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Competence Building while Migrating Technology and Operations

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Abstract

As the technology behind Dynamic Positioning continues to evolve it is finding new uses in the Maritime industry where it was never considered before. One of these areas is renewable energy and the construction of offshore wind farms. The original wind farms were built using conventional jack up barges that had to be towed into place. This was costly and labor intensive. About 8 years ago the first purpose-built DP jack-up vessel was built for turbine installation operations. A whole new industry came into being with its own unique operational hurdles.

Some of the differences between turbine installation vessels and traditional DP vessels will be addressed. Modifications to the DP control system will be highlighted as well as the concern that an experienced DPO may not have the knowledge required to safely operate the vessel due to the new features. How is a DPO expected to get the experience in the new operational mode? Currently there are no DP jack-up wind turbine installation vessel (WTIV) training schemes that address this need. DP sea time accrual is also a concern because these types of vessels only perform a limited number of DP jacking operations per year. The need for a new, pragmatic approach to jack up vessel DP operations will be covered as well as methods to possibly meet this need.

Offshore wind farms are now being built in the United States. The technology is proven in Europe so how can the information and experience from the operations in Europe be leveraged to ensure safe operations elsewhere in the world? Solutions to how to bring local knowledge, local authorities (regulations), and vessel operators together to ensure a smooth startup of a proven industry in a new region will be highlighted. An example of how a company can do this will be included.

Abbreviation / Definition

DP – Dynamic Positioning
FPSO – Floating Production and Storage and Offloading
IMCA – International Marine Contractors Association
WTIV – wind turbine installation vessel (dynamically positioned)

Introduction

The concept of competency has not always played an important role in industries. Incidents and accidents were just considered an inherent part of any risky operation. It was not until large numbers of high-profile accidents happened during the growth of the aviation industry that questions were asked and investigations started taking place. Investigators discovered that personnel could have all the skills and knowledge to perform the job safely, and still have incidents. The unquantifiable aspect was behaviors and attitudes. It is only when you bring skills, knowledge, and attitudes together that true competency can be obtained.

In general, as an industry evolves, an improvement in technical knowledge regarding operations leads to an improvement in equipment. The application of lessons learned can help reduce future incidents by improving designs and procedures. As the result of incidents, new regulations and guidelines can help change behaviors and attitudes towards risk taking. Training gaps can be identified and addressed, resulting in an improvement in skills as well as positive behavioral changes. Methods to verify knowledge, skills, and behavior are put in place to ensure competency. As the industry matures, the framework for safe operations is established and the new methodology becomes the standard; incidents become the exception rather than the norm.

This maturation process is very evident in the dynamic positioning (DP) sector of the maritime industry. Dynamically positioned vessels are frequently identified as a viable cost saving solution for many dangerous, time-consuming operations. An example of this was when DP was put on shuttle tankers in 1982. With the advent of this new application for DP came new problems to overcome. The first problem was with the shuttle tanker itself. The knowledge was soon gained that converting a conventional tanker to DP was not a viable solution. Task specific DP shuttle tankers were built, and new types of offloading facilities were created to accommodate them. Eventually shuttle tankers evolved into the DP class II vessels that they are today, with custom made DP software and multiple reference systems. Incidents, however, continued to happen despite the improvements in hardware and technology. This showed a need for regulations and guidelines specifically geared towards DP shuttle tanker operations. The United Kingdom Offshore Operators Association published the first Tandem Loading Guidelines in 2002 with the intent to reduce the incident rates. It also became apparent that the traditional method of training Dynamic Positioning Operators (DPOs) did not address the unique characteristics of shuttle tankers. Accordingly, this led to the creation of a new Nautical Institute (NI) training scheme for shuttle tanker DPOs. It took time, but DP Shuttle tankers are now part of an established operation with competent personnel.

Dynamic Positioning in the Renewable Energy Sector

More recently, DP technology has moved into the renewable energy sector onboard Wind Turbine Installation Vessels (WTIVs). About 8 years ago, the first purpose-built DP jack-up vessel was commissioned for wind turbine installation operations. A whole new industry came into being, with its own unique operational hurdles. Experience from traditional DP vessels helped with the design of the first WTIVs. However, it was only after they became operational that the true differences between traditional DP vessels and DP WTIVs became apparent. Modifications to the DP control system had to be made to ensure safe jacking operations. The equipment was now suitable to the task it was intended to perform, but this only solved part of the problem. Establishing personnel competency is also one of the challenges associated with introducing a new type of technology into an existing operation. Defining competency with regards to DP operations on a DP WTIV is difficult. In spite of this, WTIVs are now an established part of the renewable energy industry in the European sector, with several companies successfully utilizing them.

