

Modern Management in Shipping



E. Sfakiotakis

Topics

- Voyage Performance monitoring & analysis
(Επιτήρηση & ανάλυση απόδοσης ταξιδιού)
- Planned Maintenance of machinery & equipment
(περιοδική συντήρηση μηχανών & εξοπλισμού)

Part 1

Voyage Performance monitoring & analysis (Επιτήρηση & ανάλυση απόδοσης ταξιδιού)

Voyage Performance monitoring & analysis

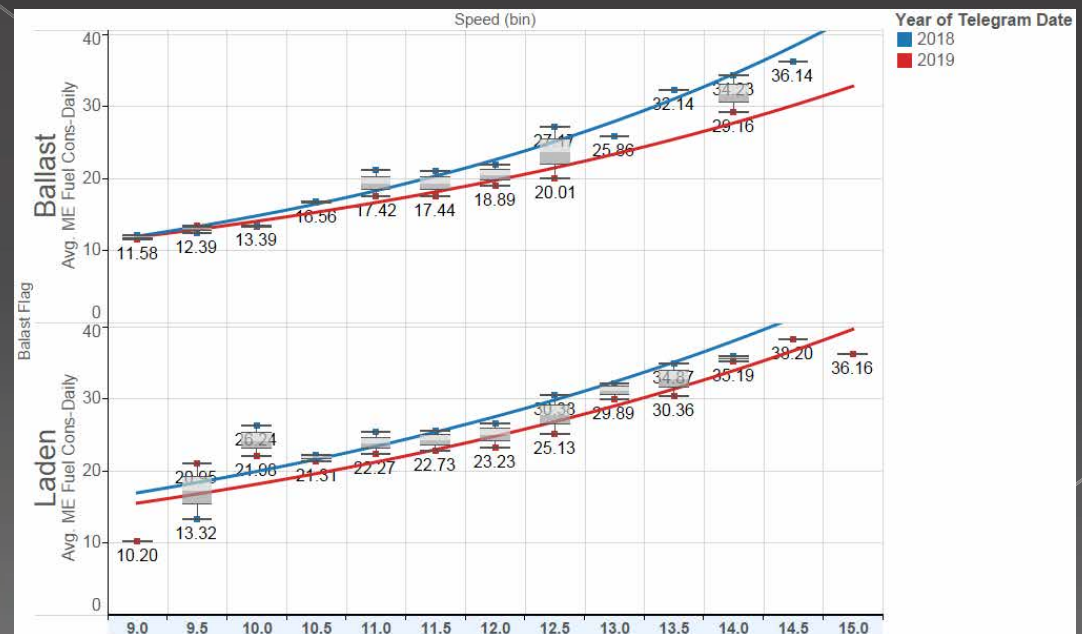
Objectives

Performance monitoring is keeping track of how efficiently a vessel operates during her lifetime

Key elements that are

monitored are:

- Fuel consumption
- Lubricant oil consumption
- Speed & routing
- Breakdown time
- Out of service & maintenance time



Voyage Performance monitoring & analysis

Benefits

- Efficient operation of the vessel ensures that all above elements are kept to an optimum at all times.
- Thus, operational costs of the vessel are minimised, which in turn conveys to better earnings on the owner side.
- In this modern age, there are several tools that assist the operator in making the right decisions how to efficiently operate the vessel.
- Key parameters, regarding the engine, the propeller & the hull are constantly monitored, giving valuable information about the health of the vessel.
- These are reported daily, via noon reports, and on real time to the operator

Voyage Performance monitoring & analysis

A Historical Review

- Noon reports sent to the company by vessel, are used to understand and monitor what is happening on the ships.
- These reports are sent by the captain every day at noon, based on data gathered manually by the crew.
- The noon report has grown over the years to give a snapshot of what has happened on board the ship since the previous noon i.e., in the last 24 hours

RECORDED COPY - 2002-00-00000000

Date.....

DECK NOON POSITION

Lat.....

Long.....

Course.....

Dist. made Good Miles

Ave. Speed.....

Steaming Time.....

Dist. By Log Miles

Weather.....

Wind Force.....

Sea.....

Remarks

.....

.....

Chief Officer

ENGINEER'S NOON REPORT

M/V-M/T.....

Date..... Voy.....

R.P.M.....

Fuel Consumed..... Bbls

Fuel On Hand..... "

Steaming Time.....

Observed Dist..... Kts

Dist. by Engines..... "

Slip..... %

Fresh Water on Hand..... Tons

Remarks

.....

.....

Chief Engineer

Performance monitoring & analysis

A Historical Review

Noon reports in the earlier days when no email services existed, were transmitted as telegrams to the company via telex. Later on telex was replaced by a daily email, that had the same structure as the telex

The information contained in the telegram something like:

DECK NOON POSITION
LAT: 06 21.0 N
LONG: 093 50.0 E
COURSE: 268
DIST MADE GOOD: 307 NM
AVE SPEED: 12.79 KNOTS
STEAMING TIME: 24HRS
DIST BY LOG: 318 NM
WEATHER: SW
WIND FORCE: 6
SEA: ROUGH
ETA COCHIN 23RD JULY 2001 1000 HRS. LT

Location, Speed & prevailing weather condition

ENGINE NOON REPORT
R.P.M: 111.3
FUEL CONSUMED:ME/DG 26.3 MT / 3.1 MT
FUEL ON HAND:FO 1031.4 MT
LS/HSMGO : 25.0 MT/58.6
STEAMING TIME: 24 HRS
OBSERVED DIST: 307 NM
DIST BY ENGINE: 340 NM
SLIP: 9.7%
FRESH WATER ON HAND: 159 M3

Fuel consumptions & engine data

Performance monitoring & analysis

A Historical Review

The information was usually encoded to save space and transmission costs

- VPM / Vessel Name
-
- 1. 1206031200 LT
- 2. 2123S
- 3. 03725E
- 4. 211 / S 4
- 5. SW 1.0 /1.0
- 6. 486 /36.75
- 7. 13.22 / -7.29 /105.20
- 8. HS 42.4 /LS 0.0 /HSMGO 0.0 /LSMGO 0.0
- 9. HS 42.4 /LS 0.0 /HSMGO 0.0 /LSMGO 0.0
- 10. HS 267.2 /LS 229.9 /HSMGO 39.6 /LSMGO 48.0
- 11. HS 267.2 /LS 229.9 /HSMGO 39.6 /LSMGO 48.0
- 12. 83/73.5/430
- 13. MAPUTO / 401
- 14. 1606032000 LT - AGW/WP (BY AV.SP./12.5)

Voyage Performance monitoring & analysis

A Historical Review – Noon Reports

With the evolution of computers, dedicated software replaced the email reporting of noon reports.

More information could be send in a telegram.

Additionally all information is stored in a database.

New Telegram Edit Telegram Delete Telegram Print Save Add Cargo Delete Cargo Send Telegram

Telegram Ref: 59L Noon

Vessel: [Redacted] Date/Time: [Redacted] Time Zone: 8 Latitude: 13 29 NORTH
 Voyage No: 59L G.M.T.: [Redacted] Longitude: 119 42 EAST
 Ordered Speed: Economical Speed Time Charter: ECA:

Distance Run: 279	TC RPM 1 / 2: 9400 / 0	Conditions	Generators
Steaming Time: 24 0	Max Temp TC 1 In /Out: 391.00 / 309.00	Dir.: Force/Speed	Hours KW
Propeller Pitch: 4.942	Max Temp TC 2 In /Out: 0.00 / 0.00	Wind: NW 4 Bft	DG-1: 0 0
Avg M/E RPM: 75.5	Air Cooler Press Drop 1/2: 60. / 0.	Wave: NW 1 Mtrs	DG-2: 0 0
Load Indicator: 54.00	Sea Temp / LT CWTemp: 28 / 0	Swell: W-SW 1.00 Mtrs	DG-3: 24 290
Avg.Eng.Power: 0 (Torque Mtr-kW)	Scavenge Pressure: 0.91	Current: SE 1.00 Knots	DG-4: 0 0
Avg.Eng.Power: 0 (PMI)	Scavenge Air Temp: 43.	Adverse Current: <input checked="" type="checkbox"/>	S/G: 0 0
Speed: 11.63 11.63	E.R. Temp: 43.	Course: NW	Ballast Exch. hrs: 0
Slip: 3.83 3.83	Blowers: <input type="radio"/> On <input checked="" type="radio"/> Off	Drafts	CH Washing hrs: 0
Engine Miles: 290.12	Blowers 1 / 2 (Amps): 0 / 0	FWD: 13.39 MD: 13.51 AFT: 13.62	A/C On: <input checked="" type="checkbox"/>
Shaft Power kW: 5,075 (Avg/24hrs)	M/E Revolution Counter: 44,342,740	<input type="radio"/> SW <input type="radio"/> FW <input checked="" type="radio"/> BW	During Bad Weather

