BALLAST WATER TREATMENT AND EXHAUST GAS CLEANING SYSTEMS

ENGINEERING AND TECHNICAL ASSISTANCE

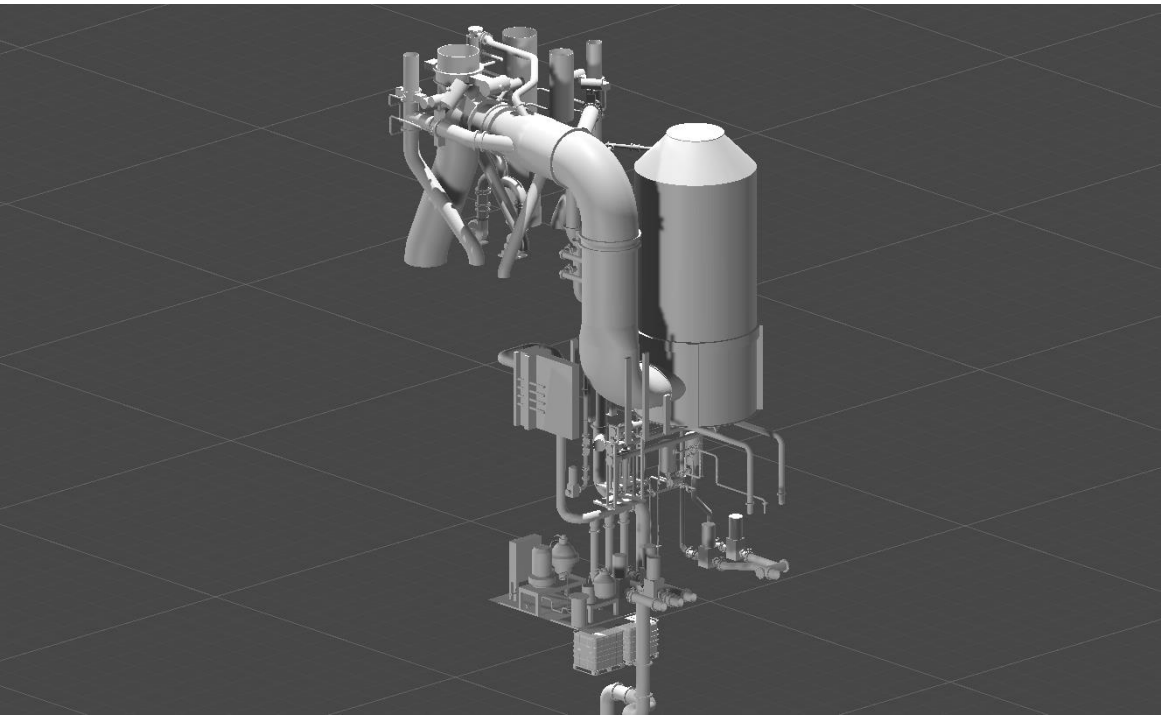

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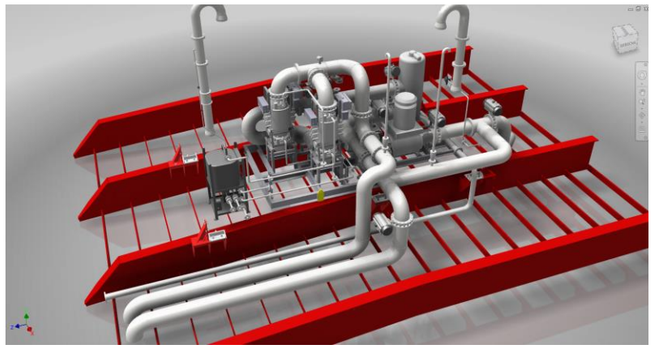
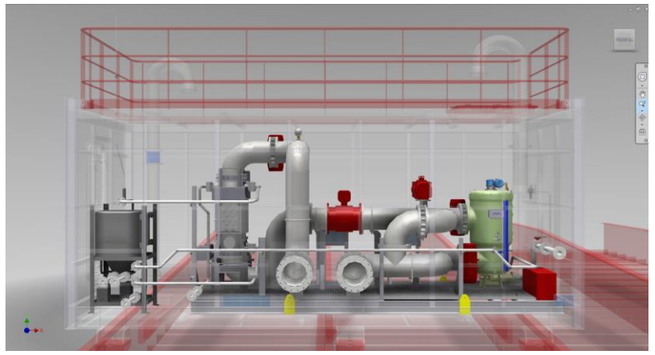
Photo right
Basic design of exhaust gas cleaning system onboard a SuezMax oil tanker.





