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Wallem to install DNV Navigator on 190 ships

Wallem Ship Management has agreed a deal that will see the company install a software system from DNV Maritime Partner across its fleet of managed vessels

Wallem Ship Management in Hong Kong has ordered the DNV Navigator software system for its managed fleet of more than 190 ships.

DNV Navigator is a decision support tool used onboard ship to assist the Master in managing port operations. This new contract with Wallem is the largest ever signed for the software system, and was agreed after the successful completion of a trial programme.

Using the application, more than 1,200 port clearance forms are automatically filled in with ship data so that required paper work can be prepared quickly.

It includes a database of information about all world ports and terminals, including publications and data from UKHO, IHS Fairplay and other sources. Arrival and departure procedures for all major ports are available, as well as a nautical library providing maritime-specific information.

A Master's Notes functionality is included, which is used for sharing port specific knowledge within the fleet. Information can also be shared with other systems, such as gangway control systems and ECDIS.

The contract with Wallem additionally includes a Work and Rest Hours module to manage compliance with international legislation on rest hours for seafarers, particularly the Maritime Labour Convention 2006 and the Standard of Training, Certification and Watchkeeping for Seafarers.

Any violation of regulations will be identified, and user-defined reports can be generated.

Captain Deepak Honawar, Wallem's director of safety and quality, and Kaveh Mansoorian, DNV senior customer service manager, signing the contract in Hong Kong

Crew timesheets can also be created in MS Excel, and the system allows for company-specific forms to be added and for data to be shared with other company-specific or third party systems.

"Wallem is striving continuously to manage their fleet in safer and more cost effective ways," said Captain Deepak Honawar, Wallem's director of safety and quality.

"We were impressed by how quickly DNV responded to our demands and added new elements in the system. We have great expectations for the use of DNV Navigator and believe the product will play a key role in our portfolio of on-board applications."

Software growth

This new contract with Wallem represents a significant coup for the DNV software team, which celebrated the subscription of the 2,000th ship using its software when it was implemented by the container vessel HS Chopin, owned by Hansa Shipmanagement in Hamburg, during the fourth quarter of 2011.

The company has managed to reach this level in less than 10 years, with DNV Navigator having been introduced in 2002.

"Industry feedback indicates that the on board paperwork burden is reduced by as much as 90 per cent," said Odd Arne Haueng, head of DNV Maritime Partner.

"This enables ships' officers to focus on what should be their primary responsibility, that is operating the ship in a sound and safe way both at sea and in port."

Wallem commenced roll-out of DNV Navigator across its fleet in March 2012.

DS

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Leveraging vessel data for efficient ship operation

Following an extensive programme of research and investment, Japanese company NYK Line is in the process of implementing a range of technologies that will use data transferred directly from its vessels by satellite to improve operational efficiency. Hideyuki Ando, Monohakobi Technology Institute (R & D company for NYK Line) spoke to *Digital Ship* about NYK's vision for the future

Constantly increasing bunker prices, the recent economic downturn and an increase in the number of international regulations have made management of fuel oil consumption a vital concern for ship operators.

The economic crisis and subsequent slow recovery have added to the strain that shipping companies are experiencing, and additional pressure to improve their energy efficiency has been exerted by initiatives such as the recently adopted Ship Energy Efficiency Management Plan (SEEMP) and Energy Efficiency Design Index (EEDI), mandatory from January 2013.

This ship efficiency framework aims to create improvements in energy efficiency through more efficient engines and propulsion systems and improved hull designs on larger ships, in order to achieve reduced fuel oil consumption and resulting CO2 emissions on a capacity basis.

In this environment, a large number of different approaches to reduce the fuel used by vessels have been tested and applied over the last number of years.

Japanese shipping company NYK currently operates around 800 vessels, necessarily consuming vast quantities of fuel oil, as well as producing emissions, that it is eager to reduce.

In this regard, the company is constantly innovating and improving its fleet operation with the aim of optimising safety, economy and protection of the environment. One of its most innovative concepts is the NYK Super Eco Ship 2030, which represents the Japanese shipping company's vision of the future.

This concept has been developed in accordance with NYK's ambitious goal of achieving zero emissions by 2050, in cooperation with the Monohakobi Technology Institute (MTI), Elomatic (a marine consulting company in Finland), and Garroni Progetti (a ship designer in Italy), as Hideyuki Ando, project manager, technical strategy group, MTI, Monohakobi Technology Institute (R & D company of NYK Line), explains.

