute the work taking into account the points cloud (in blue new pipelines).
- Obtain manually the construction drawings.
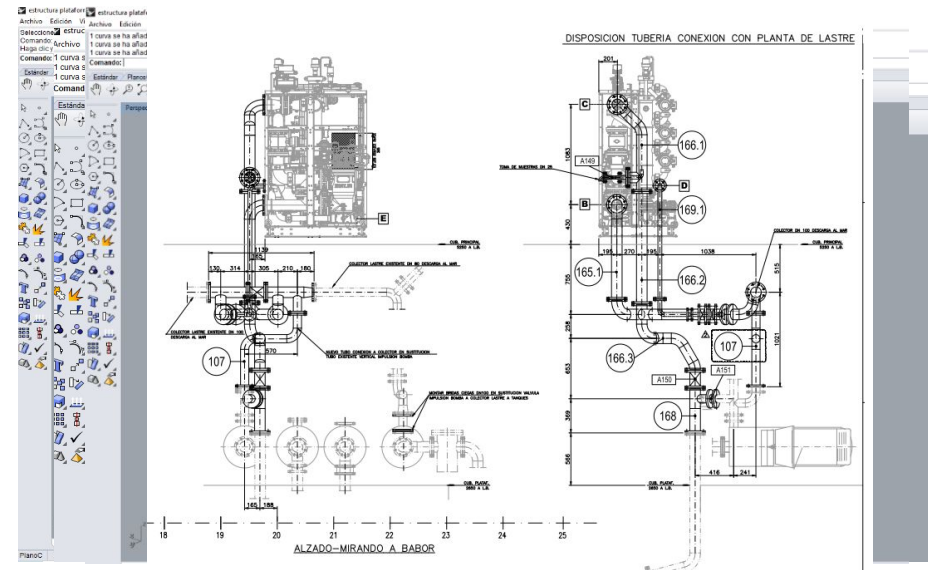
In this case, the advantage is that connections with the existing elements can be seen in 3D and all the clashes that may occur while designing can be detected. Therefore, with this procedure the start of work is faster and the results are more accurate than the previous procedure.

Points cloud viewer + 3D specific software

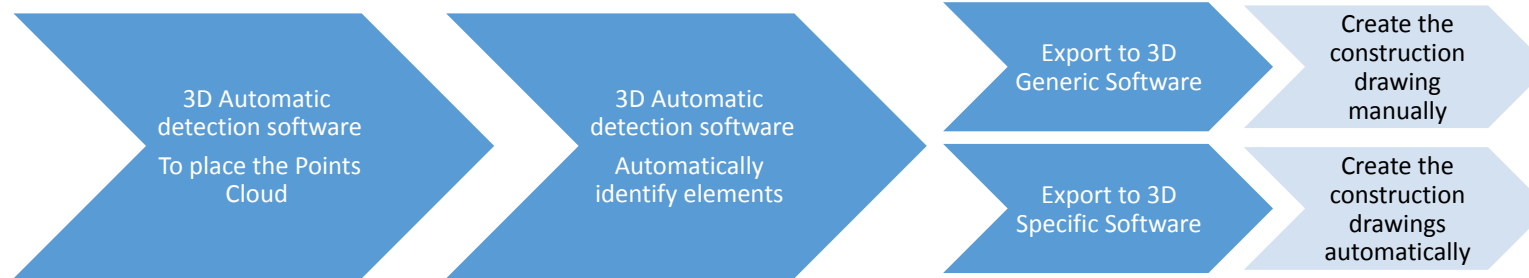|			
3D Software To place the Point Cloud	**3D Software** Adding connection points	**3D Software** Connecting the new elements with the existing	**3D Software** Create the construction drawings automatically

Steps:

