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RISKS OF MARINE TRANSFER OF PERSONNEL OFFSHORE

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This paper presents the results from recent research into the risks of transferring personnel between offshore installations and marine vessels. Using a collection of data on accidents and activity in crane transfer, a new fatality risk estimate has been developed, which is much more robust than the previous published value. Nevertheless more systematic data collection is recommended, as this would further improve the risk estimate and would also help identify ways of minimising the risk in the future.

Introduction

There are only two ways of moving personnel to or from offshore installations: helicopters or boats. Helicopters have suffered some high-profile accidents, and are well known as a major contributor to the overall risks of accidents offshore. One way of reducing these risks might be to use marine transfer instead. But there are also risks of accidents in marine transfer of personnel. These are much less well known than the risks of helicopter transfer. The purpose of this paper is to present the results of recent research into these risks, and to advocate the collection of better data.

Marine transfer methods

First, we define what we mean by "marine transfer of personnel". Marine transfer involves the movement of personnel between offshore installations and marine vessels. Offshore installations include fixed platforms, mobile rigs, floating production units and support facilities. Marine vessels include crew boats, stand-by vessels and work boats. The transfer may be required for crew rotation between shore and offshore, for in-field shift changes, for operational work-related purposes, or in response to emergencies.

There are many different transfer methods (IMCA 2010), all of which aim to bridge the variable gap between a vessel moving on the sea surface and the tall structure of an installation. Perhaps the most basic is where the crew boat nestles against part of the installation structure, such as a pontoon or ladder, holding itself in place using its own power while the passengers step across. Sometimes a rope swing is used to help passengers cross the gap. At the other end of the scale, modern designs of hydraulic gangway provide a telescopic link that pivots and extends to maintain a rigid bridge between the deck of the vessel and a reception area on the installation. This paper concentrates on the most common of the methods (estimated to account for around 80% of the transfers) – the use of a crane on the installation to lift a personnel carrier between the decks of the vessel and installation. There are several types of such crane-lifted carriers, including collapsible nets with the passengers holding on the outside, rigid baskets with the passengers standing inside and rigid capsules with the passengers seated inside.

Previous risk estimate

Risk assessments of marine transfer commonly use a published estimate of the fatality risk based on experience with rope swings in the offshore industry in Brunei and Malaysia prior to 1991 (Spouge et al 1994). Since no fatalities had occurred in the data,

the risk was estimated using an assumption about how close the operation might be to its first fatality. A wide uncertainty range was also quantified. Although outdated and limited, no more recent data has been published, so the risk estimate remains in common use (CMPT 1999, OGP 2010).

The poor quality of this estimate has the potential to lead to inappropriate evaluation of the relative safety of helicopter and marine transfer. The high level of uncertainty in marine transfer risks, compared to the relatively well-documented risks in helicopter transfer, complicates the comparison and may lead to inconsistent approaches.

Reflex Marine (RM) and DNV GL have therefore taken steps to improve this estimate, as reported in this paper. Although we believe the new estimate to be much better than the previous one, it is still not as robust as that for helicopter transfer, which has been well-studied over many years. We therefore recommend further data collection in order to obtain an estimate that would provide a good basis for further management of the risks.

New risk estimate

The new risk estimate uses as its starting point a database of crane transfer incidents collected by RM from their knowledge of the marine transfer industry. DNV GL reviewed the quality of this database, making an independent collection of fatality data from public sources, and compared the results.

In summary, DNV GL did not identify any obvious omissions from the RM database of crane transfer fatalities apart from one case of collision following a medical evacuation. The difficulty DNV GL experienced in identifying fatal accidents from public sources reinforces the desirability of improved data collection. It was clear that RM's industry contacts contributed significantly to the data collection.

In total, 15 fatal accidents were identified in crane transfer world-wide from 1976 to 2013. In the most recent 5-year period, 2009-13, there were 5 fatal accidents, so the average rate is approximately one fatal accident per year world-wide in marine transfer by crane-lifted carrier. Most of these are single-fatality accidents, but the complete dataset included two accidents that killed 2 passengers, and the average number was 1.15 passenger fatalities per fatal accident. The average annual number of fatalities is therefore taken as 1.15 per year.

DNV GL concluded that the RM fatality data appeared comprehensive and was suitable for an updated risk estimate. In contrast, the available non-fatal incident data was more variable in its quality. The ratio of non-fatal incidents to fatal accidents varied widely between regions and over the data collection period in a way that strongly suggested variations in incident reporting rather than risk. Therefore only the fatality data has been used in the risk estimate. However, the non-fatal incident data is considered to provide a representative sample, which may be used to analyse the nature of incidents and help develop improved strategies to reduce risks further.

