



SHIP EFFICIENCY 2017

by STG

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Presentation on:

Fleet Performance Program – a must to survive for bulk carrier and container ship owners

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**The German Society for Maritime Technology
Schiffbautechnische Gesellschaft e.V.**



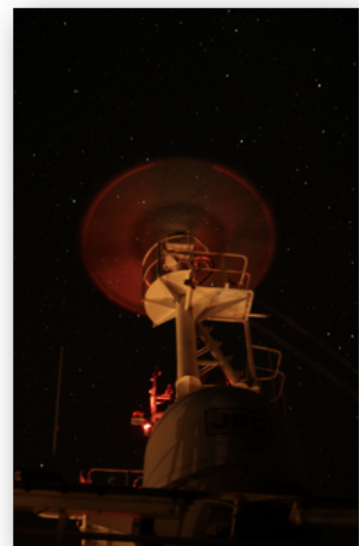
CMB's Fleet Performance Program

CMB, Hamburg, September 2017



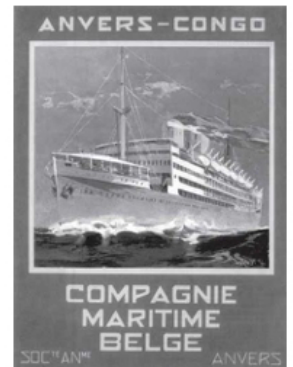
Content

- Compagnie Maritime Belge (CMB)
- Fleet performance
 - Uniform reporting (ShipReports)
 - Fleet Performance Monitoring software (FPM)
- Overview of FPM capabilities
- Next steps in the fleet performance program
- Q & A



Compagnie Maritime Belge

- At the instance of the Belgian King Leopold II, British interests established Compagnie Maritime Belge du Congo (CMBC) in 1895 in order to provide a regular shipping service to the Congo.
- In 1911, CMBC was listed on the Brussels stock exchange.
- In 1930, CMBC became Compagnie Maritime Belge (CMB).
- Throughout the 20th century, CMB developed into a diversified international shipping group.
- In 1991, the Saverys family bought a controlling stake in the company.
- In 2003 and 2004, Exmar (gas transportation) and Euronav (crude oil transportation) were listed separately on EURONEXT.
- In 2015, the Saverys family took CMB private.
- CMB is based in Antwerp with regional offices in Tokyo, Singapore and Hong Kong.



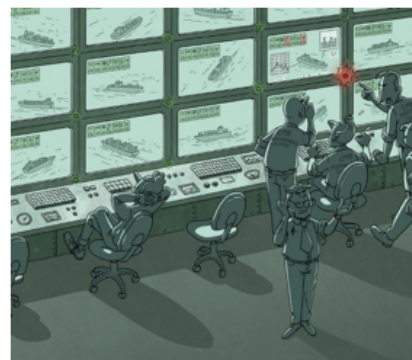
CMB owns and operates 100 ships and 130 airplanes



BOCHEMOFFICE | BOCIMAR | DELPHISOFFICE

Fleet Performance post slow steaming, nose jobs, trim optimisation etc...

- All efforts done within the company by various departments were lined up in a fleet performance program.
- A goal was set to save 4-6% on fuel consumption.
- 70% of the vessels fitted with shaft power meters and mass flow meters. Goal: 100% in 2018
- Market demanded to have actual and accurate data.
- Chartering Department's demands:
 - Warnings if a vessel overconsumed (prior to the customer complaints)
 - Accurate speed/consumption table for defining new contracts. No more 'without guarantee'.
 - In a low margins market, an accurate costs knowledge is key



The first step focused on processing the (noon) reports from the ships automatically

- In-house development of ShipReports which makes it possible to report in a uniform and standardized way for both owned and chartered tonnage.
- Through the ship's email, the report content is transferred towards an onshore CMB SQL server.
- Reader was developed so that all reports could be accessed instantly by all departments.

