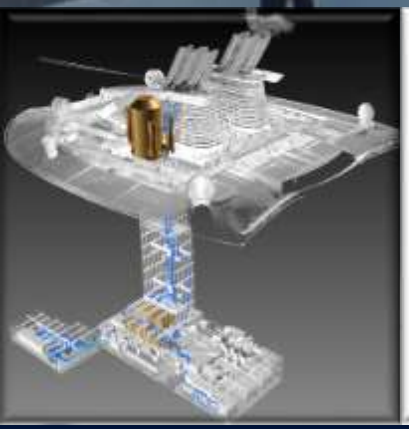
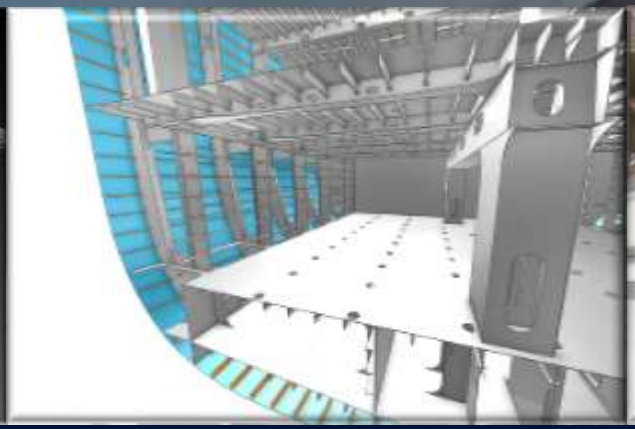
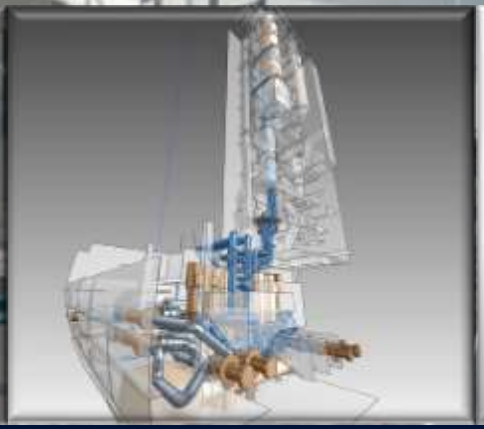
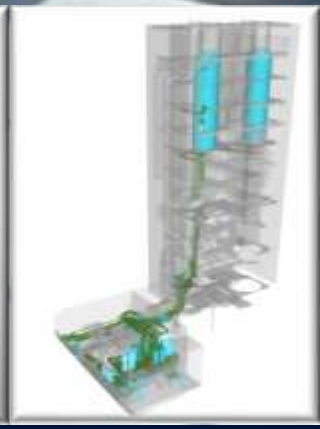
Company Presentation

