DYNAMIC POSITIONING CONFERENCE
October 7 - 8, 2008

Operations

Revisions to the Guidelines for Safe Operations of Dynamically Positioned Offshore Supply Vessels

Ian Giddings

The International Marine Contractors Association (IMCA)

Abstract

It has been over a year since these guidelines were issued as IMCA M182 and it had been agreed that these would be reviewed after such a period. This paper will look at some of the issues which have arisen and continue to do so during this process.

Some of these are subject to much discussion and debate. These include: -

- Failure Modes and Effects Analysis (FMEA) for equipment class 1 vessels.
- Should all DP OSVs now be equipment class 2 or 3?
- Is this guidance applicable to an unclassed vessel with DP capability
- Are the DP OSV Capability levels appropriate?
- Similarly are the Category A and Category B competency standards appropriate?
- The guidelines are based on the ability to swiftly disconnect but this is not the case when working hoses.

The guidelines are intended to be international in their application so this development will be of interest to offshore supply vessels working in North West Europe, Gulf of Mexico and Brazil as well as elsewhere around the world. This in turn brings further considerations such as how to recognise local guidance and regulations.

It is hoped that this paper will highlight some of the issues in this revision and lead to discussion on this document, particularly on the possible implications for OSVs around the world.

"A smooth sea never made a skilled mariner"

Introduction

The need for guidelines for the safe operation of dynamically positioned offshore supply vessels (also known as platform supply vessels or workboats) had been recognised and a number of papers addressing this issue had been presented in various fora over the years.

A few years ago the International Marine Contractors Association (IMCA) acted as the facilitator for a cross industry workgroup which resulted in the publication of IMCA M182 *International Guidelines for the Safe Operation of Dynamically Positioned Offshore Supply Vessels* in March 2006. Within this development it had been agreed that these guidelines would be revisited in one year's time and so in 2007 the group was reconvened and consulted, this time by email, about any revisions necessary.

At this point I should acknowledge the many IMCA members, offshore supply vessel owners and operators, clients and other trade associations who have contributed to both the development of the original document and to the revision currently being undertaken and in particular the input from the International Support Vessel Owners' Association (ISOA) who coordinated the responses from their membership.

It should also be remembered that there is other complementary guidance available for these vessels such as *Common Guidelines for the Safe Management of Offshore Supply and Anchor Handling Operations (NW European Area)* whose signatories are UK Chamber of Shipping, Danish Ship Owners' Association, Netherlands Oil and Gas Exploration and Production Association, Norwegian Oil Industry Association (OLF), Norwegian Shipowners' Association and the United Kingdom Offshore Operators Association (UKOOA, now known as Oil & Gas UK (OGUK)) and the USCG District 8 policy letter *Use of Dynamic Positioning (DP) By Offshore Supply Vessels (OSVs) For Oil and Hazmat Transfers*.

Finally some of these guidelines will be rewritten and some new guidelines will be developed in light of the tragic Bourbon Dolphin incident. These will principally deal with anchor handling and associated issues but may impact on this sector where vessels can be both platform supply vessels and anchor handlers or multi-role offshore support vessels.

Offshore Supply Vessel Market

There has been a significant increase in the number of platform supply vessel on the order books of yards around the world. The following table, for platform supply vessels, is the result of a small exercise carried out in-house at IMCA to try and gauge the growth in the number of vessels in various vessel types being built. The exercise was not aimed at producing definitive numbers but rather indicative ones.

	On order 2007	On order 2006	% change
Europe & Africa	55	59	-7%
Americas	70	48	45%
Middle East & India	32	24	33%
Asia Pacific	73	41	78%
Total	**230**	**172**	**34%**

Table 1 – PSVs on order/being built

During this exercise we also considered offshore construction vessels, anchor handing and tug service vessels and multi-purpose and multi-role vessels. Another of the purposes of this exercise was to gauge the growth in requirements for personnel and the effect on the skills shortage.