Bunker Consumptions (mt) since Last Report					Main Lubs ROB				
	HSFO	LSFO	HSDO	LSMGO	HBN CO	LBN CO	Cyl. Oil	M/E	A/E
Fuel S (%)	2.92 %	0.00 %	0.00 %	0.10 %	14,450	3,740	18,190	19,410	2,000
M/E	22.15	0.	0.	0.	Consumption Since Last Report				
Generator	2.15	0.	0.	0.	165	6	171	0	0
Boiler	0.	0.	0.	0.	Consumption Since Last Departure				
Total	24.3	0.	0.	0.	570	6	576	35	0

Bunker Consumptions (mt) since Last Departure				
	HSFO	LSFO	HSDO	LSMGO
M/E	76.86	0.	0.	0.
Generator	7.69	0.	0.	0.
Boiler	0.	0.	0.	0.
Total	84.55	0.	0.	0.

Bunkers ROB (mt)				
	HSFO	LSFO	HSDO	LSMGO
ROB	781.59	0.	0.	72.98

Destination: HONG KONG
 Miles to Destination: 622
 E T A Destination (LT): 02/07/2018 18:00
 E T B: 02/07/2018 21:00

Fresh Water (mt)
 R.O.B.: 164.
 Produced: 15.
 Consumed: 5.
 Ballast Laden

M/E SUMP tank with lub oil pump running: 12,100

Total FO cons
 M/E & Generator during:
 Good Weather: 24.45
 Bad Weather: 0.
 Contr. Speed: 0.
Voyage Totals: 24.45

Leg Totals
 Total Distance Run: 933
 Total Steaming Time: 83 0
 Total Average Speed: 11.24
 Total Average RPM: 75.3
 Total Average Slip: 6.79
 Total Engine Miles: 1000.90

Remarks: VESSEL PROCEED W/ALTERN SPEED/CONSUMPTIONS: ABT 12K LADEN ON ABT 24 MT IFO 380CST + ABT 0.3MT MGO AS PER PREVIOUS CHRTRS INSTRUCTIONS FROM INDONESIA LOADPORT SAMARINDA TO DISCHPORT HONG KONG.

Master Name: BENEKOS ILIAS Chief Engineer Name: CHRISTOPOULOS GEORGIOS

Voyage Performance monitoring & analysis

A Historical Review – Noon Reports

With time the number of reported parameters became larger and more details were added.

Telegram Ref: [] Noon

Vessel: [](N) Date/Time: []
 Time Charter: [] Time Zone: []
 G.M.T.: []

Latitude: 01 43 NORTH
 Longitude: 039 36 WEST
 ECA: []

Distance Run: 290
 Steaming Time: 24:00
 E T A Destination: 11/07/2019 08:00 (LT)
 Cape Town
 E T A Final Destination: 05/08/2019 08:30 (LT)
 Final Destination: ZHANJIANG
 Miles to Final Destination: 11050

Average Speed: 12.08 / 12.08
 Instructed Speed: 12.00

Drafts FWD / MID / AFT: 16.80 / 16.80 / 16.80
 Sea Temp. (C): 28

Propeller Pitch: 6.088
 Avg M/E RPM: 70.9
 Avg M/E Load: 57 %
 Load Indicator: 58.00
 Slip: 13.59 / 13.59
 Shaft Power kW (Avg/24hrs): 9,421
 M/E Revolution Counter: 49,132,130
 Engine Miles: 335.62
 Avg Cargo Temp: []
 Stoppages: [] Hrs [] Min
 Stoppages Reason: []

Reason to omit report from Performance: []

Conditions

	Dir.	Force/Speed	Unit
Wind	SE	5	Bit
Wave	SE	4	Mtrs
Swell	S	2.00	Mtrs
Current	NE	1.00	Knots

Adverse Current: []
 Course: SE

Weather Routing Requested
 Yes No

Leg Totals

Total Distance Run	1672
Total Steaming Time	152:06
Total Average Speed	10.99
Total Average RPM	71.1
Total Average Slip	21.64
Total Engine Miles	2133.75

Bunker Consumptions (mt) since Last Report

	HSFO	LSFO	Hours	LSMGO	MDO	Hours
Fuel S (%)	0.40 %	0.10 %		0.01 %	0.00 %	
L.C.V. GJ/MT	41.98	0.00		0.00	0.00	
Hours	24.0	0.0		0.0	0.0	
HMI Settings	60.00	0.00		0.00	0.00	
M/E	41.1	0.0		0.0	0.0	
A/E	3.3	0.0		0.0	0.0	
B Tank Cleaning	0.0	0.0	0.00	0.0	0.0	0.00
O Ballast Water Exch.	0.0	0.0		0.0	0.0	
I Heating	0.0	0.0	0.00	0.0	0.0	0.00
L Purging/Inerting	0.0	0.0	0.00	0.0	0.0	0.00
E Preheating	0.0	0.0		0.0	0.0	
R Other	0.0	0.0		0.0	0.0	
Incinerator Cons.	0.0	0.0		0.1	0.0	
Total	44.4	0.0		0.1	0.0	
Avg 24h Bunker Cons.	44.40					

Bunker Consumptions (mt) since Last Departure

	HSFO	LSFO	Hours	LSMGO	MDO	Hours
M/E	268.1	0.0		0.0	0.0	
A/E	21.2	0.0		0.0	0.0	
B Tank Cleaning	0.0	0.0	0.00	0.0	0.0	0.00
O Ballast Water Exch.	0.0	0.0		0.0	0.0	
I Heating	0.0	0.0	0.00	0.0	0.0	0.00
L Purging/Inerting	0.0	0.0	0.00	0.0	0.0	0.00
E Preheating	0.0	0.0		0.0	0.0	
R Other	0.0	0.0		0.0	0.0	
Incinerator Cons.	0.0	0.0		0.521	0.0	
Total	289.3	0.0		0.52	0.0	
Avg 24h M/E&A/E Cons.	45.65	0.00		0.00	0.00	

Bunkers ROB (mt)

Flowmeter Auxiliary Boilers

Generators

Voyage Performance monitoring & analysis

A Historical Review – Noon Reports

The abstract from the engine log book added as well.