Ship	Type	Latitude	Longitude	Course	Speed	Consumption	ETA	Age
01-08-12-001	12-001	59.2400 N	17.3400 E	100	14.00	120.00	12-001	10
01-08-12-002	12-002	59.2400 N	17.3400 E	100	14.00	120.00	12-002	10
01-08-12-003	12-003	59.2400 N	17.3400 E	100	14.00	120.00	12-003	10
01-08-12-004	12-004	59.2400 N	17.3400 E	100	14.00	120.00	12-004	10
01-08-12-005	12-005	59.2400 N	17.3400 E	100	14.00	120.00	12-005	10
01-08-12-006	12-006	59.2400 N	17.3400 E	100	14.00	120.00	12-006	10
01-08-12-007	12-007	59.2400 N	17.3400 E	100	14.00	120.00	12-007	10
01-08-12-008	12-008	59.2400 N	17.3400 E	100	14.00	120.00	12-008	10
01-08-12-009	12-009	59.2400 N	17.3400 E	100	14.00	120.00	12-009	10
01-08-12-010	12-010	59.2400 N	17.3400 E	100	14.00	120.00	12-010	10



In March 2016 the first version of ShipReports was launched

- Today, 88 vessels report with the ShipReports software.
- Already 40,000 reports (of which 24,000 noon report) are contained in the SQL database.

The screenshot shows the 'Noon Report Plot Pirat Sleep Voyage: 0 Cpt: Campos Magnifico' window. It is divided into several sections:

- Time & Position at Noon:** Fields for Date, Local Time (12:00), TimeZone, DataTime UTC, Latitude (0.0), Longitude (0.0), True Course (0.0).
- Next Port of Call:** Fields for Port, Distance to go (nm), ETA, Local Time TZ, DST UTC, Calc. speed (kn).
- Weather & Sea Average Since Previous Report:** Fields for Beaufort Scale, Air Temp (°C), Pressure (mbar), Sea State, Swell, Current (kn), Water Temp (°C), and a checkbox for 'Shallow Water (Sea depth less than 50m)'. Includes a 'Direction' dropdown.
- Speed Instructions at noon:** Radio buttons for Speed (kn), RPM, and MCR (%). Includes 'Speed Changes' and 'Stoppages' buttons.
- Fuel Consumed Since Previous Report:** A table with columns for HS HFO, LS HFO, HS MDO, and LS MDO. Rows include Main Engine FOC (mt), Auxiliaries FOC (mt), Boiler FOC (mt), Other FOC (mt), Bunker Correction (mt), LowerCaloricValue(kJ/kg), Density @15°C (kg/m3), Sulphur %, and Fuel Type.
- Ship's Average Since Previous Report:** Fields for Fore Draft (m), Aft Draft (m), Displacement (mt), G.M. (m), FW Produced (m3), Time Since Previous Report (h), Dist Over Ground (nm), Dist Through Water (nm), Speed Over Ground (kn), Main Engine SFOC (g/kWh), Combined A/E Power (kW), Average A/E Load (%), Air inlet temperature [°C], and LT CW inlet temperature [°C].
- Report Comments:** A large text area for notes.
- Date of the Report:** A field at the bottom.



External consultants were assessed for providing CMB with fleet performance monitoring

- 10 external consultants which offer fleet performance monitoring were contacted and invited to present their experience and competence.
 - With 5 companies a trial was started.
 - 2 companies were selected for doing a performance exercise on 20 vessels (4 series of sister ships) with the same dataset:
 - Out of the 20 vessels analyzed, only 8 vessels showed similar results. UW inspections performed afterwards showed that both parties were right and wrong in their analysis;
 - Fleet performance monitoring is a combination of experience, good data, numerical modelling (with normalization and correction) and the right people;
- It was decided to develop our own performance monitoring platform: FPM



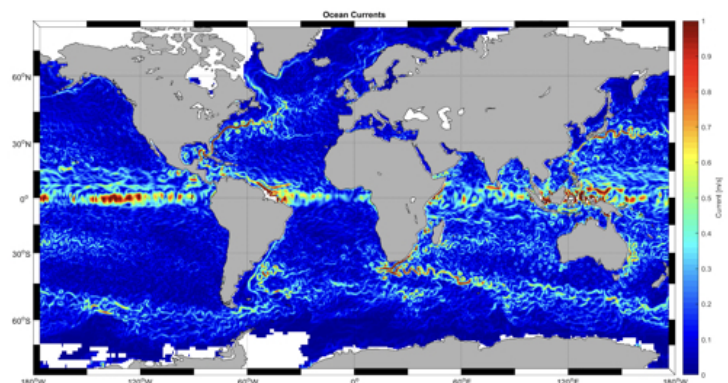
Fleet Performance Monitoring (FPM) provides the dashboards for Operations, Technical and Chartering

