Performance Monitoring and Analysis for Operational Improvements

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Reduction of GHG emissions from shipping was recently adopted as part of regulations in IMO MEPC. SEEMP (Ship Energy Efficiency Management Plan) is one of the regulations. It is about a management process to request ship owners to apply energy efficient ship operation measures and improve them with PDCA (Plan-Do-Check-Act) cycles. Performance monitoring and analysis is a key function in the PDCA process to identify cause of GHG emissions quantitatively and to take corrective actions.

Shipping companies have already made similar efforts as SEEMP according to increase of bunker cost. Slow steaming is one of most known examples and about 40 % of fuel consumption and GHG emissions can be saved by reducing speed from 24 knot to 20 knot, 16%. But at the same time, we can observe variances in total amount of fuel consumptions even for same service with same size of ships. To identify cause of additional FOC factors, we need more precise and reliable data and analysis.

Conventionally daily data for performance monitoring are used in shipping. The comparison of data interval 1 day and 1 hour clearly shows that 1 hour speed (OG and log) data gives good information about speed profiles and effects of currents. To take 1 hour interval data from ships, automatic data collection equipment onboard is necessary. As an example implementation, FUELNAVI onboard system and shore management system SIMS (Ship Information Management System) were developed. In the following, case studies with FUELNAVI and SIMS are shown.

There are several feedback loops with the performance monitoring system. Captains onboard can see realtime ship performance, such as OG voyage distance per unit fuel consumption. They can adapt engine RPM according to the information. By using trip meter function, captains onboard can test such as actual optimum trim with an optimum trim chart. Shore operators can check if vessels operate according to voyage plan. If they find vessels deviate from allowable limit, they will communicate with vessel and revise plans. The data is also sent to weather routing provider. They will check ship's performance models for simulation and weather information with forecasted data. If deviations are found, they will revise their weather routing recommendations. Performance analysis reports are provided to operations. It will identify causes of additional FOC factors and clarify base performances of sister vessels.

The performance analysis report consists of about 10 pages of contents. Voyage overview is a trend graph of speed, RPM, M/E load and slip. Breakdown analysis of total FOC is shown with comparison to past records averages, in terms of additional FOC by speed, weather, distance and optimum speed profiles. Base performance can be extracted by data filtering with calm sea conditions. Additional FOC by weather is identified by comparison between power curve at base performance and average curve in the voyage. It is a similar concept to the sea margin in ship design. Review of given weather routing and coaching comments are also included in the report. The reports are shared among ship, technical management company, ship operators and weather routing provider.

SIMS is now installed on a liner fleet widely and good examples by using SIMS have been observed. As the next step, integration of weather routing and SIMS are currently undergoing. Feedback of SIMS monitoring data is essential for ship model calibration in weather routing and it will result in better recommendations. Roadmap of performance monitoring development is finally shown and the direction is in line with SEEMP.

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