While for the oil and gas off-shore industry specific class guidelines and recommendations (OCIMF) have been introduced years ago, there is still a ‘home-made approach’ as regards the open water dry bulk trans-shipment operation with room and scope for improvement.

Introduction

With today’s financial markets turmoil, the very depressed shipping market and steel industry and the recession environment we are facing, buyers and sellers are focusing on seeking logistical improvements as being the only area where efficiency developments and sustainable cost reduction could produce long lasting and significant improvements. The development of green field ports and/or the upgrading of existing shore terminals are nowadays hampered by a myriad of problems starting with the difficulty to get suitable financing structure, land acquisition and last but not least, the environmental impact issue. Those are the major obstacles to get over, which heavily affect projects’ environmental approval, capital cost and implementation timing. Therefore floating terminals are now being taken seriously as viable high value alternatives to the shore based infrastructure, offering faster realization possibilities and lower investment/financial risk.

The operating conditions of such floating facilities are more demanding, i.e. exposure to high winds and waves in open water conditions, therefore the relative cargo handling facilities are more vulnerable and, thus, require higher safety standards since they are subjected to higher acceleration forces as compared to cranes operating on shore or in sheltered water conditions. The buoyant body of the floating facility is free to move on its axis: rolling, pitching and yawing are the movements which affect a floating crane, its equipment and mooring appliances at sea mostly. This brings about a fundamental difference in the design and selection of cargo handling facilities, which have to be designed specifically for heavy-duty operation in open sea. And also demands a deep and long lasting marine background experience which is of vital importance for reliable and smooth operation, consequently.

‘Open Water Design’
for reliable
Bulk Material Handling

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This article deals with the outlines of the open water design, developed for a new series of floating terminals to improve work efficiency, reliability and availability.
Until now there are no appropriate classification requirements, no official guidelines nor recommendations for such type of operation. To fill in the gap, Registro Italiano Navale (RINA), the Italian Classification Society (IACS member), and Logmarin are currently developing a comprehensive study aimed at setting up new guidelines to be sponsored and recognized internationally for the new generation of ‘open water’ dry bulk terminals to be built. This initiative benefits from the combined pooling of Logmarin’s shipping marine logistics knowledge and operational background and technological skills of crane manufacturer Liebherr, together with the experience and know-how of RINA. Initially, model tank tests and mathematical sea-keeping mode have been carried out to theoretically identify the effect that the various dimensional parameters of both the pontoon and the crane would have on the behaviour of the trans-shipment unit while operating in different weather and operative conditions in ‘open seas’.

For the determination of the loads on an open water operating crane, many parameters are to be accounted for, such as the environment conditions to be foreseen at the trans-shipment site, (wave height, period and sea spectrum and wind speed), the characteristics of the ship or pontoon on which the crane is installed, as well as the dynamic forces due to the relative motions of the transshipment concerned units, the lifted cargo (loaded grab) is hoisted from/to and, last but not least the duty factors. All the above issues contribute to the static and dynamic loads on the cargo handling facilities and relative foundations, affect the sea keeping features and the equipment availability, maintenance and performance.

**Princess Abby: the Evolution Floating Crane**

PT MITRA SWIRE CTM Indonesia, a joint venture between PT Mitra Bahtera Sagarasejati and Swire CTM Bulk Logistics, provided the opportunity to translate the new floating crane concept for open sea transshipment operations into the reality of ‘Princess Abby.’ Logmarin was appointed to cover the entire project implementation from the design stage to the final realization. ‘Princesse Abby’ has been jointly developed by Logmarin, its associated marine engineering company Interprogetti, and Liebherr, and built under Registro Italiano Navale (RINA) and Logmarin surveillance/supervision.

The Princessse Abby’s hull structure is made by longitudinal duly reinforced frame with spoon bow, inclined stern and two skegs aft. Bilge keels are fitted on each side to the extent of about 3/4 length of the pontoon, structural anti-rolling fins are also fitted in way of the stern skegs. Movement dumping devices and suitable dynamic factors to bear stress and fatigue connected with the continued heavy duty work in open seas, have been developed and incorporated in the design of the Princessse Abby to maximize the equipment availability for the ultimate benefit of the end user. Thanks to a combined ‘Roll Damping Systems’ (for pontoon motions attenuation), the Logmarin floating crane concept is less sensitive to adverse weather conditions as compared with the standard floating cranes.

