

JAN 2021

ISSUE
1

MBM CONSULTANCY

SCRUBBER SURVEY & INSTALLATION SERVICE

COVERED TOPICS

- COMPLIANCE
- SOLUTION METHODOLOGY
- FEASIBILITY STUDIES



NAVAL ARCHITECTURE SERVICES

SCRUBBER SURVEY, FEASIBILITY & NAVAL ARCHITECTURE

MBM MOTO - FAIL TO PLAN, PLAN TO FAIL

ISSUE
1

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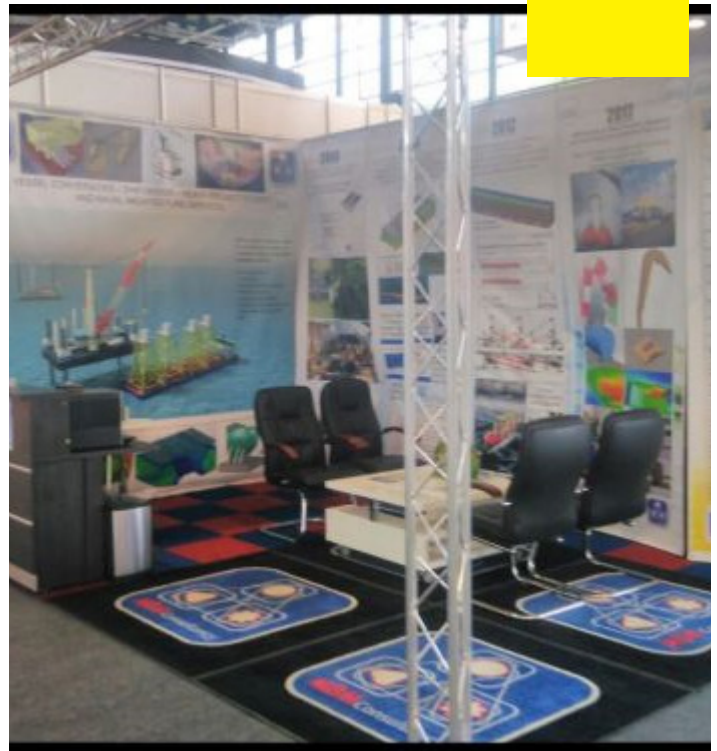
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RECENT SECTORS & ORDERS FULFILLED -

- HEAVY PROJECT SECTOR
- OFFSHORE SUBSTATIONS
- OFFSHORE JACKETS
- VESSEL CONVERSIONS
- ACCIDENT INVESTIGATIONS
- FEASIBILITY STUDIES
- RAMS APPROVALS
- MS CREATION
- LIFTING FRAMES
- GRILLAGES
- TUG CONVERSION / UPGRADES
- TECHNICAL TEAM CREATION



LEARN MORE - ARRANGE AN ONLINE WEB-CALL WITH **MBM** TEAMS.

MBM CONSULTANCY REVIEW

MBM Consultancy was founded in 2010 in Germany to provide services with Naval Architects, Graphic Designers, Surveyors, Port Captains and Technical Authors. The skills from these professionals are there to assist the Heavy Cargo market, Offshore, Shipowners, Freight-forwarders, EPC, Lawyers, and other Maritime sectors. The projects undertaken from MBM Consultancy over the years have been varied and continue to be both challenging and rewarding for ourself and our client. MBM always plans its projects in advance to provide optimum solutions in designs to make each project a success.



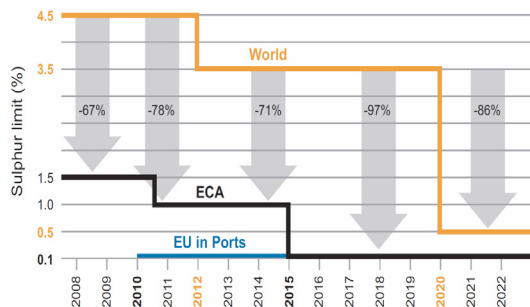
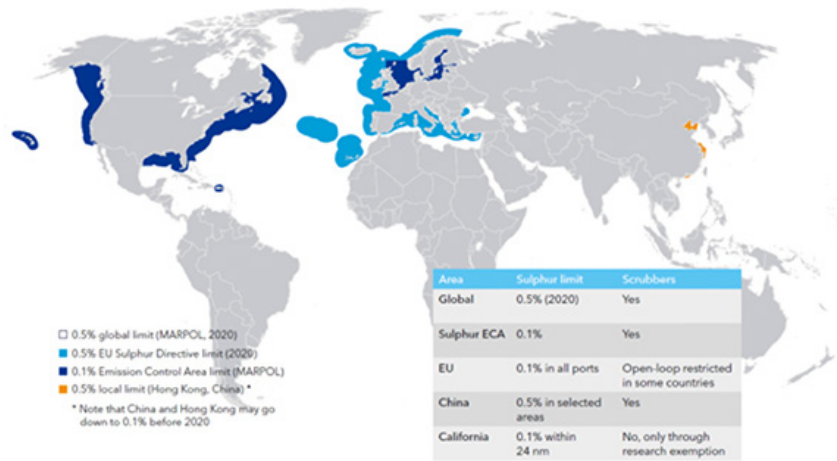
SCRUBBER INTRODUCTION