Moving to a New Geographic Region

In the continued quest for growth, some companies in the renewable energy sector are turning to new geographic areas. One country that is currently experiencing growth is the United States. There have already been several studies performed on the financial viability and economic impact of wind turbines on tourism and recreation. (1, 2) Another study looked at the impact that offshore wind will have on the local economy and tax benefits. (3) The New York State Energy Research and Development Authority (NYSERDA) commissioned GustoMSC to perform a study regarding the economic viability of using US Jones Act compliant WTIVs.(4) GustoMSC, who has a proven track record in the design of WTIVs, did the study based on a vessel design derived from the European vessel that was already successfully utilized in the United States. This leveraging of experience helps ensure knowledge of how the ships should be designed and built will not be lost, thus helping ensure the hardware will at least be proven.

Companies must be vigilant, however, because using established technology and operational excellence in one geographic area does not guarantee successful implementation of that technology in another geographic area. There are many things that can go wrong. Variables include the regulations (or lack thereof), availability of the necessary infrastructure to support the operation, local environmental anomalies, and potential personnel issues.

DP shuttle tankers are a good example of technology not transitioning well to another geographic area. Shuttle tankers are used extensively in the North Sea, but there are only 2 facilities using them in the Gulf

of Mexico. (5) In 2001 approval was given to utilize FPSOs and shuttle tankers in the Gulf of Mexico. Two companies were formed by experienced European operators who were anticipating the need for Jones Act shuttle tankers. (6) In this way, the knowledge of how successful shuttle tankers are designed would not be lost. However, there never was a study done on how these vessels would be crewed up. There was a great risk that the skills and behaviors that made the industry competent in the North Sea would not be transferred over to the Gulf of Mexico (GOM). As it was, however, the skills and behaviors were never needed. After several viability studies had been done, it was soon realized that FPSOs and shuttle tankers were not financially viable in the GOM, and by 2004, it was apparent that there was not going to be a huge market for them there. The geography of the seabed allowed for easy and more cost effective installation of pipelines. (7) This is an excellent example of how technology did not migrate due to unforeseen financial reasons.

Other countries have commissioned studies on the installation of wind farms off of their coasts. (8, 9) Some of these studies showed that using a DP WTIV would greatly reduce the amount of time it would take to complete the project. Should these countries decide to utilize DP WTIVs, there will be a serious need to address more than just the hardware and the economic viability of the project. Competent personnel both onshore and offshore will become the limiting factor as the demand for these vessels increases.

It is critical to realize the importance of the competency of the personnel who will be performing the work, but the risk that competency in the required knowledge, skills, and behaviors will not transfer to new areas has not yet been addressed. The study commissioned by NYSERDA did identify the regional requirement for a local crew, but gave no indication how a competent crew could be obtained. Even in situations where there are no regional regulations, there will still be a need for new, competent crews as the number of vessels increases. It appears that these studies assume that competent personnel will be readily available when needed.

Filling Crew Vacancies

Let us consider a company which has a pool of experienced personnel who are highly proficient in conducting a specific operation, in this case erecting off-shore wind turbines from a self-elevating platform/barge. The company decides to invest in new vessels that are still self-elevating, but instead of being towed into place the vessel will use DP technology to get into position.

The company now has a hiring dilemma: hire in new employees with the needed competencies or train up existing staff. Each option presents different challenges with regards to obtaining the required level of competence. Current employees are competent in the overall operation, but not the new DP technology. Hiring a certified DPO will fill the compliance requirement, but they are not competent with the overall operation. However, in either case the person would need to gain experience on an operating DP Jack-up vessel to become competent.

The vessel operator could choose to comply with industry guidelines, rules, and vessel charterer/warranty surveyor requirements by hiring a certified DPO. The DPO would only be present on the bridge during set up and DP approach to the transition piece. However, hiring a certified DPO to operate a new WTIV is not a guarantee of success. The DPO is unlikely to be competent in the operation of a WTIV. For example, a DPO from a drillship will not have any knowledge of the turbine installation operation, or how DP is actually utilised in that context. This gap in knowledge would need to be addressed to ensure the new hire is competent.

