CASE STUDY

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Replacement of Ballast Control System



Successful delivery of replacement Ballast, Freshwater, Fuel & Lube Oil, Tank Level Gauging and Control System.

Stena Scotia was built in 1996 by the Japanese Miho Shimizu Ship Yard and currently serves the Heysham – Belfast freight route.

The existing tank gauging and valve remote control system was obsolete and unsupportable by the manufacturers, and in 2019 MJR was awarded the contract by Stena Line for its replacement.

The system provides remote tank gauging, controls all of the valves on the ship and provides fully automatic heeling control to maintain vessel trim during loading and unloading of cargo. The system also integrates with the vessels loading and stability computer, which was also renewed, providing it with tank volume data to enable the necessary shear force, bending moment and stability calculations to be carried out. With over 700 I/O points, the system is quite extensive and being an essential system requires a fully redundant continuously available architecture. The solution was perfect for MJR's proven MAP-OE™ Integrated Machinery Automation & Control System as it was required to be delivered with full design approval from Lloyds Register of Shipping.

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MJR's replacement control, alarm and monitoring system architecture is designed to eliminate single points of failure inherent in the existing system design (figure 1) to provide continuous operation with hot-standby functionality as seen in figure 2:

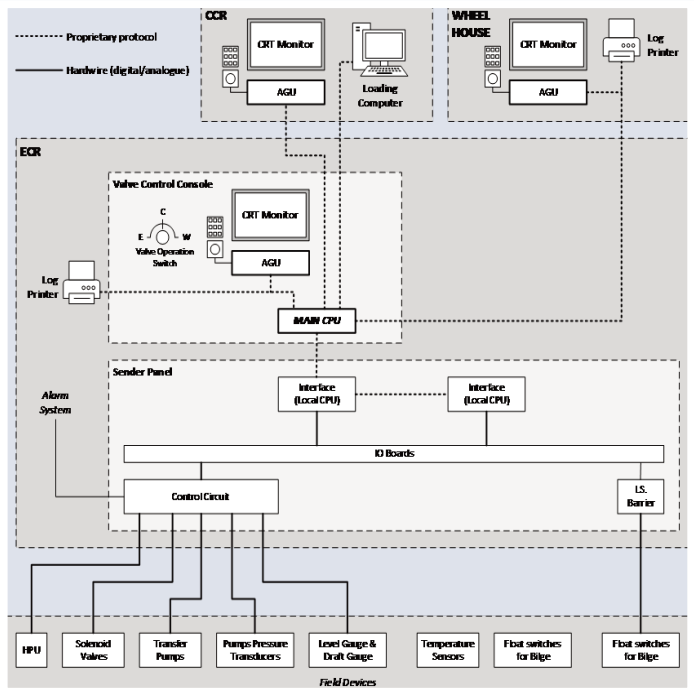


Fig. 1 Existing System

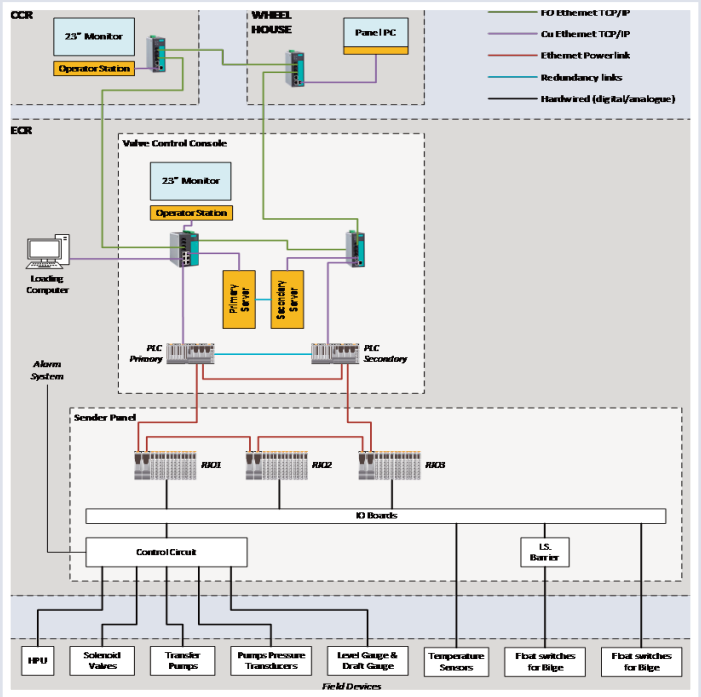


Fig. 2 New Fully Redundant System

Figure 2 presents the architecture of the upgraded control system using off the shelf Siemens control & automation hardware where single points of failure were eliminated with communication between all control devices supported by an Ethernet infrastructure ring. By implementing the interconnecting workstations and servers with a Fibre Optic (FO) Ethernet ring, the communication infrastructure is immune to a single failure either in one Ethernet connection leg or one Ethernet switch.



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The project presented some significant challenges in terms of installation and commissioning as the ship could not be taken out of service and had no scheduled dry docking period. This meant installing the new system 'side by side' whilst the existing system remained in full operation and the ship was in service.