Most ship owners today should have heard about scrubbers by now. To some it will be a highly familiar subject, having gone through the process of evaluating a scrubber option, or having even installed a scrubber system, for their fleet, whilst for others it is still a big question mark. Getting to know the rules about the upcoming sulphur limits, and the alternatives for complying, can be a hassle in itself, rendering the process of understanding the whole concept of exhaust gas cleaning a bit overwhelming. Which scrubber should one choose? Which one is best? What is the difference between open loop and hybrid, and will they be legal in the future?

SCRUBBER SELECTION BY ENVIRONMENTAL COMPLIANCE

The rules range from the International Maritime Organization's MARPOL Annex VI, regulation 4 as detailed in resolution MEPC 259(68) to the European Union Directives 2012/33/ EU. Some areas may also be faced with national or local rules. Business as usual is no longer an option.

To comply with incoming rules, ship owners must switch to costly low Sulphur fuel, or choose abatement technology. The requisite for sulphur levels in Emission Control Areas (ECA) is now 0.1% and will be 0.5% worldwide by either 2020, therefore the marine industry needs to choose a path on how to achieve compliance.



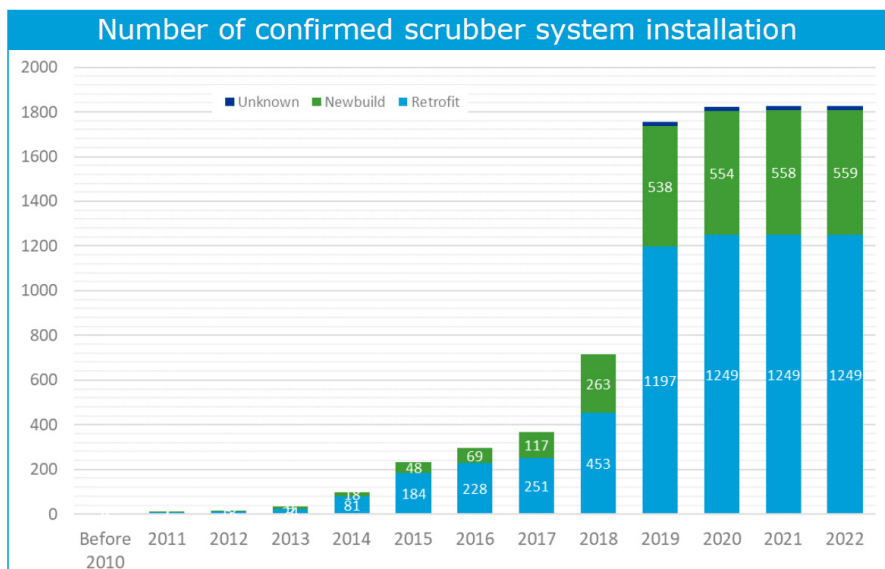
▲ Emission Control Areas

“**MBM SOLUTION TOWARD ECONOMIC, EFFICIENT AND CLEANER SOLUTION FOR FUTURE**”

◀ Sulphur Limit By 2022

There has been a significant uptake in scrubber orders in 2018

- There are about 1850 ships with installed or confirmed scrubber systems installations.
- The “first scrubber wave” started in 2014 in preparation of SECA in North America.
- The “second scrubber wave” is now on its way with over 1000 confirmed projects in the past 6 months.
- A majority of the orders are for retrofits.



HOW WE SELECT A CORRECT SCRUBBER SOLUTION!

Vessel structure

Does your vessel's structural design allow for the installation of exhaust gas scrubbing equipment? The availability of space can limit and even hinder the type of exhaust gas scrubbers you intend to install. In many cases, the funnel is modified extensively for a tailor made exhaust gas scrubber. For new-building's, the ship-owner can select "scrubber ready" notation for easy retrofit in future.