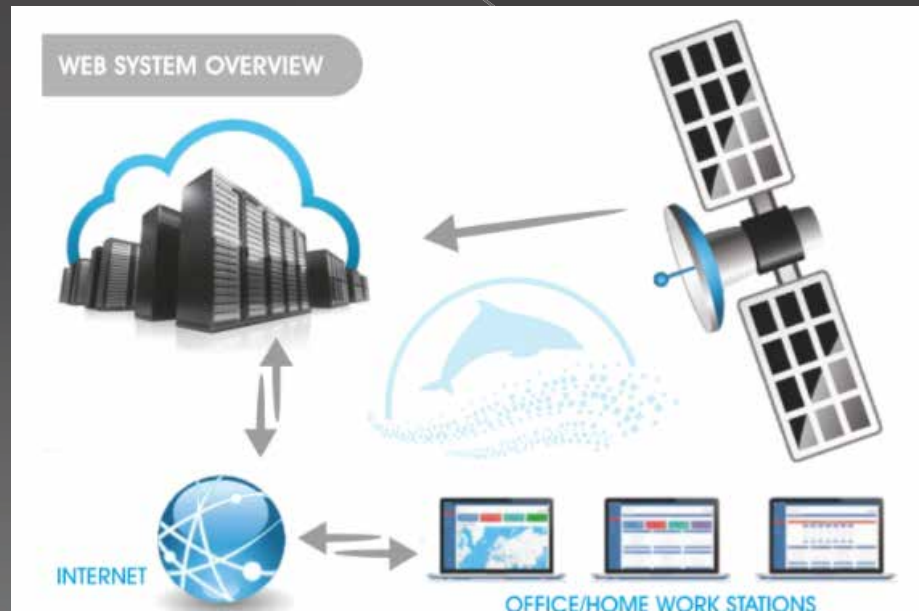
Bunkers ROB (mt)					Flowmeter Auxiliary Boilers			Generators											
TANKS	HSFO	LSFO	LSMGO	MDO	Aux. Boiler 1	Aux. Boiler 2	Comp. Boiler	Hours	KW										
ROB	2441.1	11	240.9	0	Before	624,200	1,074,100	0	0										
					After	624,200	1,074,100	0	620										
					Density	914.8	MT/m3	Temp.	100										
								°C											
Main Lubs ROB					Fresh Water (mt)			SUMP TANK											
HBN CO	LBN CO	CYLO	MELO	GELO	M/E RHS on HS CYL. OIL		R.O.B.												
17,330	1,840	19,170	14,400	3,500	M/E RHS on LS CYL. OIL	24	443												
Consumption Since Last Report					Ave.24h HBN CO Cons.			Produced											
170	0	170	0	0	170.0			26											
Consumption Since Last Departure					Ave.24h LBN CO Cons.			Consumed											
170	890	1,060	2,600	200				11											
							Sludge	4.3											
							Oil Bilge	2.8											
									11,900										
Remarks																			
ENGINE LOG ABSTRACTS																			
DIESEL GENERATORS																			
D/G 1 Exh.GasTemp	#1	0	#2	0	#3	0	#4	0	#5	0	#6	0	#7	0	#8	0	F.W Cool Out	78	
D/G 2 Exh.GasTemp	#1	370	#2	350	#3	340	#4	350	#5	360	#6	340	#7	0	#8	0	Lub Oil Cool Out	72	
D/G 3 Exh.GasTemp	#1	0	#2	0	#3	0	#4	0	#5	0	#6	0	#7	0	#8	0			
MAIN ENGINES																			
Temperatures																			
JACKET AND PISTON COOLING OUTLET FROM																			
#1 Cyl	85	#2 Cyl	85	#3 Cyl	85	#4 Cyl	85	#5 Cyl	85	#6 Cyl	85	#7 Cyl	0	#8 Cyl	0	Piston In			
Piston	50	Piston	50	Piston	50	Piston	50	Piston	50	Piston	50	Piston	0	Piston	0		44		
Exh.GasTemp	#1	339	#2	347	#3	353	#4	331	#5	336	#6	336	#7	0	#8	0			
M/E FUEL RACKS INDIC.	#1	74.0	#2	75.0	#3	74.0	#4	74.0	#5	75.0	#6	74.0	#7	0.0	#8	0.0			
TC RPM 1 / 2		7700	/	0				Thrust Temp/Press	54	/	1.9								
Exh Temp TC 1 In / Out		350.00	/	290.00				Exh Temp TC 2 In / Out	0.00	/	0.00								
Pressures																			
Lub Oil M.Bearing	Piston Cool at Eng.	J.W. at Eng.	S.W at Eng.	F.O at Eng.	Scav. Air			Air Cooler Press Drop 1/2	20		135								
1.9	1.9	4	3.8	8.2	1.3														
E/R	HFO/MGO	LUB OIL COOLER				JACK. W. COOLER													
		IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
		40	105	51	46	44	50	29	47	29	80								
Ma [REDACTED] RGIOS										Chief Engineer Na [REDACTED]									

Voyage Performance monitoring & analysis

A Historical Review – Real Time Data

In addition to noon reports, that are traditionally sent until now at noon, based on local vessel's time, real time data are also collected.

Data are collected from existing sensors and equipment on board (flowmeters, ECDIS, AIS, GPS etc.) and transferred via wired connections into a main unit on board.



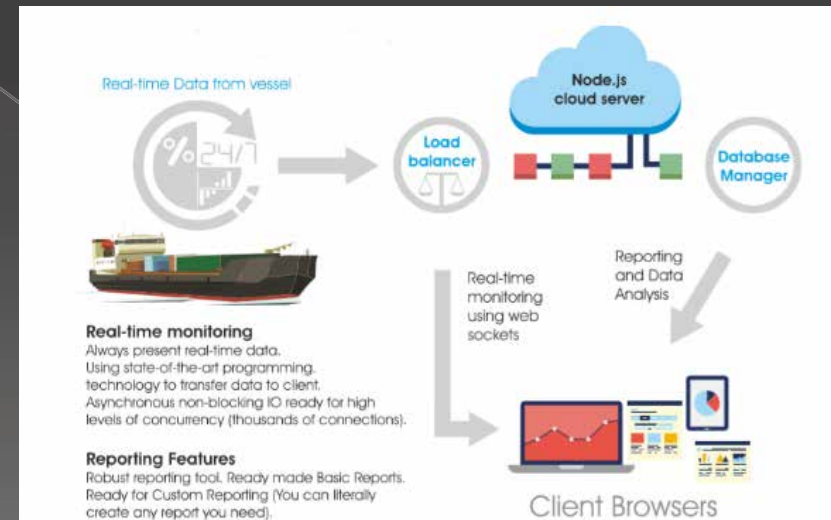
Voyage Performance monitoring & analysis

A Historical Review – Real Time Data

Key parameters are recorded every 5 seconds (and recently every second) and transmitted ashore and stored in dedicated servers.

Parameters monitored include:

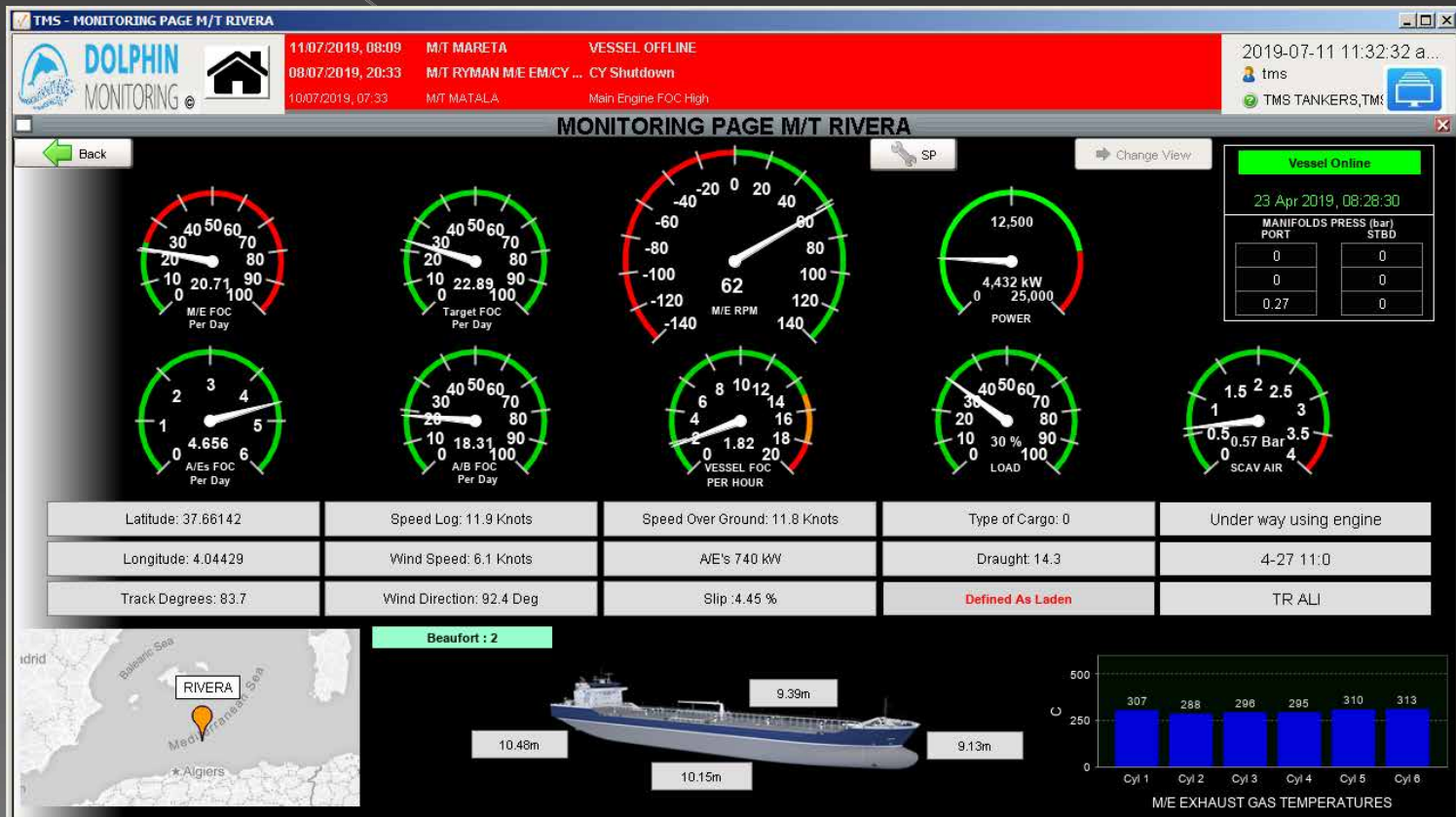
- Vessel Position & Course
- Vessel Speed over ground and through water
- Wind speed and direction
- Actual loading condition of vessel
- Main engine, Diesel Engine, Boiler fuel consumption
- Engine load, shaft power (KW) and propeller speed (RPM)