"This concept is hoped to lead the development of shipping operations, including cargo handling and traffic infrastructure," notes Dr Ando. "Moreover, we hope that NYK Super Eco Ship 2030 will inspire many young people to pursue shipping services or marine technology."

While the NYK Super Eco Ship 2030 is a vision of the future, as part of the project's development NYK has already begun the implementation of a considerable number of fuel-saving technologies.

As Dr Ando explains, at NYK, similar to many other large companies, a ship information management system (SIMS) is employed. This information management system draws on data collected both onboard and on shore.

A device on the ship that NYK calls 'FuelNavi' collects data from a number of different sources, such as the engine and data logger in the engine room (containing data from the main engine, the FO flow meter and the torque meter) and the VDR/ECDIS (importing data from the GPS, the Doppler log, the anemometer and the gyro compass), as well as the motion sensor on the bridge.

A monitoring system on board the vessels then allows the master to view and assess the collected data.

After the information is collected NYK uses the ship's satellite communication system to transfer the data to its operations centre in Singapore, where it is evaluated and compared with technical analyses supplied by NYK's research institute.

NYK Line's vessels are implementing a range of new technologies to drive efficiency in operations

Shore-based staff in the operations centre use a 'SIMS viewer' for hourly trend monitoring of various indicators, including speed, M/E RPM, fuel oil consumption and other conditions, as well as to compare planned and actual schedules.

Ultimately, a voyage analysis report is created, with a breakdown of the fuel oil consumption for each voyage. This is sent to the master of the vessel and the operator in order to provide feedback.

The onboard data is also sent to weather routing service providers to help to improve their services.

Developing energy efficient operations

NYK's expressed target is to have zero emissions by 2050, and one important stepping stone on the way to achieving this goal is optimal operational management, through a process which NYK calls its 'PDCA cycle for improvement'.

PDCA stands for 'Plan, Do, Check and Act', or take corrective action. This scheme, which is currently being implemented on the company's container vessels, represents a comprehensive and all-encompassing view of ship operational efficiency.

"The PDCA cycle is one of our visions in order to fully optimise our fleet operation," explains Dr Ando.

"We are still in the progress stage, and this method belongs to the most advanced examples of container fleet operation applied at NYK today. Additionally, once the numerous remaining issues for bulkers, tankers, car carriers and other ship types are solved, we are hoping to expand the PDCA cycle to all our vessels."

NYK has found that effective communication between ship and shore and unimpeded information flows between all stakeholders are essential in order to improve operational efficiency effectively. As such, satellite communications play a key role in the implementation of these systems.

As Dr Ando explains, the information and communication systems need to function in tandem in order to encourage stakeholders to participate in energy efficient operation, suggesting that offering incentives to stakeholders may be a useful step.

"Even financial incentives might be in order," he says. "For example if a fuel oil reduction is achieved through an extremely high effort or brought forward through a very good idea, this stakeholder should be rewarded."

However, he also admits that this is easier said than done.

Firstly, every stakeholder needs to fully understand the target and to be aware of how a change in schedule can affect the fuel oil consumption. Additionally, an extensive information sharing process is required in order for all decisions to be based on accurate information.

As such, an important prerequisite before any information sharing system can be established is a fully capable satellite broadband connection.

"In order to improve the system, we need maritime broadband, such as FleetBroadband or VSAT," says Dr Ando.

"This is especially important in view of the necessary real-time information sharing. In order to optimise our vessels with regards to energy efficiency, large data transfers and full-time connectivity are essential."

Weather routing

NYK started its research and development of energy efficiency measures with the trial of an on-board weather routing system in 2005-2006.

"Before the modern weather routing was developed, the traditional weather services could do no more than help to avoid severe weather," says Dr Ando.

"Nowadays, weather routing providers, such as WNI (Weather News Inc) or AWT (Applied Weather Technology), are moving forward to minimise the fuel oil consumption and to provide optimal weather routing."

"There is a huge demand from operators for optimum weather routing, which we, at NYK, regard to contain the best balance of safety, schedule keeping, economy and environment."

Although, NYK considers the use of weather routing to be highly effective, the shipping company has also found that the providers need to cooperate with shipping companies to optimise their services with regard to fuel oil consumption.

These service providers require comprehensive information, including detailed ship performance models to calculate the best route for each weather and vessel type. In addition, the calculations should take into account the individual vessel's RPM, speed and fuel oil consumption, as well as ship motion and performance in severe weather.