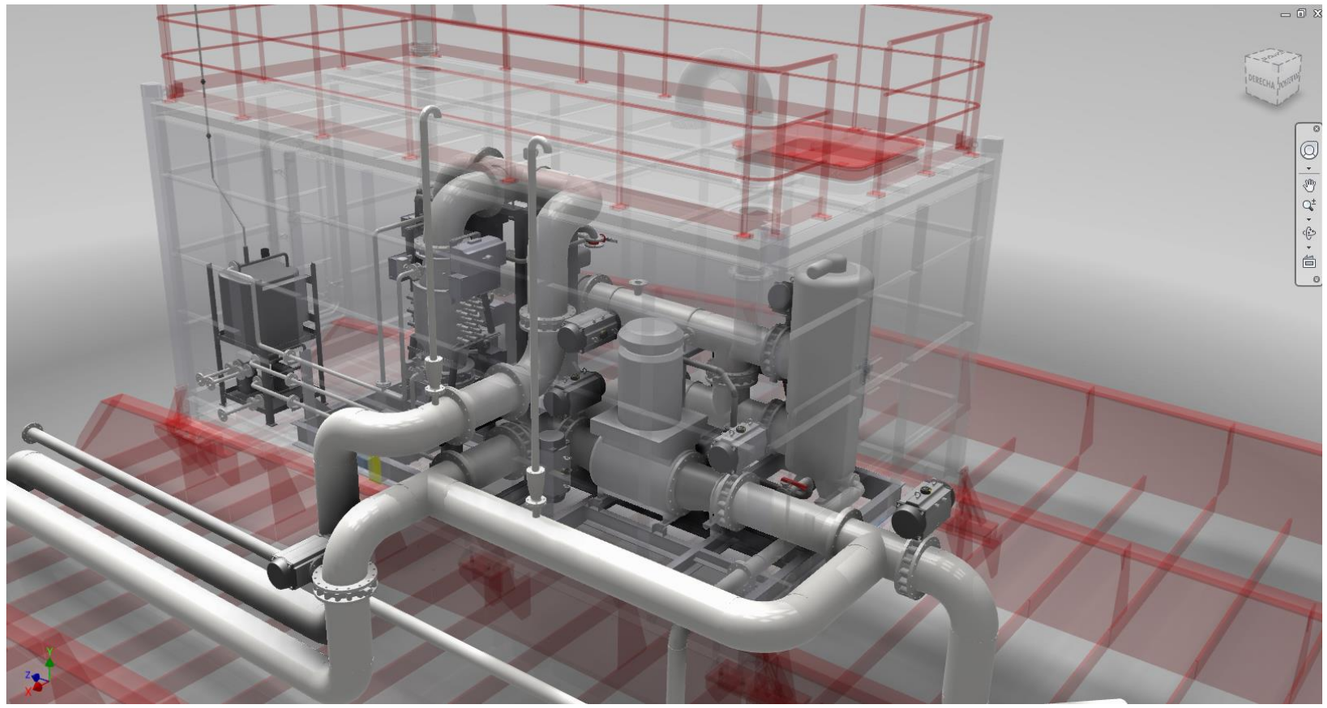


Photo top left
Detail of piping and mechanical package designed to treat a maximum flow of 1.500 m3/h.

Photo bottom left
Detail of piping and mechanical package designed to treat a maximum flow of 1.000 m3/h.

Photo right
Detail of piping and mechanical package inside deckhouse located on main deck.

MARINE ENGINEERING
BALLAST WATER TREATMENT SYSTEMS

Engineering and technical assistance

The ballast water treatment system (BWTS) packages have been designed so as to comply with DNV Rules for Classification. Ships. and intended to operate both within safe areas (typically engine rooms) as well as within Zones 1 and 2 classified areas within specially designed deckhouses (located on the main deck of oil tankers and chemical carriers).

The introduction of invasive marine species into new environments by ships' ballast water, attached to ships' hulls and via other vectors has been identified as one of the four greatest threats to the world's oceans. There are thousands of marine species that may be carried in ships' ballast water, basically anything that is small enough to pass through a ship's ballast water intake ports and pumps. If these organisms survive transport to other parts of the globe, their impact can be devastating.