Voyage Performance monitoring & analysis

A Historical Review – Real Time Data

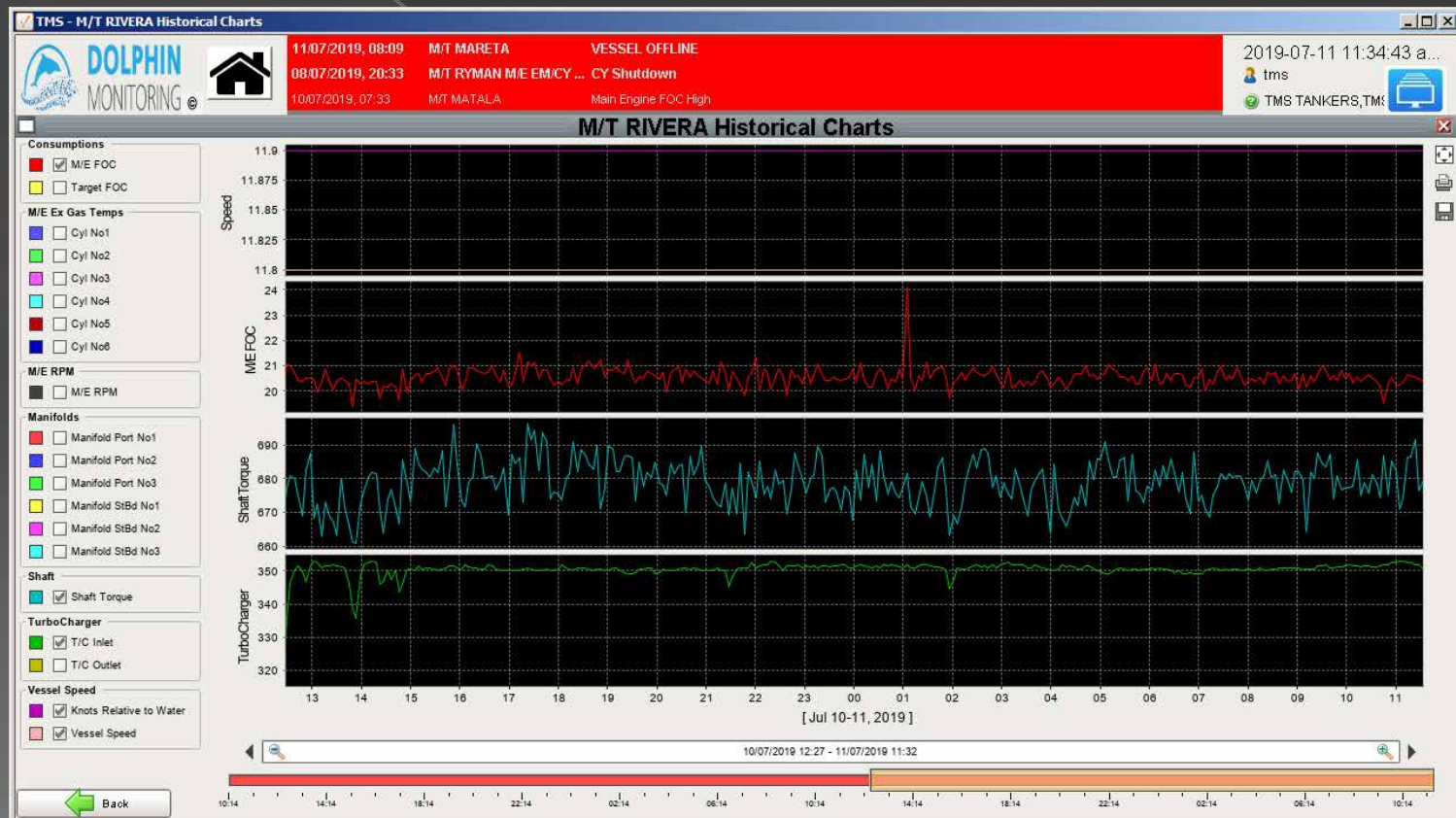
All data are presented real time, in a graphical format to the operator and any alarms are clearly visible.



Voyage Performance monitoring & analysis

A Historical Review – Real Time Data

The operator can also have analysis of all data received and highlight any abnormalities or deficiencies.

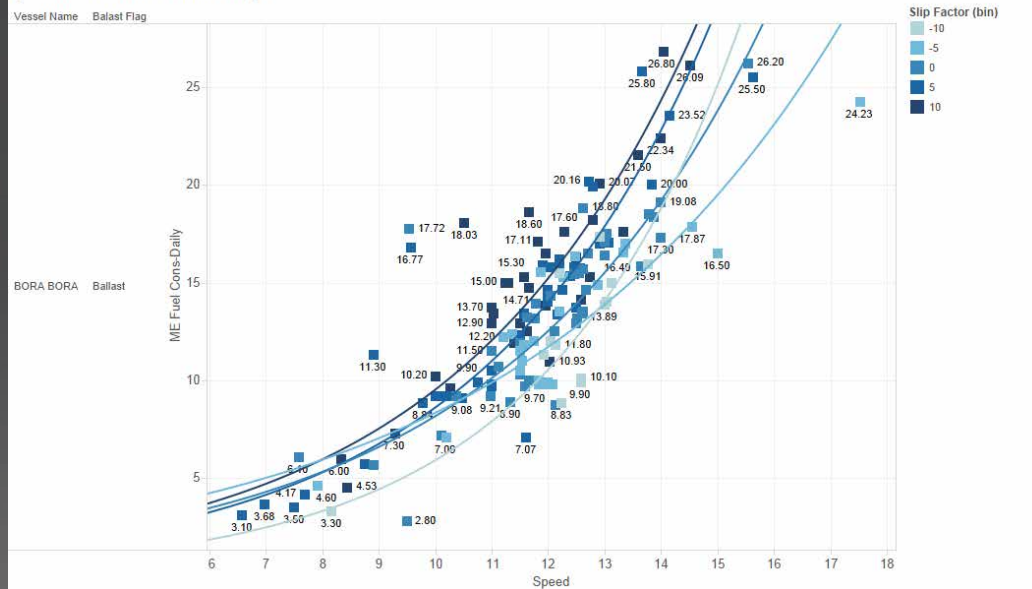


Voyage Performance monitoring & analysis

Performance Analysis

Data collected either from noon reports or real time, are analysed using powerful Business Intelligence (BI) tools:

Speed-FOC for various slips

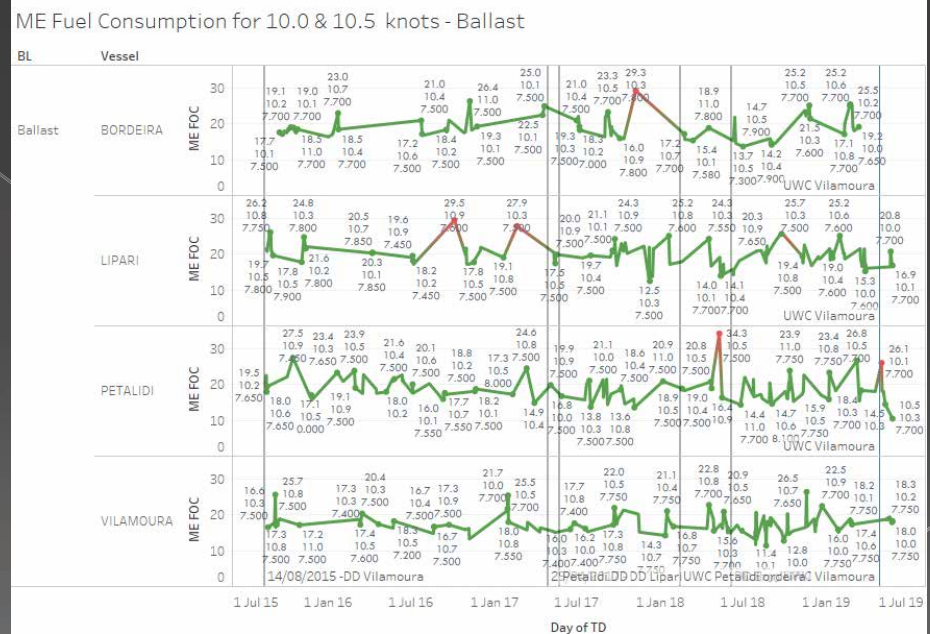
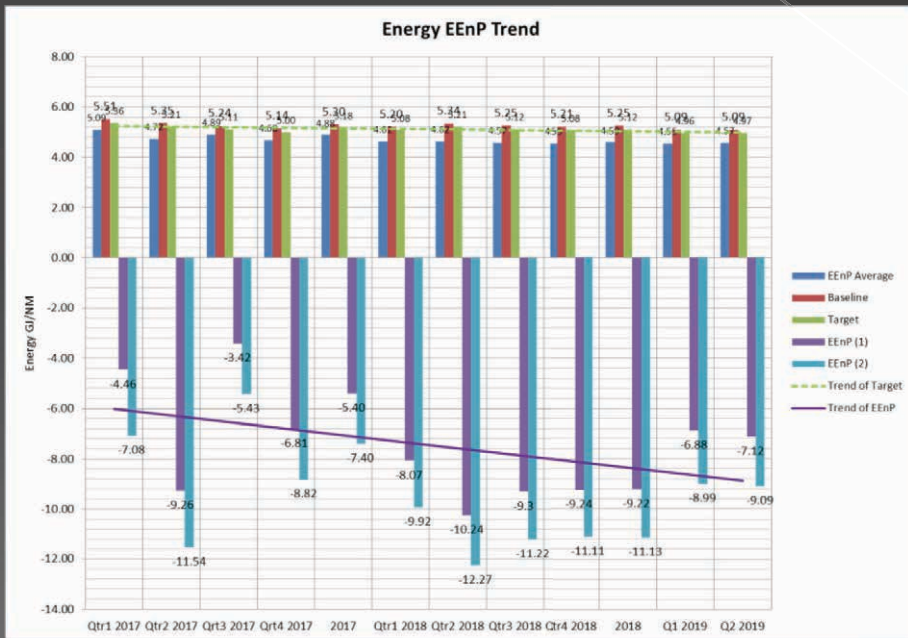


Balast Flag	Performance Speed (current dir absolute) (bi..)	Engine Rpm	ME Fuel Cons-Daily	ME+DG Fuel Cons-Daily	Performance Speed (current dir absolute) (bi..)	Slip (for performance speed)	Number of Records
Ballast	8.0	39.0	11.5	15.5	8.2	2.1	38.0
	8.5	40.9	12.7	16.7	8.7	0.9	35.0
	9.0	42.6	14.3	17.9	9.2	-0.9	24.0
	9.5	45.3	15.8	19.5	9.8	0.2	26.0
	10.0	45.8	16.8	20.8	10.3	-3.7	28.0
	10.5	47.0	17.3	21.1	10.7	-5.5	34.0
	11.0	49.2	18.9	22.6	11.2	-5.4	36.0
	11.5	52.0	22.5	26.2	11.7	-4.0	19.0
	12.0	55.1	26.7	30.0	12.2	-2.6	25.0
	12.5	55.4	26.5	30.0	12.8	-6.6	32.0
	13.0	56.7	29.0	32.7	13.2	-7.9	13.0
	13.5	57.7	30.8	34.6	13.7	-9.3	5.0
	14.0	61.5	34.3	37.7	14.3	-6.9	3.0
	14.5	63.0	37.1	40.9	14.6	-6.8	4.0
	15.0	66.0	41.3	44.9	15.1	-5.3	1.0
15.5	66.7	46.7	52.0	15.9	-10.1	1.0	
16.0							
Laden	8.0	39.4	14.0	18.4	8.4	1.6	4.0
	8.5						
	9.0	49.5	23.6	27.3	9.3	11.4	3.0
	9.5	46.6	21.9	25.9	9.7	2.3	3.0
	10.0	53.5	25.7	29.2	10.3	10.7	12.0
	10.5	53.4	25.8	29.5	10.8	6.4	32.0
	11.0	55.4	28.6	32.3	11.2	6.3	57.0
	11.5	56.2	29.3	32.9	11.8	3.5	120.0
	12.0	57.0	30.0	33.5	12.2	1.1	145.0
	12.5	58.0	30.8	34.4	12.7	-1.3	89.0
	13.0	60.0	34.7	38.3	13.2	-1.5	15.0
13.5	62.7	40.4	44.1	13.8	-1.7	13.0	
14.0	63.5	42.5	46.1	14.1	-3.4	8.0	
14.5	63.9	45.2	48.4	14.5	-4.8	1.0	
15.0	64.8	42.3	45.4	15.2	-7.9	1.0	
15.5	59.6	32.8	36.4	15.6	-20.8	1.0	

Voyage Performance monitoring & analysis

Performance Analysis

Results are compared with baselines and targets set, and KPIs are evaluated. Appropriate actions are taken when the performance KPIs exceed the targets:



The trend of average of ME_Daily_FOC for TD Day broken down by BL and Vessel. Color shows details about maximum of Status. The marks are labeled by average of ME_Daily_FOC, average of Avg Speed and average of DRAFT_MID. The data is filtered on TD, TD, Avg Speed (bin), sum of Number of Records, Slip, W Force and Hours Slc. The TD filter includes dates on or after 14/08/2015 00:00:00. The TD filter keeps 27,563 of 14,840 members. The Avg Speed (bin) filter keeps 10.0 and 10.5. The sum of Number of Records filter keeps all values. The Slip filter ranges from -10 to 15. The W Force filter ranges from 0 to 5. The Hours Slc filter includes values greater than or equal to 3. The view is filtered on Vessel and BL. The Vessel filter keeps BORDEIRA, LIPARI, PETALIDI and VILAMOURA. The BL filter keeps Ballast.

Max. Status
■ Over
■ Under

Part 2

Planned Maintenance of machinery & equipment
(περιοδική συντήρηση μηχανών & εξοπλισμού)

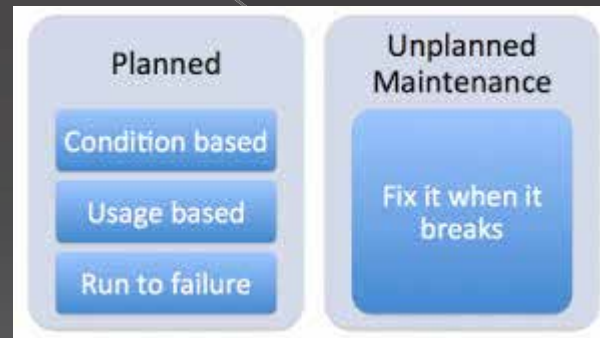
Planned Maintenance

Definition

Planned maintenance is about documenting and scheduling maintenance activities on vessel machinery and structures.

You can plan to service a system on fixed intervals, inspect for wear, or plan to let, eg, a light bulb fail before you replace it.

To the opposite, unplanned maintenance follows the “fix in when it brakes” rule.



Shipping companies have adopted planned maintenance in order to reduce machinery downtime by having all necessary resources on hand, such as labor and parts, and a strategy on when and how use these resources.