To help with training, IMCA released M223 “Guidance for the Positioning of Dynamically Positioned (DP) Jack-up Vessels on and off the Seabed” in April of 2013. This document was intended to provide

experienced DPOs with book knowledge on how to safely operate WTIVs, in an effort to make the DPOs more competent in this setting. The problem is that this document by itself is not a substitute for training and experience, and it does not address the actual turbine installation process. A WTIV spends a very limited amount of time in DP mode, and once the vessel is jacked up the DPO will not be able to contribute further unless they receive additional operational specific training. Having a certified DPO just to man the bridge for the short time it is on DP is an inefficient use of resources.

The current ideology behind manning a DP vessel is that the person behind any DP console must be a certified DPO. Companies transitioning to DP WTIVs, generally do not have certified DPOs within their current crews. That means if the company chooses to train from within, the current employee must enrol in one of a limited number of industry recognized certification schemes for DPOs. They will need to be trained in the principles of DP, the practical use of the system during operation, and the function of position reference systems, as well as all the other facets of DP operations as it pertains to a WTIV. This solution, however, is not as easy as it sounds.

The most recognized certification scheme is offered by the Nautical Institute (NI). The standard NI scheme is very broad and the training covers numerous operating methods. In 4 days the personnel are taught about most types of DP vessel (excluding shuttle tankers and WTIV), as well as all the different DP operational modes. They are then expected to go out to the vessel and accrue sea time, but only while they are at the DP console in DP mode. For some vessels, like DP drill ships, which are on DP almost year-round, this is not a problem. For WTIV this is a serious problem. They may only be in DP mode for 30 minutes once a week.

Another drawback to the onboard training period is that, most likely, operations will be routine during that time. The DPO trainee will learn how to control the system during normal operations, and they will eventually obtain their certificate and be suitable for promotion to full DPO. Everything would appear to be fine, when in reality there is a serious deficiency. On the job training rarely allows one to learn and test reactions when things go incorrectly. The DPO who can do the job 100 times when everything is perfect may have absolutely no idea what to do when something goes wrong. The current training schemes do not address this deficiency in WTIV DPO training.

When looking closely at the traditional method of training DPOs, it becomes clear that it is not entirely suitable for DPOs on WTIVs. These vessels have many of the same problems as shuttle tankers when it comes to accruing DP time and DP experience. They are only on DP when coming on location and when leaving location. Obtaining a DP certificate could take an extremely long time.

The underlying problem is that the established training schemes do not offer a specialised WTIV certificate. It can be argued that a DPO working on a WTIV will have little need to learn cable laying operations, or how to follow an ROV. Their time in training would be much better spent learning how the vessel reacts while the legs are going down, and what to do when the legs make contact with the seabed.

Shortfalls in training shuttle tanker DPOs resulted in a new training scheme, so it might be time to make a new scheme for WTIVs. This will help companies meet both the compliance and competency requirements regarding DP operations when the increase in demand for WTIVs inevitably arrives. This specialized WTIV training scheme needs to incorporate a simulator course that is designed specifically for WTIV operations. By including the unique failures that could occur into the simulator exercises, a DPO headed to a WTIV for the first time can gain confidence in their ability to recognize a bad situation and react accordingly. Upon completion of the new training scheme, the DPO will be certified for DP operations on WTIVs. For now, however, companies must still rely on company specific training, in addition to the already established certification schemes which currently do not address the WTIV industry.

In summary, companies have two ways to fill vacancies, one way is to hire from outside the company and the other is to train from within. Currently it is very difficult to hire an industry Certified DPO with WTIV experience. But in order to train up a certified DPO who is competent in WTIV operations the company will need to invest in both the accredited training courses *and* additional specialised training. Neither method appears to be particularly sustainable at the current time. A new training scheme will help alleviate the crewing problems companies are currently experiencing.

Addressing Regional Competency Gaps

WTIVs are unique vessels and port pilots are likely to have had very little exposure to a DP vessel. This is where competency gaps can appear. The pilots may not have knowledge about the unique characteristics of a DP vessel, while the crew of the DP vessel does not fully know the port and the local environment. Neither group can be said to be fully competent at this point. One way to overcome this competency gap is by modeling the WTIV vessel and the port that will be used in a simulator. This way the pilots can experience the vessel's maneuvering characteristics and work with the crew in advance to determine the best way to operate the vessel. Vessel and port limitations can also be identified and addressed prior to the operation commencing.

