Dynamic Positioning Committee
Marine Technology Society

Session – Reliability

Title: **System Verification helps Validate Complex Integrated Systems**

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Abstract

As building and operating offshore assets become more complex, and more integrated, one of the biggest challenges is centered on software. The move toward automation of offshore assets has allowed drilling and production systems to work much more efficiently. However, the introduction of complex, integrated control systems also poses new challenges. These systems can present enormous problems during operations and maintenance without thorough testing of the software. Hardware-In-the-Loop (HIL) testing is one option used for testing software actions and for crew training. This paper provides insights into the usefulness of HIL test and the benefits it had on a recently completed drillship.

Computer-based control of nearly all equipment onboard marine and offshore assets is ubiquitous, offering increased safety and efficiency but at the cost of increased complexity and increased risks of a failure with the associated consequences. Verifying system integrity is critical to identifying and mitigating system failure to safeguard marine and offshore operations. HIL testing is a method that is used in the development and testing of complex real-time integrated systems. Greater understanding resulting from such testing can be used for risk reduction and crew training by evaluating whether the system performs as expected or whether there may be a safer action to mitigate or manage the failure in a better manner.

The marine and offshore industries are realizing the important role of software in controlling the actions of the equipment aboard and especially the actions of the equipment upon a failure. Software verification allows assessment of the equipment during normal, degraded, and failed states. This assessment allows for the identification and mitigation of safety, business and environmental risks with a bonus of providing useful training for the crew. The owners of these assets are requesting some form of guidance in testing these complex control systems. Improved software quality through the use of standardized methodology provides assertion that today's complex systems perform as intended and as expected. The best method is using HIL testing with a detailed verification plan. HIL testing allows for discovering faults before deployment, leading to lower costs and lower risks of any schedule impacts. Additionally, software HIL testing is possible after commissioning for software updates and modifications made during commissioning and beyond. System verification testing can be applied after the system has been installed on existing assets.

Safety and reliability of integrated software-dependent systems is now becoming an industry demand. A control system interacts not only with the operator, but also with the numerous connected control systems, input and outputs, as well as the data sources. Cascade failures are possible with integrated systems, resulting in faltering operations, reducing efficiency, and increasing non-productive time (NPT). Integrated software testing using the HIL method may help prevent these failures.

Continued on next page

The system verification process addresses these challenges and provides guidance for properly testing the control systems. By testing the essential functions within the control systems, it increases owner and operator confidence in the vessel's performance. This paper provides a testing method for software-dependent control systems that aim to reduce the risk of software failures and improve operational efficiency.

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