The IMO's Ballast Water Management (BWM) Convention has entered into force on September 8th, 2017. Under the Convention, all ships in international traffic are required to manage their ballast water according to a ship-specific ballast water management plan.

The ballast water management standards are being phased in over a period of time, with new ships being required to meet the ballast water treatment standard. Existing ships should exchange ballast water mid-ocean but they will need to meet the ballast water treatment standard by the date of a specified renewal survey. Eventually, most ships will need to install an on-board ballast water treatment system.

In order to ensure their ships comply with the rules and regulations set by IMO regarding Ballast Water Management, several shipping operators have started implementing ballast water treatment systems on their ships. The proper treatment of ballast water, as required by the IMO, actively removes, kills or neutralises organisms prior to discharge.

The challenge with retrofits is to fit a ballast water treatment system into an existing ship infrastructure as easily and cost effectively as possible.

We can provide design and engineering packages based upon available documentation, drawings, and onboard survey results, to Class and customer approval including:

- Equipment layout in engine room or deckhouse.
- Structural arrangement drawings.
- Schematic and P&IDs.
- Piping arrangement and isometric drawings.
- Material Take Off lists.
- Electrical block drawings.
- Installation notes and drydock specification.

MARINE ENGINEERING
EXHAUST GAS CLEANING SYSTEMS

Engineering and technical assistance

This retrofit engineering package, focused on the installation of Exhaust Gas Cleaning Systems (EGCS) equipment, complies with DNV Rules for Classification. Ships. and permits operation both in closed loop as well as in open loop mode, with provisions for a hybrid operating mode where process water is either re-circulated or directly discharged back to sea.

The marine industry faces the challenge of adopting new technologies and operational practices to comply with stricter international, regional, national and local regulations to reduce exhaust emissions from ships.

Critical amongst these regulations are the measures to reduce sulfur oxide (SOx) emissions inherent to the relatively high sulfur content of traditional marine fuels. Ship designers, owners and operators have a number of different routes to achieve SOx regulatory compliance including the installation of an Exhaust Gas Cleaning System (EGCS).

Black carbon and heavy metal emissions are drastically decreased with the implementation of an EGCS, close loop systems in particular. Systems which operate on a closed loop offer environmental benefits, by not incurring in local acidification of the sea, nor discharging particles or heavy metals. Soot amounting to roughly 1% of fuel burnt can be recovered and disposed of/recycled in a responsible way by using closed loop systems.

Based on available documentation, drawings, and onboard survey results, a complete proposal with all required Class drawings can be developed comprising:

- System layout/ arrangement of equipment in engine room and deckhouse.
- Structural arrangement drawings.
- Schematic and P&IDs.
- Piping arrangement and isometric drawings.
- Material Take Off lists.
- Electrical block drawings.
- Installations notes and drydock specification.

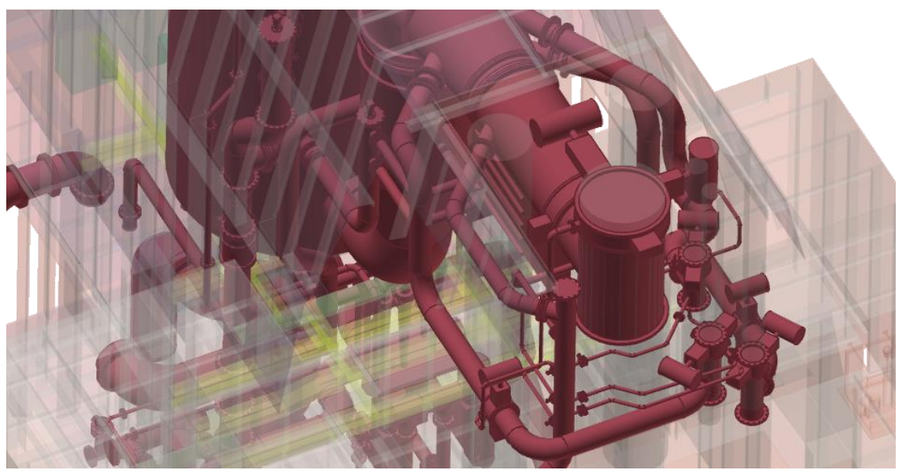


Photo above
Integrated 3D model of a closed loop exhaust gas cleaning system.

