In late March, shipping’s moribund financial markets saw the public flotation of GasLog, an international owner, operator, and manager of a fleet of liquefied natural gas (LNG) carriers for US$310 million – a large chunk of which will help finance eight new builds worth US$1.4 billion under construction at Samsung. GasLog’s fleet of 24 vessels also boasts 11 ships managed for BG Group. Six of these were the subject of an announcement last year regarding a condition-based maintenance (CBM) planning scheme developed by Wärtsilä. “This will enable our company and our customers to benefit from optimized availability, increased lifecycle efficiency, and reduced maintenance costs for our engines,” explains Sallis Theofanis, GasLog’s technical manager.

The five-year contract covers 24 dual-fueled engines (diesel or gas). According to Wärtsilä, this enables “dynamic maintenance planning”, with readings from the engines transmitted to Wärtsilä’s CBM data center. Actual inspections may still be required, but the CBM concept enables maintenance to be carried out when it’s actually needed, rather than being based solely on time intervals.

Such flexibility leads to avoidance of unnecessary costs, and less downtime – welcome news to shareholders when the price-to-book ratio between US$130,000 and US$150,000 per day to hire. However, GasLog is one of only a few operators currently pursuing an active CBM strategy.

“More shipping companies are working to integrate standalone systems, and that will enable data to be turned into knowledge and hence employ condition-based techniques for maintenance management,” says Theofanis, principal consultant Maritime Advisory Services with the classification society DNV. “I believe that the CBM concept is being increasingly embraced. In addition, the need for continuously optimized performance to ensure availability and fuel efficiency is steadily ensuring that condition-based techniques are regarded as more and more important.”

Inspection concerns

Wärtsilä is not alone in providing CBM to interested operators. For example, MAN Diesel offers an online troubleshooting and reporting capability, using the Inmarsat network of satellites, which feeds a CBM planning and scheduling package. The engine manufacturer works closely with Germanischer Lloyd (GL), whose customers include German stalwarts Peter Doebel Schiffahrts (bulker and container) and Hapag Lloyd (container).

Clients of GL and other classification societies make the case that physical inspections come with the risk of damaging a component – for example, where a crankshaft is opened up by crew members. “We experienced problems due to crew or ship repair yard mistakes during inspections,” said Konstantin Globenko, technical director at Prisco, a Russian tanker shipping company. “MAN Diesel now states clearly that bearing removal is not recommended.

More and more operators and classification societies are realizing the benefits of shifting from a time-based to a risk-based strategy for maintenance management.
In the case of Wärtsilä, the manufacturer’s recommendations combined with the work of customer-facing PCMS data analysts who monitor the feed from the unit can then drive maintenance timing. “The Songa Eclipse thrusters use oil condition monitoring in a more advanced setup, i.e. online oil monitoring,” explains Songa’s maintenance and systems manager, Eugene Payne, who is based in Singapore. “Data is collected and any deviation creates an alarm in the system and also sends an email externally to Wärtsilä to alert them of the issue. The PCMS for the thrusters not only informs us of the equipment condition, but also allow us to see what operating parameters are potentially harmful to the equipment, for instance operating at critical speed or inducing additional erosion effects due to orientation of thruster in respect to one another.”

The timing will likely not coincide with a requisite inspection, which is based solely on a time-based interval. Here, CBM makes sense. In the case of Wärtsilä, the manufacturer’s recommendations combined with the work of customer-facing PCMS data analysts who monitor the feed from the unit can then drive maintenance timing.

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Besides the focus on CBM for thrusters in the Songa fleet, Payne says he is exploring further opportunities “We also use vibration analysis on some equipment periodically, however we are yet to develop this into a fleet-wide program.”

Joining the dots
Wärtsilä has developed what it calls the “optimizers’ concept” - where the ship and shores are linked. “The existing CBM system provides a basis for a more comprehensive and more integrated way of monitoring the operation of the whole ship,” says Lena Vägar, manager CBM at Wärtsilä Technical Services in Vaasa, Finland. “However, the concept provides a platform to add different equipment, and to link, through any type of communication link, to any application located anywhere. The monitoring provided at Wärtsilä’s CBM center can, therefore, be used in conjunction with the owners’ and operators’ own office-based systems, as well as third-party tools such as turbocharger analysis systems. Instead of having 10 different monitoring systems, we need just one platform to support decision making,” says Vägar.