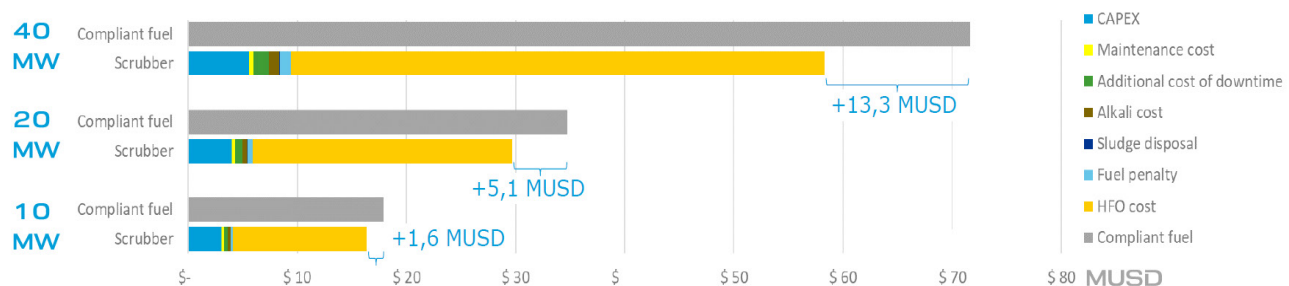
Guidance on method implementation based on vessel age, size and operation

With older vessels, there is less payback time for investment of the EGCS installation. For a very old vessel, it may be more economical to switch to cleaner fuel alternatives. The payback is also better for ships with high powered engines – it is not viable to plan retrofit for ships with low powered engines. A simple calculation can be carried out based on spread between cost of LSFO and high-sulfur marine fuel (HSFO), cost of exhaust gas scrubber including operating cost, annual fuel consumption, and residual ship life to justify your decision.

With the support of MBM we can provide options for alternative exhaust gas cleaning technology instead of switching fuel results ;

- Lower operating costs through access to less costly fuel.
- Avoiding fuel switching, storage and availability and technical issues.
- Reducing your operational impact on the environment.
- Scrubber systems will increase the ship's fuel consumption of approx 2%.
- Downtime of the scrubber systems will introduce a cost for running of compliant fuel.
- Installation of scrubber systems will increase the maintenance cost (more for closed loop).
- For closed loop systems there will be an additional cost for alkali bunkering and sludge disposal.

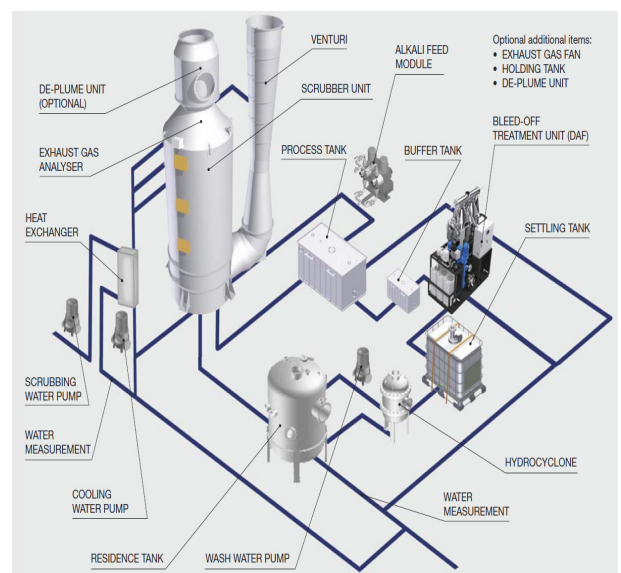
Accumulated 5 year costs compliant fuel vs costs scrubber + HFO