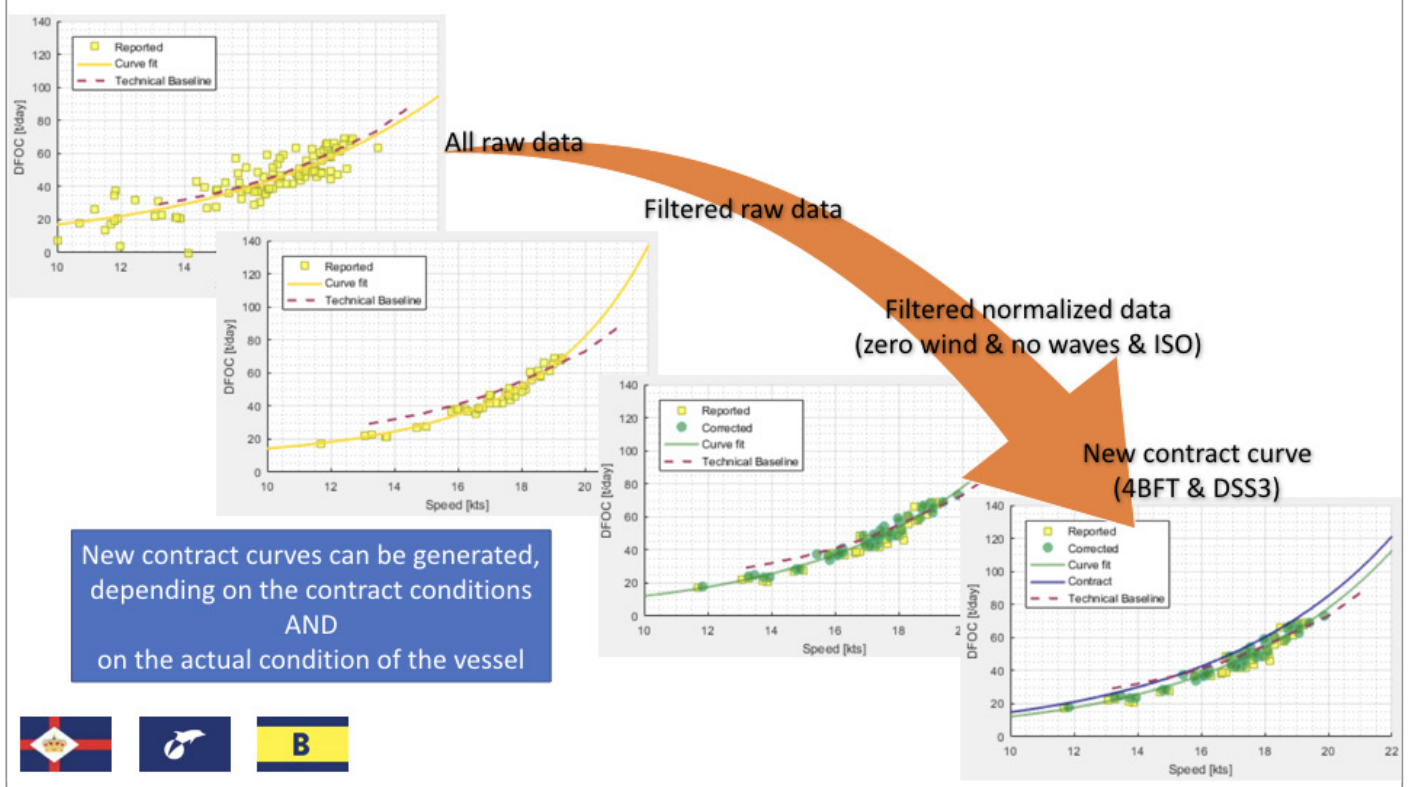
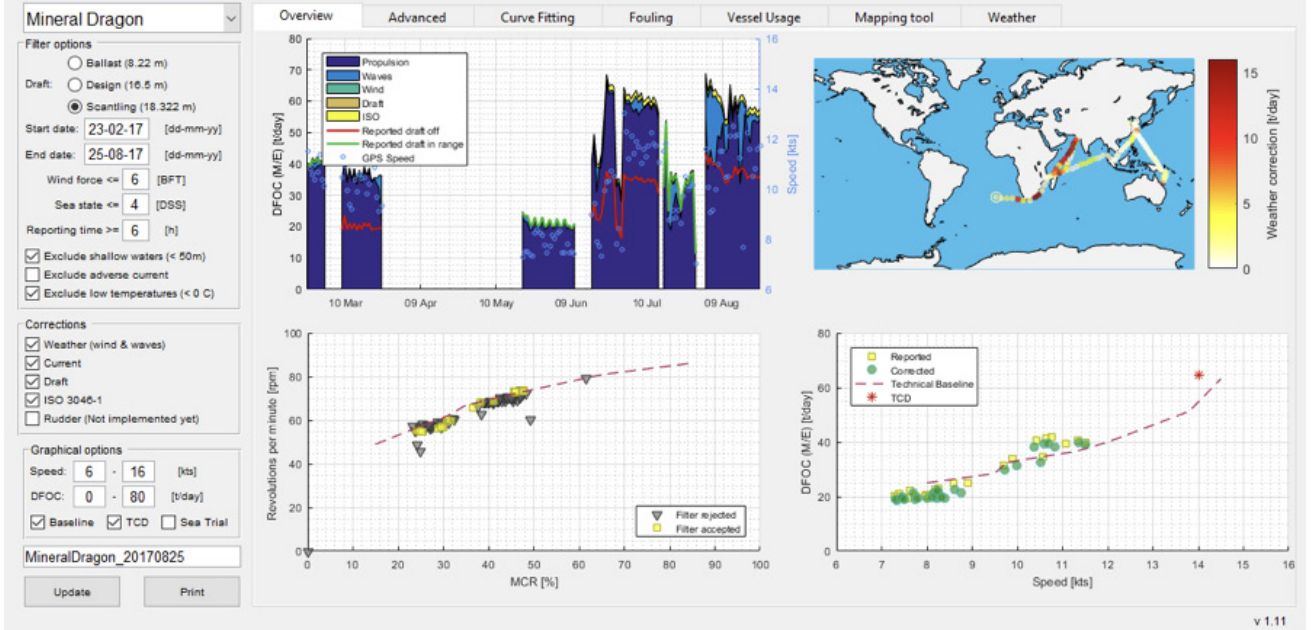
- Basic method for data processing:
 - Filter the dataset
 - Normalize/correct for reference condition
 - Apply statistics
- Cooperation with research institutes was set up to further improve the code
 - Delft University of Technology
 - Ghent University
 - University College of London