Planned Maintenance

A Historical Review – Unplanned Maintenance

In the early pre-ISM days, the common rule was that the maintenance performed on machinery was after a breakdown.

- No instructions for when or how or what resources to use existed
- No records were kept of any maintenance
- Equipment downtime was longer and



Planned Maintenance

A Historical Review – Planned Maintenance

In the beginning of adoption of ISM code, shipping companies adopted the planned maintenance approach.

The early systems were solely paper based and consisted of:

- Job cards that described the maintenance to be performed
- Maintenance logs for logging down the activities done
- Forms for recording measurements

PMS no	Maintenance Item	Critical	Months											
			1	2	3	4	5	6	7	8	9	10	11	12
PM 161	BOW THRUSTER HYDRAULIC PUMP NO 2	X			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>
PM 162	STEERING GEAR	X	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PM 163	STEERING MOTOR NO 1	X		<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>	
PM 164	STEERING MOTOR NO 2	X			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>
PM 165	EMERGENCY GENERATOR	X	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>		
PM 166	MAIN SWITCHBOARD	X		<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>	
PM 167	EMERGENCY SWITCHBOARD				<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>
PM 168	EMERGENCY FIRE PUMP	X	<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>	
PM 169	LIFEBOAT ENGINE NO 1	X		<input type="checkbox"/>					<input type="checkbox"/>					
PM 170	LIFEBOAT ENGINE NO 2	X			<input type="checkbox"/>					<input type="checkbox"/>				
PM 171	ELEVATOR		<input type="checkbox"/>					<input type="checkbox"/>			<input type="checkbox"/>			
PM 172	WORKSHOP - LATHE			<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>
PM 173	WORKSHOP - GRINDER				<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>				<input type="checkbox"/>
PM 174	WORKSHOP - ELECTRIC WELDER		<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>		
PM 175	OXYGEN / ACETYLENE EQUIPMENT			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>	
PM 176	TRAVELLING CRANE				<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>
PM 177	SMOKE DETECTOR SAMPLE PUMP NO 1	X	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>		
PM 178	SMOKE DETECTOR SAMPLE PUMP NO 2	X		<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>	
PM 179	AUX. BOILER NO 1	X	<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>
PM 180	AUX. BOILER NO 2	X		<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>	
PM 181	EXHAUST GAS BOILER		<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>

Planned Maintenance

A Historical Review – Job Cards

Paper based planned maintenance systems, although simple to use by vessel's crew have major drawbacks:

- Machinery maintenance instructions and intervals were generic
- No alerts for when jobs became due
- Maintenance history for a machinery was difficult to keep and retrieve when required
- Maintenance of critical machinery could be easily overlooked, thus leading to frequent breakdowns
- Keeping the maintenance system updated was costly and inflexible.

CM/DT/SC	PLANNED MAINTENANCE WORK CARD AUXILIARY MACHINERY	Issue Date: 01.07.01 Revision: 000 Authorised By: KG
PM CODE 01 ENGINE / MAIN AIR COMPRESSOR NO 1		
Every Three Months		
Perform Megger Test of electric motor Inspect High and Low pressure suction and delivery valves Change or clean oil filter		
Every Six Months		
Overhaul High and Low pressure suction and delivery valves Inspect cooling pump Inspect relief valves (if adjustable)		
Every Year		
General overhauling Inspect crankcase, bearings, pistons, piston rings and piston rods		
Every Five Years		
Open up compressor for inspection, overhaul and survey.		
SPECIAL WORK PROCEDURES		
Any work carried out shall be performed only when safe to do so on the instructions of the Chief Engineer under an appropriate Permit to Work. When opening up compressors they must be positively isolated.		
Follow <u>makers</u> instructions when performing maintenance tasks		

Planned Maintenance

A Historical Review – Early computerized systems

A first approach to introducing computerized systems for planned maintenance was the spreadsheet based systems (Excel)

Although this approach solves partly the problem with generic job activities and alerting, it is still difficult to follow up and maintain.

M/V				DATE	31.07.08	MENU																	
WORK SPECIFICATION				Date Last Done	Engine Total Running Hours When Work	Run. Hours Since Last Done	Remaining Hours	Remaining Days	DUE DATE	WORK SCHEDULE & RECORD FOR THE YEAR 2008												EXTENSION	
ITEM No.	ITEM	WORK	INTERVAL							JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
MAIN ENGINE				Total running hours	23,000																		
01.	M.E. CYLINDER No.1																						
01	Cylinder unit	overhaul	10,000	25.11.07	15,000	8,000	2,000	83	22.10.08														
02	Piston crown	renewal when required	20,000	25.09.07	2,500	21,500	-1,500		16.08.08	X													
03	Cylinder liner	renewal when required	60,000	25.09.07	0	23,000	37,000	154	19.10.12														
04	Stuffing box	overhaul	10,000	25.09.07	12,500	10,500	-500		10.07.08					X									
05	Exhaust valves Stellite	overhaul	4,000	25.09.07	3,400	10,600	400	16	16.08.08								X						

RUN HOURS FROM LAST OVERHAUL OR INSPECTION UNTIL REPORTING DATE

REMAINING HOURS

REMAINING DAYS COMMENTS:
 •Over 30 days before due date cell's colour white.
 •From 0 up to 30 days before due date cell's colour becomes yellow
 •If over due date cell will be white colour and empty.

DUE DATE - COMMENTS:
 •Over 30 days before due date cell's colour white.
 •From 0 up to 30 days before due date cell's colour becomes yellow.
 •If over due date cell's colour becomes red.
 •If special attention is required, cell's colour becomes pink.

MARK X FOR THE MONTH OF DUE DATE. COMMENTS:
 •Over 30 days before due date cell's colour white.
 •From 0 up to 30 days before due date cell's colour becomes yellow.
 •If over due date cell's colour becomes red.
 •If special attention is required, cell's colour becomes pink.
 •If the month of due date is in different year of the schedule year then the X does not appear but only when we fill in the cell of schedule year the year of due date.

EXTENSION: COMMENTS
 Extension date granted by the office after relevant correspondence with Ch. Engineer.
 Records should be kept in file

Planned Maintenance

A Historical Review – Modern PMS Systems

Contemporary computerized systems such as Task Assistant are addressing all these problems and introduce more capabilities

The screenshot displays the 'Task Assistant R9 SP1 - v2.9.45' application window. The main area shows a 'Maintenance Schedule (1152 items)' table with columns for Component Name, Designation, Job Title, Job Description, Status, Due Date, Due RH, and Last Done Date. The table lists various maintenance tasks such as 'WATER BALLAST TANK ... WATER B...', 'M/E EXH. GAS & TURBOCHARGER SAFETY TESTS', and 'M/E BEARINGS SAFETY ... M/E BEAR...'. The status of these tasks varies, with some marked as 'Overdue' and others as 'Due'. The interface also includes a 'Task Navigator' on the right with a search bar and a list of tasks, and a 'Context Navigator' at the bottom right showing a 'Vessel List' with 'MT Balla' selected. The bottom status bar indicates '1152 items for Maintenance Schedule loaded.' and the system time is '5:13 pm'.

