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Personnel Transfer System for Offshore Demands

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1 Introduction

Access to offshore constructions is the most important aspect for all O & M and repair work activities for such structures. This results from own experience and analyses as part of many years of experience of the involved companies ep4 offshore GmbH and Teupen Hylift GmbH. ep4 offshore represents the experience of the offshore wind farm branch and Teupen Hylift is one of the leading companies for aerial access platform production. Both sets of experience guaranty a high level of production quality and a safe operation of the Personnel Transfer System (PTS) for many years.

Teupen Hylift and ep4 offshore formed a Joint-Venture for effective marketing of PTS.

PTS is used for the transfer of personnel and cargo from a ship to a fixed structure in the sea without mechanical contact between the ship and the foundation of the offshore structure.

The first priority for the use of the PTS is to avoid injuries of the personnel, which could be probable if a vessel tries to moor on a fixed building in moved seas. Furthermore the PTS allows material transfers of up to 500 kg with 15 m range and heavier good with 8 m range.

The considerable positive economic effects of the extension of the weather window for offshore work could be reached only by the elimination of the influence of the waves

2 Challenge

The accessibility to offshore structures is limited by the wave height. Manoeuvres with boats and vessels with a direct contact between the structure and the vessel or boat are limited to significant wave heights of approx. 1.5 m. According to the sailings directions no. 2006 of the BSH (Federal Maritime Administration) for the North Sea wave heights of 1.5 m occurred approximately 54 % per annum. This is equivalent to 54 % accessibility. During winter time the lower values are between 35 – 40 % and the highest values could be found during the summer with 75 – 80 % (Fig. 1). For supply work of many single structures, for example an offshore wind farm, this accessibility is inadequate.

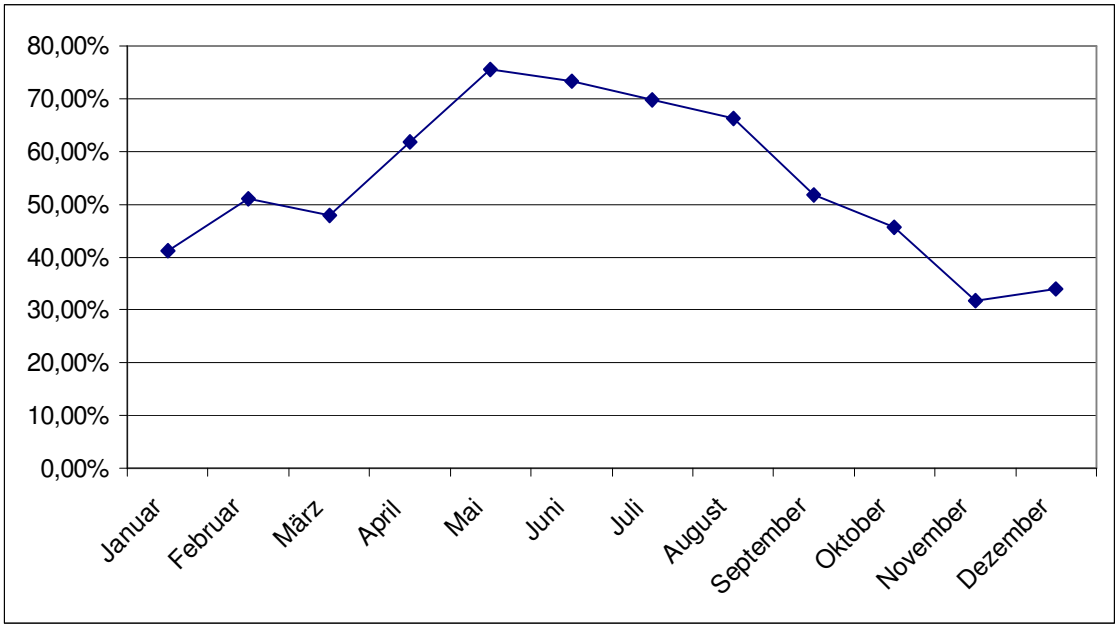

Fig. 1: Distribution of the Combination of Wave Heigth up to 1.5 m and Wind Speed up to 6 Bf.

As result of such a low accessibility the technical availability for an offshore wind farm will be reduced by 15 – 20 %. The distribution showed in Fig. 1 results in dramatic effects for the organisation of the work. Higher productivity in wintertime results in a higher probability for repairs and unscheduled visits of the WEC in comparison to summertime. To be able to handle these events during the short weather windows given by Fig. 1 it will be necessary to employ a higher number of staff than it would

be necessary with better accessibility. The labour organisation is therefore defined by wintertime demands. This results in a too high number of working forces during the summertime. In-house calculation showed that the described effect can be in the range of 50% fewer personnel for access for up to 3 m significant wave height. In the future it is expected that there will be a lack of well educated staff for this kind of work, so it will be desirable to bind the personnel to the company and to reduce the number of worker as much as possible.