The information of the Vessels is also verified with external data sources

- NOAA server provides data such as:
 - Significant wave height
 - Swell direction
 - Sea water temperature / depth
 - Salinity
 - Wind force and direction
 - Ocean current
- AIS data sources such as Vestrak.
- MeteoGroup from the Netherlands.





Mineral Dragon

Filter options

Ballast (8.22 m)

Design (16.5 m)

Scantling (18.322 m)

Start date: 21-04-16 [dd-mm-yy]

End date: 20-02-17 [dd-mm-yy]

Wind force <= 6 [BFT]

Sea state <= 4 [DSS]

Reporting time >= 6 [h]

Exclude shallow waters (< 50m)

Exclude adverse current

Exclude low temperatures (< 0 C)

Corrections

Weather (wind & waves)

Current

Draft

ISO 3045-1

Rudder (not implemented yet)

Graphical options

Speed: 6 - 16 [kts]

DFOC: 0 - 80 [t/day]

Baseline TCD Sea Trial

MineralDragon_20170220

Update Print

Overview Advanced Curve Fitting Fouling Eco Speed Vessel Usage Mapping tool

Fouling settings

Higher fouling risk after 7 idle days

Period: 7 Accepted points

Short < > Long

Check fouling

Last dry dock: 22/03/2015

Last UW cleaning: 5/04/2016

Last propeller cleaning: 5/04/2016

Paint type: International Paint LTD.

