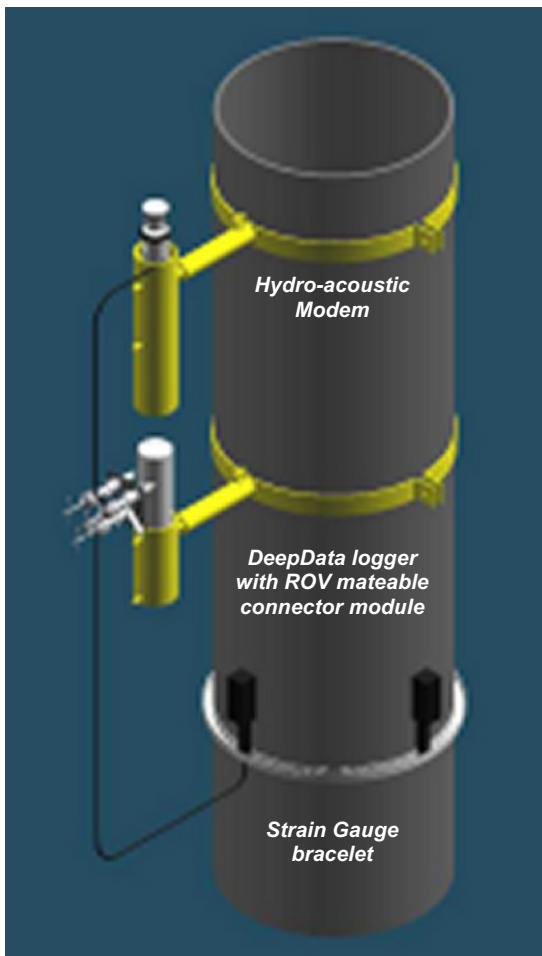


Structural Monitoring

DeepData - VIV Assessment System

Introduction

One of the most important factors to be considered during the design and operation of deepwater risers is the issue of vortex induced vibration (VIV). The phenomenon of VIV may lead to fatigue on riser components, thus leading to a significant risk of failure and reduction in riser life.



DeepData VIV Assessment System with hydro-acoustic module, ROV connector and strain gauge Bracelet option

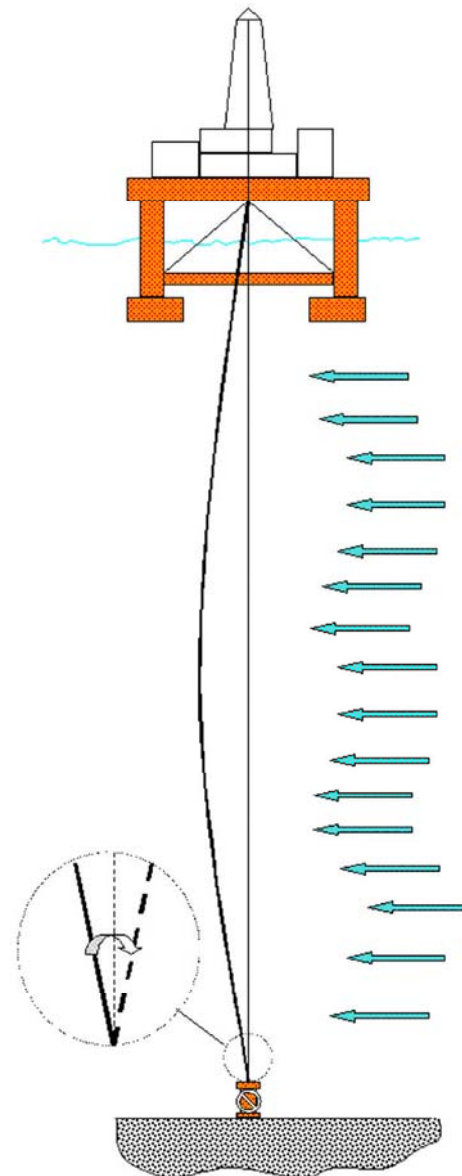
Research on the cause of VIV has suggested that the phenomenon may not be induced by current conditions alone. Other sources, including vessel motion and characteristics of flow within the riser have been suggested.