BLOM Maritime
Naval Architects & Marine Engineers



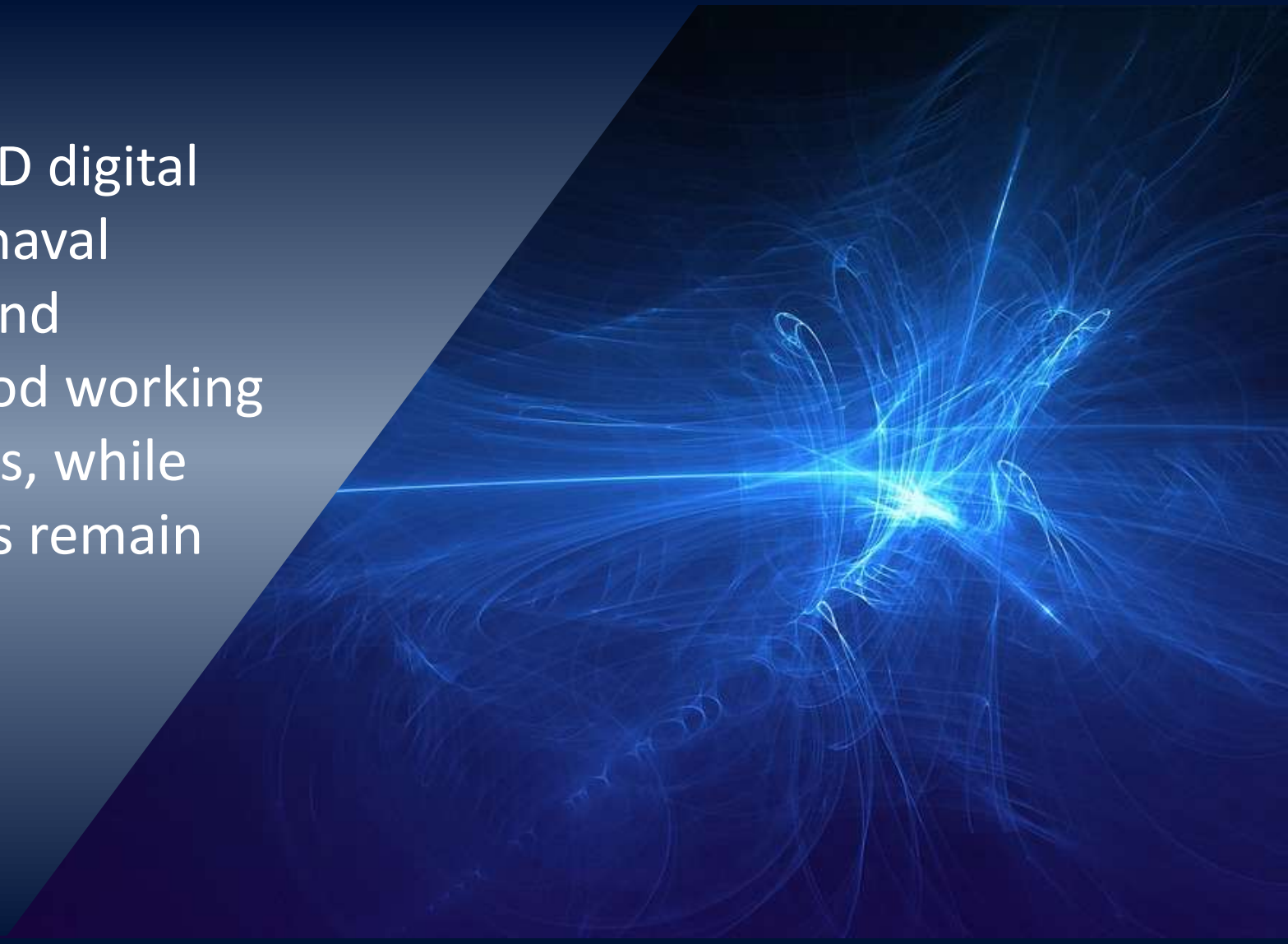






Vision

To be the leading provider of 3D digital data capture, while supplying naval architectural services, design and engineering to our clients. Good working environment for our employees, while ensuring company HSEQ values remain firm.