It may even be that our figures are underestimates of what will happen judging by other reports of the number of vessels on order. A further indication of the growth of this sector can be gained from looking at vessel owners' websites where one owner is anticipating two new vessels in 2008, four in 2009 and two in 2010. This is fairly modest in comparison to others. For example at a conference in 2007 one speaker said there 462 AHTS and 247 PSVs currently being built around the world.

However within all these statistics it is notable that the majority will have dynamic positioning fitted and in most cases this will be a duplex DP system and maybe even to the requirements for DP 2 classification. Thus we anticipate a significant growth in the numbers of DP offshore supply vessels in the market over the next few years.

Existing Guidelines

The existing guidance within IMCA M182 *International Guidelines for the Safe Operation of Dynamically Positioned Offshore Supply Vessels* was written with the terms of reference:

"To develop procedures and best practice to an achievable international standard for all vessels operating in any class of DP, as defined by IMO MSC Circular 645, within or outwith a 500 metre zone, in order to conduct supply or any other ancillary operation associated with that type of vessel and not covered by existing IMCA guidance."

These terms of reference are reflected in the statement about application of these guidelines is within the document itself:

"These guidelines apply to OSVs that have a DP class notation equivalent to IMO equipment class 1, 2 or 3 when carrying out supply and other ancillary operations in DP mode inside or outside the 500 metres zone of an offshore installation."

The important points to take from the two statements above is that they apply to OSVs when they operating in DP mode wherever they are and not just within the 500 metres zone and they are not covered by existing guidance. The offshore or platform supply looks like a straightforward operation. However many of the vessels used for these operations are also used for other work such as:

Anchor Handling
Cable Laying
Flexipipe Laying
Stand By
Oil Recovery Operations
ROV
Towing
Trenching

Although not multi-role in the same way that many of the large offshore construction vessels are, some of these offshore supply vessels are indeed multi-functional and as such have to consider which are the most appropriate guidelines for the vessel and its operation. Thus these guidelines needed to be clear and not contradict anything within other available guidance from IMCA and other organisations.

Figure 1 – DP2 Multifunctional Anchor Handling & Tug Supply Vessel (Photograph courtesy of Solstad)

The guidance itself is divided into three sections:

1. Introduction
2. Existing Rules and Guidance
3. Guidance on Procedures

The third section giving guidance on procedures is in itself quite extensive covering:

- Arrival Checks
- Communications
- Approaching the Installation
- DP Location Setup Checks
- Close Proximity Time
- Separation Distance
- Selecting a Safe Working Location
- Safe Working Heading
- Escape Route
- Environmental Forces Monitoring
- Maintaining a Safe Working Location
- DP Watchkeeping Handovers
- Onboard Engineering, Electrical and Electronics Support
- Critical and Allowable Vessel Excursions
- Electronic Off Position Warning and Alarm Limits
- Electronic Off Heading Warning and Alarm Limits
- Position and Heading Changes
- Power Consumption and Thruster Output Limits
- Consequence Analyser
- Safe Operating Limits
- Position Reference Systems

- Change of Operating Control Mode
- Standby Time
- Vessel Thruster Efficiency at Different Drafts and Trims
- DP Alert Status

This section, and the whole document, is further supported by a number of appendices covering:

1. Relevant IMCA Publications
2. DP FMEA
3. Annual DP Trials
4. DP Capability Plot
5. DP Footprint Plot
6. Sample Arrival Checks Document
7. Sample DP Watchkeeping Handover Checklist
8. DP Incident Reporting

The document also illustrates risk assessments which should be carried out for DP platform supply operations with two examples, one of which is given below: -

