

## MARIN helps Shell study LNG floating production options

**New Floating Liquefied Natural Gas (FLNG) systems are being developed by Shell to economically produce and process gas in remote offshore locations. And as Jaap de Wilde reports, the FLNG system can be used in a remote oil development or in a green field gas case.**

### Numerical analysis

When sufficient LNG is accumulated in the storage tanks, it is off-loaded to an LNG carrier and shipped to the customer. Alongside berthing and loading of the LNG carrier is being considered as the preferred offloading option in areas with relatively calm seas, such as the Timor Sea, North-West Australia. Side-by-side offloading allows conventional loading arms to be used. MARIN's experience in both numerical and experimental analysis of relative motions between two bodies in close proximity led Shell to awarding a series of motion studies. The work started in 1999 with the preparation of the numerical tool for the complex hydrodynamic analysis of the alongside moored system. Early this year, simplified model tests were carried out to validate and calibrate the numerical tool. A number of important modifications were implemented in the program. Subsequently, detailed numerical analyses were carried out, which show very promising results.

### Model testing

In August of this year an extensive model test program was carried out in the new Offshore Basin on a detailed model of the side-by-side moored system. The weather-vaning properties of the LNG barge were accurately modelled using a detailed model of the turret. Furthermore, the mooring lines and fenders between the LNG barge and the LNG carrier were accurately modelled. The system was analysed for a large number of environmental conditions, with wind, sea, swell and current from different directions. The study confirmed that side-by-side offloading should be feasible under the conditions considered and the data gathered will serve as input to the further development of the Shell Floating LNG Concept.



Offloading test with weather-vaning LNG barge and alongside berthed LNG carrier.

In remote oil developments, the LNG system converts the problem of associated gas disposal into a money-making opportunity. In the green field gas case, the Floating LNG System is an economical means to develop remote offshore gas fields. The Floating LNG System consists of a barge with accommodation, a mooring turret, gas pre-conditioning and liquefaction plant, LNG storage tanks and off-loading facilities. It is positioned over the reservoir and replaces the offshore platform, the pipeline to shore, the onshore LNG plant and the jetty.