Component Name	Designation	Job Title	Job Descri...	Cr...	Ri...	Status	Due Date	Due RH	0...	Last Done Date	La
WB Tank	No.6 S	WATER BALLAST TANK ...	WATER B...	<input type="checkbox"/>	<input type="checkbox"/>	Overdue	10/07/2019	0	<input checked="" type="checkbox"/>	10/07/2018	
M/E Alarms and A...		M/E EXH. GAS & TURBOCHARGER SAFETY TESTS		<input type="checkbox"/>	<input type="checkbox"/>	Overdue	10/07/2019	0	<input type="checkbox"/>	10/04/2019	
M/E Alarms and A...		M/E BEARINGS SAFETY ...	M/E BEAR...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input type="checkbox"/>	11/04/2019	
Various Alarms An...		INTERMEDIATE SHAFT ...	INTERME...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input type="checkbox"/>	11/04/2019	
Various Alarms An...		VARIOUS E/R SAFETY T...	VARIOUS ...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input type="checkbox"/>	11/06/2019	
E/R Alarms & Trips		'DEAD MAN' IN PUMP R...	TEST :PU...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input type="checkbox"/>	11/06/2019	
WB Tank	No.2 P	WATER BALLAST TANK ...	WATER B...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input checked="" type="checkbox"/>	11/07/2018	
Steering Gear Alar...		STEER GEAR-BRIDGE C...	STEER GE...	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input type="checkbox"/>	11/04/2019	
Wires And Ropes		MONTHLY ROUTINE ON ...	MONTHLY...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input checked="" type="checkbox"/>	11/06/2019	
WB Tank	No.1 S	WATER BALLAST TANK ...	WATER B...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input checked="" type="checkbox"/>	11/07/2018	
WB Tank	No.2 S	WATER BALLAST TANK ...	WATER B...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input checked="" type="checkbox"/>	11/07/2018	
WB Tank	No.4 S	WATER BALLAST TANK ...	WATER B...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input checked="" type="checkbox"/>	11/07/2018	
M/E Alarms and A...		M/E MAIN L.O. SAFETY ...	M/E MAIN...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input type="checkbox"/>	11/04/2019	
Stern Tube L.O. S...		3 MONTHLY ROUTINE O...	3 MONTH...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input type="checkbox"/>	11/04/2019	
M/E Alarms and A...		M/E SHUTDOWN TESTS	M/E SHUT...	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input type="checkbox"/>	11/04/2019	
Local Fire Fighting ...		LOCAL FIRE FIGHTING ...	Local Fire ...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input type="checkbox"/>	11/06/2019	
Diesel Generator ...	No.3	D/G VARIOUS SAFETY T...	D/G VARI...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input type="checkbox"/>	11/04/2019	
WB Tank	No.3 S	WATER BALLAST TANK ...	WATER B...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input checked="" type="checkbox"/>	11/07/2018	
Fire Wires		MONTHLY ROUTINE ON ...	MONTHLY...	<input type="checkbox"/>	<input type="checkbox"/>	Due	11/07/2019	0	<input checked="" type="checkbox"/>	11/06/2019	
Purifier Space Exh...		3 MONTHLY ROUTINE O...	3 MONTH...	<input type="checkbox"/>	<input type="checkbox"/>	Due	12/07/2019	0	<input type="checkbox"/>	12/04/2019	
Vapour Emission C...		MONTHLY ROUTINE ON ...	CHECK SA...	<input type="checkbox"/>	<input type="checkbox"/>	Due	12/07/2019	0	<input type="checkbox"/>	12/06/2019	
Various Alarms An...		EMCY SWITCHBOARDS	EMCY SW...	<input type="checkbox"/>	<input type="checkbox"/>	Due	12/07/2019	0	<input type="checkbox"/>	12/04/2019	

Planned Maintenance

Modern PMS Systems

Critical Machinery is easily identified and all activities related to them are given priority:

The screenshot displays the 'Monitor Critical Components' window in a PMS software. The window title is 'Task Assistant R9 SP1 - v2.9.45 (Server Name: cmsrv-ulysses03, Database Name: B05P5e)'. The user is logged in as 'admin User: PMS Administrator Athens Office'. The main area shows a table of 42 critical components for vessel MT Balla. The table has columns for Vessel, Base Component, Component Name, Designation, and Model. The components include various systems like Alarms & Trips, Fire Fighting, Navigation Equipment, Emergency Power Supply, Fans/Ventilators, Fire Detection, and Lifeboats. On the right, there is a 'Task Navigator' pane showing a tree view of maintenance tasks, with 'Monitor Critical Components' selected. Below it is a 'Context Navigator' pane showing a list of vessels, with 'MT Balla' selected. The bottom status bar indicates '42 Items for Critical Components loaded.' and the time is 5:25 pm.

Vessel	Base Component	Component Name	Designation	Model
MT Balla	Alarms & Trips System()	Aux. Boiler Alarms and Trips	No.2	*MISSION OL
MT Balla	Alarms & Trips System()	Aux. Boiler Alarms and Trips	No.1	*MISSION OL
MT Balla	Equipment()	Bridge & Communication Equipment		S811
MT Balla	Fire Fighting()	Cargo Area Deck Foam System		S811
MT Balla	Alarms & Trips System()	Cargo Pump Alarms And Trips		KV450-3-
MT Balla	Main Engine()	Crankcase Oil Mist Detector		HYUNDAI B&W 6G60M
MT Balla	Primary Navigation Equipment()	ECDIS		WITH HDD
MT Balla	Primary Navigation Equipment()	Echo Sounder		-
MT Balla	Emergency Power Supply()	Emcy Generator Electric Starting Sy...	1	
MT Balla	Emergency Power Supply()	Emergency Generator		M46.2 M3 C6/4
MT Balla	Emergency Power Supply()	Emergency Generator Diesel Engine		AD086YIS
MT Balla	Fans / Ventilators()	Fan AWA-300	Garbage Locket Exh Fa	AWA-300
MT Balla	Fans / Ventilators()	Fan AWA-300	Paint Locker Exhaust	AWA-300
MT Balla	Fire Fighting()	Fire Detection & Alarm System		s811
MT Balla	Fire Fighting()	Fire Fighting Equipment		.
MT Balla	Fire Main System()	Fire Main Piping		s811
MT Balla	Fire Fighting()	Fire Main System		.
MT Balla	Fire Fighting()	Fixed CO2 Fire Extinguishing System		..
MT Balla	Equipment()	Gas Detection System		SW2020
MT Balla	Pollution Prevention/Environmental()	Incinerator		HMP-16M3
MT Balla	Inert Gas System and Alarms()	Inert Gas Alarm And Safety System		HHI2
MT Balla	Life Saving()	Life Saving Appliances		.
MT Balla	Lifeboats()	Lifeboat Engine	Stbs	NoA

Planned Maintenance

Modern PMS Systems

Dry-docking scheduling is practically ready with the click of a button

The screenshot displays a software interface for monitoring maintenance jobs. The main window is titled "Monitor Jobs For Dry Dock" and shows a list of jobs for the vessel "MT Balla". The interface includes a "Task Navigator" on the right, a "Context Navigator" at the bottom right, and a "WorkPlace" area on the left. The main table lists various components and their scheduled maintenance jobs.

Component Name	Status	Component...	Job Title	Type	Critical	Due Date	Due Runni...	Con
Accommodation Ladder Falls	Scheduled		2 AND A HALF YEARLY ROU...	Deck Main...	<input type="checkbox"/>	28/10/2019	0	
Accommodation Ladder Winches	Scheduled		OVERHAUL OF ACCOMMOD...	Machinery...	<input type="checkbox"/>	28/04/2022	0	
Air Condition Compressor	Scheduled	No.1	OVERHAUL OF AIR CONDIT...	Machinery...	<input type="checkbox"/>	28/04/2022	0	
Air Condition Compressor	Scheduled	No.2	OVERHAUL OF AIR CONDIT...	Machinery...	<input type="checkbox"/>	28/04/2022	0	
Air Receiver	Scheduled	Service	OVERHAUL OF AIR RECEIVER	Machinery...	<input type="checkbox"/>	28/04/2022	0	
Air Receiver	Scheduled	No.1	OVERHAUL OF AIR RECEIVER	Machinery...	<input type="checkbox"/>	28/04/2022	0	
Air Receiver	Scheduled	Auxiliary	OVERHAUL OF AIR RECEIVER	Machinery...	<input type="checkbox"/>	28/04/2022	0	
Air Receiver	Scheduled	No.2	OVERHAUL OF AIR RECEIVER	Machinery...	<input type="checkbox"/>	28/04/2022	0	
Air Receiver	Scheduled	Control	OVERHAUL OF AIR RECEIVER	Machinery...	<input type="checkbox"/>	28/04/2022	0	
Anchor And Chains	Scheduled		OVERHAUL OF ANCHORS A...	Deck Main...	<input type="checkbox"/>	28/04/2022	0	
Ballast Stripping Eductor	Scheduled		OVERHAUL OF BALLAST ST...	Deck Main...	<input type="checkbox"/>	28/04/2022	0	
Bedplate	Scheduled		OVERHAUL OF MAIN ENGIN...	Machinery...	<input type="checkbox"/>	28/04/2022	0	
Boiler Uptake Valves	Scheduled		OVERHAUL OF BOILER UPT...	Machinery...	<input type="checkbox"/>	28/04/2022	0	
Bulkhead Isolating Valve	Due		OVERHAUL OF BULKHEAD I...	Deck Main...	<input type="checkbox"/>	28/04/2020	0	

Task Navigator: admin User: PMS Administrator, Athens Office. Search: Monitor Jobs For Dry Dock.