Operation	DP OSV Capability 2 vessel is set up on the windward side 10 metres from an offshore installation in moderate environmental conditions.
Event and Response	Failure of one of two bow thrusters. There is now only one bow thruster operational. The vessel is no longer in DP OSV Capability 2, but is degraded to Capability 1. Immediate response is to cease operations and proceed to safe location downwind of the installation
Hazard	The vessel no longer has thruster redundancy but is still able to maintain position. But a further failure of the remaining bow thruster would result in loss of position.
Hazard Severity	Loss of position is likely to result in collision with the installation. Depending on circumstances the worst case outcome could be medium or HIGH, particularly since the vessel is on the windward side.
Hazard Likelihood	The loss of the remaining bow thruster is a foreseeable event and is PROBABLE.
Risk	The associated risk is HIGH and is unacceptable. The vessel must discontinue operations until the risks are reduced, at least to medium.
Additional Risk Reduction Measures	Resume operations as a DP OSV Capability 1 vessel. Relocate to leeward side of the installation if possible.
Revised Risk Assessment	Hazard severity is now LOW. Hazard likelihood remains at PROBABLE. New risk is MEDIUM. Vessel can resume operations at new location on leeward side.

Table 2 - Example of severity, likelihood, risk reduction measures and revised risk assessment

Finally the document sets out a system of DP alert status levels, similar to those found on other DP vessels, as shown in the table below. Though it is not currently normal for these vessels to be fitted with DP alert status lights found on larger offshore construction and other larger DP vessels, this system is important for multi-purpose PSVs when carrying out other operations and could prove useful to these vessels when carrying out platform supply work.

	NORMAL OPERATIONS (Green)	Complies with appropriate DP OSV capability conditions	◆ Position and heading excursions are within acceptable limits, and ◆ Power and thrust outputs are within limits for capability of vessel, and ◆ Environmental conditions are acceptable, and ◆ Minimum risk of loss of position and/or collision, and – For DP capability 2 and 3 vessels – DP equipment redundancy is intact and DP system is operating within 'worst case failure' limits, or – For DP capability 1 vessel – DP equipment is intact and operating within acceptable limits.
	DEGRADED CONDITION (Yellow)	Not in compliance with appropriate DP OSV capability conditions	◆ Position or heading excursions out of acceptable limits for more than brief or isolated periods, or ◆ Power and thrust outputs are greater than the limits for capability of vessel for more than brief or isolated periods, or ◆ Environmental conditions or other conditions are considered unsuitable for continuing DP operations, or ◆ Increased risk of loss of position or collision, or – For DP capability 2 and 3 vessels – failure in DP equipment that results in loss of redundancy and the vessel operating outside "worst case failure "limits, or – For DP capability 1 vessels – failure in DP equipment that does not result in a loss of position
	EMERGENCY CONDITION (Red)	Emergency	◆ For DP OSV capability 1, 2 and 3 vessels – Unable to maintain position, or – Imminent threat of collision, or – Any other emergency situation

Table 3 – Examples of status levels

Thus above is set out the current landscape in which the review was to be undertaken. The review itself is being done by an email correspondence group, as mentioned above may be necessary at some point to have a meeting of participants and possibly a close-out meeting.

Issues Arising

The secretariat went out to the participants of the original workgroup as well as other interested parties. From these the principal issues arising from the consultation on the revision were:

- DP FMEA & annual trials
- DP OSV capability
- Close proximity situations
- DP Operators
- DP operational procedures
- IMO vs. classification
- Unmanned engine space

DP FMEA & Annual Trials

The first of these issues, DP FMEA and annual trials, was a somewhat thorny one. The purpose of the FMEA, as defined in the DNV rules, is "to give a description of the different failure modes of the equipment when referred to its functional task." Classification societies do not require a FMEA to be carried out on a DP Class 1 vessel or more correctly do require that one is carried out on DP Class 2 or 3 vessels do need an FMEA.

For example the DNV rules state:

"For vessels with the notations DYNPOS-AUTR and DYNPOS-AUTRO, documentation of consequences of single failures in accordance with rule requirements is required in the form of a failure mode and effect analysis (FMEA)."

