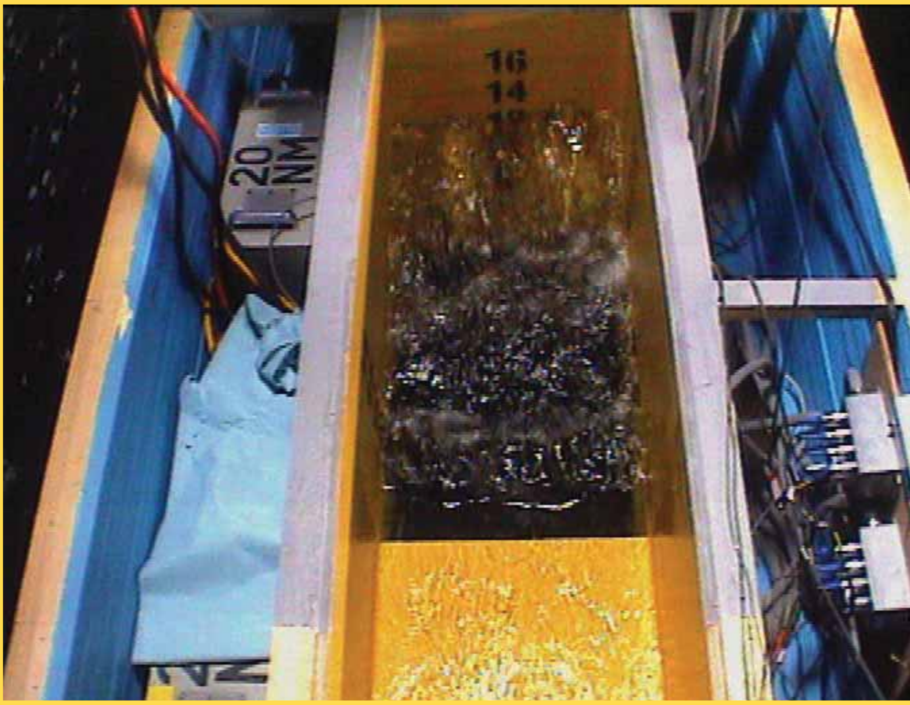
When looking at drillships two major features stand out: firstly they need to be able to hold position on a particular spot and secondly, they have to move speedily from one place to another. But both of these actions can potentially be hindered by a moonpool.



Frans Kremer
f.kremer@marin.nl

MARIN tackles the problems of open moonpools on drillship

This becomes especially apparent when sailing because the interference between the outside water flow and the open moonpool causes additional resistance that can even be up to 20%. Due to the severe instationary water movements inside the open moonpool - with vertical piston motions and sloshing in longitudinal direction - surging and heaving of the vessel can be induced when the moonpool is relatively large compared to the vessel. The figure shows an example of the resonance inside the moonpool which caused water height movements above 3m in amplitude. In addition, the large water mass inside the moonpool experienced sloshing resonance, in this case for periods of about 10 seconds.

Reducing drag

An easy method to reduce severe flow movements inside the moonpool and therefore, reducing the additional drag is by avoiding or reducing the source of the excitation. This can be done by avoiding flow separation at the leading edge of the moonpool and/or avoiding the re-entry of the formed vortex inside the moonpool. Such an effect can be obtained by adding a wedge to the leading edge of the moonpool and making a cut-out at the trailing edge. In the case shown, the effect is quite drastic with the moonpool water movements reduced by a factor of two.

A simple means to reduce moonpool water movements is to prolong the inclined surface of the cut-out inside the moonpool with a flap. The outside flow is better below the moonpool opening and the inside swirl is broken. Water inside the moonpool becomes relatively smooth (below 0.5 m in the example).

Of course, the flap and other similar solutions, such as a grid of flaps have the drawback that these contain moving parts that can cause many practical operational problems. Therefore, these solutions are only advised if the vessel has to sail long distances regularly.

In terms of design advice, the first step is to identify the risk of resonance of the moonpool. Such risk can be evaluated by looking at the natural frequency of oscillations in piston mode and compare this with the frequency of the two possible sources of excitation. In transit in calm water the source will be the vortex shedding from the leading edge (related to the so-called Strouhal number), in stationary conditions in waves the source will be the pressure and vertical accelerations at the bottom of the moonpool (related to the wave peak period).