



LNG carrier in irregular seas.

# Coupling effects on large LNG tanks

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Different gas production projects are today under development or scheduled in the near future. Offshore LNG gas production raises different problems associated with the sloshing of the liquefied gas in the tanks of LNG carriers or LNG-FPSOs but the impact on large tanks has never been examined and tested in detail. Outlined are tests that MARIN is due to carry out in this field.

One of the problems relates to the design of the tanks themselves because the fluid may impact the tank walls while the floating structure is submitted to external environmental conditions (waves, wind...etc). The knowledge of realistic impact conditions will govern the design of these tanks.

Another problem is the seakeeping of the floating structure itself because the fluid motions in the tanks can significantly change the floater response in waves.

Even though coupling between anti-roll tanks (U-shape types or free-surface) and motor yachts or working vessels has been deeply investigated, the amplitude of these effects for large LNG tanks has never been tested until now.

## Objectives & scope of work

- Model testing: Tests will be carried out at MARIN on models of moored LNG-FPSOs and LNG carriers in transit. In the latter test a full, free sailing model will be used. Ship motions with and without full coupling and tank reaction forces will be performed.
- Numerical modelling: Improvement of numerical tools dedicated to seakeeping and internal tank excitation. Extension of frequency domain model to time domain and forward speed. Investigation of non-linear methods for higher order phenomena.

- Analysis of different concepts: A number of configurations including varying filling ratios, sea states, loading conditions and forward speed will be analysed. Frequency domain software developed by Principia will be used and validated.

## Organisation

The 18 month project is conducted as a joint industry effort, with participating companies represented in the project Steering Group. Principia R.D is the project manager, assisted by MARIN and ESIM. The model test campaign is due to be performed in November, 2003.

## Participation

The project is relevant for oil and gas companies, FPSO operators, shipyards, safety authorities, offshore engineering and classification societies. At the moment, the following companies are participating:

- PETROBRAS
- Gaztransport & Technigaz (GTT)
- SAIPEM
- Single Buoy Moorings
- ABS
- Bureau Veritas
- Lloyd's Register
- MARIN
- PRINCIPIA

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