Port	Duration	From	Till	Water temp
Fukuyama, Kagoshi.	23 days	29 Jun 16	21 Jul 16	26 °C
Rotterdam	11 days	28 Sep 16	08 Oct 16	13 °C
Puerto Nuevo	7 days	24 Oct 16	30 Oct 16	26 °C
Umuiden/Velsen	9 days	30 Nov 16	08 Dec 16	5 °C
Pepel	22 days	22 Dec 16	12 Jan 17	25 °C

v 1.6.2



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Cleaning info
+ Hull antifouling

Fouling sensitive areas
+ lay-up position

Lay-up Periods
+ Water temperature

v 1.6.2





Mineral Dragon

Overview | Advanced | Curve Fitting | Fouling | Vessel Usage | Mapping tool | Weather

Filter options: Ballast (8.22 m), Draft: Design (16.5 m), Scantling (18.322 m), Start date: 23-02-17, End date: 25-08-17, Wind force: 6 [BFT], Sea state: 4 [DSS], Reporting time: 6 [h], Exclusion options: Exclude shallow waters, Exclude adverse current, Exclude low temperatures, Corrections: Weather, Current, Draft, ISO 3045-1, Rudder, Graphical options: Speed: 6-16 [kts], DFOC: 0-80 [t/day], Baseline, TCD, Sea Trial, MineralDragon_20170825

Fitting options: Empirical, Curve fit: Power: 2.8, Contract description: Draft: 18.322 [m], Wind force: 4 [BFT], Sea state: 3 [DSS], Margins: DFOC Upscaling: -5 [%], Speed shift: 0.5 [kts]

General | Graph | Speed Table | MCR Table | DFOC-%MCR | %MCR-RPM

Include in total DFOC: A/E: Hotel load consumption 4 t/day, AUX blower consumption 1.5 t/day below 45 %MCR, BLR: Boiler use consumption 3 t/day below NaN %MCR

Graph: DFOC [t/day] vs Speed [kts]. Legend: Reported, Computed, Curve fit, Technical Baseline, TCD. Annotations: Good speed-DFOC curve-fit (R2 = 0.93748), Good DFOC-%MCR curve-fit (R2 = 0.98803), Bad %MCR-RPM curve-fit (R2 = 0.79888).

Speed Table:

Speed	DFOC fit	RPM	%MCR
6.0	14.1	51.9	18.2
7.0	16.8	54.7	21
8.0	20.6	57.9	25
9.0	25.3	61.7	30
10.0	31.3	65.8	37
11.0	38.5	70.2	45
12.0	47.3	74.8	54
13.0	57.6	79.6	65.6
14.0	69.7	84.6	78.7

%MCR-RPM Table:

%MCR	Speed	DFOC fit	RPM
15.0	4.3	11.1	49
25.0	7.9	20.3	58
50.0	11.6	43.3	73
75.0	13.7	66.3	83.3

Annotations: "Not verified with measurements" (red arrow pointing to the Speed Table), "RPM model used by FPM is less reliable" (red arrow pointing to the %MCR-RPM table).



Mineral Dragon

Overview | Advanced | Curve Fitting | Fouling | Vessel Usage | Mapping tool | Weather

Overview | Block Diagrams | Compare data

Dropdown menu with all logged data: Idle A/E DFOC, Average A/E DFOC: 1.8307 t/day