The thinking behind not carrying out FMEAs for DP Class 1 is that if it fails that is it. However many clients taking these vessels on hire do require a DP FMEA to be carried out for DP Class 1 vessels. The eventual compromise between the two groups involved was to insert the following paragraph in the section on FMEAs;

"Although classification societies do not require DP FMEAs for equipment class 1 vessel there may be occasions when charterers do require a DP FMEA to ensure the quality of the system design and operation."

DP OSV capability

The second issue of DP OSV capability was about how that capability is expressed and the effect on close proximity situations. The guidelines contain three tables outlining the DP OSV capability, the close proximity situation and a vessel positioning matrix. The first below show the DP OSV capability and the second the capability required for certain close proximity situations or risks.

	DP OSV Capability Conditions
DP OSV Capability 1	DP IMO equipment class 1 (class society equivalent DP class notation) Vessel operating within limits of intact thruster capability in existing environmental force conditions. DP control location manned by at least one category A bridge watchkeeping officer and one other person clearly only relevant when DP is to be used on an OSV. At least one position reference system operating and on line.
DP OSV Capability 2	DP IMO equipment class 2 or 3 (class society equivalent DP class notation). Vessel operating to identified 'worst case failure' limits in existing environmental force conditions DP control location manned by at least one category A bridge watchkeeping officer and one category B bridge watchkeeping officer. Two totally independent position reference systems operating and on line. At least three position references should be immediately available of which two should be operating and online
DP OSV Capability 3	DP IMO equipment class 2 or 3 (class society equivalent DP class notation) Vessel operating to identified 'worst case failure' limits in existing environmental force conditions DP control location manned by two category A bridge watchkeeping officers At least three independent position reference systems operating and on line.

Table 4 - DP OSV capability conditions

Not only does this outline the requirements for the vessel to meet a certain DP OSV capability but also this capability is used within the close proximity situations table set out below.

Close Proximity Situations

The above table is straightforward in that the DP class as determined by classification societies is used to establish the DP OSV capability. However it should be noted that DP OSV Capability 2 can be fulfilled by either a DP IMO equipment class 2 or 3, as can DP OSV Capability 3. For this table to work in all cases it does require that a vessel fitted with DP equipment has a DP classification.

	DP OSV Capability 1	DP OSV Capability 2	DP OSV Capability 3
Close Proximity 1 (low risk)	✓	✓	✓
Close Proximity 2 (medium risk)		✓	✓
Close Proximity 3 (high risk)			✓

Table 5 - Vessel positioning matrix

Having determined the risk the close proximity situations table then outlines the consideration of a working position for the vessel. However there are no definitive values entered but rather an expression that the vessel should be 'x' metres as shown in the table below. Some members of the workgroup felt that this should expressed in percentage of power used/available rather than distance. Although this might be a workable method the vessel would still have to work to a determined and agreed distance and on many occasions this distance would be determined by factors which fall outside the vessel's control such as crane reach.

	Close Proximity Factors
Close Proximity 1 (low risk)	'x' metres from the offshore installation on lee side More than 'x' metres from the offshore installation on weather side
Close Proximity 2 (medium risk)	Less than 'x' metres from the offshore installation on lee side (for brief periods only) 'x' metres from the offshore installation on weather side
Close Proximity 3 (high risk)	Less than 'x' metres from the offshore installation on lee side Less than 'x' metres from the offshore installation on weather side (for brief periods only)

Table 6 - Close proximity situations

DP operational procedures

In the fourth of these issues the major item for consideration was is it always preferable to set up on the leeward side of the platform? The first point to mention in this issue is that by leeward side lee side was meant so it was not being suggested that the wind was the only consideration here. Under the definitions within the current document lee side means "Position where any combination of environmental forces through wind, waves, swell, wave drift, surface current, surge current, tidal current, as well as changes in those factors, would move the vessel away from the installation."