Photo below
Integrated 3D model of a closed loop exhaust gas cleaning system.

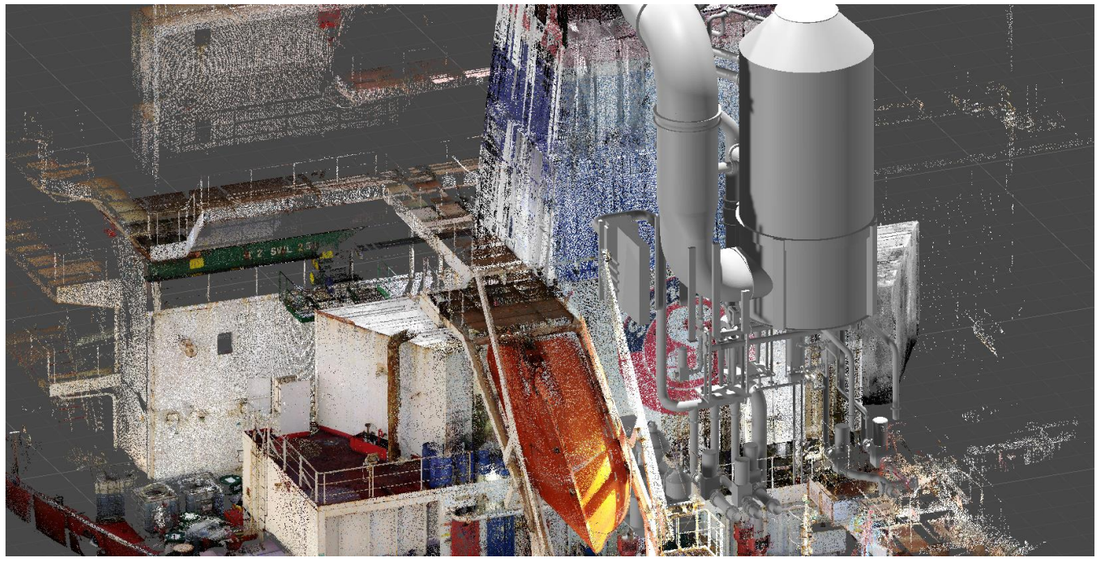


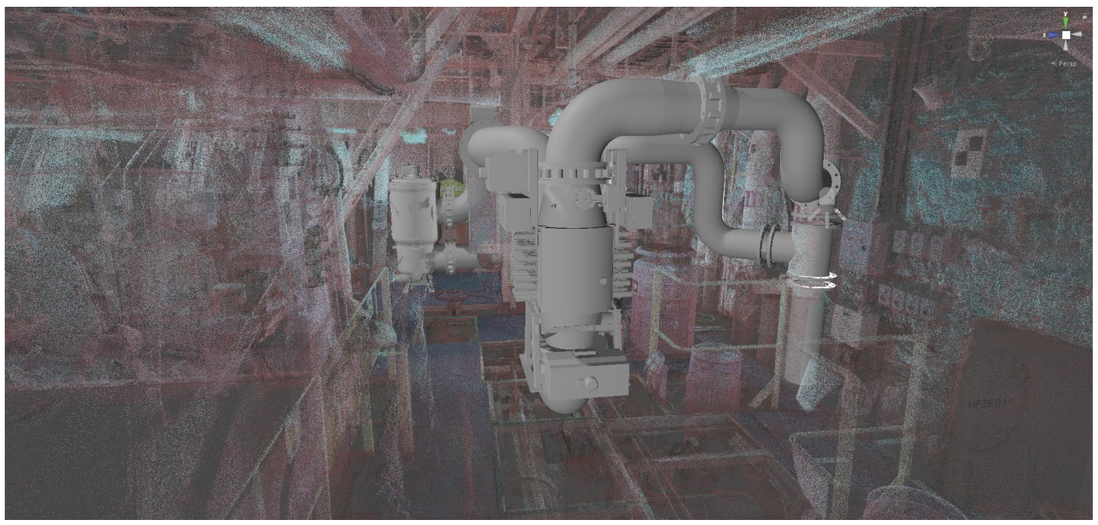
Photo above
Point cloud scan data merged with 3D model of developed EGCS package onboard a chemical tanker (steelwork hidden for clarity).