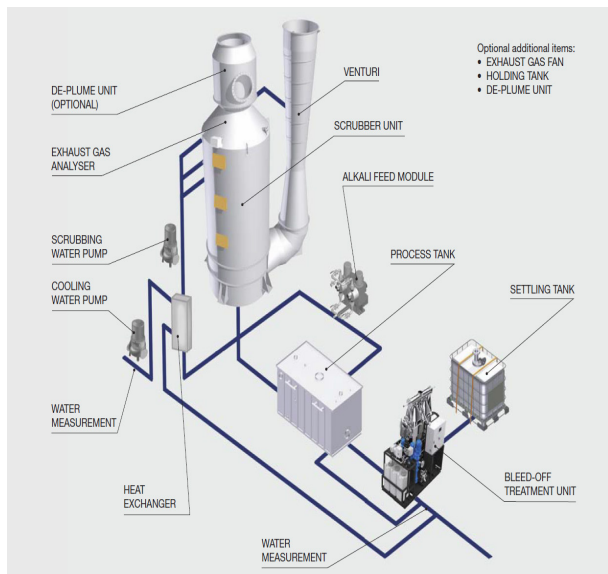
TYPES OF SCRUBBER

Hybrid Type Scrubber

These solutions have the flexibility to operate in both open and closed loop. This provides a flexibility of operation in low alkaline waters as well as the open ocean. The hybrid approach enables operation in closed loop mode when required, for instance whilst in port and during manoeuvring using NaOH as a buffer. The system can be operated in zero discharge mode for a limited period. When at sea the switch can be made to open loop using only seawater.



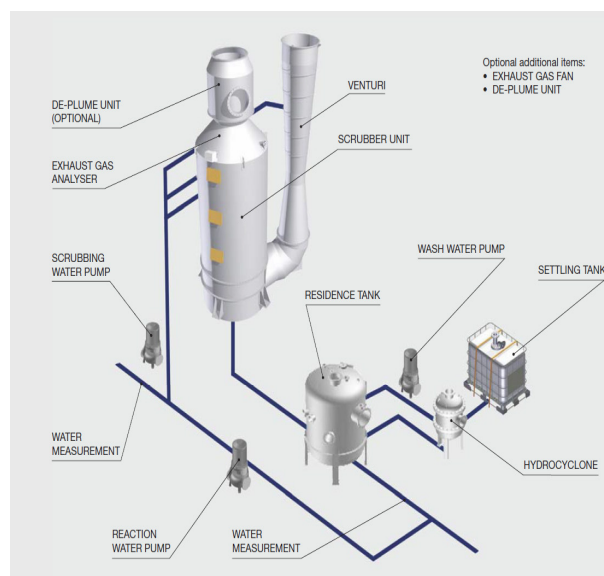
Closed loop Scrubber



These are uncommon and with low flexibility. Closed loop scrubber system works continuously in closed loop, which means that one does not need to worry about seawater alkalinity levels. This system is best suited for full time operation in low alkalinity areas (e.g. Greatlakes). In a closed loop scrubber system, the exhaust gas enters the scrubber and is sprayed with seawater that has been mixed with caustic soda (NaOH). The sulphur oxides in the exhaust react with this mixture and are neutralised. A small bleed-off is extracted from the closed loop and treated to fulfil IMO requirements. Cleaned effluents can be safely discharged overboard with no harm to the environment. If operation in zero discharge mode is requested, the effluent can be led to a holding tank for scheduled and periodical discharge.

Open loop Scrubber

This may be more suitable for vessels performing long voyages compared to other types. The system operates in an open loop utilising seawater to remove SOX from the exhaust. Exhaust gas enters the scrubber and is sprayed with seawater in three different stages. The sulphur oxide in the exhaust reacts with water and forms sulphuric acid. Chemicals are not required since the natural alkalinity of seawater neutralises the acid. Wash water from the scrubber is treated and monitored at the inlet and outlet to ensure that it conforms to the MEPC 184(59) discharge criteria. It can then be discharged into the sea with no risk of harm to the environment.



Scrubber System Operation

	OPEN LOOP	CLOSED LOOP	HYBRID
Dependable on seawater alkalinity	Yes	No	Partly
Alkalinity Reactant	Sea Water	NaOH	NaOH/Seawater
Zero Discharge Possible	No	Yes	Yes
Applications	Ocean going ship	Low alkalinity water and for zero discharge	Ship operating in both types of water or require full flexibility

MBM is in constant communication with approximately 10 leading scrubber equipment suppliers to have up to date information. During the selection process, MBM will independently select the right solution from those suppliers.

MBM SERVICES TO RETROFIT A SCRUBBER

To be a lasting solution, your scrubber must be engineered to suit your vessel and sailing profile. MBM solution platform provides a high degree of system flexibility, with multiple operating arrangements, a choice of scrubber designs and many other options. These possibilities allow almost any challenge to be overcome, even on vessels with space and stability issues.