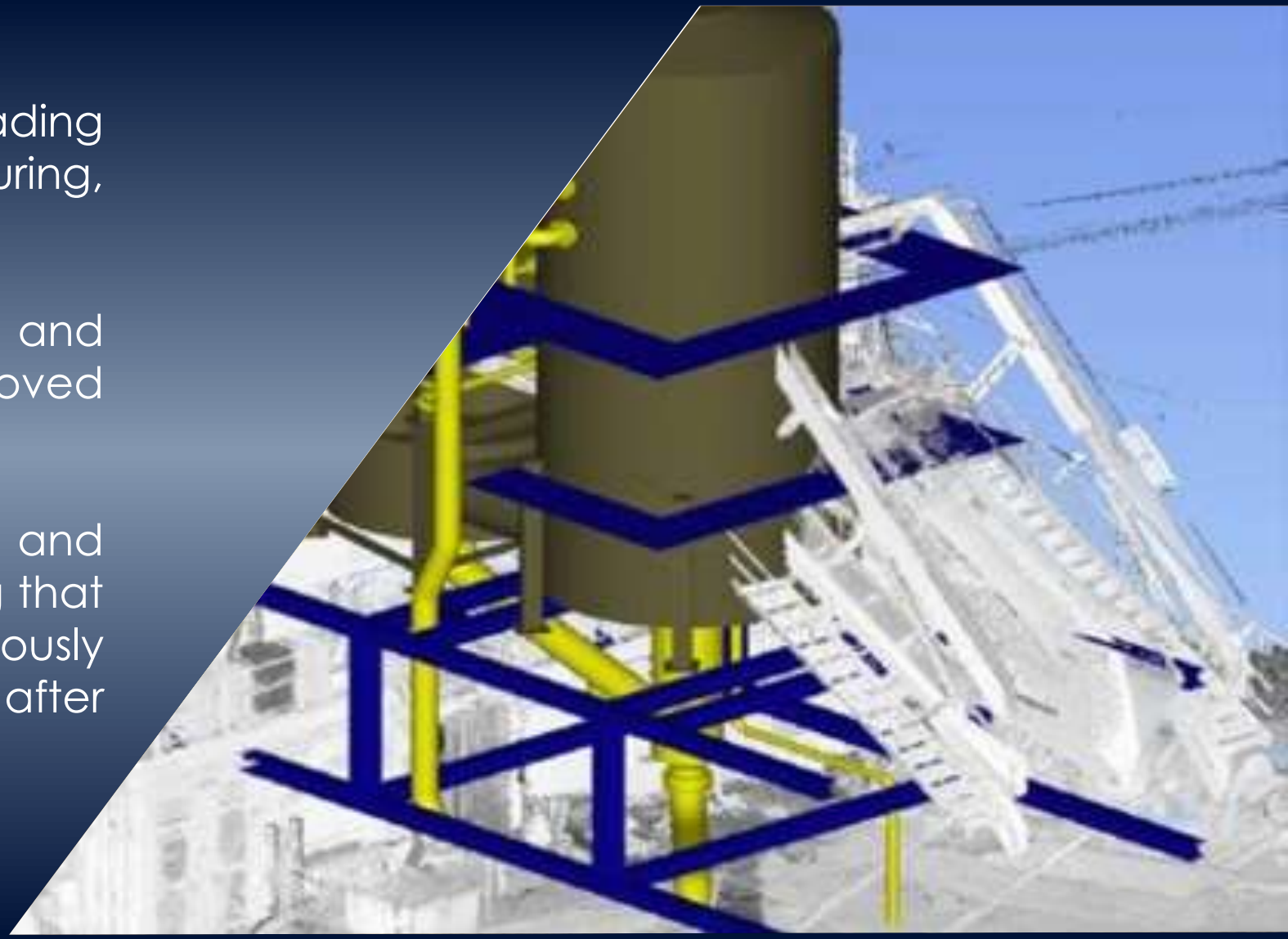


Facts

BLOM Maritime is a world leading supplier of 3D digital data capturing, Design and Engineering.

We specialize in capturing and optimizing "as-is" data for improved engineering and project execution.

We provide full-cycle design and engineering services, while ensuring that cost effective solutions are continuously implemented before, during, and after the projects.

