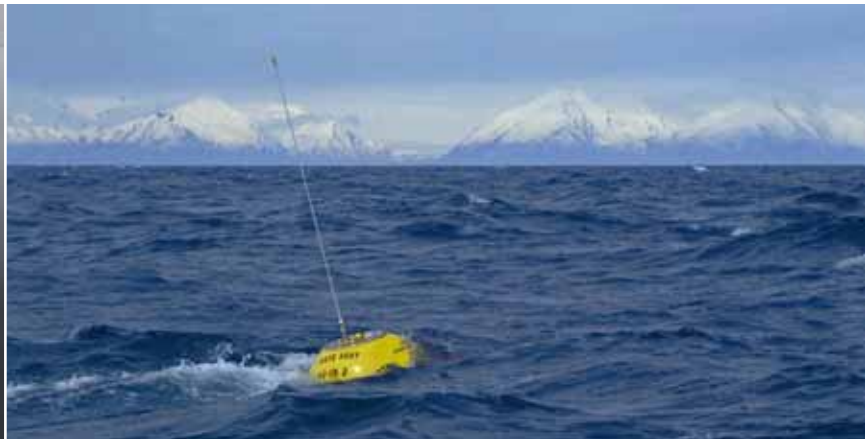
Wave buoy measurements on a hexapod

MARIN has recently expanded its facilities with a hexapod. This system can be used to generate forced oscillations in six degrees of freedom, either on a standalone basis or under the carriage of one of our basins. It is a useful tool to assess the efficiency of anti-roll tanks, sloshing in LNG tanks, safety of cruise ship swimming pools or drop tests with a free-fall lifeboat from a moving platform.



As the positioning system of the hexapod is very accurate, another useful application is the validation of measurement equipment. Recently, we used it to evaluate the measurement accuracy of a Datawell wave buoy for Shell and Woodside. Wave buoys are occasionally used in conditions outside their design range, in very long or short waves. The hexapod tests proved very useful to gain more insight into the limits and properties of buoy measurements, by comparing them to the hexapod motions and a set of independent MARIN acceleration sensors.

A first challenge during the project was the need to synchronise measurements from three different sources: the MARIN Measurement System (hexapod motions, MARIN accelerations), the direct buoy acceleration and rotation measurements and the derived motions in the buoy log files (which are stored every half hour). Each of these files was sampled at a different frequency. Synchronisation was done based on a trigger signal that was recorded by all systems. In this way the synchronisation was limited only by the lowest sample rate.
The vertical acceleration sensor inside the buoy was compensated for rotations, while the compass and horizontal acceleration sensors, hexapod motions and MARIN acceleration sensors were not. Alignment of the buoy and determining the zero positions were not as easy as they would be for a dedicated setup, therefore comparing the measured signals required a careful setup and extensive analysis work.

Although the measurement setup is not a perfect representation of the buoy response in a real life wave environment, we were able to make a good assessment of the accuracy of the wave buoy for different motion periods, amplitudes and degrees of freedom. Additionally, we have learned a lot about the buoy properties and limits, and gained valuable experience in the measurement procedures with the hexapod.

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