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# “Open Water design” for reliable bulk material handling

## Maximising process throughput and equipment availability

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### Introduction

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

This article discusses an overview of the Open Water design, developed for the new series of floating terminals to improve work efficiency, reliability and availability.

### Present challenges

With today’s financial markets in turmoil, a shipping market and steel industry facing economic challenges along with the recession, buyers and sellers are focusing on seeking logistical improvements as the only area where efficiency developments and sustainable cost reductions can produce long lasting and significant improvements.

The development of green field ports and/or the upgrading of existing shore terminals are hampered these days by a myriad of problems, beginning with the difficulty of getting a suitable financing structure, land acquisition and, last but not least, the environmental impact issue. These major obstacles heavily affect a project’s environmental approval, capital cost and implementation timing.

Therefore, floating terminals are now being taken seriously as viable high value – faster realisation – low profile – lower investment/financial risk alternatives to shore based infrastructure.

The operating conditions of such floating facilities are more demanding, through exposure to high winds and waves in open water conditions etc., 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. The movements which affect floating cranes and their equipment and appliances the most are rolling, pitching and yawing.

This brings about a fundamental difference in the designing and selection of cargo handling facilities, which have to be designed specifically for heavy-duty operation in open seas.

Consequently, Vast and long lasting marine background experience is a vital designing milestone for reliable and smooth operation.

### Comprehensive study

Until now there haven’t been any appropriate Classification requirements, official guidelines or recommendations for this type of operation. To fill in the gap, 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 recognised 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 Liebherr’s technological skills, together with the experience and know-how of RINA.

Initially, model tank tests and mathematical sea-keeping mode were 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.

To determine the loads on an open water operating crane, many parameters must be accounted for. These include environmental conditions, which are foreseen at the trans-shipment site (wave height, period and sea spectrum and wind speed), the characteristics of the ship or of the pontoon on which the crane is installed, as well as the dynamic forces due to the relative motions of the trans-shipment concerned units and the lifted cargo (loaded grab) is hoisted from/to and, last but not least, the duty factors.

All of the above issues contribute to the static and dynamic loads on the cargo handling facilities and relative foundations, and affect the sea keeping features and the equipment availability, maintenance and performance.

### Princesse Abby

PT MITRA SWIRE CTM gave Logmarin the opportunity of translating the new floating crane concept into reality with the introduction of the “Princesse Abby” floating crane (see cover page).

The Princesse Abby is owned by PT MITRA/SWIRE CTM Indonesia, a JV between PT Mitra Bahtera Segarasejati ([www.mbss.co.id](http://www.mbss.co.id)) who looks after her commercial operations and Swire CTM Bulk Logistics ([www.swirectmbl.com](http://www.swirectmbl.com)).

The above theoretical results have been used to design and implement the FC Princesse Abby which is also equipped with an inclinometer and accelerometer data logger (three axis acceleration and amplitude measurements in different sea and operational conditions).

The recorded data will then be analysed to allow a final tuning and validation of the theoretical experimental sea keeping model.

Logmarin has been appointed by the Owner to cover the entire project implementation from the designing stage to the Princesse Abby commissioning and crew training.

The Princesse Abby floating crane commenced her coal transshipment operation early this November by loading the large panamax “Navios Prosperity” at the Muara Pantai in the Sulawesi Sea (East Kalimantan) for Coal Transshipment operations on behalf of PT Berau Coal.

The Princesse Abby has been designed by Logmarin/Interprogetti, built under Registro Italiano Navale (RINA) and Logmarin surveillance/supervision. Her hull’s 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 skags.

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 Princesse Abby in order to maximize the equipment availability for the ultimate benefit of the end user.

Thanks to a combined 'Roll Damping System' (for pontoon motions attenuation), the Logmarin floating crane design is less sensitive to the adverse weather conditions as compared with standard floating cranes.