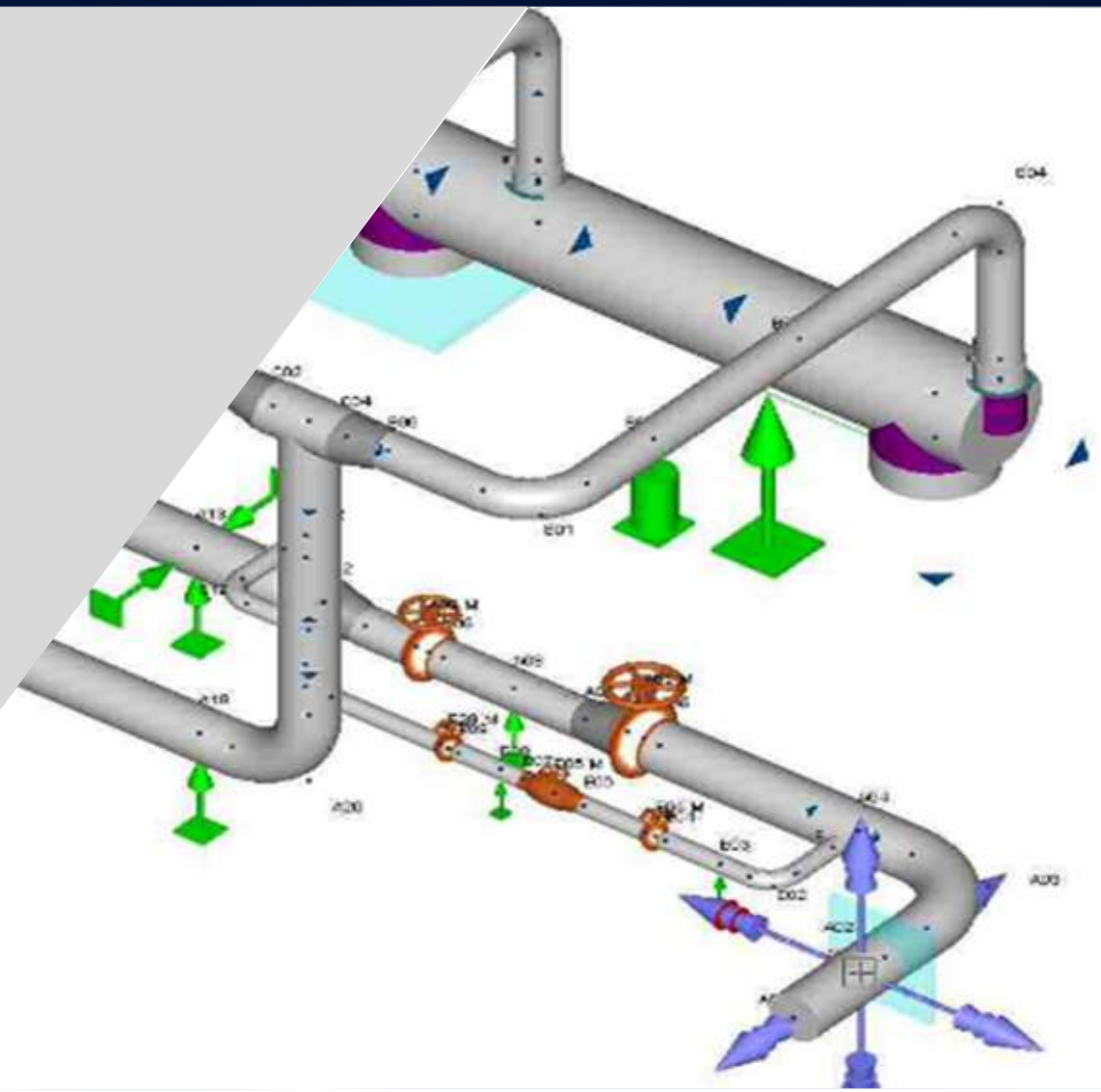


Mission

- Introducing applied 3D technology to execute design and engineering.
- Executed more than 70 scrubber retrofit engineering projects
- Executed more than 30 BWTS retrofit engineering projects
- Offices in Oslo (HQ) - Norway, Miami - USA, Krakow - Poland and Pula – Croatia -Singapore
- > 40 marine engineers and surveyors
- Encourage the maritime industry to utlize digital twins and host digital data
- Create «best pratcise» sustainable engineering solutions for owners and operators
- Cooperate with integrators and yards and product makers
- Consultancy service for owners to find optimal soultions
- Work in a virtual environment securing design before any element is fabricated

Services

- Laser scanning & Data Processing
- Data web based interactive hosting services
- 3D design/Model
- Multi-discipline detail engineering
- Flow-calculations
- Pipe stress calculations
- Structural calculations
- Finite Element Analysis
- Process Engineering / Calculations



Services

- Electrical tasks
- Updates to Ballast Water Management Plan (BWMP)
- Co-ordinate the complete class approval process
- Installation using our sister company or third party installer
- Commissioning assistance
- Complete Turn-key project capability

Retrofit – The 7 Step process

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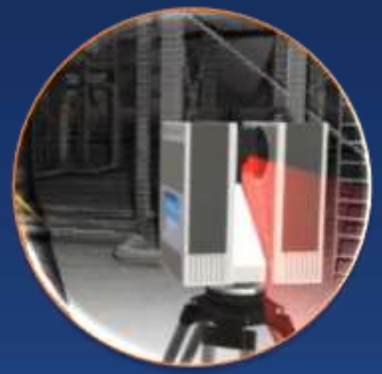

Step 1

Equipment and System selection

Step 2

Survey and 3D laser scanning

Step 3

3D Model & Conceptual design "Digital twin"

Step 4

Detailed Engineering

Production of MTO, Fabrication and class drawings

Retrofit – The 7 Step process

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Step 5

Class Approval process support

Step 6

Purchasing and Pre-fabrication

Step 7

Installation and Commissioning

GIEK

Step 8

Finance options by GIEK & Eksportkreditt

Equipment and System selection, step 1

- We assist owners and shipyards in selecting the right equipment
- Rules and regulation
- Confusions can be addressed and solved early
- We assist throughout the process

