ABSTRACT
A new type of float-over method, called floaters float-over (FFO), is innovated and presented in this paper. FFO concept is to float the deck using two groups of floaters at the deck opposite sides. By ballasting and deballasting of the floaters, the system will be able to raise the deck from the transportation barge, move it and then lower it down above the jacket/spar (Geba 2013). FFO can work in wider range of sea states more than conventional float over methods. Also, it eliminates the need to design the platform for a "float through". In this paper, the concept and design philosophy of the FFO are presented. The comparison between the FFO motion characteristics and the results from model experiments shows good agreement. A time domain analysis during mating is performed, where the impact forces between deck and jacket legs are computed to investigate the sea states limitation. From the structural point of view, with the FFO the deck is exposed to a static sagging condition as the deck is hinged from its extreme sides rather than its original support locations. The additional stiffening required for the deck, globally and locally, is discussed and compared to other types of installation techniques.

KEY WORDS: Float-over; motion analysis; structural analysis; fluid-structure interaction; mating analysis.

INTRODUCTION
Offshore platforms are manufactured in fabrication yards and then transported to their offshore site location for installation. Topside deck structures are installed above jacket / spar structures using either heavy lift or float-over methods. Heavy lifting installations are always constrained by the capacity of the heavy lifting barges and their availability, which makes them uneconomical for heavy deck installations. Float-over provides an attractively cost effective way to install offshore decks, especially when the deck weight exceeds available crane lifting capacity. However FFO is very sensitive to weather. Jacket and deck require special design to comply with the internal float over requirements. The deck should be designed to be supported on internal supports during transportation and installation, and to be supported on external supports located at larger span during the mating operation. The jacket should be designed to accommodate vessel entrance (i.e. vessel breadth and draught plus additional sufficient margin), which means no jacket braces should be located in the area of vessel operation. The loads are increased on the deck/jacket legs due to the required modifications. In addition, this has a significant effect in locations subject to seismic loads, (Chakrabarti, 2005). Other float-over methods depend on supporting the deck from its extremities by two barges, such as float-over decks above spars (Maher, 2001), and VERSABAR float-over (Thompson, 1997). These types are usually more sensitive to weather because of the phase differences in motions between the two barges carrying the deck, which create torsion moments in the deck, as it is the only connecting structure between them. The limitations of these methods require that the transportation be performed only in sheltered areas between fabrication yard to installation site (Chakrabarti, 2005). Avoiding torsion in the module during sea transport, the catamaran arrangement can be solved by loading the catamaran onto a self-propelled transport vessel (Seij, 2007), but this is considered an uneconomical solution. If there is a method of offshore deck installation that can work in harsher sea states than the conventional float-over methods, and can avoid the float through and raking effect, and of course has the capabilities to install decks with higher capacities than heavy lifting cranes can do, it would be very profitable. That is where the concept of FFO comes from.

FFO concept is to float the deck using two groups of floaters at the deck opposite sides. By ballasting and deballasting of the floaters, the system will be able to raise the deck from the transportation barge, move it and then lower it down above the jacket/spar. Both the floaters small water plane area and large mass of the system make the system’s natural period exceed most of the wave periods and consequently reduce the system response to waves compared to other installation methods. This allows the proposed system to work in a wider range of sea states. The use of side floaters, rather than barge in float-over, eliminates the need to design the platform for a "float through". Moreover, FFO has the capability to install larger and heavier decks than the range covered by the heavy lift.

The limiting sea state suitable for FFO and the effect of FFO on deck strength are discussed in this paper.

DESIGN PHILOSOPHY
FFO concept is illustrated in Fig. 1, where the deck is transported onboard a transportation barge. When the deck arrives in location, two