The crane is designed by Liebherr through mastering proven technologies with Logmarin/Interprogetti's vast experience in design and operation of offshore transshipment systems. Specific features for open water and heavy duty conditions have been incorporated such as:

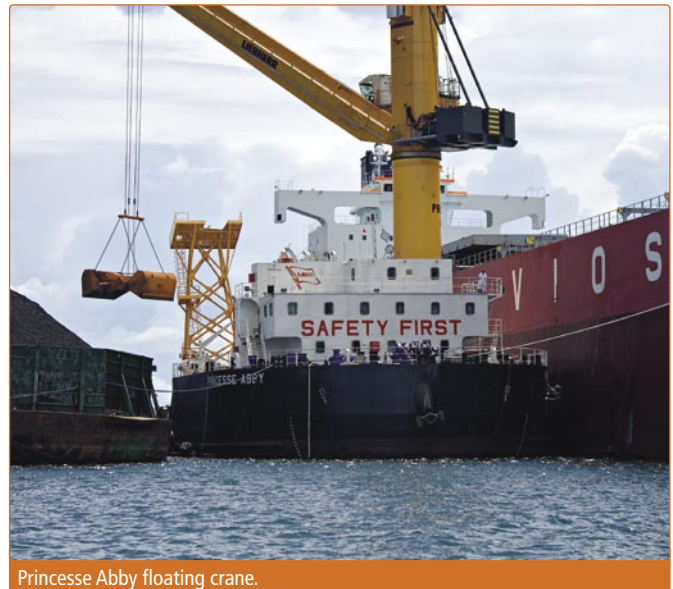
- Duly designed heavy duty hoisting winches, strengthened boom
- Slew bearings conceived with triple roller and four equally distributed slewing motors (thus minimising the risk of breakdown to one of the most critical component of the crane)
- Four-rope grab configuration, heel and trim alarm systems, thus ensuring high turnover, efficient and effortless loading/unloading from most types of vessels up to Capesize
- Smooth and wider life cycle time.

Last but not least the cost is overall more competitive as compared with standard floating cranes, and thanks to the standard and proven components assembled together with the Liebherr world-wide service network, maintenance costs and spare part availability are optimised, thus ensuring the highest working reliability.

## Conclusions

The above capabilities express innovation and efficiency in the supply chain to tackle the downturn currently being experienced in the market.

The experience gained in the development of the above research will be utilised to reasonably improve the design criteria of both the crane and the pontoon 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. The development of the above 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, consequently, might affect the raw material supply chain and project economics.



Princesse Abby floating crane.

Princesse Abby	
Main Features	
Owner:	PT Mitra Swire CTM
Operator:	PT Mitra Bahtera Segarasejati (MBSS)
Designer/Project Manager:	Logmarin Advisors/Interprogetti
Class:	RINA/ BKI
Flag:	Indonesia
Length	60,00 meters
Breadth	22,60 meters
Depth	5,00 meters
Operative Draft	2,50 - 3,50 meters
Light ship weight	1450 tonnes
Crane	CBG 35t swl x 35m Liebherr
Grabs	2 x 24,3 cu.m
Accommodation	28 berths
Fresh water capacity	645cu.meters
Marine diesel oil capacity	321cu.meters
Water ballast capacity	4.455 cu.meters
Electrical power installed	3.690 Kw
Electrical cables length	12.120 meters
Designed daily loading capacity	18.000 tonnes
Monthly throughput	450.000 tonnes

Princesse Abby floating crane.

In short, this information can be used to obtain the best compromise on price versus sea keeping capability/equipment availability.

## ABOUT THE AUTHOR AND THE COMPANY

**Captain Mario Terenzio** is a shipping and logistics professional with 12 years seagoing experience in oceanographic, container and Ro-Ro vessels. He has held a Marine Master Licence since 1987. Capt. Terenzio joined CoeClerici in 1992 as Coal Terminal Manager, and since 1994 was in-charge of business development activities, focussed in providing customised floating terminals. In 2006 he joined a newly established consultancy company, "Logmarin advisors srl" a joint venture, among first class and internationally renowned firms, (Rina group, Charles Taylor Consulting, Bancherocosta group).

**Logmarin** concentrates the capabilities and the different expertise, professional skills and experience of the partners to provide an integrated and comprehensive advisory service for marine terminals and associated handling infrastructures both off-shore and on-shore. Logmarin individuals and its associates have pioneered dry-bulk shipping logistics off-shore, devising and designing innovative floating terminals, self unloading vessels and floating cranes.

## ENQUIRIES

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