This issue was further complicated by reports that PSVs traditionally did on occasions operate on the weather side of the platform on joystick but there was suggestion that this should not happen when on DP. Thus DP, which should be an enhancement to the vessel and its operation, could be seen as a restriction.

Although most agreed that it was ideal to set up in a location where, in the event of failure, the environment would take the vessel away from the platform, rig or vessel, this was not always possible as

the position may be determined by the crane or other operational considerations, as mentioned above when considering distance from the platform.

It was further argued that it was better to set up the vessel in DP some distance from the platform, rig or vessel, outside the 500 metre zone, and to assess the situation before entering the zone. It was also emphasized that the vessel should set up so that it would drift clear in the event of total thrust or power failure, that is the escape route should be considered. This consideration should also take account of both current and anticipated weather conditions.

It is also worthwhile noting that there was significant discussion on whether you needed to carry out DP checks at arrival at every work location or would field arrival DP checks would be sufficient. There may be some argument that if a vessel operates entirely on DP within the field the checks at every location may not be necessary. However if it should come out of DP to transit between two platforms then the checks may be necessary upon arrival at the next platform.

It is also necessary to consider what action to take in the event of a failure. Here, quoting from the Guidelines for the Safe Management of Offshore Supply and Anchor Handling Operations (NWEA), "The shiphandler must be ready at all times to change modes of operation e.g. from DP to joystick, joystick to manual in the event of an equipment failure. The assistant should be ready to take over the shiphandling of the vessel in the event of the shiphandler having to be relieved (comfort breaks, illness, etc)."

Not only does this statement recognise the need for redundancy in certain areas including personnel but also acknowledges that competent shiphandling should also be a pre-requisite for the DP bridge watchkeepers on board. It should be noted that within the guidance document there is a danger of relating the redundancy in equipment to the redundancy in the qualifications of the DP personnel. The danger of viewing the DP bridge watchkeepers in a similar manner to the equipment is that eventually someone will suggest for DP OSV Capability 3 you need three DP bridge watchkeepers and one should be in a separate compartment!

There were also a number of other issues which the workgroup have to address. Of these DP footprint plots were not considered appropriate by some for these vessels as, generally speaking, they do not spend enough time in DP at a location to enable any significant data to be gathered to compile these.

Bridge Watchkeepers

A perennial question is the level of experience and qualification for the bridge watchkeepers on these vessels. It should be noted that these persons are styled bridge watchkeepers rather than DPOs. On many DP vessels the DPO is expected to maintain the position until it can be made safe to end the usually complex operation. This may involve significant time to, for example, recover the divers and move to a safe location. On PSVs it appears to be easier to end the operation and move that location if necessary, although the need to disconnect hoses may impinge upon this.

In the existing document the DP bridge watchkeepers are in one of two categories, either A or B as shown in the table below.

Category	Competency Standards for DP OSVs (DP Bridge Watchkeeper)
Category A Master or navigating officer	♦ STCW 95 navigating officer certificate appropriate to class of vessel ♦ NI DP certificate ♦ Fully competent in operating the OSV in manual control when in close proximity to an offshore installation ♦ Adequate experience of the DP control system type and equipment classification – recommend 14 days ♦ Knowledge of the vessel's FMEA, together with a detailed understanding of the implications of all identified failure modes. ♦ Detailed knowledge of the vessel's DP operations manual and adequate knowledge of the contents of the vendor manuals. ♦ Consideration should also be given to providing manufacturers' courses for masters and officers in this category, in particular for the DP control system and position reference systems.
Category B Navigating officer or 'other person'	♦ STCW 95 navigating officer certificate appropriate for class of vessel or other appropriate certification, as required by the DP OSV owner (such as engineer, crane driver and so on). ♦ Received on board training of the vessel's DP system, using the NI DPO logbook to record training received. ♦ Competent in taking control of the vessel in manual control and moving away from the installation.