3 Objectives

To enable the continuous supply of unmanned offshore structures, it would be desirable, if the transfer manoeuvres are possible up to a significant wave height of 3.0 m. With this the annual average accessibility increases to approximately 88 %. Even in winter time this value is not below 75 % (Fig. 2).

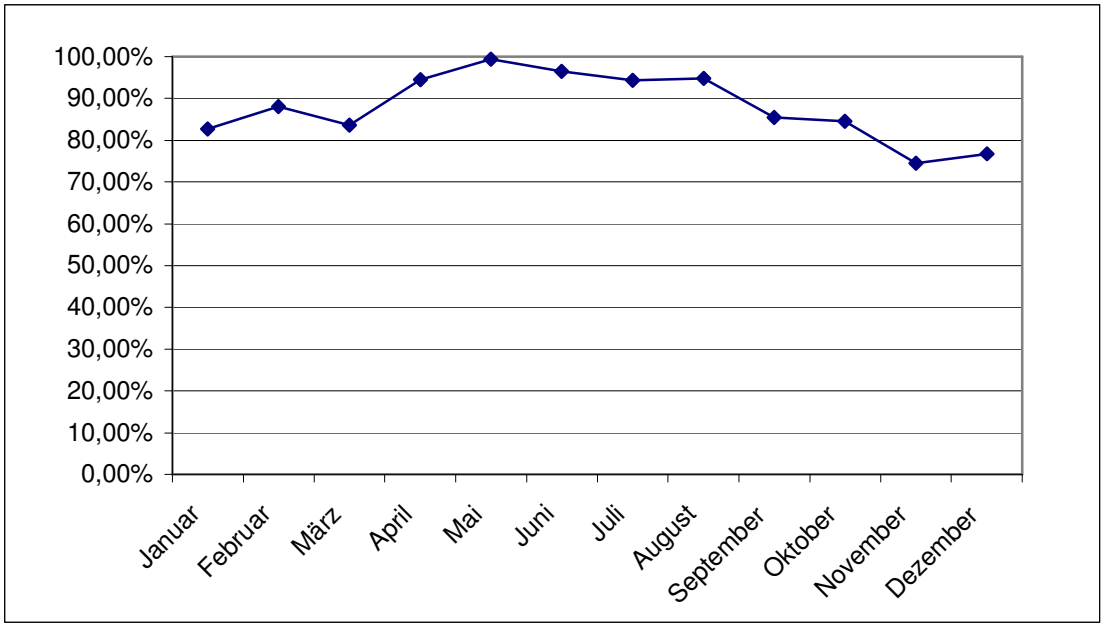

Fig. 2: Distribution of the Combination of Wave Height up to 3 m and Wind Speed up to 8 Bf.

The necessary service and repair work could be distributed regularly over the year. The service crew could be used for service work during the winter time and in the summer they could, besides a smaller service program, prepare the annual inspections and assist the inspectors.

The regular work avoids seasonal employments which are quite common for tourism in the coastal communities. Furthermore the special know-how will be preserved in the company, because the amount of fluctuation of the crew is lower, if the single worker has a long term perspective.

4 Solution

The PTS is a radio controlled two-armed hydraulic boom, which will be installed on every single offshore installation. The principle of the transfer is similar to a helicopter transfer. For this transport the person uses a belt system and connects this to the “transfer hook”.

The procedure of the transfer works as follows:

The supply vessel holds position close to the offshore structure with a safety distance of at least 5 m (Fig. 3). The PTS will be activated and swing out from the neutral position into the working position. The system is fully heave compensated. The transfer hook moved by the winch will follow the movements of the vessel. This is enabled by a fuzzy logic control and different movement detections systems. The person (mechanic) steers the PTS via radio remote control in a way that the transfer hook will be approx. 1.5 m above the aft deck of the vessel. The system compensates the vertical movement of the vessel. The hook stands still in relation to the deck. The mechanic connects the transfer hook to his harness and presses the “lift button” and the system lifts the person from deck and outside the dangerous area. After that the person steers to the PTS to the landing point on the service platform and removes the connection to the transfer hook. The vessel is then free again and could take on other tasks.

The material transfer works similar, though there is now a person on the service platform of the offshore structure to steer the PTS.

The way back to vessel is more difficult, because the person can not feel the movements of the vessel. The automatic control of PTS enables a smooth and save transfer back. The mechanic moves the PTS over the deck of the vessel high enough outside dangerous area of the vessel. He lowers himself down by the winch and in a safe distance he asked the supervisor to switch the compensation on and under

compensation of the vertical movement of the vessel the user approaches to the deck of the vessel.