- Import points cloud into the 3D software.
- The new piping is routed and the necessary structure is modelled, as well as modelling of the cable trays, platforms and position the new equipment.
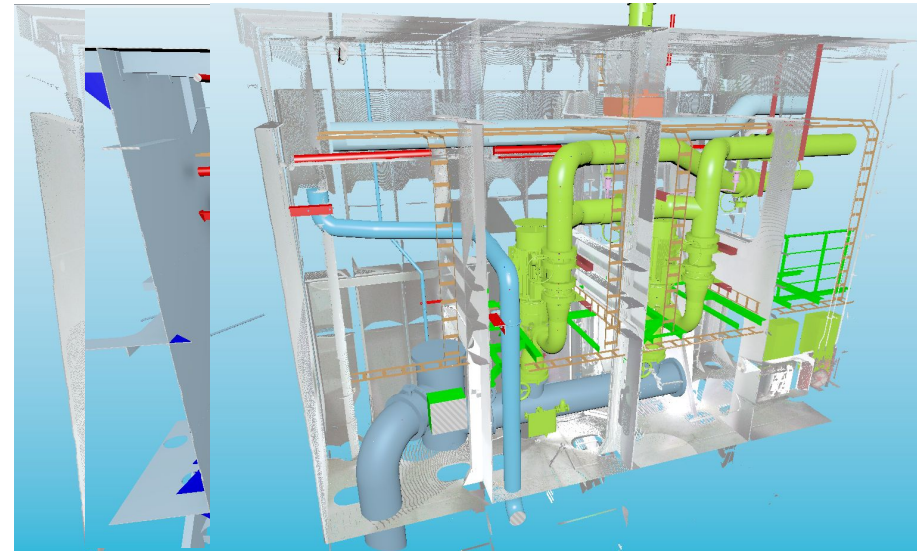

In this case, the advantage is the software since is an specific software to the shipbuilding industry, the tools for the modelling of pipes, structure, etc. are adapted and their use is much faster and easier to perform.

Points cloud + 3D automatic detection software

3D Automatic detection software To place the Points Cloud	3D Automatic detection software Automatically identify elements	Export to 3D Generic Software	Create the construction drawing manually
		Export to 3D Specific Software	Create the construction drawings automatically

Steps:

- Insert the points cloud into Edgewise.
- Structured and unstructured points cloud can be inserted.
- Straight pipe sections are identified automatically and structures, gutters, ventilation ducts can be identified man
- Export to programs such as Rinhoceros (geometry) or to programs such as Aveva or Cadmatic (geometry with attributes).
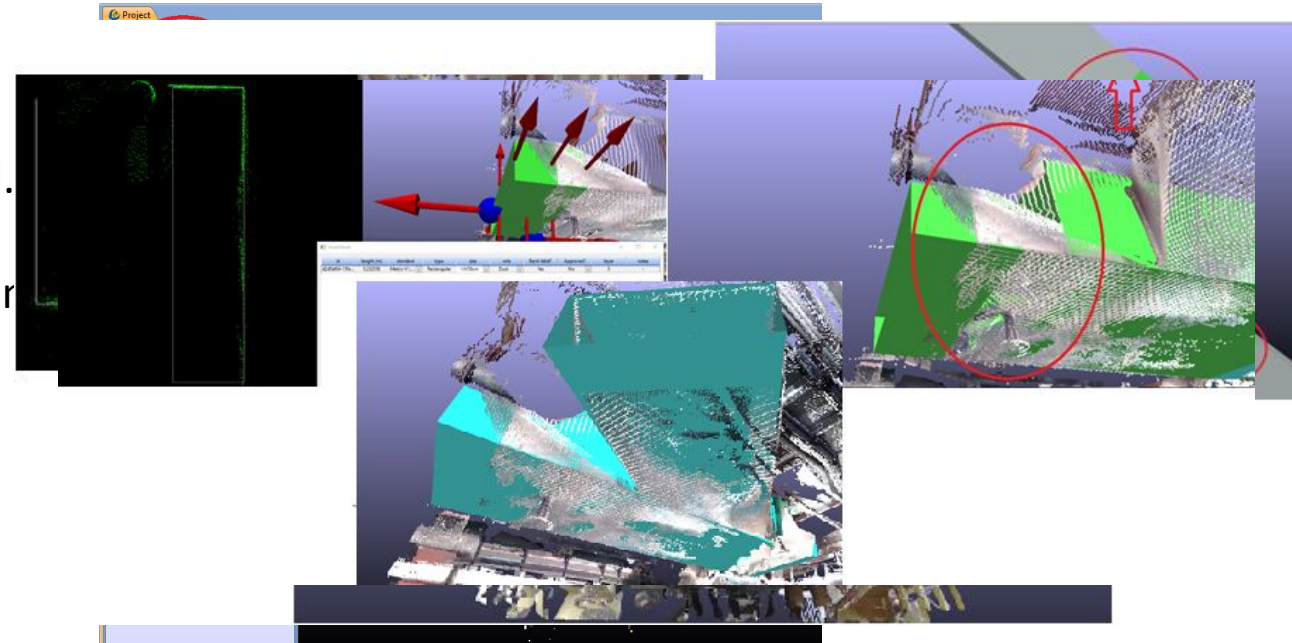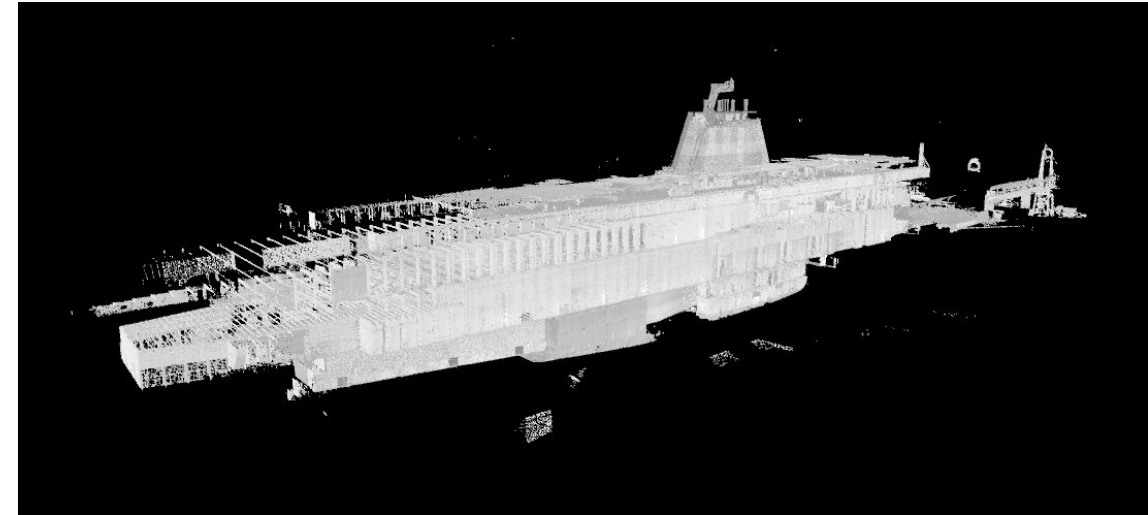
In large projects it can be a great time saver to identify elements

Depending on the purpose of the project documentation, different procedures can be done with different tools.

1. Virtual model only for visualisation or taking measurements.

   Photogrammetry

2. Updating of documents based on the constructed vessel.

Updating during construction ⟶ Project monitoring

Updating at the end of construction. Depending on the work to be carried out, a different level of precision will be required.

Tasks that do not involve a great precision, such as updating the arrangement of equipment in a room. ⟶ Photogrammetry or LIDAR

Tasks that require high precision, such as drawing piping isometrics. ⟶ Fixed laser scan

A large volume of work with different accuracies.

⟶ Fixed laser scan + LIDAR

Thank you for your attention!