Table 6 – Competency recommendations for bridge watchkeepers on DP OSVs.

The above system is designed such that a Category A person will be a master or navigating officer and that Category B persons who are qualified navigating officers may progress to become Category A. Others who may be Category B are, for example, engineers, electricians, electronics officers and crane drivers.

However the point has also been made that as the number of DP bridge watchkeepers available onboard may be limited, they should not be separated into two grades but rather be fully qualified. This, of course, raises the question of what fully qualified means and how full qualification is achieved within a working environment with limited opportunity for on-board training.

IMO or Class

It should be noted that there are some minor differences between the requirements of IMO MSC Circ. 645 "Guidelines for Vessels with Dynamic Positioning Systems" and the requirements of classifications for assignment of DP Class. This means that despite what has been stated previously in this paper a

classification of an OSV may not be straightforward as it seems. Indeed some have commented that as class rules do not exactly match IMO requirements and that there are some minor differences between classification societies, the question of class in whatever form it is worked may be an issue. This, although it has been raised, is not believed to be a major issue and would apply further than just this area of the industry.

It has been asked during the consultation that has not the time arrived to insist that all PSVs are DP Class 2 or 3. This may be difficult achieve, even if it was wanted to, however returning to the point made at the beginning of this paper, the vast majority of PSVs currently being built or on order are DP Class 2.

Unmanned engine space

During the revision a question has been asked about unmanned engine or machinery spaces as the document seems to infer that the machinery space or engine room may be unmanned in certain circumstances during DP operations. Thus the ability to return the vessel's power generation and propulsion to a suitable level for DP operations may not be as important as on other DP vessels. However, as mentioned previously, these vessels are normally able to cease operations swiftly.

It was also commented that there is some lack of appreciation of the entire DP system as a single system, namely power, propulsion, sensors, control units and personnel making up the system and all need to be considered within operations.

Conclusions

The main point to bear in mind with DP PSVs is that they are PSVs fitted with DP and by this it is meant they can operate adequately and successfully in joystick, as they have done for many years, and if the DP fails the operators can just resort the tried and tested system of holding the vessel or moving it away on this joystick. Thus, as stated above, DP is an enhancement and the full potential and benefits of this are still being established.

Gary Ritchie said in his book on anchor handling and platform supply vessel operations "At present, members of IMCA are generally companies involved in Diving, Construction, ROV and Survey, however as more Anchor Handling and Supply Vessels re fitted with Dynamic Positioning Systems as standard, it would be anticipated that membership would rise from this sector of the industry." IMCA is seeing this with new members joining from companies operating in the PSV and AHTS sector of the industry. This adds a dimension to the DP incident reporting system operated by IMCA in that some of these companies are forwarding incident reports. It would be useful to receive more reports from this sector of the industry so that the lessons learnt and actions taken to prevent re-occurrence can be shared within both this area and the wider industry sector.

There is still work to be done to complete the revision of this document and on-going work to ensure the document remains relevant in this sector of the industry where technology is rapidly developing. However it is hoped that this guidance together with other guidance available goes some way to ensuring the continuation of an excellent safety record and implementation of realistic guidance.

Finally many of the topics addressed are still under discussion and we would be happy to receive further comment and opinion, bearing in mind that we will want to complete this work in the near future. In conclusion watch this space.

REFERENCES

Det Norske Veritas - Rules For Classification of Ships, Newbuildings, Special Equipment And Systems, Additional Class, Part 6 Chapter 7, Dynamic Positioning Systems – January 2008

Clarkson Research Services Ltd. - Practical Introduction to Anchor handling and Supply Vessel Operations – Gary Ritchie - 2007

www.imca-int.com/documents/divisions/marine/docs/IMCAM182.pdf

www.british-shipping.org/publications/codes

www.uscg.mil/D8/prevention/preventionpolicys.asp