Study on the Motion Monitoring of the Semi-submersible Vessel HYSY278 with the HZ25-8 Topside during the Transportation

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ABSTRACT

The semi-submersible vessel HYSY278 was applied to transport the HZ25-8 topside from Qingdao to the South China Sea. Field measurement was carried out using inertial navigation system (INS) and global positioning system (GPS) for the safety of dry-towing. Signals of pitch, roll motions of the vessel are monitored during the transportation. The measurements lasted 6 days. The maximum peak-peak value recorded for roll and pitch motions is 1.07 and 0.23 degrees respectively, which is smaller than the threshold design value. Low frequency component is observed from the roll signal recorded. It is concluded that the maximum roll angle recorded was not caused by the waves but due to the collision avoidance that result in the modification of courses and then large roll motions.

KEY WORDS: HZ25-8 topside, dry-towing, ship motions, field measurement.

INTRODUCTION

The installation of HZ25-8 DPP (Drilling Product Platform) of China National Offshore Oil Corporation (CNOOC) topside was successfully completed in the eastern waters of the South China Sea for the Enping Oilfields on 21st May, 2014, which was the first offshore platform installation in China using dynamic positioning (DP) floatover technology. The semi-submersible heavy lift vessel HYSY278 is applied for the transportation from the Qingdao Fabyard to the oilfield site in South China Sea and also for the floatover operation. The weight of the topside is about 15,000 MT. In order to avoid overstress of the sea fastening structures on the deck of the submersible vessel, the motion of HYSY278 should not exceed a certain amount under a certain level of sea environmental loads. So it is necessary to monitor the motion of the vessel HYSY278 during the transportation. Similar motion monitoring was carried out for the safety of the transportation of LW3-1 jacket in 2012 and PW34-1 jacket in 2013 using the T-shaped launching barge from Qindao Fabyard to the South China Sea.

One real-time motion monitoring system was applied to measure and monitor the vessel motion responses during transportation, thus allowing corrective measures to limit critical barge motions to ensure the structural integrity of the jacket. The motion monitoring system consists of inertial navigation system (INS) and global positioning system (GPS) so that the accuracy of the field measurement can be achieved. The field measurements include six degrees of freedom of the barge motions and accelerations.

The field measurement lasted 6 days starting from 15th to 19th May, 2014. The maximum peak-peak value recorded for the roll and the pitch motions is 1.07 and 0.23 degrees respectively, which is less than the threshold of design values. The sea state encountered was smaller than the lower limit of Sea State 5 (Hs=2.5m) obviously according to the ship’ log on board. According to the installation design for the transportation, the maximum value for the roll motion is 1.82 degrees, which occurs when the significant wave height is 4.9m and peak period is 12.1s in beam seas. Detailed investigations are carried out.

This paper presents the motion monitoring technique and the field measurement finding for the HYSY278 with the HZ25-8 topside during transportation. Low frequency component is observed from the roll signal recorded. This phenomenon observed is different with those recorded in previous field measurements on motions, where the maximum roll motions are caused by the wave encountered. The results will benefit the future installation design for the topside transportation when the HYSY278 is used.

SET-UP OF FIELD MEASUREMENTS

The main particulars of the HYSY278 are shown in Table 1. The Gyroscope System from Beijing C.S. U. Technology Development Co., Ltd. is adopted to measure the roll and pitch motions. The model type is ZX-NAV620A. The precision level of the Gyroscope is 0.05º for the motion angle. The Gyroscope System integrated with the Data Acquisition System is located on the main deck as shown in Fig.1 with signals of ‘DAQS’.

ZX-NAV620A is an inertial navigation system (INS), which includes a GPS (global position system) with two antennae. The GPS antennae are located on the top of the pillars erected on structures with height 4.00 meters above the main deck as shown in Fig. 2. It is also indicated as