

Acoustic Mooring Line Monitoring - Results from Petrojarl Knarr

This report presents observations and conclusions from an analysis of the first 10 days of data from the Scanmatic acoustic mooring line system which now is permanently installed on Teekay's FPSO Petrojarl Knarr, located in the North Sea.

Background

Scanmatic has collaborated with Teekay to implement a retrofit system for monitoring the integrity of the mooring lines of a FPSO located in the North Sea. The system uses very small inclination sensors with wireless hydroacoustic communication. In June 2019, each of the 12 mooring lines were at depths around 70 m fitted with a magnetic ROV clamp containing two such sensors.

After a successful logging campaign using a receiver hanging from the side of the FPSO, a permanent installation was established. A novel method was used for installing the receiver in the I-Tube, an ATEX certified signal conversion cabinet was installed in the turret and the topside computer with Scanmatic developed SCADA software started receiving sensor data in the beginning of December.

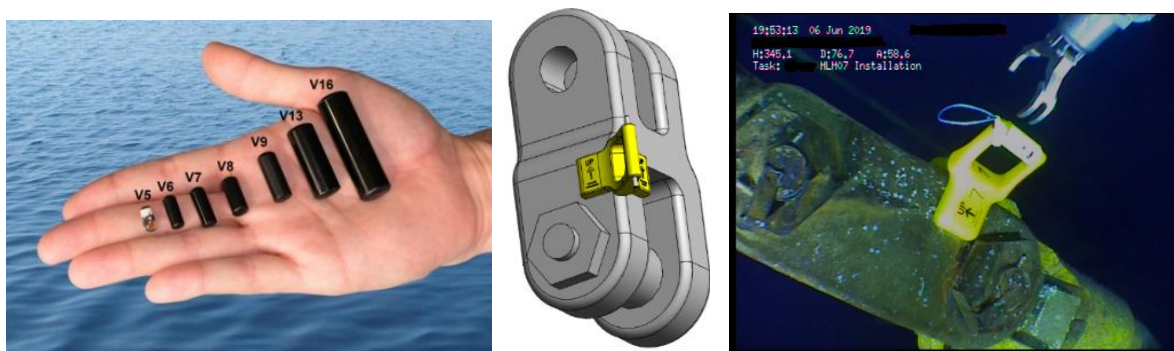


Figure 1 Example of sensors, Scanmatic ROV clamp design, sensor installation by use of ROV in June 2019

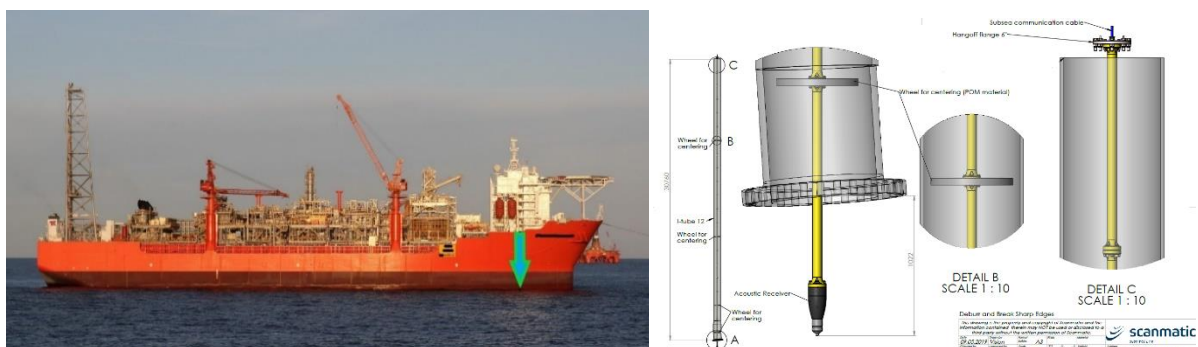


Figure 2 Teekay FPSO Petrojarl Knarr, receiver installation in I-Tube

For more information about the initial installation and logging campaign conducted in June 2019, please consult "Scanmatic test report_Acoustic MLM logging campaign_June 2019". For technology background and more information on related Scanmatic projects, please see "Scanmatic Acoustic MLM_Background and references_August 2019". These reports, and a system data sheet, are available on request.