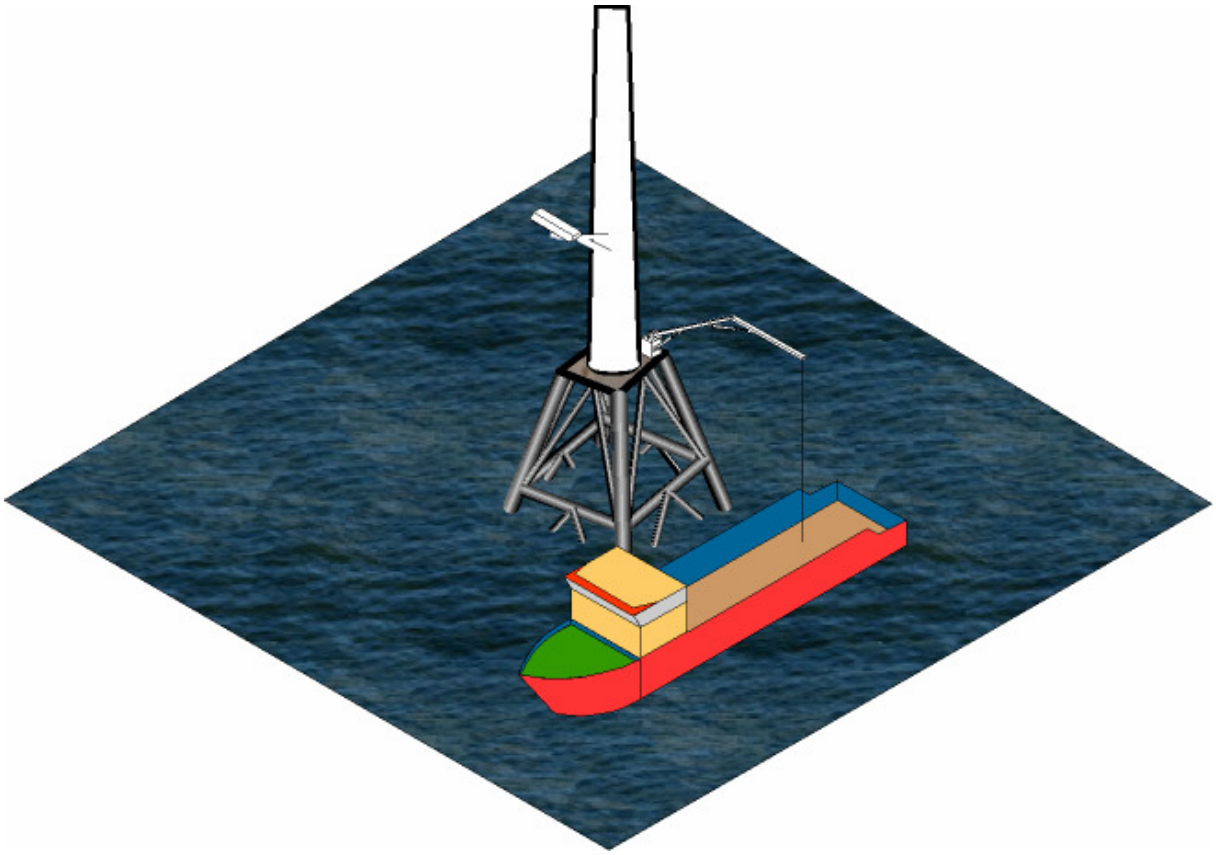

Fig. 3: Schematic Picture of the Personnel Transfer System Inclusive Service Vessel

Under permanent compensation the user can release the hook from the harness and leave the landing zone. PTS will then be steered into its basic position.

The PTS has a complex sequence of movements, which guarantees that for the user any danger is minimized. The PTS has three positions. In between these positions the PTS could move smoothly. In the basic position the PTS is switched off and could activate remotely controlled (Fig. 4). The boom B of the PTS could be moved independently from boom A (Fig. 4). By lifting boom B work position 1 is reached. In this position the PTS could be used for heavier goods with a range of 8 m and could be used up to wave heights of 1.5 m. The maximum weight will be defined individually with the client. When lowering the boom A, B will shift parallel (Fig. 4). The fully stretched PTS (work position 2) reaches 15 m. In the work position 2 up to

500 kg of goods could be lifted. This modus is especially important for the personnel transfer.

