INTEGRATION HIL TESTING

Verification and testing of control system software with Marine Cybernetics services

Modern vessels and rigs are equipped with sophisticated data systems required for the functioning of the vessel as a whole. At the heart of these systems are computer control systems that run complex software delivered by different system suppliers. Integration hardware-in-the-loop (HIL) testing includes both verification of signals and interfaces, and testing and verification of integrated functionality.

**Why do we test?**

The control system’s software from several suppliers must work simultaneously together as an integrated system to achieve the desired and required safety and operational performance.

The reasons for testing the software for control systems are many:

- To ensure the proper coordination between functions among several systems
- To test that decisions taken from one system serve as a proper basis for the actions of another system
- To show where the control systems use different signal units, scaling and philosophy
- To detect hidden software errors, configuration parameters and design flaws

The scope of Integration HIL is to verify the integrated functionality between different systems often involving different vendors.
Relevant system candidates for integration testing

Any system with connections and dependencies between different control systems is a candidate for integration testing. Some control systems are more tightly integrated than others, such as dynamic positioning (DP)/power management system (PMS)/thrust control systems and drill floor/well/blowout preventer (BOP) control systems. The PMS is important for many other systems, and integration testing for PMS and large power consumers should be included.

How do we test?

HIL testing, as part of our Marine Cybernetics services, is accomplished by connecting the control systems, which are the target of integration testing, to the HIL real-time simulator (CyberSea HIL simulator) that we developed ourselves. The CyberSea simulator represents the vessel/rig, as well as its systems and environment.

Our CyberSea HIL simulator responds to commands from the target control systems, and feedback from sensors and actuators to the control systems is simulated in a realistic manner according to unit-specific equipment. The different control systems are connected together and respond as they would in real operations on board the vessel or rig. This allows all testing to be carried out systematically in a controlled environment.

The control systems may be tested either in a test set-up at a vendor location or in a virtual test bed in an HIL test lab. Test labs are equipped with all the necessary hardware, including a control station, programmable logic controller (PLC) and sensors. The test set-up is connected and commissioned as it would be on board the vessel or rig.

Life-cycle services

By using the simulators and test facilities established during an HIL project for life-cycle testing of the control system, it will be possible to verify that changes/updates/patches made to the software are working according to specifications and that they will not introduce any unintended consequences on board the vessel/rig when installed.

Tests are performed during different phases:

Software testing is performed early to ensure that the control system software is ready and verified as extensively as possible before the start of commissioning and trials. Most findings from this initial testing should be solved and concluded during a software retest.

Software updates and patches may be thoroughly tested in a controlled environment before being installed on the vessel or rig, thereby verifying that updates are according to specification and do not introduce unexpected problems into the integration with other systems.

In addition, troubleshooting can be performed at the HIL test lab to identify the cause of problems that may arise.

CONTACT

Tom Arne Pedersen
Product Manager HIL
Phone: +47 952 80 695
E-mail: tom.arne.pedersen@dnvgl.com