Equipment and System selection, step 1

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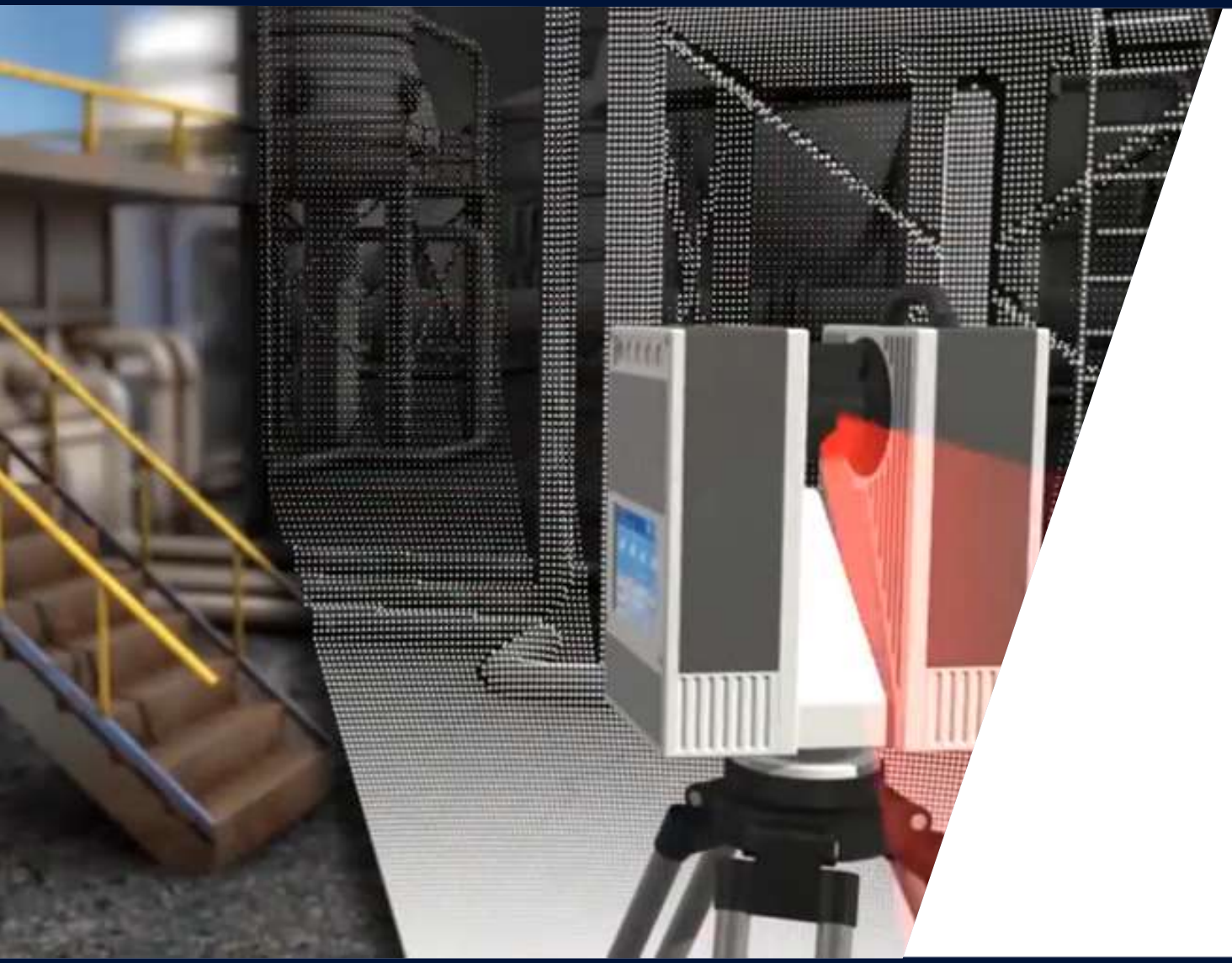
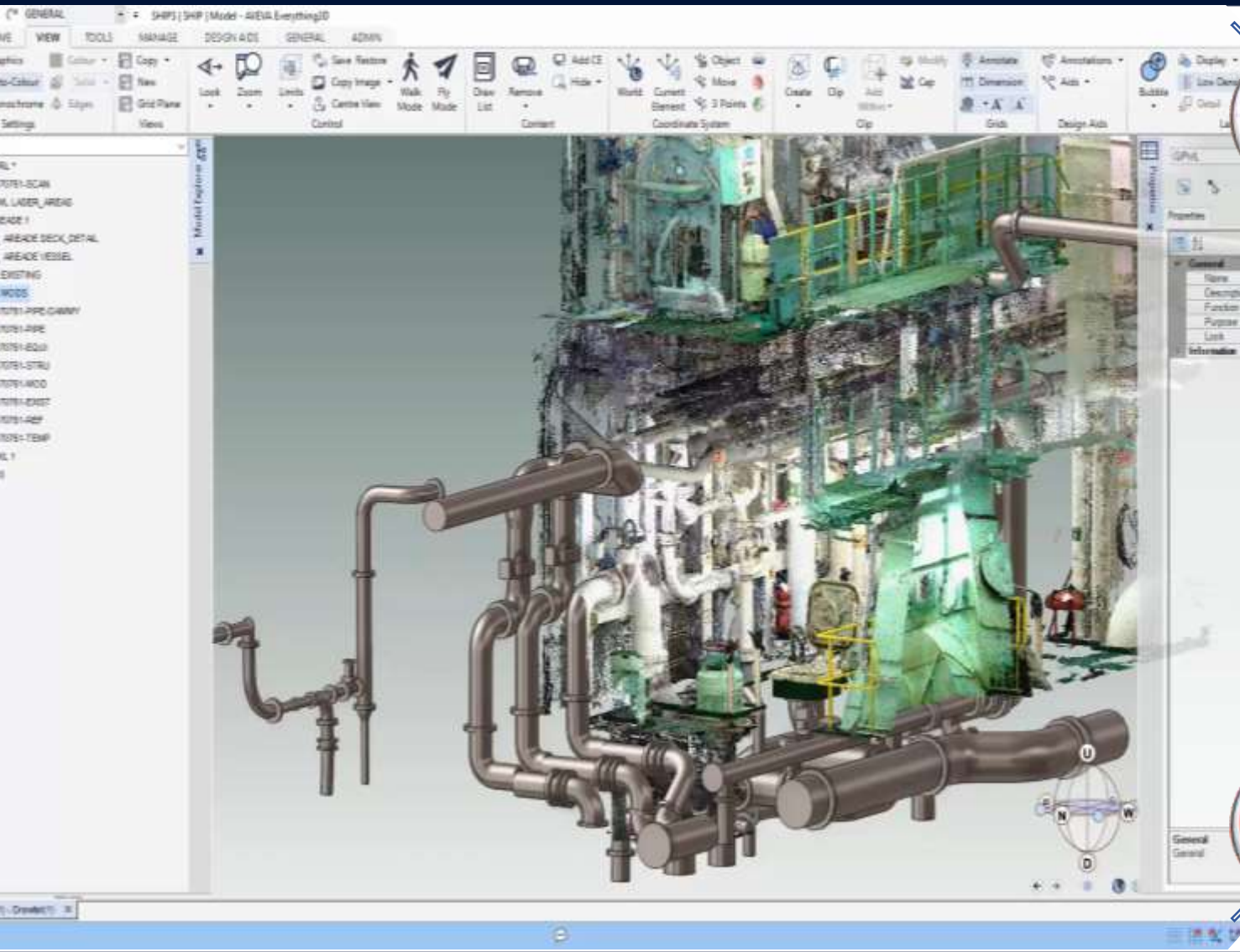
Supplier	Alfa Laval	CROE		WARTSILA		Yara
POWER Consumption (kWh)	119 (open loop)	N/A		260 (Seagoing); 210 (Manoeuvring)	255 (Seagoing); 255 (Manoeuvring)	150 (open loop)
Scrubber backpressure (mm W.C)	<= 100	N/A		<= 150		Max. 150
Sea water manifold flow speed [m/s]	See 'Calc' Sheet	See 'Calc' Sheet	See 'Calc' Sheet	See 'Calc' Sheet	See 'Calc' Sheet	See 'Calc' Sheet
Sea water manifold / branch lines modification	For 1.1 (50%/50%) - an new line on PS sea chest; branch lines are OK (DN350).	N/A		For 3.1 & 3.3 (50%/50%) - an new line on PS seachest and new line on SB seachest are required, branch lines are OK (DN350).	For 3.1 & 3.3 - an new line on PS seachest and new line on SB seachest are required, branch lines are OK (DN350).	For 4.3 (50%/50%) - new line on SB seachest is required, branch lines are OK (DN350).
Tower Dimensions	Length 5.5m, Height 8.6m, Dia 3.0m; 2 pcs	Height 6.9m; Dia 1.75m; 6 pcs	Height 11.2m; Dia 3.9m; 1pcs	Length 5.09m; Width 3.1m; Height 8.39m; Dia 2.9m; 2 pcs	Length 1.55m; Width 1.6m; Height 6.8m; Dia 1.45m; 6 pcs	Height 14.8m; Dia 2.3m; 2 pcs
Tower Weight (t)	9.4 (dry); 11.2 (operational)	N/A		9.5 (operational)	2.9 (operational)	8.1 dry (each)
