Crane motion reference unit (MRU) malfunctions after overheating

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A member reports the following incident in which a crane paid out winch wire unexpectedly whilst in active heave compensation (AHC) mode.

What happened?

A vessel was engaged in inspection of a floating production storage and offloading unit (FPSO) mooring chain in around 80 metres of water, with the AHC crane being utilised to lift and hold sections of the mooring chain off the sea bed for cleaning and inspection by ROVs.

During one lift while operating in the AHC mode, the crane unexpectedly disengaged from AHC mode and the wire slowly paid out approximately three to four metres, lowering the chain and then coming to a complete stop all without operator intervention.

There was no damage to the crane, mooring chain or the ROV. All activities were stopped, the chain lowered and the seabed and the crane de-rigged. Once the condition of the crane was established and a risk assessment had been conducted, the rigging was recovered to deck and the crane taken out of service.

What were the causes?

The chief engineer and electrical technical officer of the vessel investigated the incident in co-operation with the crane manufacturer, who was able to remotely interrogate the crane's computer diagnostic system. The following details were recorded:

- Crane type – active heave compensated offshore knuckle – jib
- Crane safe working load (SWL) – 70 tonnes (T)
- Lift weight – 44T at time of incident
- MRU location – crane pedestal – mounted in lower section
- Winds – 7-10 knots
- Sea state – 0.5-1.2 metres (calm conditions)
- Ambient temperature – 32 °C
- Solar radiation – high.

With regard to the causes of the incident, the following points were noted:

- The MRU returned a signal error that resulted in the AHC mode being deactivated by the high-high-position deviation alarm. This was confirmed by the crane log print out.
- Activation of the AHC high-high-position deviation alarm activated a stop condition for the AHC mode and therefore the crane control system reacted accordingly by shutting down the AHC mode.
- The MRU produced spurious signals due to overheating:
    - the calm conditions, high ambient temperature and solar radiation resulted in reduced cooling capability of the crane hydraulic power unit (HPU) cooling circuit.
        - As a result of this and the AHC being in use, there was a very high ambient temperature within the upper and lower crane pedestal. This high temperature caused the internal temperature within the MRU junction box to increase over time, which in turn increased the MRU operating temperature, and caused it to supply a spurious signal
    - the air-conditioning (AC) unit in the crane pedestal tripped out resulting in reduced cooling to the pedestal-mounted MRU junction box.

Actions

The following actions were taken to mitigate against re-occurrence:

- An additional cooling fan was installed on the MRU cabinet to provide additional air circulation to increase the cooling capacity.
- A trip alarm was installed on the pedestal AC unit to alert engine control room of a shut-down of the cooling to the junction box.
- MRU inspection was added to crane start-up checklist. Additional actions were considered.
- MRU junction box temperature sensor with readouts to crane operator and engine control room.
- Purpose designed AC for the MRU.

Lessons learnt

The important lesson is to keep a close eye on MRU operating temperature when the crane is operating in AHC mode and the vessel is in calm conditions, high ambient temperatures and high levels of solar radiation.

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