This information, which is used to calculate the ideal speed for any condition (draft or weather), as well as to gauge the effect of aging on hulls and propellers, needs to be obtained from the vessel operators.

"This kind of technical understanding is absolutely essential in order to give

correct and comprehensive advice," explains Dr Ando.

"Even with the highly sophisticated models that are needed in order to produce optimum weather routing, the ship performance model and the weather forecast are subject to errors, which is why ample feedback from the vessels is always needed."

"The live measured wind and ship motion data are valuable feedback for weather routing providers. The actual wind speeds can be compared to the forecasted wind speed, and the ship motion data (maximum roll angle in one hour) can be matched against the forecasted wave height. This way forecast systems can be refined."

In order to remedy this information gap and to further optimise its vessel operation, NYK has developed a system that combines weather routing and performance monitoring.

The shipping company first uses a weather routing model to devise a theoretical voyage plan, which includes course, speed, RPM, fuel oil consumption and weather data, as well as information from the ship performance model.

Detailed performance monitoring is then applied to provide comprehensive feedback on the actual voyage data, including the actual speed, RPM and fuel oil consumption, as well as live actual weather data.

NYK sends the analyses from the vessels to weather service providers, who use this data in order to improve the accuracy of their forecast. Dr Ando notes that for this system to be effective the company requires broadband on the vessels.

"Real-time feedback," says Dr Ando, "is essential in order for the weather routing service provider to verify whether his assumptions are correct or not. This way, corrective action can be taken quickly."

"We hope that through the participation of a large number of vessels, the accuracy of the weather forecasts can be improved significantly. This takes time, but in the long run the collection of weather and current data through the shipping industry and the sharing of this data will be to the benefit of all stakeholders."

Performance and fuel monitoring

Probably the most important aspect of energy efficient fleet operation is the reduction of fuel oil consumption.

One of NYK's key measures to achieve this is performance monitoring, collecting a variety of information from the vessels and assessing this data in order to monitor the fuel oil consumption and to take appropriate action to effectively reduce it.

NYK has realised how important it is to make both its seagoing and onshore staff aware of the importance of energy efficiency and fuel oil consumption topics if it is to create a process of continuous fleet optimisation.

"Again," says Dr Ando "the information flow is key. Information technology is an indispensable prerequisite to collect, aggregate and share the correct and necessary information at the right time."

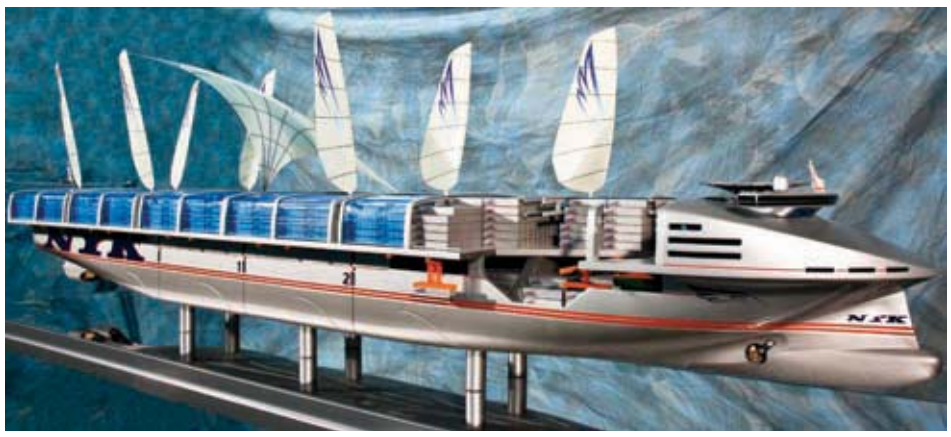
To facilitate this, NYK developed a performance monitoring device for onboard use, which was designed to provide crew with real-time information on their vessel's fuel oil consumption. This device, the previously mentioned FuelNavi, has been supplied to the entire container fleet and collects a number of key operational indicators.

FuelNavi consists of a data collection box that is installed on the vessel and interfaced with on-board equipment, such as engine data logger, GPS, anemometer, flow meter, thermometers for fuel oil and seawater, the rudder autopilot or the gyro compass.

Through the use of a PLC (Programmable Logic Controller) industrial computer, significantly more robust than a commercial PC, NYK says it has achieved a high level of reliability with the solution.