Tower Installation	The new Scrubber Rooms to be build attached to existing Casing (PS & SB). 3-way valves to connect exhaust piping	Scrubbers to be installed in Casing (PS & SB) - probably in the Yard	Not feasible	The new Scrubber Rooms to be build attached to existing Casing (PS & SB). 3-way valves to connect exhaust piping	Scrubbers to be installed in Casing (PS & SB) - probably in the Yard	The new Scrubber Rooms to be build attached to existing Casing (PS & SB). 3-way valves to connect exhaust piping. Additional impact with navigation equipment due scrubber rooms height.
Sulphur content HFO (%)	3.0	3.5		3.5		3.5
Consumables (kwh/mt)	55	N/A		N/A		55
Class dwgs	Classification certificate included	N/A		Approval documentation (including P&I Diagram)		N/A
Shipment FOB ships	Under the Agreement Alfa Laval will deliver the exhaust gas cleaning system ("System") at the agreed place of delivery.	N/A		Vessel no 1 - FOB		FCA Gothenburg (Incoterms 2010)
Price	2,190,000 EUR	2,850,000 USD	1,870,000 USD	1,760,000 EUR	2,080,000 EUR	1,610,000 EUR
Requirements	Location scrubber deck 20000 mm BL	N/A		A bypass arrangement is needed and is permitting operation of the combustion units e.g. during EGC unit service breaks. Maximum vertical distance from EGC unit bottom to vessel baseline (m) 35,0.		The scrubber tower is designed for dry running when not in use, a bypass is not required, saving both space and weight on board the vessel. Installation inlet flange position - Placement (in mm) above baseline. (To be clarified before signing contract)
Reliability factor						