Systems are available to help prevent the onset of VIV, but these can be extremely costly in terms of materials and disruption to drilling activities. It is also possible that they will cause an increase in the load on the riser due to drag. In many situations the riser may perform within acceptable limits without the provision of fairings or other VIV suppressants.

Rather than implementing these costly measures, it is now possible to monitor a drill riser to assess its performance in-situ. This can be done using the DeepData - VIV Assessment System.

Using the DeepData - VIV Assessment System you can:

- Directly measure VIV
- Derive riser reflection
- Quantify fatigue



Historical information on riser dynamics can be used for:

- Input to the design of production risers
- Evaluation of fatigue for riser management
- Verification of the riser dynamic design

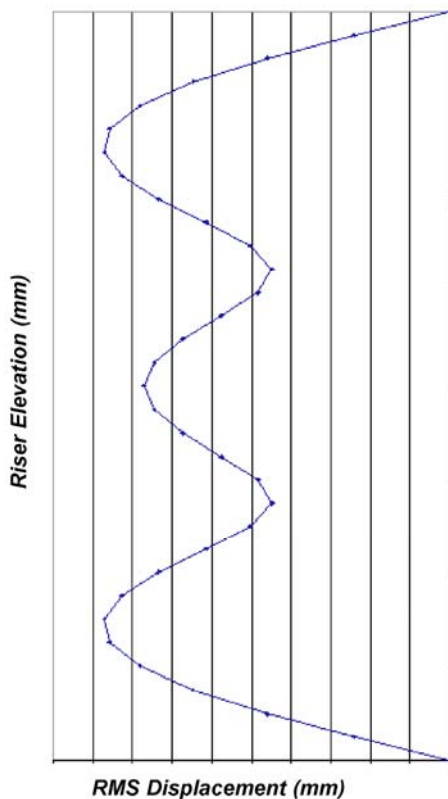
The DeepData - VIV Assessment System is:

- Inexpensive
- Highly reliable
- Simply configured
- Implemented on a well by well basis as required

Hardware

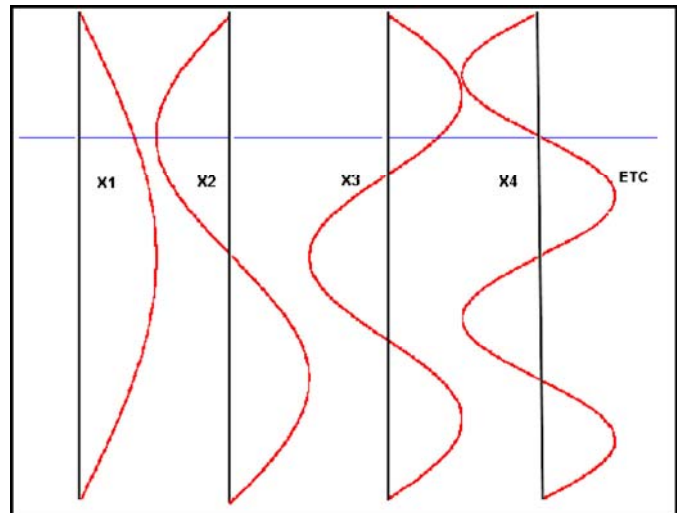
The DeepData - VIV Assessment System contains high accuracy accelerometers, which are used to determine the dynamic response of the riser.

The components are housed within an enclosure rated and tested to a depth of 2000 metres. A mounting bracket to receive the DeepData enclosure is installed just above the lower flex joint. The system can then either be deployed by ROV or placed as the riser is run.



**RMS Displacement Profile of Riser
5th May 1999 09:01 to 09:21**

Where historical data is required, information can be stored within the unit for recovery at the end of the drilling programme or at any intermediate time by ROV. For 'real-time' operations a hydro-acoustic modem is fitted to the DeepData unit to allow the transmission of data to the surface.



Predicted Mode Shapes

Data Acquisition and Analysis

The measurement of VIV on a drilling riser in 1600mm of water has shown excellent agreement between measured and predicted riser natural frequencies. This gives confidence that, to the level of accuracy required, the predicted riser vibration mode shapes will also be valid.

The data recorded by the DeepData VIV system can thus be used to estimate the profile of the riser RMS displacement over, say, each 40 minute period. This, in turn, can be used to quantify the displacement cycles experienced by each joint in the riser string.

DeepData



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