Analysis

The basis for analysis is the data acquired between 6th and 16th of December. During this time there was a period of bad weather, visits from supply ships and use of the FPSO's heading stabilizing thrusters, all of which are potential data degradation sources for hydroacoustic systems. The data source is thus believed to be a good representation of normal operation on the FPSO.

For this installation, the main sensors are configured to wake up every 14 – 16 minutes, perform an inclination measurement and transmits that information by use of sound, before going back to sleep. Estimated battery life is more than 10 years.

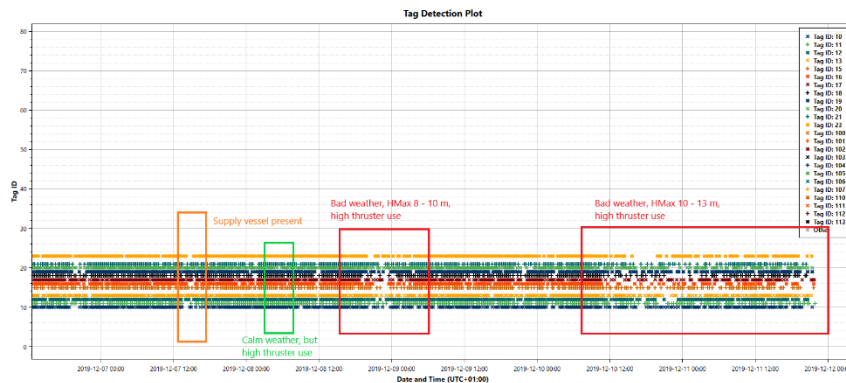


Figure 3 Received sensor transmissions by ID, showing various events.

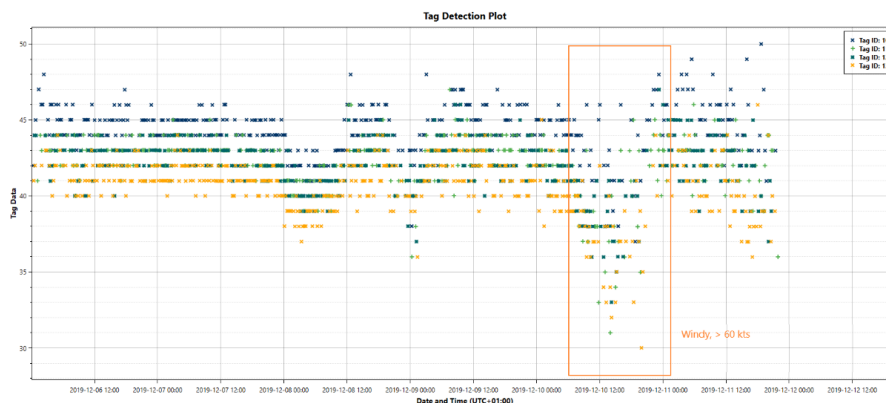


Figure 4 Sensor angle data from Cluster 1 (Line 1, 2, 3, 4). Highlighted is a particularly windy period with > 60 kts

Key observations

- Inclination measurements from all mooring lines are consistent and continuously updated
- Approximately 90 % transmission success rate during “good” and 80 % during “bad” weather
- Visits from supply ships impacts the system to some degree. The source of interference is likely to be an echo sounder on the ship. This interference is clearly visible in the background noise level data coming from the Receiver

Main conclusions

- The Acoustic Mooring Line Monitoring System provides cost effective situational awareness, especially for retrofit applications
- The data from the system forms a good basis for alarm handling and mooring line breakage detection