Survey and laser scanning, step 2



- Retrofit Survey
- 3D laser scanning
- Virtual representation
- Cloud data with an accuracy of +/- 2 mm is achieved
- No interruption to the vessel's operations, while scanning

Conceptual 3D design, step 3



Conceptual design

Merging of virtual & new equipment and system

Alternative solutions discussed

Multiple systems could be modelled to verify their suitability onboard.

Conceptual design freeze

Detailed engineering, step 4

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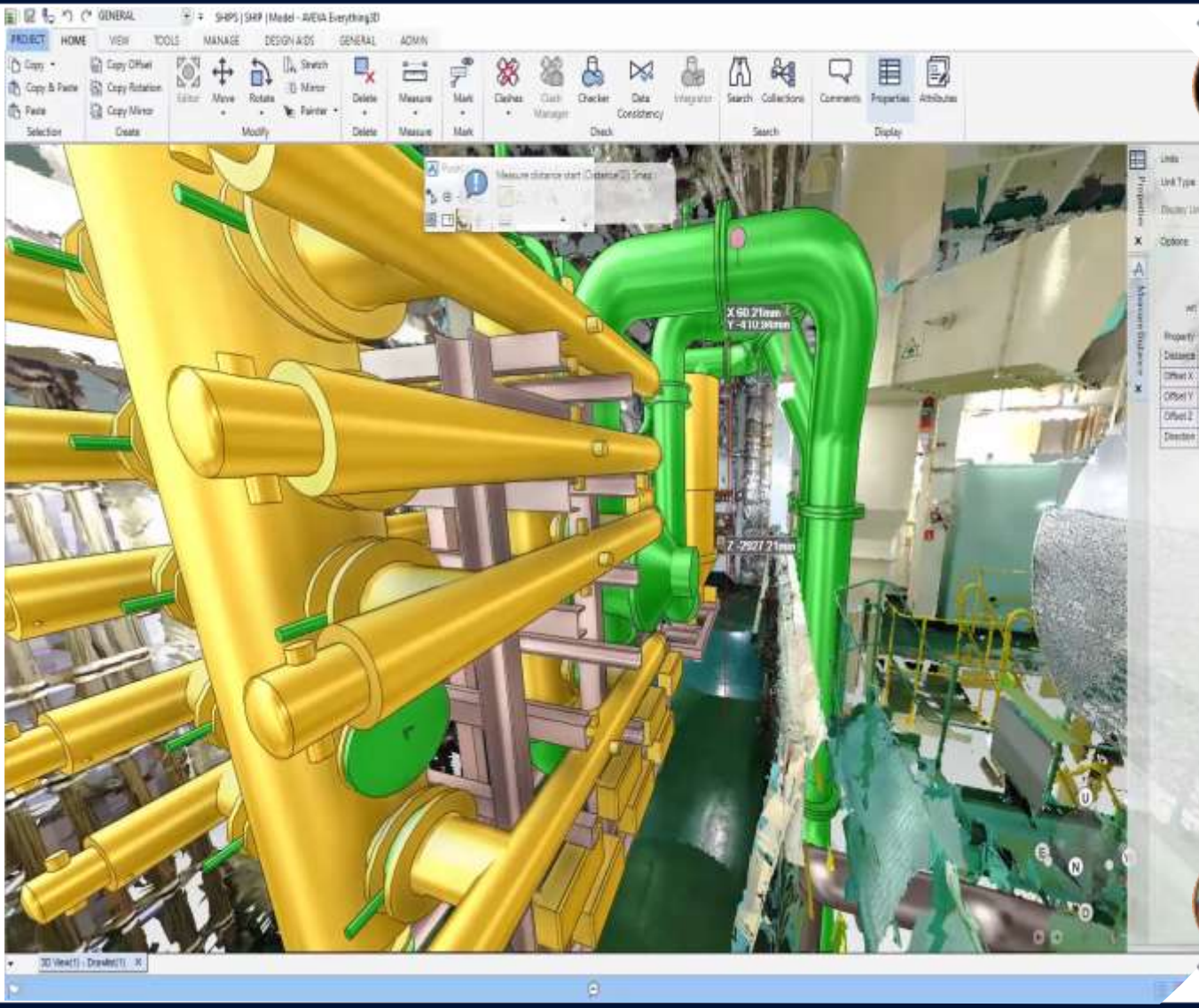