The crane is designed by Liebherr using proven technologies and Logmarin/Interprogetti’s vast experience in design and implementation of different offshore transhipment systems. The design incorporates specific features for open water and heavy duty conditions such as: duly designed heavy duty hoisting winches,
strengthened boom, slew bearings conceived with triple roller and four equally distributed slewing motors (to minimize the risk of breakdown of the most critical crane components), four-rope grab configuration, heel and trim alarm systems, everything to ensure high turnover, efficient and effortless loading/unloading from most types of vessels up to Capesize, and an expanded and worryless life cycle time. Both the two independent electrical generator sets (one set on duty, one stand-by/maintenance, to ensure 24 hours per day non-stop operation) meet the most demanding emission control regulations with their highly fuel efficient and economical combustion system.

Cargo gathering and crane cycle time are improved by using a Peiner 24.3 m³ four rope scissor lobster type of grab. Thanks to the large spread of the grab lips (nearly horizontally when open) and the shorter closing stroke the floating crane’s productivity is maximized.

The Princesse Abby is equipped with an inclinometer and accelerometer data logger for three axis acceleration and amplitude measurements in various sea and operational conditions. The recorded data will then be analyzed to allow for final tuning and validation of a theoretical experimental sea keeping model developed by Logmarin to improve the reliability and the efficiency of the new floating terminals design.

Offering more than 3000 tons of buffer storage, the utilization rate of this new concept can be maximized by using the spare idle time to transport the goods as well and for vessels final trimming purpose.

Last but not least the cost is overall more competitive if compared to standard floating cranes (its capital cost is between 15% to 28% cheaper compared to cranes having a similar performance). Thanks to the duly assembled standard and proven components, together with theLiebherr worldwide service network, maintenance costs and spare part availability are optimized, thus ensuring highest working reliability.

Successful Operation

Early this November Princesse Abby has completed its first transshipment operation at the Muara Pantai in the Sulawesi Sea (East Kalimantan). Over 80.000 tons of “Pt Berau” coal have been loaded onto the panamax vessel “Navios Prosperity” at a daily average loading rate exceeding 16.000 tons, even before comple-

tion of crane fine tuning and crew training. The performance rate will exceed 18.000 tons per day once commissioning will be completed.

Future Prospects

The basic floating crane design can be further tuned to meet specific requirements of the client i.e. can be self-propelled, fit with sheltered area for steel products, containers, heavy lift, larger storage capacity, etc.

The experience gained during the development of the above mentioned research work will be utilized to reasonably improve the design criteria of both the crane and the pontoon, and then sort out the weather thresholds under which the floating crane can safely operate within the new crane limit design criteria in the intended operative location. Further development of the previously mentioned software can also be used to estimate the operational weather working day based on the prevailing weather condition at a specific site and to duly assess the downtime due to bad weather which might affect the raw material supply chain and project economics, consequently.

About Logmarin

Logmarin advisors is a joint venture company set up among internationally renowned partners with special fields of expertise, namely Rina group, Charles Taylor Consulting and Bancherocos-ta group. The advisory aims to achieve optimization and consequent cost savings in the base and energy industries’ logistics supply chain.

Although the company started its activity three years ago only, Logmarin individuals and its associated engineering company Interprogetti have almost 20 years experience gained on the field, devising and designing different technologies for self-unloading vessels, floating cranes, floating terminals, or transhipment vessels, which operate in various environmental conditions world-wide.

Logmarin has been involved in several Supply chain related consulting and project feasibility studies for commodities such as alumina, coal, iron ore, liquefied natural gas, steel products, in Australia, Brazil, Finland, India, Indonesia, Italy, Romania, Russia, Suriname, USA and in the Arabian Gulf.

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