December 15, 2014

Final Report – "Energimyndigheten" co-financing project, project nr: 38070-1:

Marorka Propulsion module installation dates:

Cavatina: 27-Jan-2014
Calypso: 21-Jan-2014
Corrido: 17-Feb-2014

AE massflow meter (MFM) installation dates:

Cavatina: 05-Jul-2014
Calypso: 10-Jun-2014
Corrido: 04-Jun-2014

Final commissioning dates of AE MFM (within the Marorka system):

Cavatina: 24-Sep-2014
Calypso: 25-Sep-2014
Corrido: 15-Oct-2014

Comparison of accuracy of ME fuel consumption pre and post massflow meter installation:

When calculating the Fuel Oil Consumption on the Main Engine (ME) the consumption of the Auxiliary Engines (AE) is deducted from a Mass Flow Meter (MFM) that measures the total (ME+AE) consumption.

Prior installation of the AE MFM's the AE consumption was manually calculated by taking readings (difference between supply and return) from the Volumetric Flow Meters (VFM), multiplied with density at the correct temperature. This is done automatically in Marorka).

As can be identified on the following graphs, the ME Specific Fuel Oil Consumption (SFOC) has become substantially lower and closer to design criteria due the higher accuracy in having MFM's also for the AEs.

When taking management decisions onboard on fuel and speed management (small power/speed reductions, using large radius for turns, controlling speed/power vs. weather and generally following our Energy Management System and SEEMP) then it is very important to have a correct measurement of the consumption for the ME.