"These PLC," explains Dr Ando "are often used for the automatic control of mission-critical plants. They work 365 days 24/7 without maintenance."

Further advantages of the PLC technology, according to Dr Ando, include comparatively low implementation costs as well as the option and flexibility to customise.



NYK Super Eco Ship 2030 represents the Japanese shipping company's vision of the future

In addition to the PLC a monitoring device is installed on the bridge. This FuelNavi display allows the captain to monitor the real-time fuel oil consumption, which can be displayed in several formats, such as ton/day, ton/mile USD/day, USD/mile, the CO2 emission per day or per mile, as well as showing additional performance indices, such as OG speed.

The device also contains a trip meter function for on-board performance trials, which allows for energy efficiency comparisons.

"The FuelNavi monitor resembles the idea of the fuel meter in the car," explains Dr Ando. "The idea was to urge the master to drive efficiently by showing him the real-time fuel oil consumption of this vessel."

"Normally, real-time fuel oil consumption of ships is not shown to the captain on deck or the officers that operate the vessels. However, these are the people responsible for deciding on the vessel's engine RPM (speed) and course, and they should be more conscious about fuel oil consumption."

However, despite its impressive technological capabilities, after having tested the solution for some time NYK found that having the FuelNavi monitor on board did not noticeably improve the fleet's performance.

"It turned out that, although some captains do indeed use the FuelNavi, showing the real-time fuel oil consumption does not entice our captains to adjust their decisions accordingly. The effect of the FuelNavi on our performance monitoring aim, which was to achieve the reduction of fuel oil consumption, was hardly noticeable," says Dr Ando.

Shore systems

After the unsatisfactory trial of the onboard performance monitoring system, NYK decided to convert the FuelNavi solution into an on-shore monitoring system. This led to the creation of the company's ship information management system (SIMS).

SIMS combines the critical performance data collected through the FuelNavi data collection box on board the vessels with additional navigational data, with this data then shared between ship and shore via a broadband connection.

Today, NYK uses a combination of manually and automatically collected data for performance monitoring. Auto logging data, which is collected hourly and automatically transferred to shore via e-mail, is complemented by a daily electronic log-book entry, containing port departure/arrival information and other navigational data, which cannot be collected automatically.

The shore monitoring software displays information on all vessels, including their route, whether they are under way or in port, and the departure and arrival destination. The software also offers colour-coded information quickly highlighting important aspects of operation, such as safety, scheduling and bunker costs.

Green, yellow and red lights indicate the status of the vessel. If a red light is displayed, staff onshore will know that corrective action needs to be taken. This allows the shore operation to manage the fleet and to initiate immediate rescheduling or changes in routes.

The effectiveness of the process is a function of how often NYK can transmit data across its satellite link, Dr Ando explains.

"The quality of the corrective action taken," he says, "depends on the intervals in which the data is monitored."

Traditionally, vessels usually reported the manually collected data once-a-day, for example in the noon-day report.

NYK has experimented with different intervals and found that the more often data is collected, the more accurate the resulting information. This analysis was performed through a testing programme conducted by NYK using various different intervals on a VLCC vessel, over a period of three days.

The comparison between the traditional, once-a-day data collection process and the envisioned FuelNavi approach, which collects data every hour, has provided NYK with interesting results.

In the traditional scenario, the results for the OG speed and the log speed (over ground speed equals speed over ground measured by GPS, whereas log speed defines speed through water measured by doppler log or electromagnetic log) are very similar. Consequently, a graph would show the vessel is sailing at optimum speed most of the time.

However, if an automatic data collection and reporting system is used the result looks quite different, with sample data taken every second, and detailed reports on the vessel performance and weather conditions created every hour.

With this greater depth of information it becomes apparent that the vessel does not sail at a constant speed at all but speeds up and slows down, for example due to wind resistance or the effect of the current.

"Hourly reported data gives us much more detailed information on the vessel performance and helps with the analysis and decisions for corrective actions," notes Dr Ando.

"In general, the on-shore performance monitoring and fleet management option is very well received by the liner operation and we see the benefits of the FuelNavi system confirmed."

"In a next step we have combined the SIMS with weather routing services. This way we not only review the past voyage but preview the coming voyage, which is a better approach to support optimum ship operation. Now, the data interface between our SIMS and the weather routing service are in good working order."