Context Navigator: Search: [Empty]. Only search below highlighted item.

Vessel List: MT Agrari, MT Alicante, MT Balla (highlighted), MT Belmar, MT Bonita, MT Bora Bora, MT Bordeira, MT Botafogo, MT Burri, MT Calda, MT Carmel, MT Cascais.

274 Items for Jobs For Dry Dock loaded. 5:47 μμ

Planned Maintenance

Modern PMS Systems

Maintenance reporting made simple & consistent

The screenshot displays two overlapping windows from a PMS application. The background window, titled 'Monitor Maintenance Reports', shows a table of maintenance tasks. The foreground window, titled 'View Scheduled Job Maintenance Report', provides a detailed view of a specific job.

Monitor Maintenance Reports (Background Window)

Type	Component Name	Designation	Maintenance Report Title
	Cargo Pump	No. 3 COP	6 MONTHLY ROUTINE C
	Pump ACE 032L3 NTBP	No. 2 HFO P...	3 MONTHLY ROUTINE C
	Pump ACE 032L3 NTBP	No. 2 M/E S...	3 MONTHLY ROUTINE C
	Cargo Pump	No. 2 COP	6 MONTHLY ROUTINE C
	Pump FEWV-300-3D	No. 1 Scrub...	3 MONTHLY ROUTINE C
	Pump ACE 032L3 NTBP	No. 1 HFO P...	3 MONTHLY ROUTINE C
	Pump ACE 038K3 NTBP	No. 1 M/E F...	3 MONTHLY ROUTINE C
	Cargo Pump	No. 1 COP	6 MONTHLY ROUTINE C
Safety Maintenance	Lifeboat Davit	Port	MONTHLY ROUTINE ON
	Lifeboat HDL71CFA	Stbd	MONTHLY ROUTINE MA
	Lifeboat HDL71CFA	Stbd	3 MONTHLY ROUTINE M
	Lifeboat HDL71CFA	Port	3 MONTHLY ROUTINE M
	Lifeboat HDL71CFA	Port	MONTHLY ROUTINE MA
	Lifeboat Davit	Stbd	MONTHLY ROUTINE ON
	Fire Fighting Equipment		MONTHLY ROUTINE ON
	Life Saving Appliances		MONTHLY ROUTINE ON
	Fire Fighting Equipment		MONTHLY ROUTINE ON
	Life Saving Appliances		MONTHLY ROUTINE ON
	Cargo Area Deck Foam System		MONTHLY ROUTINE ON
	Fire Fighting Equipment		MONTHLY ROUTINE ON

View Scheduled Job Maintenance Report (Foreground Window)

Scheduled Job Maintenance Report

MONTHLY ROUTINE ON LINE THROWING APPARATUS

Completion Report

Vessel: MT Balla

Component: Life Saving Appliances()

Report Title: MONTHLY ROUTINE ON LINE THROWING APPARATUS

Work Performed:

Stowage and condition of equipment checked.
No sign of wearing and deterioration
Expiry date: December 2019

All found in good condition and ready for use.

Performed By: 2nd off

Date Performed: 09/07/2019

Man Hours Required: 0.3

Component Condition: GOOD

No Spares Recommendation - No Spares Consumed

Pages:

- Completion Report
- Job Details
- Activity Description
- Special Job Instructions
- Maintenance History
- Comments
- Materials Used
- Related Files

Planned Maintenance

Modern PMS Systems

With clear evidence that maintenance is actually carried out

Task Assistant R9 SP1 - v2.9.45 (Server Name: cmsrv-ulysses03, Database Name: BOSPSse)

Monitor Maintenance Reports
Maintenance Reports for: MT Balla

Task Navigator
admin User: PMS Administrator
Athens Office

WorkPlace
Maintenance Reports
Maintenance Reports (Last 30 Days)
Maintenance Reports (Not Reviewed)
Maintenance Reports (Last Year)
Maintenance Reports (All)

View Scheduled Job Maintenance Report

Scheduled Job Maintenance Report

MONTHLY ROUTINE ON MAGNETIC COMPASS

Related Files

Vessel: MT Balla
Component: Magnetic Compass()

Activity:

Name	Filename	Description

Maintenance Report:

Name	Filename	Description
IMG_5849	IMG_5849.JPG	
IMG_5850	IMG_5850.JPG	
IMG_5851	IMG_5851.JPG	
IMG_5852	IMG_5852.JPG	
IMG_5853	IMG_5853.JPG	
IMG_5854	IMG_5854.JPG	

98 Items for Maintenance

Task Navigator
MAINTENANCE Plug In
Maintenance Monitoring
Monitor Current Work Plan
Monitor Component Running...
Monitor Critical Components
Monitor Maintenance Reports
Monitor Unscheduled Maintenance
Preview 5yr Maintenance Schedule
Monitor Jobs For Dry Dock
Vessel Survey Status

IMG_5853.JPG - Windows Photo Viewer

IMG_5850.JPG - Windows Photo Viewer

Planned Maintenance

Modern PMS Systems

Measurements and calibrations during overhauling service are reported within the planned maintenance activity

Form Viewer

You are viewing the following form instance : [TEC/510] TEC/510:Main Engine Cylinder O/H Report

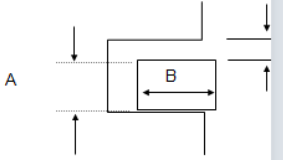
Export Print Add Files Remove Files View File Export Attachment(s) Edit Attachment Info Close

Form Properties History Additional Contexts Attachments

File

N47

PISTON RINGS IN USE (after o/h)				PISTON RINGS in mm				(When 'B' has more than 15% wear must be r				
TYPE	HEIGHT	MARK		A	B	C	New	Used				
1 DRYDOCK	NEW	No Record					<input checked="" type="checkbox"/>	<input type="checkbox"/>				
2 DRYDOCK	NEW	No Record					<input checked="" type="checkbox"/>	<input type="checkbox"/>				
3 DRYDOCK	NEW	No Record					<input checked="" type="checkbox"/>	<input type="checkbox"/>				
4 DRYDOCK	NEW	No Record					<input checked="" type="checkbox"/>	<input type="checkbox"/>				
5							<input type="checkbox"/>	<input type="checkbox"/>				
6							<input type="checkbox"/>	<input type="checkbox"/>				



ACCESSORIES

	Yes	No	FUEL / LUBS DATA	
Telescopic cooling pipes overhauled	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Fuel oil type	IFO 38
Telescopic cooling pipes replaced	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Cylinder oil type	SHELL / ALB
Stuffing box overhauled	<input type="checkbox"/>	<input type="checkbox"/>	System oil type	SHELL / MEL
Stuffing box rings replaced	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Piston crown engraved marks	

REMARKS:

SPANOS M

WF.TEC.510

Ready

100%

Planned Maintenance

Maintenance KPIs

- KPIs are measured on a quarterly and annual basis.
- Targets are set based on previous year performance

KPI	Actual 2ndQuarter	Target	
		Short Term	Long Term
1 Maintenance Outstanding PMS Activities KPI- 12 Month running Average	2.71%	3%	3%
2 Critical machinery failures per vessel (YTD)	2.37	2.5 Defects/Ship	2 Defects/Ship
3 Critical machinery defects over all defects KPI (YTD)	8.16%	15%	10%
4 Critical defects over all unscheduled jobs (YTD)	1.80%	2.5%	2%
5 Unscheduled jobs as a percentage of all jobs (YTD)	2.69%	2.5%	2%
6 Rescheduled Jobs (YTD)	1.56%	2.5%	2%
7 M/E Performance Monitoring - Engines not meeting optimal running conditions	8.9%	5%	3%
8 Lub oil analysis results	1.2%	3%	2.5%
9 Stoppage days over total operating days	0.342%	0.15%	0.12%

Performance monitoring & analysis

Monitoring of Key Performance Indicators enable management to evaluate the efficiency of the fleet and take appropriate actions and measures when the targets are not met.

Performance monitoring & analysis

Thank you for your attention!