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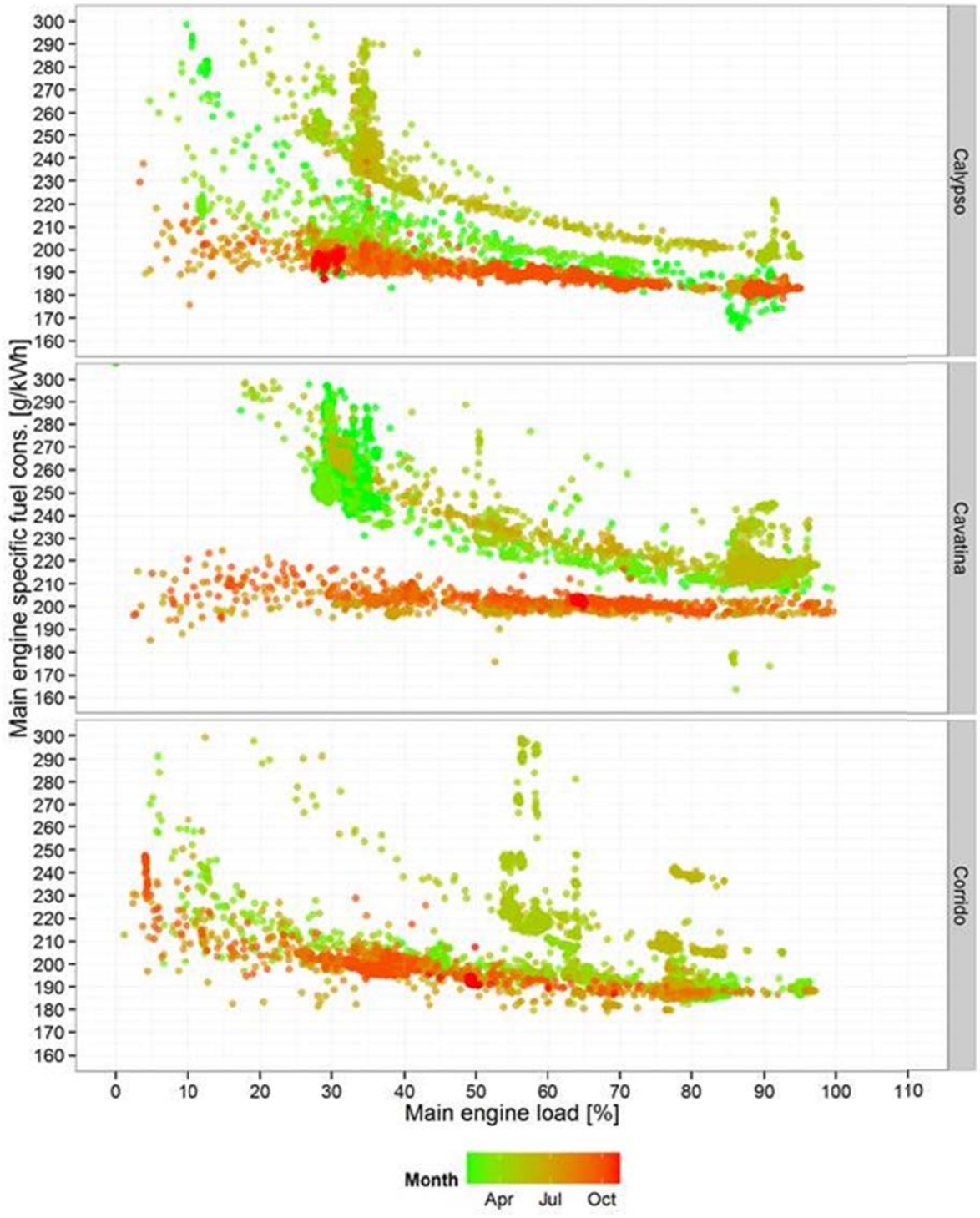
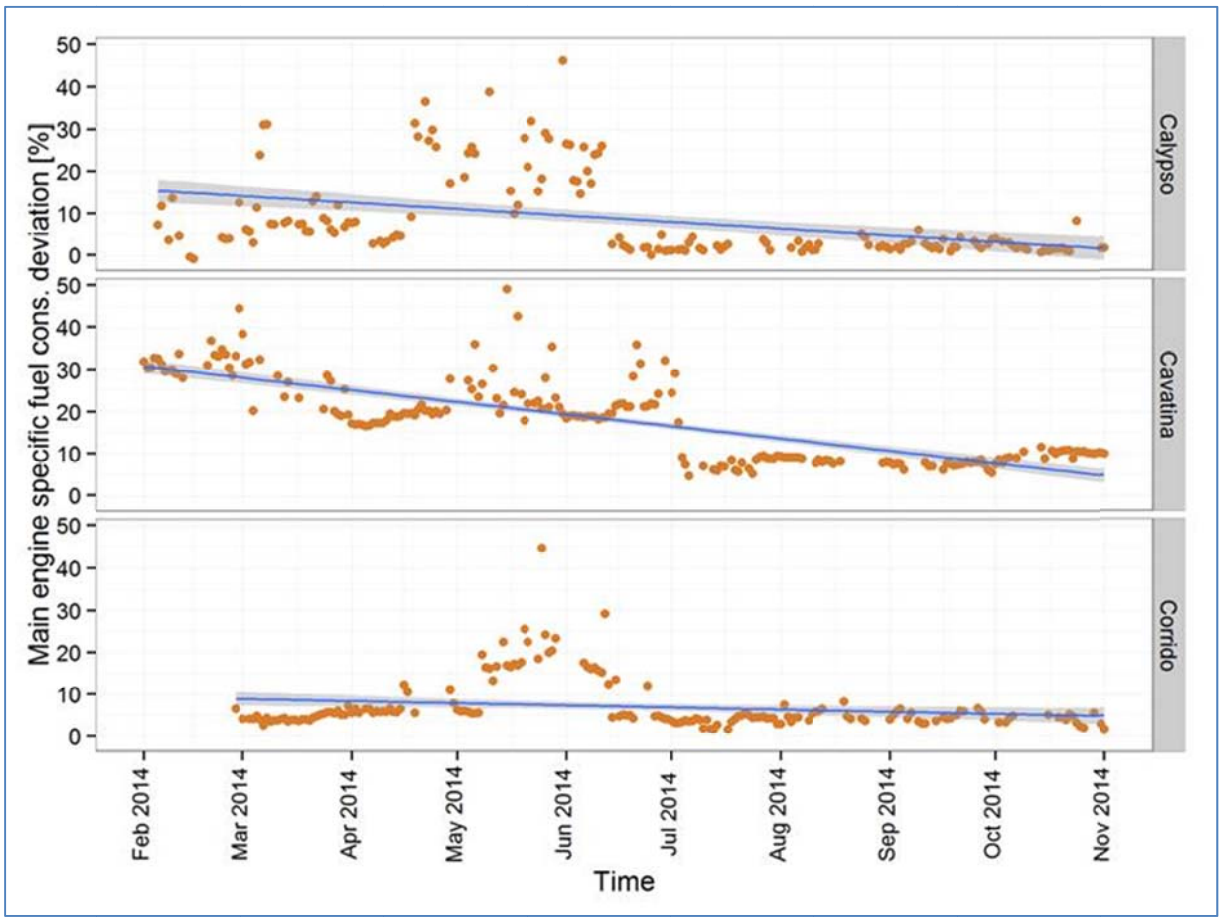