Data analytics

Of course, collecting information and monitoring the fleet performance are only useful measures if the resulting data is subsequently analysed and corrective action is indeed taken by the ship. NYK notes that it is only through careful assessment of where improvement is possible that its vision of highly optimised vessel operation and fuel oil efficiency can be realised.

"Shipping companies use a variety of monitoring strategies and systems," says Dr Ando.

"These provide a large amount of data which, if not processed further, is often just stored somewhere in the company. This does not help. In order to carry out the ideal improvement cycle (PDCA - plan, due, check, act) it is essential for us at NYK to be able to pinpoint where corrective action might most efficiently be taken."

At NYK, technical staff on shore conduct a wide variety of analyses on the total fuel oil consumption data provided by the ship information management system and the FuelNavi solution.

Amongst the key aims of these analyses is understanding the different causes of fuel oil consumption, assessing vessel performance in different conditions, and establishing the ideal vessel speed for a variety of situations. The results are then subsequently shared with NYK's captains, operators, and ship management companies.

Through one analysis method, fre-

The FuelNavi system collects information from around the vessel, and uses it to display updated fuel consumption levels

quently used at NYK, the different causes of fuel oil consumption on a vessel are displayed on a bar chart. The biggest, fixed part of fuel oil consumption is for basic ship performance (each ship is compared to model-based performance, which specifies the total fuel oil consumption under ideal conditions).

This base amount is added to by including various additional factors, some of which can be influenced and are therefore important to know.

For example, fuel oil consumption is subject to the trim and draft of the vessel, while some of the fuel consumption might be due to the use of the generator. The weather conditions can also have a significant effect on the fuel oil consumption, especially through wind (bad weather effect) and moving against a strong current.

In addition, the vessel might have to deviate from the planned route, for example, in order to avoid bad weather, and have to travel a longer distance. This also adds to the total amount of fuel oil consumed.

Lastly, the fuel oil consumption is influenced by the maintenance condition of the engine, propeller and hull.

So, drawing on all of these variables, in any particular set of circumstances there is an optimum speed for each vessel with regards to fuel oil consumption. If this speed is exceeded the amount of fuel oil used will be accordingly higher, so using all of the data available to calculate this figure as accurately as possible can make a big difference to operations.

"In my experience," says Dr Ando, "the factor that causes the highest excess of fuel oil consumption is the increase in speed."

NYK uses a particular analysis method to gauge the fuel consumption of the specific vessel under different weather conditions.

This speed/fuel oil consumption curve of a specific vessel identifies a baseline for that vessel model, indicating the fuel oil consumption under ideal conditions. In addition, there are curves gauging consumption under calm conditions (Beaufort less than 2), average conditions and bad conditions.

The vessel performance is measured over a period of 240 hours and this data is fed into a grid.

As an example, in one analysis a certain vessel, provided it is sailing at a planned speed of 21.5 knots, is predicted to consume 117 MT/day under ideal conditions (calm weather). The analysis further provides the information that the vessel is likely to consume 129 MT/day, with an added 12 MT fuel oil consumption, due to a predicted weather deviation.

Another NYK chart displays the actual fuel oil consumption of a certain voyage, broken down and allocated to different causes, such as distance, weather and speed, with the average fuel oil consumption for this vessel type and voyage.

On the basis of this analysis, NYK aims to assess if any increase in fuel oil consumption could be affected by the actions of the vessel's captain, the operator or the agent.

"The amount of additional fuel oil consumption due to bad weather is something that we can hardly influence," says Dr Ando.

"Having said that, there are other factors, such as speed, that might be within the responsibility of humans. We use these analyses to determine corrective actions and the responsible addressees."

"If, for example, an increase in fuel oil consumption is down to a delay in departure we discuss with the agent whether it is possible for the vessel to depart earlier. Based on this detailed analysis and breakdown we can discuss with each stakeholder the possible room for improvement and the corresponding corrective actions."

A post-voyage analysis, taking into account several factors, such as M/E RPM, speed (log, SOG), constant M/E load, M/E load, optimum M/E load and a slip weather index, assesses what would have been the ideal speed of the vessel for each situation.

The diagram shows deviations (higher fuel oil consumption) with regard to bad weather or drifting and subsequent reductions in speed. The post voyage analysis identifies how much improvement to the level of fuel oil consumption is possible.

"The voyage from Oakland (near San Francisco) to Tokyo, for example, takes about 10 days," explains Dr Ando.

