

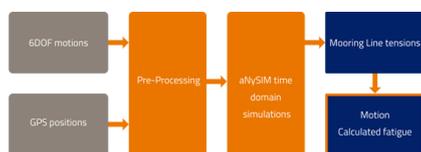
MoniMoor JIP

Fatigue integrity assessment of mooring lines from floating production systems and floating wind turbines by in depth analyses of existing in-service measurements

Floating production systems and floating wind turbines are designed to remain on station for a prolonged period of time. To ensure station keeping, these floaters are equipped with mooring systems which must be able to withstand harsh weather loadings. Deterioration of the mooring lines over time will result in a lower resistance against breakage. Therefore, early diagnostics of mooring line damage plays a key role in ensuring a safe performance of floaters. Several technologies and methods exist to monitor the integrity of the moorings. The MoniMoor project aims to improve the understanding of the fatigue mooring loads from floating production systems and floating wind turbines by in depth analyses of a wide variety of existing in-service measurements by an integrated mooring integrity management platform. The latter platform uses MONITAS and aNySIM Onboard integrity monitoring tools.



MONITAS GUI



aNySIM onboard flow scheme



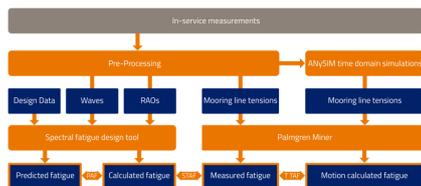
Courtesy to Shell

Fatigue integrity assessment with MONITAS

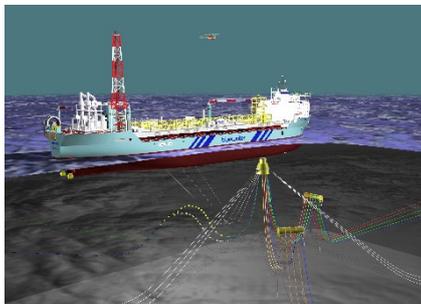
One aspect of the integrity assessment of mooring systems is the fatigue integrity. A monitoring system which manages the fatigue integrity of hulls and moorings of floating production systems is being done by MONITAS. It helps the owner to understand the real age of the vessel by monitoring fatigue loading and coupling it back to the design tools. MONITAS not only measures the fatigue by sensors on hull or moorings but also explains why the measured fatigue deviates from design predictions. Differences may originate from different conditions (environmental and loading) assumed during the design process or from simplifications in the fatigue design tool. The MONITAS system has already been successfully implemented onboard of seven production units: the Glas Dowl FPSO (Bluewater), the USAN FPSO (ExxonMobil), the CLOV FPSO (TOTAL), the Ichthys FPSO (INPEX), the Moho Nord FPU (TOTAL), the Bonga FPSO (SHELL) and the Aoka Mizu FPSO (Bluewater).

aNySIM Onboard

The aNySIM Onboard system is based on MARIN's aNySIM XMF simulation software. With a detailed numerical model of the mooring system, the mooring line tensions are calculated with the time domain simulation software, using the measured wave frequency motions and the measured horizontal GPS positions in the field as input. Using the measured response of the floater avoids the uncertainty resulting from a prediction of the hydrodynamic response.



Integrated mooring integrity platform



Courtesy to Bluewater



Instrumented chainstopper

References:

- [1] Advisory Hull Monitoring System for the Bonga FPSO, Pieter Aalberts et al, OTC 29250, 2019.
- [2] Integrity management of mooring systems, Remco Hageman et al, OTC 29560, 2019.

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Scope of work

In the MoniMoor project the various approaches for mooring integrity management are integrated. The key concept is to combine different types of information, including various sources of in-situ data such as wave data, motion response and mooring loads, with design data such as numerical models to address mooring load challenges. By combining multiple data sources, a more reliable assessment of the load history and the condition of the moorings can be made. This information source can be used in the decision making process of the mooring integrity management plan.

The scope of work comprises the integration of the existing integrity management tools into an integrated framework. In addition, the integrated framework will be used to analyse and understand the mooring integrity of multiple floating production systems and floating wind turbines. Existing in-service measurements, including the environmental conditions, motions and structural response, of 8 floating production systems and 4 floating offshore wind turbines will be used as input for the integrated framework.

The fatigue assessment task focuses on understanding the physics involved in the fatigue accumulation and whether all relevant processes are adequately included in the analyses. Extensive post-processing of the measured data is needed to retrieve relevant information.

Environmental fatigue induced loads acting on the floater can be categorized by wave frequency loads and low frequency loads. Both will be considered. Potential snap loads in extreme conditions can also adversely affect the fatigue lives. The fatigue contribution due to snapping loads will be determined for floating wind turbines.

Participants are invited to bring in data (floater characteristics and measurements) of their own floaters (max 2 production units, 2 wind-floating turbines or 1 production unit and 1 wind-floating turbine) for the analyses.

Costs

The participation fee for oil companies, energy companies and contractors for the four years project equals in total 45 kEuro. The total participation fee for classification societies, authorities and small sized companies equals 22,5 kEuro.



MARIN will take the lead in this project as JIP manager. Project meetings will take place every six months during the FPSO JIP Week. The project started in 2023 and will be completed in 2026.