Main engine specific fuel cons. [g/kWh]
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
Calypso
Cavatina
Corrido
0
10
20
30
40
50
60
70
80
90
100
110
Main engine load [%]
Month
Apr
Jul
Oct



The comparisons show an approx. variation of in between 0-25% for the ME SFOC (when removing impossible erroneous readings) at different ME load. The comparisons do also show that the wrong readings, prior final commissioning of the installed AE MFM's, has been substantially reduced and can now be considered as being close to manufacturers claimed SFOC (see orange/red measurements in above diagrams).

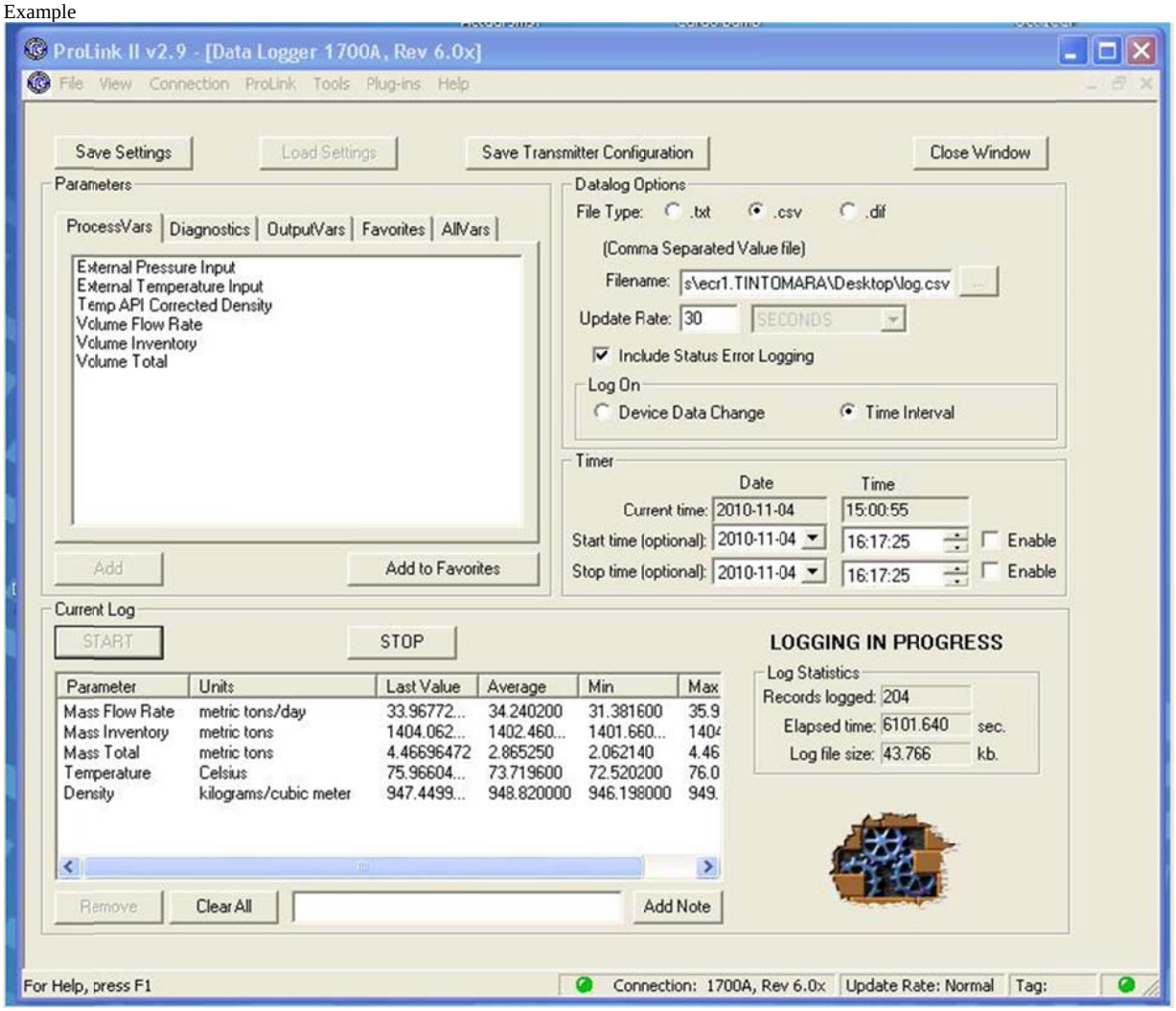
As the main MFM measure the total consumption (AE's and ME) the resulting very high SFOC on the ME prior commissioning then naturally resulted in that the AE's had a general lower consumption.