"Each vertical line in our diagram shows the noon position. This diagram is basically checking the speed allocation. If vessels use unnecessarily fast speed or drift before arrival, those non-energy efficient operations can be easily checked."

"At the same time, if the vessel encounters bad weather, it can be also easily checked by using slip. Slip is a number calculated by using engine RPM, log speed and propeller pitch, and it corresponds to the severity of weather."

To improve the safety of cargo, NYK is examining various methods to compare the estimated ship motion with the actual movements of the vessel.

Before long voyages, or if a vessel voyage plan/schedule needs to be reviewed, a ship motion simulation is carried out which takes into account the type of vessel, the ship hull form, ship speed and waves (height, direction, length), as well as cargo securing parameters and ship structural safety.

This analysis tries to gauge how the ship will behave in the expected weather situation. Later on, this data is verified against the actual ship motion and acceleration data.

"Though it is still very much in a trial phase, we are planning to share these simulation tools with the captain on board, the operator and the weather routing service provider in the future," notes Dr Ando.

Performance monitoring roadmap

NYK is aiming for the ambitious goal of zero emissions in 2050, and this journey will incorporate a series of milestones which have been highlighted by the company in a detailed roadmap for performance monitoring, including past achievements and future key goals.

"The roadmap shows how we have approached performance monitoring until now and what our vision is for the future," says Dr Ando.

While a number of measures outlined in the roadmap have already been accomplished, such as the on-board weather routing trial (in 2005/2006), the electronic logbook SPAS (from 2006 onwards) and the development of the fuel oil consumption monitor FuelNavi (in 2007/2008), other measures are in the planning stage or in on-going development.

The next step towards optimum operations is real time monitoring, which necessitates the fleet-wide introduction of a broadband solution.

Currently, FleetBroadband and VSAT is used only on some vessels, and a substantial number of ships still use an Inmarsat Fleet solution. NYK is therefore planning to roll out a broadband connection on its entire fleet in the near future.

Another reason for the implementation of a broadband solution is the fact that weather routing service providers are developing the next generation of forecasts, which cover up to 15 days and offer high resolution displays of the currents.

"The high-resolution displays of current are very valuable for our vessels," says Dr Ando.

"However, in order to use this data, high bandwidth is needed to transfer the data from shore to the vessel. In order to improve the vessel performance, actual live data needs to be reported back and matched with voyage simulation data from shore and vessel."

NYK also believes it is essential to have good communication between the master on the vessel and the designated route manager onshore, and is currently assessing the potential introduction of a new position of route manager, which would be assigned to captains and chief engineers on shore.

The idea behind this role is that the captain on the vessel would be able to share live voyage data in real-time with the route manager, who could use their own experience and expertise to discuss the optimal route and speed.

The exchange of live data should contain the actual sea state, actual wind and ship motion and other factors influencing the fuel oil consumption like weather risks, operational requirements, berth windows and requirements from the next voyage schedule.

This way, the vessel's schedule can be continuously assessed, revised and agreed between ship and shore, and the optimum fuel oil consumption level reached.

"This is a new challenge for us and in order to excel we need broadband, and the NYK liner operation has started an IBIS project to evaluate all such possibilities," says Dr Ando.

"The different possible solutions will certainly take some time to be evaluated, but we are sure there will be reductions of fuel oil consumption through real-time information sharing. In addition, we believe that the information platforms will be utilised as SEEMP platforms."

NYK is also planning to expand its utilisation of ship performance monitoring data in order to improve its fuel-efficient ship design (with regard to new wave sensors, accurate wave and wind measurement, accurate torque and thrust measurement, accurate log speed management, accurate fuel oil consumption management and ship performance modelling), as well as to evaluate fuel saving coatings.

"We could have already successfully implemented such a new way of vessel performance evaluation," explains Dr Ando, "however, we realised that there are several necessary developments in the sensor technology."

In addition, NYK is assessing the option to automatically process the collected data on board and to calibrate the ship performance model through the implementation of a system identification technology.

"This is part of our vision of a smart ship," says Dr Ando.

"At NYK, we believe that information sharing among all related parties and cooperation are key for energy efficiency. In addition, the integration of weather routing and performance monitoring is a base system for energy efficient fleet management."

"Automatic data collection onboard provides high quality and large data sample for making data analytics and high level integration of weather routing, performance monitoring, real-time broadband network and organisations are our current and next challenges." DS

This article will be the first in a series of articles in upcoming issues of Digital Ship covering different aspects of IT and communications development at NYK Line