- Multi-disciplinary concurrent engineering
- Pipe, Structure and Electrical design
- ISO and Updated GA drawings
- Flow, CFD/Stress calculations
- Drawings & documents
- Design validation
- Material take off

Class approval, step 5

- All deliverables submitted to class authorities
- Criteria of class rules are followed while design
- Our deliverables are standardized to match class requirements
- Minimal changes to deliverables after class comments.
- Class comments are addressed diligently
- Smooth class approval process.
- Class approval process will go on till Installation and Commissioning phase.

Purchasing & pre-fabrication, step 6

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- Material take out (MTO)
- Pre-fabrication of pipes and structures
- TECO Maritime Group offer procurement, pre-fabrication and installation
- Highly skilled fabricators and welders
- Superior fabrication facilities
- Quality without compromise

Installation & Commissioning, step 7

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- Installation and Commissioning tasks
- Installation in dry-dock, along-side or @sea
- Installation @ any geographical location
- Installation report with work-list to shipyard
- Supervision & crew training during installation and commissioning.

Virtual vs actual

References

Royal Caribbean Cruise Lines
- Oasis of the Seas
- Allure of the Seas
- Freedom of the Seas
- Adventure of the Seas
- Jewel of the Seas
- Grandeur of the Seas
- Enchantment of the Seas

Norwegian Cruise Line Holdings
- Norwegian Jewel
- Norwegian Gem
- Norwegian Pearl
- Norwegian Dawn
- Norwegian Sun
- Norwegian Sky
- Norwegian Epic
- Norweigan Star

Carnival Cruise Line
- Carnival Miracle
- Carnival Valor
- Carnival Victory

CMA CGM
- Zheng He

BW Offshore
- Berge Helene (FPSO)
- Adolo (FPSO)
- Pioneer (FPSO)

MSC Cruises
- MSC Orchestra
- MSC Poesia
- MSC Musica

AIDA Cruises (Carnival)
- AIDA Vita
- AIDA Diva
- AIDA Mar
- AIDA Luna
- AIDA Blue
- AIDA Bella
- AIDA Sol

COSTA Cruises (Carnival)
- Neo Romantica
- Luminoza

Princess Cruises (Carnival)
- Star Princess
- Crown Princess
- Golden Princess
- Grand Princess
- Coral Princess
- Ruby Princess
- Emerald Princess
- Caribbean Princess

Spliethof
- MV Genca
- MV Krafca
- MV Pulpca
- MV Timca
- MV Trica
- Saimaagracht
- Sampogracht
- Scheldergracht
- Shippersgracht
- Singelgracht
- Slotergracht
- Sluisergracht
- Snoekgracht
- Spaarmegracht
- Spiegelgracht
- Spuigracht
- Stadiongracht
- Statengracht
- Suomigracht

Hoegh LNG
- Hoegh Galant
- LNG Libra

Frontline
- Front Balder
- Front Endurance
- Front Queen
- Front Eminence
- Front Energy
- Front Signe
- Front Kathrine
- Front Ull

Eimskip
- MT Holmfoss

TE Subcom
- MT Resolute
- MT Responder
- MT Durable
- MT Dependable
- MT Decisive

Maersk Line
- Merete Maersk
- Mathilde Maersk
- Maersk Essex
- Maersk Esmalralds
- EMMA Maersk

Transpetrol
- Stride
- Progress
- Alpine Confidence
- Eternity

Lindblad Expeditions
- National Geographer explorer

BW Tankers
- LPG Pine
- LPG Cedar

Vroon Tankers
- Iver Progress
- Iver Prospor

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