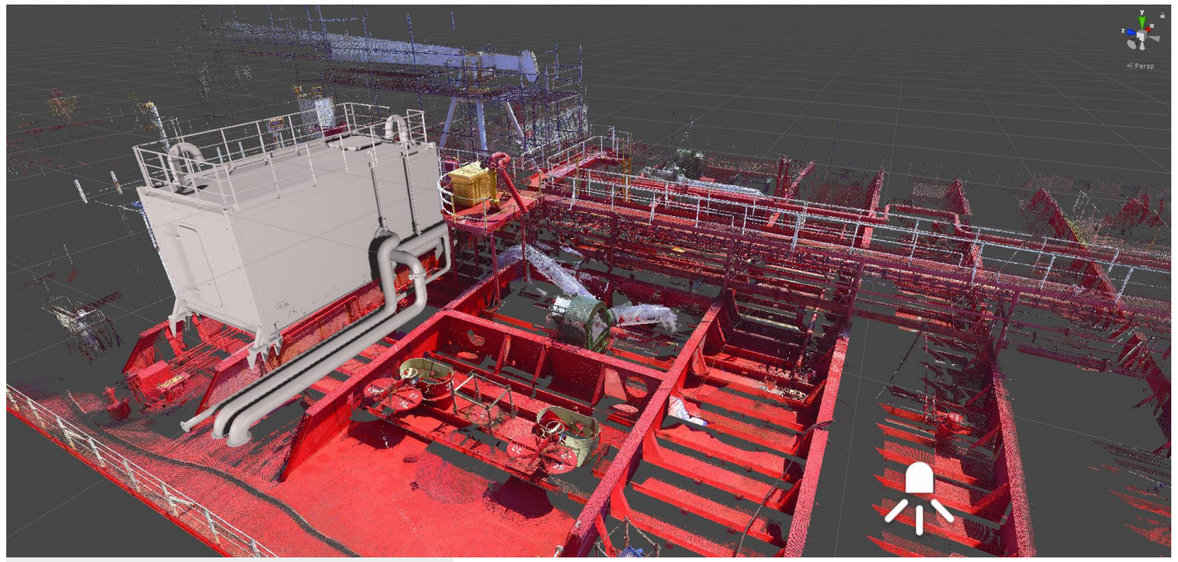
The accuracy of the point cloud scan data facilitates the development of an accurate production package containing drawings that show all foundations, mechanical and electrical components, as well as a comprehensive overview of all the parts needed for installation. Piping, connections and foundations can be prefabricated with high precision, minimizing the impact of time-consuming pipe fitting process.

Ships which are scheduled to enter drydock for regular maintenance or renewal survey may choose to install both retrofit packages (EGCS and BWTS) at the same time, resulting in significant time savings and avoiding potential future bottlenecks as the time for mandatory, widespread application of IMO's BWM convention nears.

Both design packages can be developed in parallel utilizing the point cloud scan data gathered during a single survey. Where potential interferences between both packages might be present, these can be identified at a very early stage of the design process and promptly acted upon.

Photo below
Point cloud scan data merged with 3D model of developed BWTS package installed within an engine room.





Virtual Reality (VR) is a valuable tool for developing spatial awareness and a detailed model of a retrofit package, as it can reveal design flaws and prevent routine workflows from being disrupted because of engineering decisions. This reduces costs and allows more time for finalizing designs.

MARINE ENGINEERING
IMMERSIVE VIRTUAL REALITY

Engineering and technical assistance

Constant review of the engineering scope can avoid unnecessary development costs and delays in the production phase. VR allows, in a much easier way than with a classic 3D CAD environment, to locate faults in the model or clashes between different packages within a complex model.

By interfacing point cloud scan data with the developed 3D model, and presenting the resulting model within a VR environment, we can:

- Verify suitability of the developed package to the intended purpose, and evaluate alternatives.
- Confirm that the developed package can be installed on the target site.
- Ensure that no unanticipated collisions will occur between the developed package and existing structure or ancillary systems.
- Identify needs for demolition and/or modifications to existing structure or ancillary systems, providing valuable information to develop the corresponding engineering packages.
- Assess potential accessibility problems or new hazards resulting from the installation of the developed package, at a very early stage of project development.

