Field Measurements of the Sea Environments and Barge Motions for the Floatover Installation of Kenli 3-2 Mega Topside in Bohai Bay

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ABSTRACT

This paper presents the field measurement techniques and the major instruments used in the successful floatover installation of the Kenli 3-2 mega topsides in Bohai Bay on 5th January, 2014. The motion measurements of the T-Shaped floatover barge HYSY228 and the environmental field measurements, etc., were conducted to study the effect of the T-shaped barge hull and other influence factors. The field measurement data were processed instantaneously on site to obtain the real-time statistical results of the motion and the sea environments, and therefore ensuring the floatover operation to be performed as rapidly as possible and coincident with safe practice.

KEY WORDS: Field measurement; environmental monitoring; motion monitoring; T-shaped barge; floatover installation.

INTRODUCTION

Three different sea environmental and motion monitoring systems have been successfully applied to the challenging floatover installation of 15,000 MT integrated topsides for the Kenli 3-2 oilfield development in Bohai Bay. These field measurement systems were designed to ensure a safe and efficient floatover operation in 16.0 meters depth water and the harsh environment.

This comprehensive field measurement program consists of a barge motion monitoring system, sea environmental monitoring systems and a visual monitoring system. The motion monitoring system includes an integrated Inertial Navigation System (INS) and Global Positioning System (GPS), used as mobile units, as well as a single Real Time Kinematic (RTK) base station installed on a fixed platform nearby, thus providing up to centimeter-level accuracy to monitor the six-degree-of-freedom barge motions and the movements of topsides leg mating unit (LMU) cones and tips of deck support units (DSU). The environmental monitoring systems include one buoy system measuring the wave height, period and direction, an Acoustic Doppler Current Profilers (ADCP) for the profile current speed and direction, an anemometer, and a tidal gauge. The visual monitoring system includes 12×360-degree spherical video cameras installed on the deck support frames to observe the mating operation of the LMU and the separation of the DSU, as well as the routine operations on deck.

This paper describes the field measurement techniques and the major instruments used in the successful floatover installation of the mega topside in Bohai Bay on 5th January, 2014, which is the first one performed in winter by China Offshore Oil Engineering Co., Ltd. (COOEC). The motion measurement of T-shaped launching barge HYSY228 and the sea environmental measurements, etc., were conducted to guide the entire floatover operation and also used to study the effect of the T-shaped barge hull and other influence factors. Fig.1 shows the position of Kenli3-2 oilfield in Bohai Bay.

Fig.1 GPS position of the Kenli3-2 oilfield

SETUP OF FIELD MEASUREMENTS

The setup of the barge motion monitoring system, the sea environmental monitoring system and the visual monitoring system are described here. Fig.2 shows the general arrangement of these field measurement systems on main deck of HYSY228. Installation locations of twelve 360-degree spherical infrared video cameras are illustrated, where six ones are on portside as 'A1'-'A6' and six ones are...