Apart from what already has been mentioned and that we now have very accurate means to measure our ME and AE's fuel oil consumption we had initially issues to get both the Marorka Propulsion module and the new MFM's for AE's to operate as intended.

But when once the installed MFM's were properly commissioned, one never has to question the accuracy of the measured fuel. Thus if values are unrealistic, it is possible to find the reason, like internal leakage in a fuel oil supply module (valves, no-return valves, safety valves) etc.

The MFM comes with a software tool (Pro Link), that is used to log the consumption in real time and with very high accuracy. This is very useful when performing trials etc.

Example

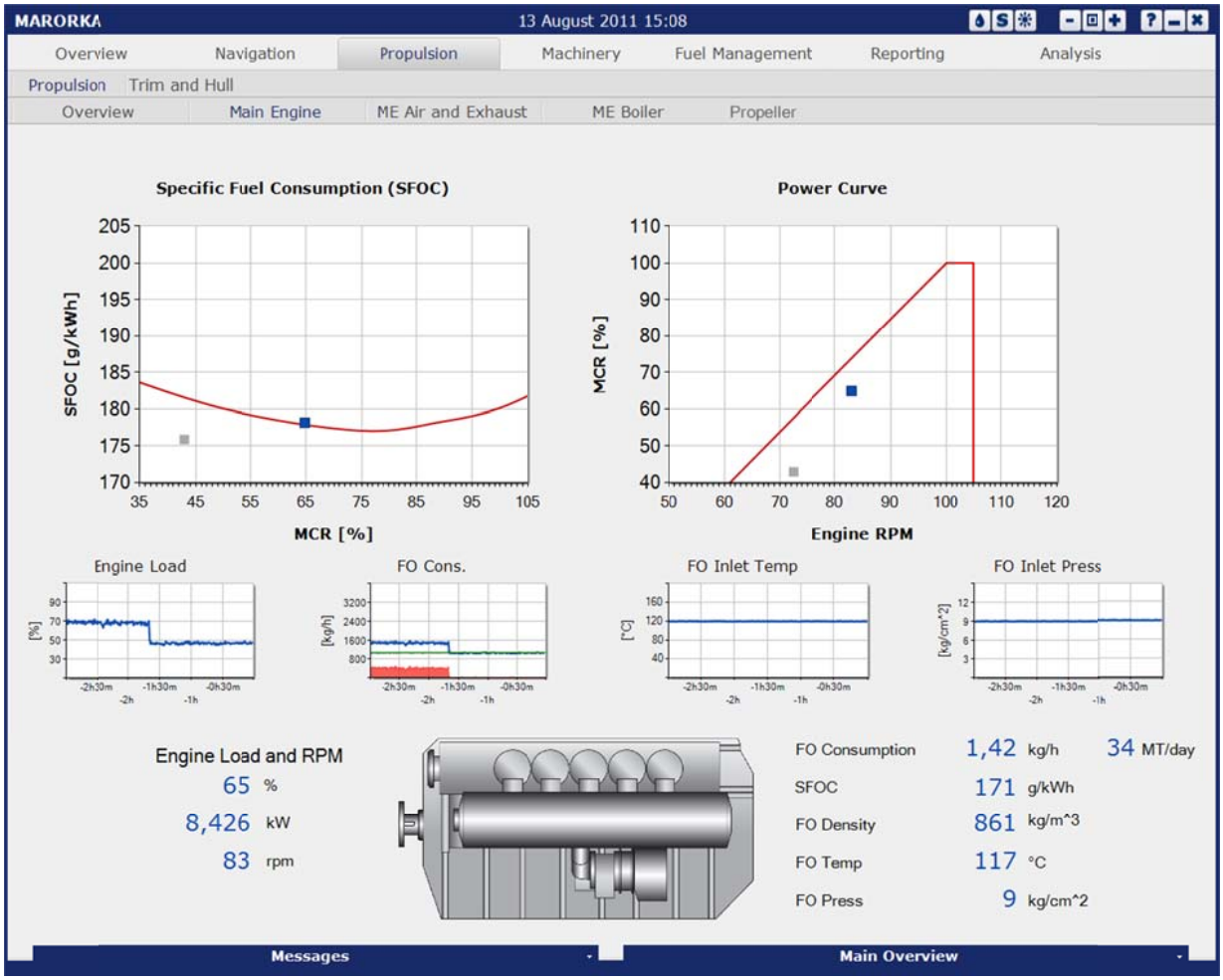


Marorka Data logging system

When being able to very accurately measure the ME consumption it is possible to take steps to avoid higher consumptions. The last year the consumption for propulsion (i.e. Main Engine) represents 75% of the total consumption (which for these three vessels was around 15.000 MT of Fuel Oil). If saving 5%, the total savings in having the Marorka data logging system installed during one typical year will then be approx. 750 MT of less fuel oil consumed which equals approx. 2.300 MT less CO_2 emitted to the atmosphere.

From now on it will become possible to take management decisions directly onboard as described previously and thus in real time the crew will be able to see how much fuel that is saved.

See screenshot from the Marorka Propulsion Module here below (example), where e.g. the available dip in the engine load easily gives the operator onboard a confirmation that the correct action has been taken (the red marked area in the FO Cons. diagram disappears):



Conclusions

During this trial-period the wrong measuring prior having the AE MFM's correctly commissioned has been the key issue in the entire project.

The measuring of fuel consumption, exactly quantified, for Main Engine and for Auxiliary Engines constitutes together with the quoted text here below the proven savings in having a data logging system installed onboard.

Extracted text from our Marorka project:

Quote

Facts on savings from having the Marorka data log system

From when the Marorka data log was installed on Tosca (Mar 2012) until when the Environmental Manager visited Tosca (May 2012) at which time he instructed the crew how they should use the system onboard, the ship consumed 91,5 kg/nm @ an average speed of 12,7 knots. From after the visit onboard until just prior the hull cleaning (Aug 2012) the ship consumed only 82,9 kg/nm @ an average speed of 12,6 knots.

All data above was filtered to speeds over 10 knots and weather conditions better than 5 Beaufort.

The difference made a total saving of 137 MT of HFO based on the sailed distance in the latter period. If comparing with a MT/day figure for the mentioned period (now including all speeds and weather conditions) it is around 1.4 MT per day.

This represent a 9,4% energy saving due to managing speed/power/weather/turns in a better way. However to avoid possible errors we would only like to use the figure 5% as representative when talking about energy savings due to having a data logging system.

So without Marorka and proper instructions to use it, the vessel would have continued consuming as during the first period.

Unquote

During this evaluation period a group of 4 Chalmers students (Energy Efficiency Management course led by Hannes Johnson) have been performing a parallel study of the effects of having the Marorka Propulsion Module installed.

Their report will be delivered to Hannes Johnson around 19th of December and will then be evaluated prior its final issuance sometime in January 2015.

As per agreement with Kenneth Asp the late arrival of that final report is accepted by the Swedish Energy Board.

Pär Brandholm
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