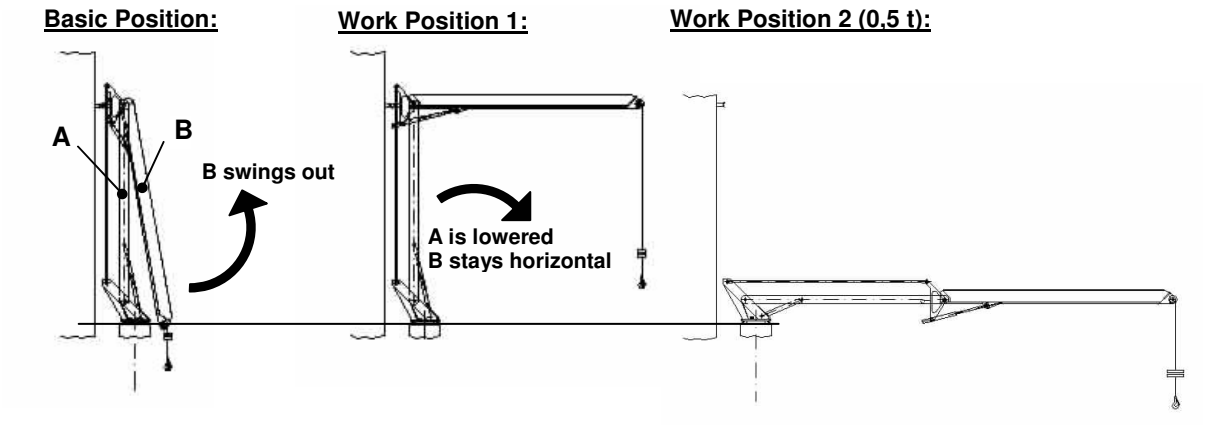

Fig. 4: Various working positions of the PTS

The turning angle of the PTS is 270°. The special sequence of movements of the PTS enables the user with only one action to gain altitude and to leave the vessel by reducing the range of the PTS (lifting boom A, B will be shift parallel) (Fig. 4). Through this “up and away” the dangerous area could be left quicker.

The PTS is universally usable and could be mounted on top of transformer stations at sea as well as on top of foundations of offshore wind mills or on light houses.

Fig. 5: PTS-Prototype during Hamburg Wind Energy Fair May 2006

5 Current Status

PTS has passed the prototype phase and is now ready for final tests offshore. During November/December 2007 and January 2008 PTS was tested at a harbour site in Hamburg, Germany. The purpose of this test was long-term loading of the complete system including its radio remotely control, winch, hydraulic, sensors and controls. For this PTS was installed on a quay wall and a boat was floating in the river Elbe used as target.

fig. 6: PTS in Hamburg

In total PTS transferred 526 times ballast and 90 times a person from the quay wall to the boat and back. Especially the personnel transfer tests were successful. This part was needed to test the equipment, the routine of use, the command structure and the safety strategy.

fig. 7: Boarding the boat

PTS passed all test positive and is now in the reengineering phase to introduce the lessons learned during the tests.

It is assumed that in late summer of 2008 PTS will have passed also the final test.

6 Health and Safety

Primarily the PTS should only be used by specially trained persons!

PTS will offer training courses for your personnel or for your contractors.

The personnel safety equipment consists of survival suit/safety jacket and helmet. A radio connection is integrated in the helmet. PTS representatives can procure the necessary equipment for the safe transfer of personnel.

There are two major groups of events to be taken into account. First the person is not fully lifted to the tip of the PTS and failure occurs (winch failure) and second the person is fully lifted to the tip of the PTS (hydraulic failure).

In the event of a loss of hydraulics while the person is fully lifted to the tip of PTS an auxiliary hydraulic system will enable the system to fold together to bring the person back to the working platform of the wind energy converter. In a case in which a person has not reached the tip of the PTS then he or she can use a personal safety gear to lower him or herself down to the water surface. Before this the master of the service vessel has to bring out a boat to salvage the person. Helicopter transfer of personnel remains another option.

In the case of a damaged radio control, the master controls on the bridge of the vessel can be used to control the PTS independently from the actual operator. The user's signal can be operated by the master control. This aspect is very important in the case of panic or fainting. This covers all defects of the radio control. A defect of the receiver can be covered by redundancy.

In order to reduce the risk of injury, the landing area on the vessel should be covered with shock absorbing flooring.

7 Summary

The PTS can increase the accessibility of offshore structures in the North Sea from approx. 54 % to approx. 88 % by avoiding dangerous mooring manoeuvres around the offshore structure in the moving sea. This will dramatically increase the technical availability of offshore wind energy converters. In addition, this system can be used in conditions up to 3.0 m significant wave height and up to 8 bf wind.

Design parameters of the PTS are 500 kg capacity with a 15 m range. By reducing the range, the capacity can be increased for the transfer of heavy goods. Redundancy and intensively trained personnel will help to reduce injuries which can occur during the pure boat transfer.

Increased technical availability enabled by the PTS adds significant economic benefit to the offshore wind farm. Seasonal work can now be avoided which will help increase the acceptance of offshore wind farms.

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