Calculate Summary

A/E DFOC: Average A/E Consumption: 4.1209 t/day

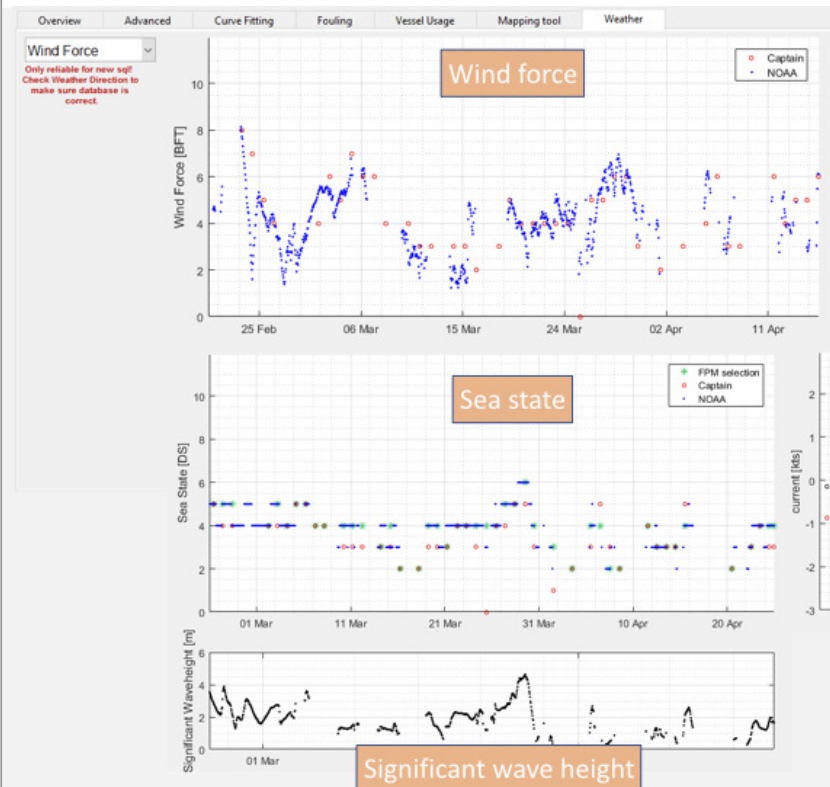
Graphs: A/E consumption [t/day] vs Time (01 Jan 17 to 01 Oct 17). Legend: HSHFO, HSMDO, LSHFO, LSMGO. Annotation: "Gasoil use" (red arrow pointing to a peak in the graph).

Parameter Summary Table:

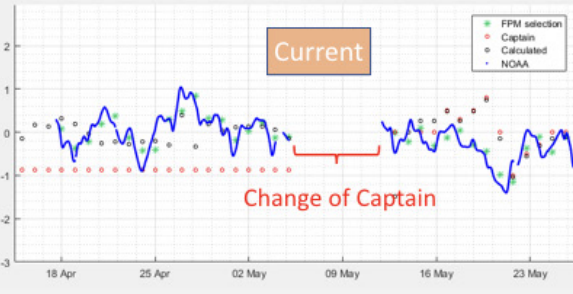
Parameter	Average	Median	Max	Min
Draft [m]	12.04	9.13	18.25	7.43
SFOC [g/kWh]	1.00	1.00	1.00	1.00
RPM [-]	63.27	67.80	79.20	0.00
%MCR [-]	35.85	39.10	61.50	0.00
A/E consumption [t/day]	4.12	3.98	5.87	2.85
BLR consumption [t/day]	0.08	0.51	0.83	0.10
Speed [kts]	9.88	10.24	13.10	7.20
Average A/E Load [%]	73.63	72.50	93.00	44.00
Idle A/E Power [%]	0.41	0.40	0.60	0.06
Idle A/E DFOC [t/day]	1.83	1.90	2.90	0.10
Idle BLR DFOC [t/day]	1.83	1.90	2.90	0.10
Combined A/E Power [MW]	0.67	0.66	1.20	0.40
Trim [m]	0.85	0.68	2.69	0.00

Annotation: "The data in contract can easily be verified/modified with the logged data" (blue box).





Reporting quality of the Captain can be verified with external data sources

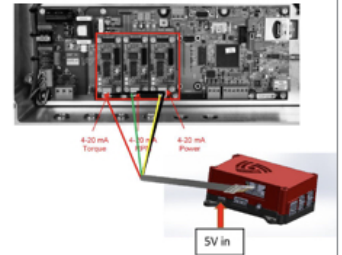


Next steps within the Fleet performance program

- Light logging system
- Automated reporting
- Route optimizer



Light logging system



- Combination of the benefits of noon reports (complete and verified data) and continuous monitoring (high frequency data), but at an acceptable cost.
- Installed by crew with the help of an easy to understand instruction video and manual.
- A logger is installed which captures only the most important parameters (DFOC, GPS, RPM, %MCR, Torque, speedlog, anemometer/anemoscope and rudder sensor).
- The ShipReporting program reads out this logger and sends the data on a similar way like the ship reports towards the CMB SQL server.
- MatLab transforms the data into information.



Vessel performance is a game played on many fields

- Buy a good ship from a good yard.
- Operate it effectively (avoid bad weather, negative currents, smart speed distribution over the voyage, etc).
- Install accurate measurement devices (such as mass flow meters and torque meter) and analyze the reported data.
- Crew attitude, crew training (avoid running of pumps without purpose).
- Regular propeller and hull cleaning.
- Maintenance
- Analyze data: ShipReports and FPM.





Q & A

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