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)
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 send 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.
Noon reports in the earlier days when no email services existed, where 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:

**Location, Speed & prevailing weather condition**
- **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: 24 HRS
  - WEATHER: SW
  - WIND FORCE: 6
  - SEA: ROUGH
- **ETA COCHIN 23RD JULY 2001 1000 HRS. LT**

**Fuel consumptions & engine data**
- **ENGINE NOON REPORT**
  - R.P.M: 111.3
  - FUEL CONSUMED: ME/DG 26.3 MT / 3.1 MT
  - FUEL ON HAND:IFO 1031.4 MT
  - LS/HSMGO: 25.0 MT/68.6
  - STEAMING TIME: 24 HRS
  - OBSERVED DIST: 307 NM
  - DIST BY ENGINE: 340 NM
  - SLIP: 9.7%
  - FRESH WATER ON HAND: 159 M3
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)
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.
With time the number of reported parameters became larger and more details were added.

Voyage Performance monitoring & analysis

A Historical Review – Noon Reports
Voyage Performance monitoring & analysis

A Historical Review – Noon Reports

The abstract from the engine log book added as well.
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.
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.
Data collected either from noon reports or real time, are analysed using powerful Business Intelligence (BI) tools:
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:
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, e.g., a light bulb fail before you replace it. To the opposite, unplanned maintenance follows the “fix it 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 to 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
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 the described the maintenance to be performed
- Maintenance logs for logging down the activities done
- Forms for recording measurements
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.
### 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.

#### Spreadsheet Example

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Work</th>
<th>Interval</th>
<th>Date Lost Done</th>
<th>Engine Total Running Hours When Work</th>
<th>Run Hours Since Last Done</th>
<th>Remaining Hours</th>
<th>Due Date</th>
<th>Remaining Days</th>
<th>Work Schedule &amp; Record for the Year</th>
<th>2008</th>
<th>Extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Cylinder unit</td>
<td>overhaul</td>
<td>3-a</td>
<td>10,000</td>
<td>25,11.67</td>
<td>15,000</td>
<td>4,000</td>
<td>22.10.08</td>
<td>3-b</td>
<td>JAN</td>
<td>2150</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Piston crown</td>
<td>removal when required</td>
<td>3-c</td>
<td>20,000</td>
<td>25,09.67</td>
<td>2,500</td>
<td>17,500</td>
<td>18.06.08</td>
<td>3-d</td>
<td>FEB</td>
<td>21,500</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Cylinder liner</td>
<td>removal when required</td>
<td>3-e</td>
<td>60,000</td>
<td>25,09.67</td>
<td>0</td>
<td>60,000</td>
<td>10.10.12</td>
<td>3-f</td>
<td>MAR</td>
<td>1540</td>
<td>31.10.08</td>
</tr>
<tr>
<td>34</td>
<td>Stuffing box</td>
<td>overhaul</td>
<td>3-g</td>
<td>16,000</td>
<td>25,09.67</td>
<td>12,500</td>
<td>3,500</td>
<td>10.01.03</td>
<td>3-h</td>
<td>APR</td>
<td>1540</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Exhaust valve stem</td>
<td>overhaul</td>
<td>3-i</td>
<td>4,000</td>
<td>25,09.67</td>
<td>3,400</td>
<td>600</td>
<td>16.01.00</td>
<td>3-3</td>
<td>MAY</td>
<td>1540</td>
<td></td>
</tr>
</tbody>
</table>

**Due Date Comments:**
- Over 30 days before due date, cell's colour becomes white.
- From 0 up to 30 days before due date, cell's colour becomes yellow.
- If over due data cell will be white colour and empty.

**Mark X for the Month of Due Date Comments:**
- Over 30 days before due date cell's colour becomes yellow.
- From 0 up to 30 days before due date cell's colour becomes yellow.
- If over due data cell's colour becomes red.
- If special attention is required, cell's colour becomes pink.

**Extension Comments:**
- Extension date granted by the office after relevant correspondence with Chief Engineer.
- Records should be kept in file.
Contemporary computerized systems such as Task Assistant are addressing all these problems and introduce more capabilities.

Planned Maintenance

A Historical Review – Modern PMS Systems
Critical Machinery is easily identified and all activities related to them are given priority:
Planned Maintenance
Modern PMS Systems
Dry-docking scheduling is practically ready with the click of a button.
Planned Maintenance
Modern PMS Systems

Maintenance reporting made simple & consistent
Planned Maintenance
Modern PMS Systems

With clear evidence that maintenance is actually carried out
Measurements and calibrations during overhauling service are reported within the planned maintenance activity.
### Planned Maintenance

#### Maintenance KPIs

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

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