To estimate the risk, we need to know the activity level (i.e. the number of transfers carried out) in the same period and scope as the accident data. RM therefore estimated world-wide marine transfer activity from their knowledge of the industry. This totalled an estimated 5.15 million passengers transferred by crane in the year 2012.

We acknowledge that it would be desirable to gather improved accident and activity data on marine transfer from across the industry, rather than just from RM's own knowledge. However, in the absence of such industry-wide data collection, DNV GL considers the RM data is suitable to update the previous risk estimate.

The average individual risk in crane transfer is therefore estimated as:

$$\text{Individual risk per transfer} = \frac{\text{1.15 fatalities per year}}{\text{5.15 million people transferred per year}}$$

$$= 2.2 \times 10^{-7} \text{ fatalities per transfer}$$

This is approximately a 1 in 5 million chance of fatality for each person transferred.

This result is uncertain, mainly because it is based on a small number of events, which fluctuates randomly from year to year. Hence the best estimate above may not be representative of the long-term average risk. We estimate a 90% confidence range from 8.8×10^{-8} to 4.7×10^{-7} fatalities per transfer. In other words, we acknowledge that future updates might be from 2.1 times higher to 2.5 times lower than the current best estimate.

Comparison with previous estimate

The previous published risk estimate, based on no recorded fatalities in 2.6 million passenger transfers prior to 1991, was an individual risk of 2.7×10^{-7} per transfer (Spouge et al 1994). At that time the confidence range was estimated to be from 4 times higher to 14 times lower than the best estimate.

Figure 1 shows the current and previous results, with I-shaped bars representing their 90% confidence ranges. In simple terms, the new risk estimate (a 1 in 5 million chance of fatality) is very similar to the previous one (which was approximately a 1 in 4 million chance of fatality). The main difference is the much greater degree of confidence in the result (that is, the narrower confidence range), because it is based on a larger group of transfers with actual fatality experience. This illustrates a general lesson: that collecting accident experience does not necessarily increase the risk estimate, but it does give much better understanding of what the risks really are.

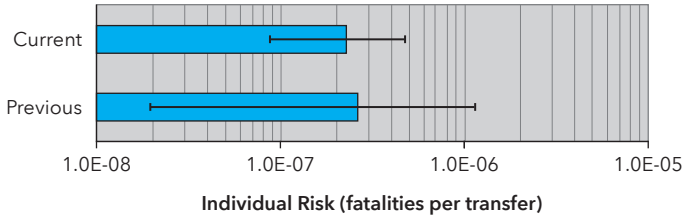

Figure 1 Individual Risk Comparison with Previous Estimate

Marine transfer risk

The results above refer only to risk of death among the passengers being transferred by crane. The complete marine transfer operation between an installation and the shore includes several other elements:

- Risks in port while boarding/unloading the vessel, such as falling from the gangway to shore.
- In-transit risks during the journey between the installation and the shore, such as fire or grounding.
- Risks to vessel crew and third-parties, such as people on other vessels that may be struck by the crew boat.
- Risks of major accidents that arise from the interaction between the vessel and the installation, such as collision or ignition of hydrocarbon leaks.

Major accident risks are difficult to quantify, but there is experience of an accident of this type. In 2005,

following a basket transfer of a medical casualty between a multi-purpose support vessel (MSV) and the Mumbai High North platform, the MSV struck the platform riser causing a fire that led to 22 fatalities (Daley 2013). This accident resulted from a crane transfer, and hence can be considered to reflect some of the risks involved, although the transfer itself had been completed before the collision occurred. It was also an emergency operation, in which the risks are likely to be higher than in routine crew transfer. Since it appears the passenger was not a fatality in this incident, it is not included in the risk estimate above.

The occasional occurrence of such major accidents should be considered separately in any analysis of transfer risks. As a rough indication, we note that there were 22 fatalities in this accident, and just 15 passenger fatalities in all other crane transfer accidents in the data. This suggests that on average the major accident risk is at least as large as that from accidents affecting the passengers alone, but site-specific risk analysis would be needed to quantify it more accurately.

At present there is no reliable source of information on the risks in the other phases of marine transfer. The previous paper estimated a similar risk for both in-transit and transfer phases, but this was based on an absence of fatalities in either phase. This now appears pessimistic, as very few in-transit fatalities are known. However, further data collection would be needed to quantify the risk.

Comparison with helicopter transfer

If the total risk in all phases of marine transfer could be quantified, it could then be compared with the risks for helicopter transfer. Based on the latest published data for offshore helicopter operations world-wide during 2003-07 (OGP 2009), the average individual risk in helicopter transfer is estimated as:

$$\text{Individual risk per transfer} = \frac{\text{20.8 fatalities per year}}{\text{8.70 million people transferred per year}}$$

$$= \text{2.4 x } 10^{-6} \text{ fatalities per transfer}$$

This is approximately a 1 in 400,000 chance of fatality for each person transferred. This is approximately 11 times higher than the current risk estimate for crane transfer. Figure 2 includes confidence ranges, which show that this difference is statistically significant.