Photo top
Point cloud scan data merged with 3D model of deckhouse onboard a chemical tanker.

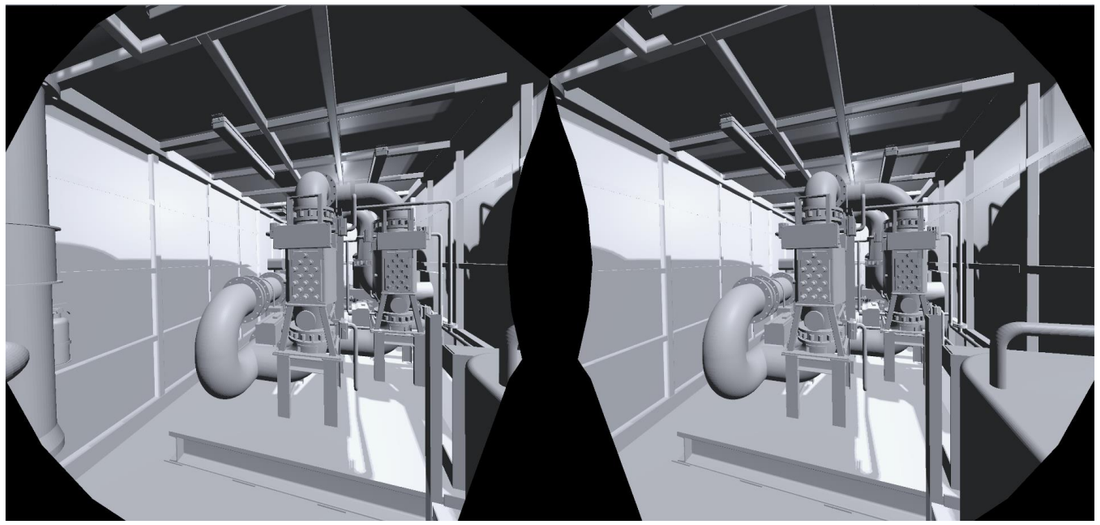
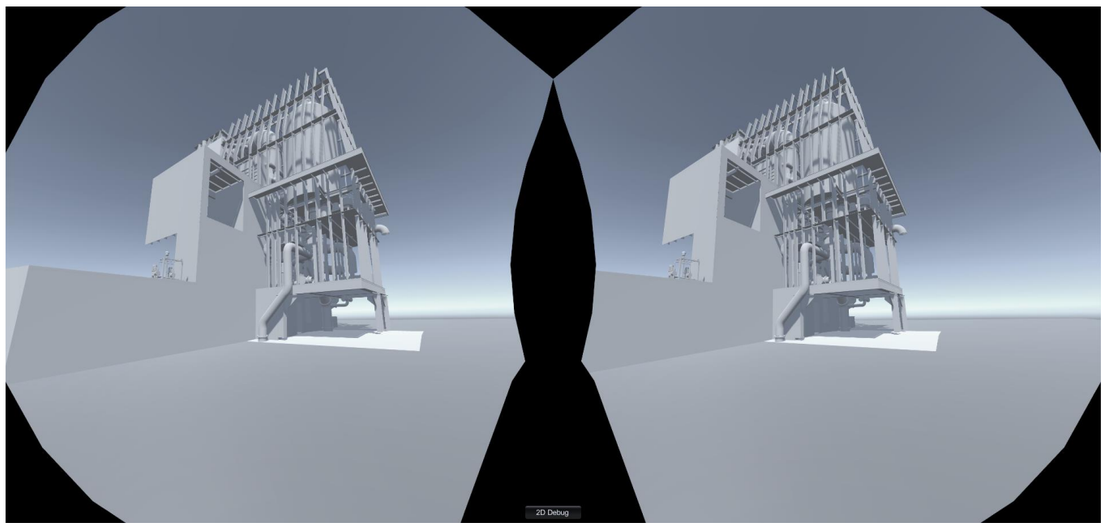