The value of this type of planning was demonstrated when a WTIV operator asked Maersk Training to help them initiate operations in the US. The offshore wind industry is relatively new to the northeast coast of the US. The specific type of vessels, and the technology they employ, has not been seen there before, which creates multiple new challenges, both operationally and with regards to working with local authorities. The WTIV company chose to use a proactive approach to these problems by building a relationship with local authorities, and they approached Maersk Training to help facilitate this.

In this case there were practical considerations put forward by the local authorities. The local pilot commission was unsure of whether it was possible for the WTIV vessels to actually transit the pilotage or not, and if it was possible, how it could be achieved. The operator proceeded to invite the interested parties to visit our facility in Denmark. Attendees included representatives from the Massachusetts pilots commission, active pilots, the US coast guard, as well as the captain and chief officer of the actual vessel. One purpose of the workshop was to determine the operational limitations of the company's WTIV during arrival and departure scenarios of the Pilotage area, with specific focus on passage through the hurricane barrier.

The company had already commissioned a full hydrodynamic, DP capable model of their vessel that was installed in our full mission simulator for training their WTIV crews. This proved advantageous as it allowed for an accurate simulation to be performed after the port in the United States was recreated in the simulator. The analysis of the simulations performed would prove to have a great influence on how the logistics of the final operation would be accomplished. The meeting also helped to refresh the knowledge of the DP theory for both the pilots and the WTIV vessel crew, as well as helping align the operational understanding of the DP systems, including the systems' limitations.

Sitting face to face with local authorities contributed to an understanding of the detailed practical possibilities and challenges for the specific operation, while at the same time creating an opportunity to increase overall knowledge. During the workshop, the WTIV company was able to explain their operational philosophy and training methodology, all of which was based on the experience gained during the development of vessels and operations in the European offshore industry. By the end of the workshop the local authority was reassured that the WTIV that will be operating in their waters has a fully trained and competent crew. The local pilots now know the best way to transit the WTIV through the hurricane barrier

before ever attempting it in real life. This example highlights the importance of being proactive and utilizing lessons learned elsewhere when trying to ensure a successful start up in a new area.

Conclusion

The risks of introducing a new technology into an established industry are hard to determine prior to its implementation. Incidents are likely to occur when the new technology is introduced. Improvements are made based upon lessons learned and new rules and regulations are written. Eventually incidents go down as the new technology is fully adapted into the industry and personnel competency goes up as training improves. The new technology eventually becomes the norm. This process takes time and is still occurring in the WTIV sector.

Deficiencies in the current DP certification schemes are causing concerns with regards to crew competencies. The problem will come when a new vessel is built and the local authorities want to verify that the vessel has a qualified and certified crew. How will the operator show that the DPOs have the necessary training on their equipment? Even if the DPO is certified, the current DP certification scheme does not address the unique nature of WTIVs. The company will have to send their DPOs to company specific training to ensure they are actually qualified for WTIV operations. Having to enroll in the DPO training scheme and take company specific training takes time and is costly. It might be time for the DP industry to learn from its own past. The precedent has been set with the shuttle tanker training scheme, so why not create a new WTIV training scheme?

When introducing an established industry into a new region there are many things that need to be considered. It is not merely a matter of making sure that vessel is fit for purpose and the crew is competent. There are many other factors that have to be addressed. Project owners can help ensure safe operations by verifying the shoreside facility is suitable to the task. Vetting a location and equipment for suitability is an easily quantifiable goal. Is the infrastructure in place to ensure the operation can be carried out? Dock space, overhead clearances, staging areas can all be visually seen and physically checked.

What is harder to do is to provide assurance that all the personnel involved are competent. The local authority, the pilots, and the warranty surveyors; do they understand the principles of dynamic positioning? Do they know what DP 2 actually means? Can they foresee any possible operational limitations if they do not know these things? For example, is it safe to use full DP in narrow passages during pilotage?

The personnel challenges involved with introducing an established technology in a new region can be mitigated by the use of training facilities. The WTIV operator, the crew, and all the concerned parties from the new region can come together to gain a better understanding of the operation. Vessels and ports can be simulated, operations can be performed and tested to ensure that everybody understands how things should work. Problems can be identified and addressed prior to the vessel ever arriving in the new region. This methodology of bringing all concerned parties together prior to an operation taking place is nothing new, however it is rarely used when migrating technology and operations to a new region. Doing this does involve a cost, but the benefits of establishing a good working relationship with personnel in the new region. as well as the potential for finding possible issues that could hamper the operation, far outweighs that expenditure.

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