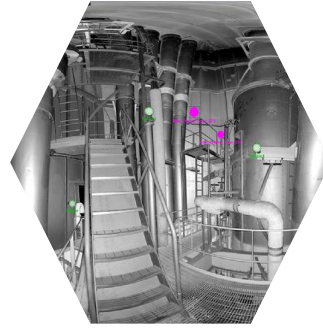
SURVEY

- Our technicians carry out an inspection on-board the vessel during dry docking or when in port in order to investigate feasibility of installation of the Scrubber System.

ENGINE ROOM SURVEY



ENGINE ROOM SCAN



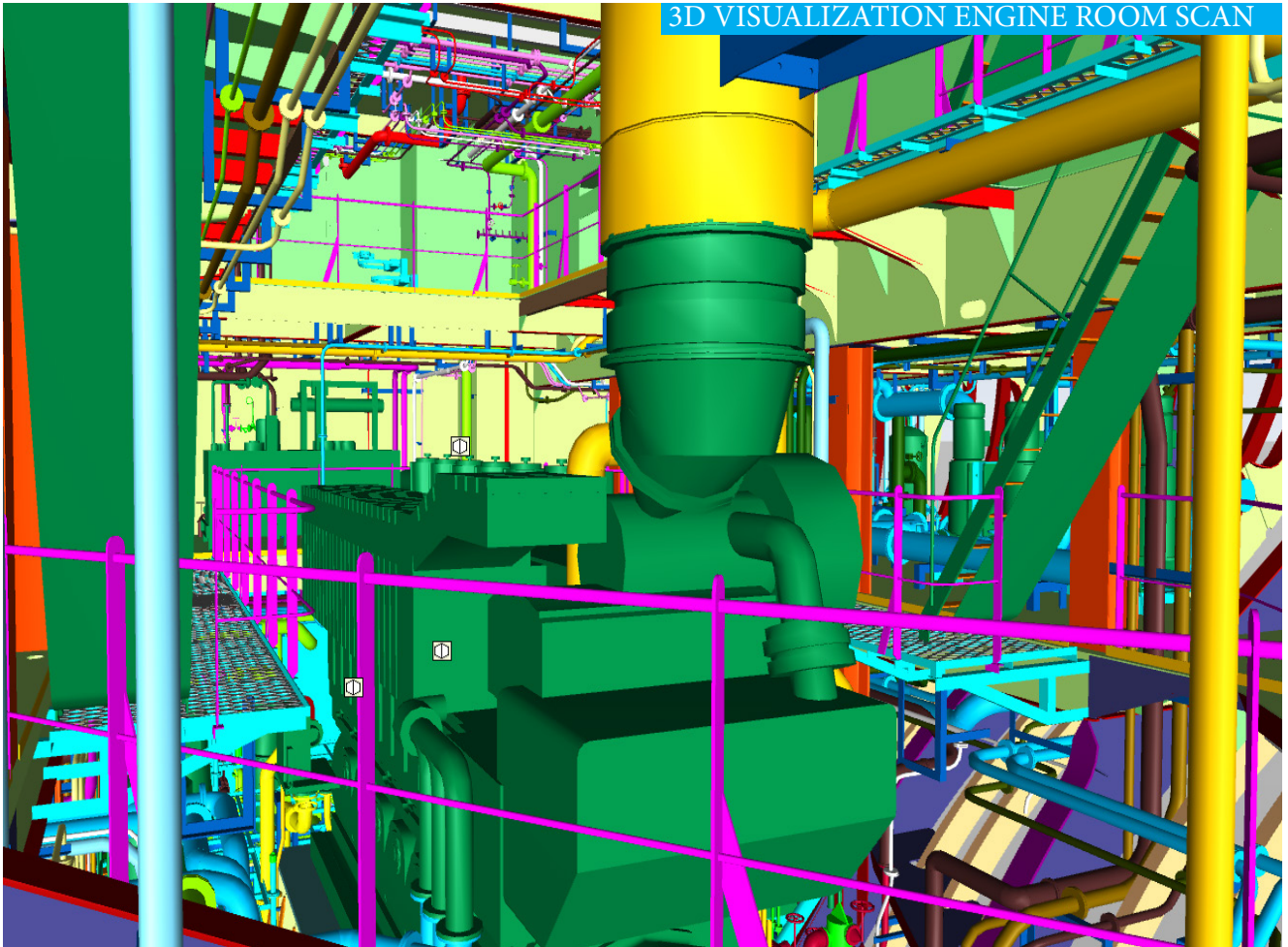
3D SCANNER



3D LASER SCANNING

- Two technicians carry out an inspection on board the vessel during dry docking or when in port in order to investigate feasibility of installation of Scrubber System. All necessary areas will be scanned with a 3D Laser scanner and the generated PDF file will be used to evaluate/verify the different installation layouts.
- Approximately Estimated Time is One week after completion of the survey on board.