Employs dynamic positioning, where GPS signals are used to guide onboard azimuth thrusters (sourced from Wärtsilä with motors manufactured by ABB), to stay on station. The rig benefits from Wärtsilä’s status as an American Bureau of Shipping (ABS) class-approved Propulsion Condition Monitoring Service (PCMS) provider. As a result, Songa gets real-time transmissions about the workings of the thrusters (along with monthly reports), which are below the waterline. Most importantly ABS conducts a yearly audit of the PCMS and the class-required, five-year internal survey is waived.

Dry-docking windows for such rigs are unfeasible, however it is possible to do an internal survey and an alarm in the system and also sends an email externally to Wärtsilä to alert them of the issue. The PCMS for the thrusters not only informs us of the equipment condition, but also allow us to see what operating parameters are potentially harmful to the equipment, for instance operating at critical speed or inducing additional erosion effects due to orientation of thrusters in respect to one another.”

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PCMS vibration sensors are mounted externally, however it is also possible to have different types of systems, often from different manufacturers, to communicate. We are confident that Wärtsilä can develop a suitable communication protocol that can be used by its partners – a major step in this direction has been achieved with the Wärtsilä 3C control system. “This is the first such system to fully integrate all significant data into a single platform to support decision making,” says Vägar.
Challenges ahead

DNV’s Johansson notes that despite his society offering a CBM notation, few shipping operators currently take advantage of it, especially when compared with the offshore industry.

In his view, the offshore industry can call upon a certain amount of in-house expertise where CBM may have been applied to other facilities in the group, and where that experience can be transferred. “CBM takes a lot of resources and considerable amounts of training,” he says. “A company must assess available tools, resources, and knowledge when deciding on the most appropriate maintenance strategy – it is not a law of nature when choosing the most appropriate tools, resources, and knowledge that CBM is the right way to go given the operational context.”

Johansson also notes that, “Many ship owners don’t necessarily want to be tech leaders; they want to be seen as reliable and competent, employing techniques that are proven in use and have been applied successfully in the industry. Shipping companies have long-standing traditions, which includes ways of doing maintenance. Training and culture is tailored toward these well-established regimes.

The oil industry is younger with a different culture toward technology advancement, but also a completely different situation in terms of resource availability and in addition with a less liquid workforce in that the people come back to the same equipment and get a more in-depth knowledge of it to a larger extent than in traditional shipping.”

LR’s Shorten sees the need for further coordination with classification societies. ‘It is suspected that a significant number of vessels successfully employ some form of condition monitoring on a regular basis, and may even use condition as a foundation for their maintenance strategy, but do not take up the opportunity to align these processes with their classification society,’ he says. ‘These ships must therefore be performing unnecessary invasive surveys, and in so doing, increasing the risk to reliability.’

The trend toward coordination between vendor and class was highlighted in a recent classification alert from LR. ‘Turning out main engine bearings for survey is expensive, time-consuming, and carries the risk of damage by disturbing a bearing that is performing well,’ noted the alert.

Despite its current lack of penetration, it would appear that CBM is a good investment. LR’s Shorten notes that you can’t always put a precise number on costs and benefits, while concluding that, ‘Every day that you have a reliable day – it is a profitable day.’

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Eugene Payne, Songa fleet

Oil monitoring

The use of oil condition monitoring as a CBM strategy makes sense in terms of maintenance of main engine bearings. The ABS accepts the use of a bearing wear monitor, to verify that the main bearings are in good working order and to provide evidence that there is no bearing metal in the flow of lube oil. Its guidelines state: ‘If there was significant bearing metal in the oil sample, this would indicate that the bearing is damaged, even if that damage had not reached the alarm point for the bearing wear monitor system.’

DNV’s Johansson identifies some further opportunities that oil-based monitoring offers: “Measuring the consumption of lubricating oils (lubes) in the main engine is very high on the agenda,” he says. “Many companies are closely following cylinder oil consumption [measured in g/kWh of power produced]. In terms of cost, it’s important to achieve the correct ignition environment – lube oil and fuel oil is very expensive – breakdowns and off hire even more. There are ways to fine-tune the ignition, based on manual methodologies and using automated approaches.”

At a recent International Association of Drilling Contractors (IADC) seminar, Bob Speirs, a CBM specialist at Transocean, revealed that the rig operator had split the analysis of lube oils aboard 138 rigs between five laboratories, led by SGS Vernolab and Intertek. Each laboratory has an individual database that rigs can access to display their reports and results, with abnormal analysis results emailed direct to the rig for action. Transocean’s crews also have portable test kits from Kittiwake, to make on-the-spot assessments of lube oils.

“A critical step is the development of a baseline of the current oil program condition, equipment failures, and reliability for each rig – as this is needed to measure progress,” noted Speirs during the conference.

Above: Wärtsilä’s condition-based maintenance center in Vaasa, Runso