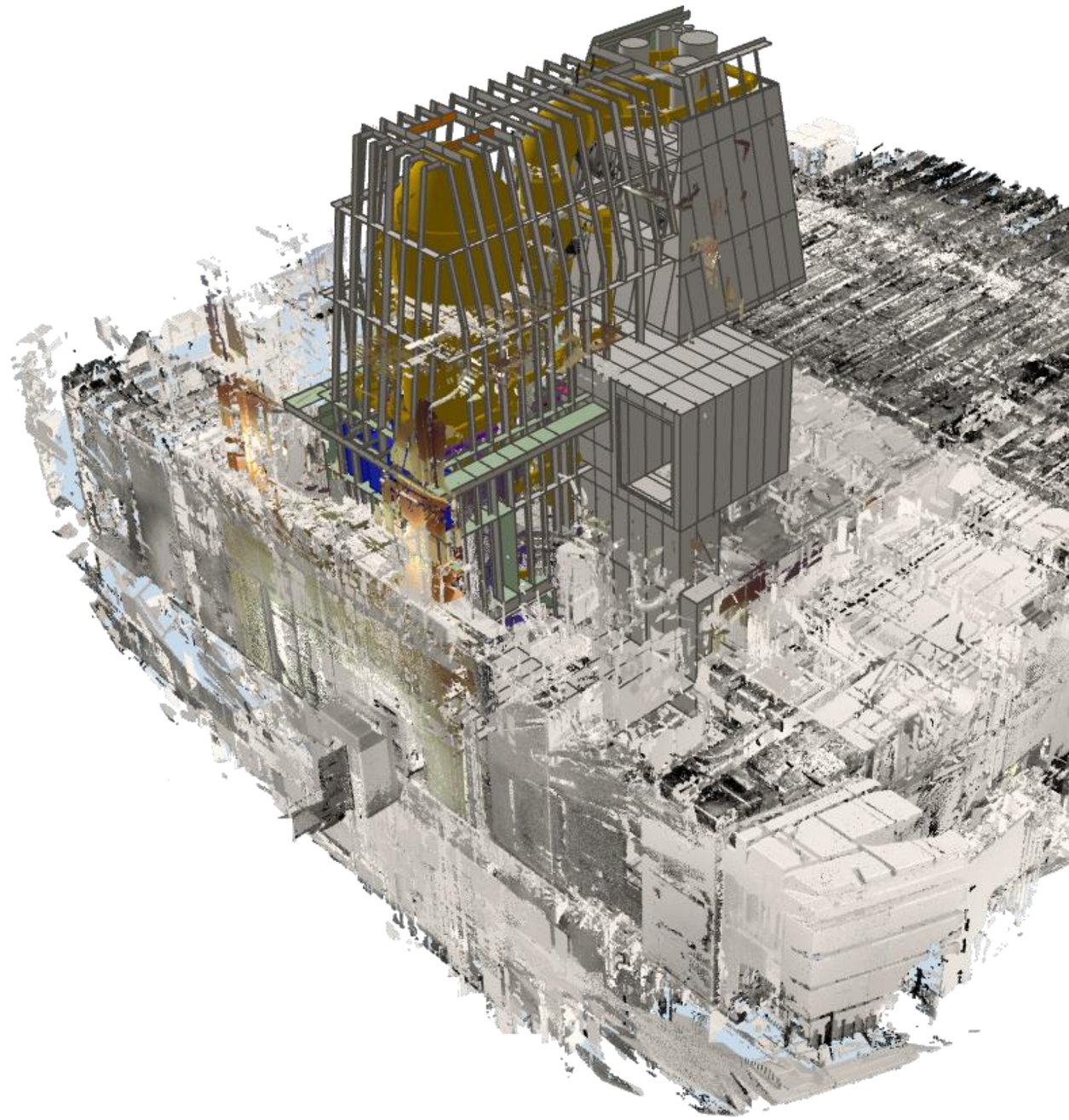
Photo above
Virtual reality environment showcasing a skid mounted 1500 m3/h ballast water treatment system installed within a deckhouse.

Virtual Reality (VR) is a technology with great potential for engineering and manufacturing, as it allows for improvements in the design and planning stages, in an interactive collaborative environment, providing a deep and thorough understanding of the product while immersed in a complete 3D environment.

This design enviroment, which places the designer within the scene, allows for a much better understanding of the space in a much more natural way. Development of an equipment layout, routing of pipes, cable trays, HVAC ducts, definition of supports and other outfitting structures, are but a few activities that benefit from this hand on approach.

Photo below
Virtual reality environment showcasing a modular exhaust gas cleaning system.





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Basic design of exhaust gas cleaning system onboard a SuezMax oil tanker.

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