Load Monitoring Systems

Jack-up Leg Load Monitoring

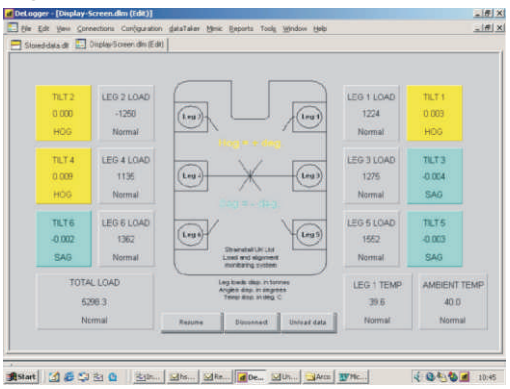
Project: Anadarko - Jack-up Rig Permanent Production Facility

The Al Rayyan PPF 'Al Morjan', a six-legged jack-up rig, was successfully located in position 80km north of Qatar in the Arabian Gulf. A milestone in the project in which Strainstall UK Ltd played a crucial role.

Strainstall's contribution to this successful operation was to provide systems to accurately monitor the load and tilt at each of the rigs six legs during the important rig jacking operations. These systems enable the precise control of jacking down, and the safe raising of the 10,000 tonne rig to its operational height.

Several jacking operations were performed (M.C.C.) during the construction works and subsequent deployment of the rig. Each time the Strainstall leg load and deck tilt system performed excellently, providing instant display of the decks attitude and the distribution of weight applied to its legs. The Bargemaster was able to precisely control the weight distribution through switching of the jacking motors which drive the rig up/down the legs. By momentarily pausing drive on legs 4 and 5 (which initially had taken more of the rigs weight during touchdown on the seabed), the bargemaster equalised the load distribution.

For protection of valuable jacking equipment, which can be damaged due to overloading if loads are unevenly distributed, and also for protection of the deck structure, a combined system of leg load and deck tilt monitoring was fully utilised. The rig designers had determined that whilst the deck structure had good strength and stiffness, an excessive jacking on one leg, or undue bending of the deck, could still cause damage. It was therefore important to have both leg loads and deck tilt monitored simultaneously.



The correlation of tilt and load at each leg can be readily identified on the records of the jackings shown in the graph. The deck tilt sensors were also of assistance during the final 'leveling-off' of the structure.

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The World of Load Measurement and Stress Analysis

System Features

- Control Leg Jacking Operations
- Monitor Deck Tilt During Jacking
- DT505 Multi-channel DAS, up to 90 Channels
- Local Jack-House Displays of Load
- Simple Hardware Configuration
- Deck Tilt Range ±1.0° Accuracy ±0.001°
- Leg Load 3000 Tonnes
- Real-time Trend Plots
- Windows XP
- Mimi Display
- Alarm Limits - Digital Outputs

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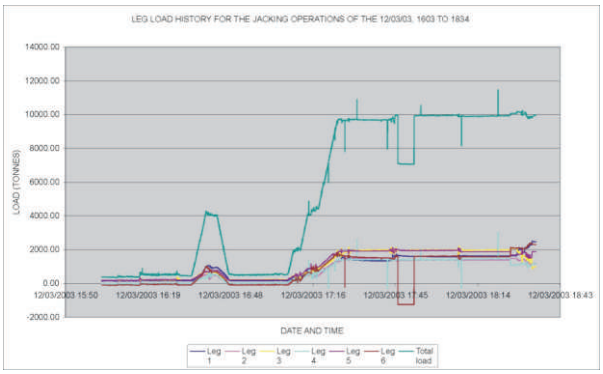
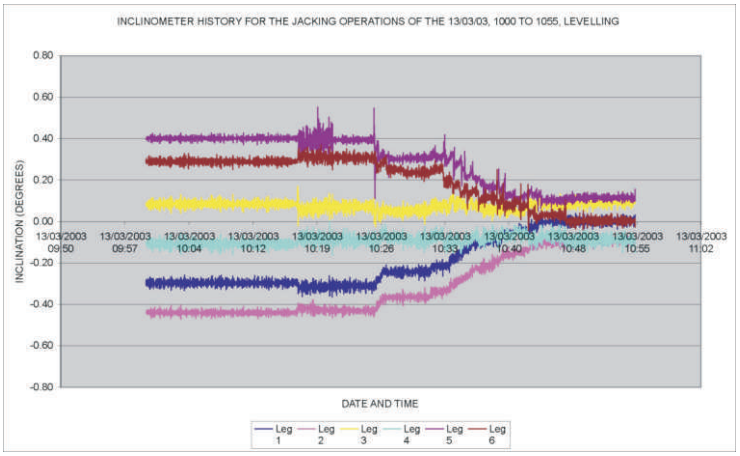


Fitting of strain sensors or load cells to the rigs structure is a common method used to create a leg load measurement system, with the sensors located in areas of predictable stress distribution, as this achieves repeatable and reliable load measurement.

In the case of the Al Morjan (formerly the DMS Venture), an appropriate location for the sensors was already known, as Strainstall had been involved with the leg load measurement since the rig had been in operation in the north Sea during the 1980's. However, before installing the new system, a full stress investigation was completed during jacking trials at Jebel Ali, UAE. A new multi-channel system was designed which enabled balanced load measurement, and which compensated for mis-aligned loads due to leg bending, with 4 strain sensors per leg.



The monitoring system comprised main and back-up circuits. It was installed and commissioned by Strainstall at the Jebel Ali Freezone site whilst the rig was under construction. During all the crucial jacking operations, onshore and offshore, our staff were in attendance to operate the system and ensure 100% success was achieved.

Load signals were fed directly into local displays at each jack-house and then routed to a central location (the jacking control cabin), from where all jacking operations were driven.

The heart of the monitoring system was Type DT505 DAS, which marshalled all the signal inputs and fed them into a PC Windows management program. The software was set up and programmed by Strainstall to the specific requirements of Anadarko. The on-screen display of load and tilt alarm limits were set so that loads in excess of 2000 tonnes were clearly visible.

The leg loads and tilts will continue to be monitored permanently throughout the life of the structure, so the long term stability of the rig can be assessed.

Strainstall's team of experienced engineers operate from offices in Cowes, Bath and Aberdeen (UK), Norway, Belgium, USA and Dubai.

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