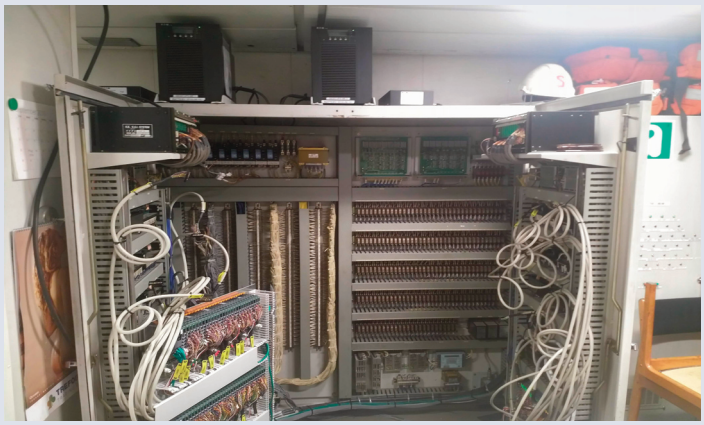


Fig. 3 Existing Control Cabinet



Fig. 4 Side by side testing of new system

The system had to be designed in such a way that the I/O from the existing system could be quickly and partially swapped from with the new system during some weekend layover days for progressive testing and commissioning. During these layover days the existing system was kept fully operational and the I/O swapped back again to the original system before cargo operations and sailing.

MJR's MAP-OE™ control & automation platform is integrated to provide ships automatic Ballast, Bilge and Heel control functions supported by friendly, ergonomic operator screens and mimics with touch screen functionality which can support a large number of Operator Stations.

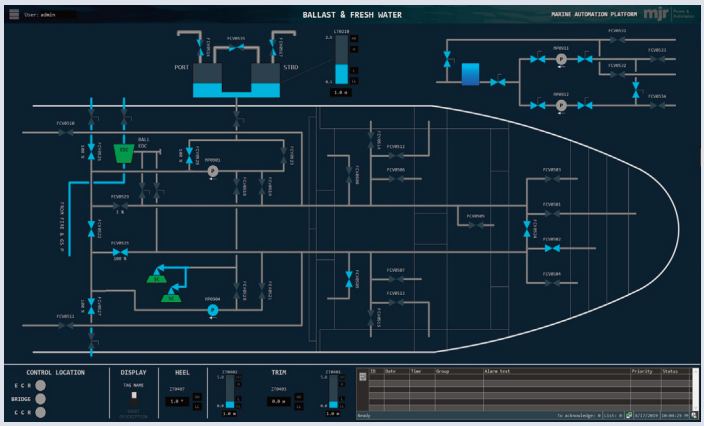


Fig. 4 Ballast & Fresh Water System Mimic

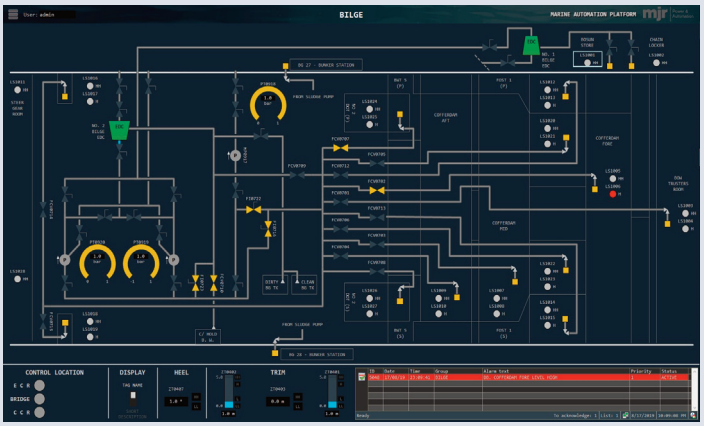


Fig. 5 Bilge System Mimic

Piping, pumps and valves are arranged according to the system schematic and are fully animated, providing the ship's crew with a truly intuitive user interface.

Dashboard type gauges and status indicators are provided, providing the ship's crew with an 'at a glance' view on the performance of the system.

Marine & Offshore Electrical Power and Automation Engineering

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The final changeover to the new system was carried out in June 2020 together with on board survey, site acceptance trials and final approval by Lloyds Register.

Project Summary

- Replacement of obsolete Ballast Control, Monitoring & Alarm System
- Off the shelf Siemens hardware & open software protocol
- Fully redundant network & system solution
- Auto & manual control of Ballast, Bilge & Heeling Systems
- Ergonomic Operator Screens & Mimics

Project Benefits

- Commercially competitive system replacement
- In-house turnkey project delivery
- In-service installation & commissioning
- No single points of failure
- Delivered with full Lloyds Register approval
- UK 24/7 service & support

> “Installing and commissioning a system of this size with the ship in service and without causing any vessel downtime was extremely difficult. The skill, flexibility and ingenuity of our engineering and installation team is second to none and I congratulate all involved in doing a great job.”
>
> **Paul Cairns, Managing Director of MJR Power & Automation.**



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