3D VISUALIZATION ENGINE ROOM SCAN

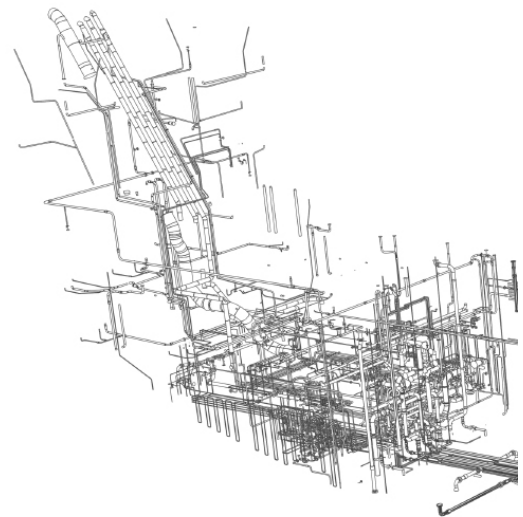


FEASIBILITY STUDY AND DETAIL DESIGN ENGINEERING

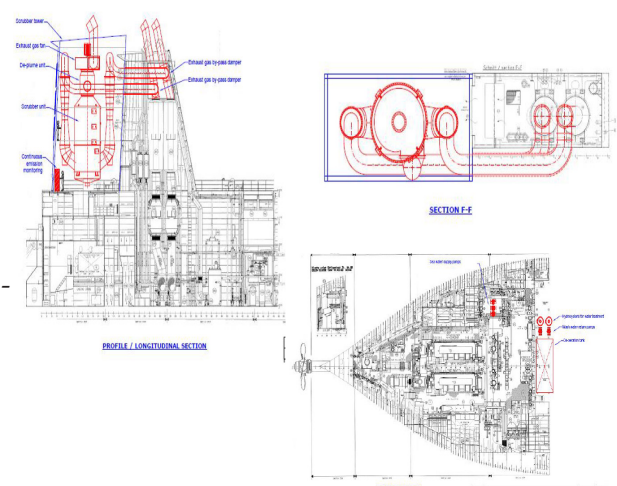
- After completion of scanning, 3D modelling of the main piping will be performed. The 3D modelling is being reviewed by using the output of the 3D scans of the areas chosen for new equipment components' installation so as to evaluate their preliminary arrangement feasibility. These feasibility study results will be taken into consideration for the selection of the system, of which installation will be further studied and is considered to be the first stage of the installation study.
- Performance of an engineering study for Scrubber System installation, based on available documentation and on-board survey results, including complete proposal with Scrubber system modelling, routing of piping (including vent, duct, piping isometric drawings, materials and parts list), specification of structure and outfitting modifications and Class required drawings.

“Feasibility studies are a large part of MBM’s workload in the industry to assist clients remain competitive and effective in current economic climate”

- Preparation of all necessary modifications of the “as built” drawings (structural, piping, outfitting, electrical).
- Submittal of those drawings specified to the Client for their comment and approval. On receipt of the Client’s comments, MBM will revise the affected drawings accordingly to obtain the necessary approvals.
- Preparation of the required drawings, which will be submitted to vessel’s Classification Society and/ or Flag State as necessary, for approval.
- Preparation of technical specification of modification/ retrofitting, in order to be submitted to various ship-yards or repair facilities for receiving quotations.
- Approximately Twenty weeks after completion of the survey on board.
- A report with the survey findings in electronic format. Also, all 3D scan files will be given to the Client.
- A detailed report with the preliminary arrangement for the Scrubber system, including 3D model of the equipment, the basic vent, duct and piping systems and their location in the point cloud created after 3D laser scanning, for reference, followed by a detailed report of the study’s outcome.
- The deliverable engineering study file shall include:
 - Project Management.
 - Isometric Vent, Duct and piping drawings. (with materials’ and parts’ list)
 - Detailed Vent, Duct, piping sections/ spools.
 - Modifications of the affected as built structural, outfitting, diagrammatic piping and single line electrical drawings.
 - Class approved drawings.



3D MODEL ARRANGEMENT OF SCRUBBER



FINAL APPROVAL DRAWINGS



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ALL PROJECTS IN THIS BROCHURE ARE AVAILABLE ON THE MBM WEBSITE, LINKEDIN, AND TWITTER.