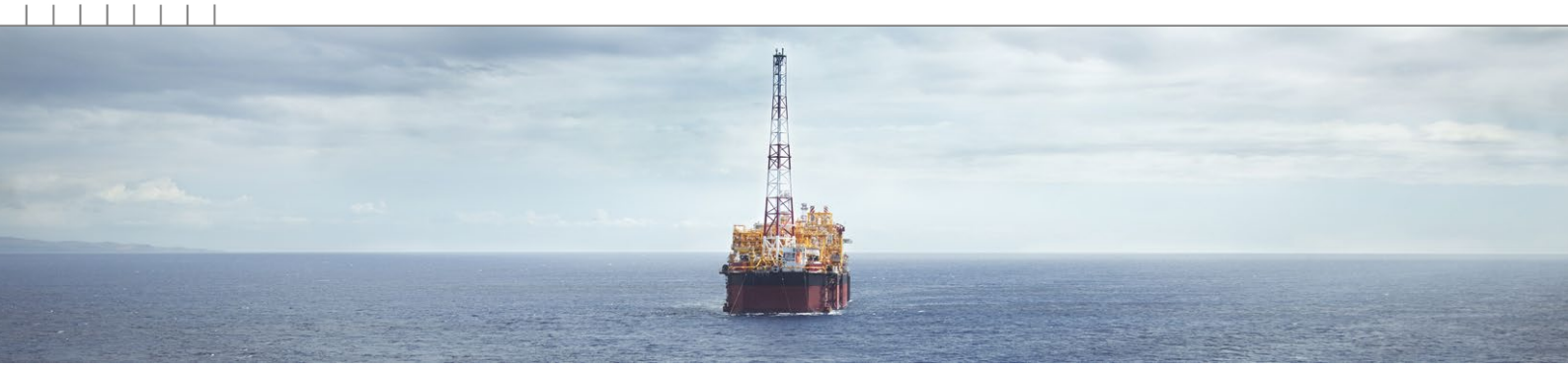


Lifetime extension with AHMS

Monitoring in combination with structural fatigue integrity management tool MONITAS increases safety, reduces inspection and maintenance costs and contributes to lifetime extension

The Advisory Hull Monitoring System (AHMS) is an advanced hull monitoring system, which shows, explains and advises on fatigue integrity of floating structures. It explains reasons for potential deviation of the actual fatigue consumption from design predictions and translates the monitoring data into operational guidance and advice in an easily understandable format. Therefore, it also provides the designers with feedback on the quality of their design tools. The methodology and specifications of AHMS have been developed within a Joint Industry Project (MONITAS) of 16 participants including the major oil companies and class societies.

Crack in stiffener

Monitas JIP participants

Long Base Strain Gauge on deck

Directional wave rider buoy

Methodology description

An Advisory Hull Monitoring System comprises strain measurements at cold spot locations. These locations are characterized by a uniform stress distribution. For these locations, the system not only determines the measured lifetime consumption but also calculates real time by means of the floater design tool the predicted and calculated lifetime consumption, based on the design conditions and the actual measured conditions. For this reason, the floater design tool is part of AHMS. Based on the measured, calculated and predicted lifetime consumption at the cold spot, tool accuracy factors and prediction accuracy factors are determined, which can be applied at the analyses of the (critical) hot spot locations. For more detailed information reference is made to the publication described by L'Hostis, Kaminski and Aalberts in 'Overview of the Monitas JIP', Offshore Technology Conference, 3-6 May 2010, Houston, Texas, USA, OTC-20872.

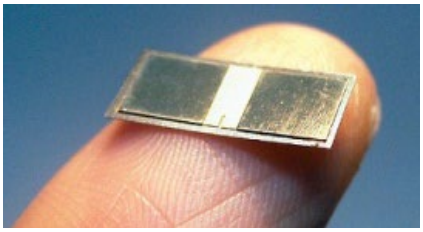
AHMS software

The AHMS software has been developed in cooperation with ABB and WaveForce Technology. This dedicated software is set up and operates within the widely used OCTOPUS framework, which originates from ABB. The AHMS software can easily be tailored for any particular FPSO.

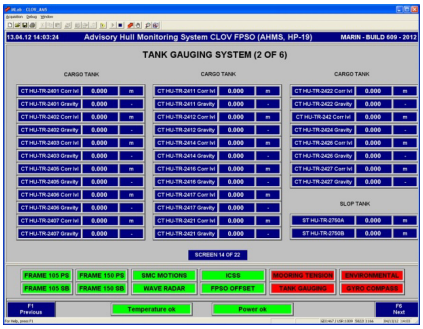
Some features of the software are listed below:

- Detailed Life Time Consumption on a monthly basis
- Continuous comparison with the Life Time Consumption calculated at the design stage

Screenshot Octopus Monitas software



Fatigue Damage Sensor



Software screenshot

AHMS cabinet

- All data is available in easily readable graphs, tables or percentage bars
- Easily accessible data with user friendly pull-down menus
- Easily selectable period in time to track down detailed information
- Windsea and swell separation and fitting using XWaves from WaveForce Technology
- Incorporation of design software of the floater's owner or operator for calculation of the fatigue damage
- Independent fatigue calculations based on the Rain Flow Counting method
- Warning for end-users in case of disordered sensors

AHMS features

- Applicable for new built and existing floater
- Links to the floater's ICSS, RTDB, loadmaster system, tension mooring system, environmental system and motion (incl. position/offset) system
- Serial and TCP/IP Ethernet communication (MOdBUS, NMEA etc.)
- Results real-time available on secured website
- Alarm and warnings to ICSS
- Interfaces with various monitoring systems including Datawell directional wave rider buoy, Fugro wave scan buoy and Oceanwaves WAMOS system

AHMS specifications

MARIN provides dedicated hull monitoring systems for the maritime and offshore industry. Typical applications of the offshore industry comprise FPSOs, TLPs and semi-submersibles. The advisory hull monitoring systems are provided based on clients' electrical and instrument specifications. Basic specifications are:

- Sensor type: Long Base Strain Gauges, local strain gauges and Fatigue Damage Sensors
- DNV/GL type approved PC and monitor
- Measurement resolution: 0.2 με
- Synchronized data between all interfaces
- Adjustable sampling rate
- ATEX and IECEx certified equipment for hazardous areas
- Stainless steel 316L, IP66 and EExe certified junction boxes

AHMS benefits

- Understanding of actual lifetime consumption of floating structures
- Prevention of unexpected failures resulting in loss of production
- Increased safety
- Rational lifetime extension
- Improved design of future units
- Link to Risk Based Inspections

AHMS references

Hull Monitoring Systems have been provided to the maritime industry by MARIN since 1992. AHMS has been developed within the four years' MONITAS Joint Industry Project, which was initiated in 2006. Since then AHMS has been installed onboard of 9 FPSOs:

- FPU Moho Nord, Congo (TOTAL)
- FPSO Glas Dowr, Sable Field (Bluewater)
- FPSO USAN, Nigeria (EXXON MOBIL)
- FPSO Ichthys, Australia (INPEX)
- FPSO Aoka Mizu, West of Shetlands (Bluewater)
- FPSO CLOV, Angola (TOTAL)
- FPSO Bonga, Nigeria (SHELL)
- FPSO P78, Brazil (Petrobras)
- FPSO P79, Brazil (Petrobras)

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