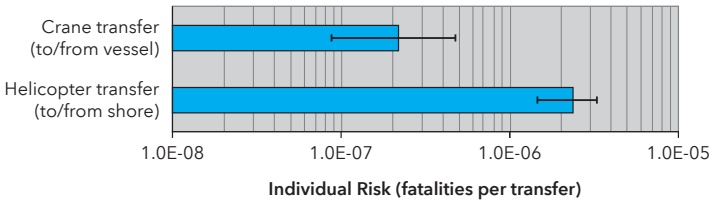

Figure 2 Individual Risk Comparison for Crane and Helicopter Transfer

However, this comparison may be misleading for several reasons. For example, crane transfer excludes risks in transit, whereas helicopter risk covers the complete journey to/from shore. The crane transfer risk excludes major accidents such as collisions, which are analogous to the risks of fire due to helicopter crash onto the installation. It also excludes risks to vessel crew, whereas the helicopter risk includes fatalities to flight crew. In addition, it does not include injury risks, which are more significant for marine transfer than helicopter transfer.

Furthermore, these results refer to world-average risks, and reflect the fact that marine transfer is often used in relatively benign climates, while helicopter transfer is often used for installations that are far offshore. If transfers to the same installation were compared, the differences might be much more or less than shown here. For example, the previous study showed no significant difference between marine and helicopter risks in the specific case of an installation close to shore.

Risk perception

The psychological perception of risks, as it applies to the comparison of helicopter and marine transfer risks, may be significant in some cases. Risks are in general perceived to be higher when accidents are readily available in the memory. Since offshore helicopters have suffered some high-profile accidents that are readily recalled, it might be expected that their risks would be perceived as being very high. The pre-departure training and emergency preparation for offshore helicopter travel, which help reduce the fatality risk, paradoxically make the prospect of an accident seem more likely.

On the other hand, where helicopter transport is used, familiarity with it as a routine part of offshore

working may diminish the perceptions of risk. Where accidents occur, particularly if they are mechanical failures, they are often seen as problems with specific helicopter designs, rather than helicopter travel in general.

In contrast, unknown risks are often subject to a dread that does not attach to well-known risks. People who are unfamiliar with marine transfer might therefore perceive it as a high risk activity. Underlying factors might include concern about motion sickness while on the vessel, anxiety about injury during the transfer phase, or a feeling of helplessness at being shipped and lifted along with the other materials and supplies for the offshore installation. Marine transfer risks are highly concentrated in the transfer phase, which may make them easier to manage, but also heightens anxiety for the passengers. Although such concerns might reduce once the method is more familiar, they could be influential in the decision whether to adopt marine transfer.

Some of these perceptions may be modified, given an understanding of the current risk estimates. However, we acknowledge that risk perceptions often contain subjective evaluations of aspects that are not fully reflected in fatality risk estimates. Such factors include injury risk or sensitivity to weather conditions, which we have not considered.

Other factors that are relevant when evaluating transfer methods are the convenience (as reflected in the transit time) and the financial cost for the operator. These raise the important question of how accident risks should be balanced against time and money. Some believe that safety is paramount, implying that these other issues are relatively unimportant. On the other hand, it might be argued that the accident risks are very small in either transfer method, so that the financial cost or the time spent in transit are more important. Where appropriate, the current risk estimate is suitable to combine with these other factors in a cost-benefit analysis.

Conclusions

This paper presents the key results from new research into accident experience in personnel transfer by crane between marine vessels and offshore installations. We estimate that approximately

5 million passengers are transferred by this method each year world-wide, and that there have been approximately 15 fatal accidents since 1976, with a current average of one fatal accident per year. The risk for individual passengers is therefore approximately a 1 in 5 million chance of fatality for each transfer.

This estimate is considered much more robust than the value that was published in 1994, although in absolute terms it is only slightly smaller. We recommend that the new value is used for risk assessments of marine transfer.

On average, the risk of crane transfer is much lower than that for helicopter transfer. However, to make a proper comparison it would be necessary to estimate the risks associated with vessel transit and major accidents while the vessel is alongside the installation, which would vary substantially from case to case.

In order to improve the estimate presented here, we recommend collecting accident and activity data from across the industry, and covering other transfer methods as well as distinguishing between different types of crane-lifted carriers. The data should identify the purpose of the transfer, so as to differentiate between routine crew supply, operational transfers and emergency transfers, and should also cover the marine transit phase. This would not only help to understand the risk better, but would also help identify ways of minimising the risk in the future.

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Further information

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