



**DYNAMIC POSITIONING CONFERENCE**  
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**Risk**

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**Good DP Practice –  
(A Positive Approach)**

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## Background

Much guidance has been written for dynamic positioning and in summary we have the following:

- IMO MSC 645 Guidelines for Vessels with DP
- Classification Rules
- IMCA M103 Guidelines for the Design and Operation of DP Vessels
- IMCA M101, M112, and M139 Annual Trials
- IMO MSC 738/ IMCA M 117 Training & Experience
- IMCA M166, M179, etc. FMEA Guidance
- IMCA M182 Guidance for DP OSVs

The first two are equipment orientated and designed for and with a surveyor in mind. M103 was written with design and practical DP operations in mind. It has been in need of an update with respect to operation and practice for some time and an update is awaited. M101 and M112 remain unchanged because they are the basis of the agreement for annual trials between oil company representatives, contractors and government authorities.

M166 and M179 deal with the options for FMEA production and arrangement while M182 tries to just address offshore supply vessels. The common theme in all this guidance is that it is all possible and practical for any DP vessel in any part of the world working for any client. The real situation is that there is a kaleidoscope of practices. This paper will document some of them, which, from the author's viewpoint, are good DP practice.

## DP Specification

The good DP practice starts with the specification of what is wanted. Occasionally a DP specification that more than one DP system supplier can respond well to is written. In these circumstances all of them are in with a chance of winning the order. This however does require some market research and, ideally, discussions with more than one supplier from a position of knowledge and commercial strength. This takes time and up front investment but pays off in terms of fewer variations and extras. For many new DP vessels, and indeed upgrades, the discussion is mostly financial rather than technical and the vendor has been all but decided. Nevertheless a specification is valuable; it does not have to be one vendor's proposal with a few alterations. It can be quite short and at a higher level, but clearly set out the goals that must be met. This is better than just using "class requirements" because this gives away the technical authority. It is good DP practice to specify what is wanted and not just list documents to be complied with.

## FAT

It is also good practice to have a FAT for all DP critical systems and have in attendance at the FAT somebody who is intimate with the hardware and/or software that is being tested. Of course the specification of what is being ordered is also important. Some FATs are very well executed and the benefits are significant.

1. The status of the hardware and software can be assessed.
2. Likely compliance with the order can be determined.
3. Problems can be found and cleared at a small cost.
4. Understanding on both sides will be improved.
5. Sea trials time with the vessel will be reduced.

The FAT programme is usually set by the vendor but there usually is flexibility to extend and improve the FAT programme and have a facility to simulate inputs. With ICMS (Integrated Control & Monitoring System) and PMS (Power Management System) software being able to simulate inputs is essential to have a meaningful FAT. Some vessel managers do send an experienced vessel operator to the FAT and this is always a benefit, particularly if the order is for an upgraded system. Of course this person has to be informed about the contractual position or accompanied by someone with that knowledge. When the order has been placed by the shipyard there is potentially a conflict between the owner's representatives and the shipyard, but the best practice even for the shipyard will be for an experienced person, familiar with DP operations to be present. A problem can occur if too many persons with different objectives attend the FAT.

Good practice is to:

1. Receive the vendor's proposed FAT in good time.
2. Comment and amend vendors the FAT as thought necessary and ask for some flexibility.
3. Review vendors' own pre-FAT checks.
4. Select the order (priority) for the testing.
5. Add some tests in areas of perceived doubt.

This is sometimes done and not only is it good practice it is good commercial sense as well.

## **A Shipyard Team**

Normally the key DP personnel arrive before the sea trials and become familiar with the new vessel. If the shipyard work is an upgrade then some crew may have been standing by throughout but they are not usually part of the shipyard team managing and progressing the work. These are however the exceptions and it is good DP practice for at least one person from each of the key DP disciplines (DPO, engineer, and electrician) to become attached to the project team and interface with the vendor undertaking the commission of equipment. This is difficult to set up and manage, and several owner/managers who have tried have been left upset when the individual who has been paid, trained and promoted hands in his notice because he has acquired a new skill. This is no reason not to specifically identify how a transition from shipyard project team to sea-going operational team should be carried out. This starts when the ships generators provide the power (rather than shore power) and is completed when the shipyard team wave goodbye. So many times commissioning, testing and trials are carried out without any of the key DP personnel really being involved. If circumstances make involvement difficult then the next best thing is a briefing from one team to the other. This has happened but it is so difficult to set up at the latter stages of a shipyard experience. There is often an assumption that if an engineer watches another engineer carry out a procedure (series of logical actions) it is then possible for the observer to do the same. There are a few engineers like that, but most need to go through the same series of actions a couple of times for the procedure to sink in.

## **On Board Training**

There are several types of on board training but four groups can easily be identified:

1. Training by a vendor after new equipment is installed.
2. Training by a vendor during a visit to fix or service equipment.
3. Training by a qualified trainer sent on board for this purpose
4. Training by experienced key DP personnel for new starts.

Each will be discussed in turn.

It is good DP practice to have a vendor's representative on board a new vessel (or one that has been upgraded) for a few days, especially when equipment like the DP control system and/or power management system, are new and different. The number of vendors' representatives and the duration of their stays on board will depend on what was achieved at the shipyard. Irrespective of how efficient the hand over and knowledge transfer was in the yard, the key DP personnel will benefit from a one-to-one with an expert. It is however essential for the vendor's representative to be of the right outgoing character; some software engineers, for example, are not extrovert enough. It is not enough to get one man to remain on board just to investigate problems if they occur the person selected must be able to pass on his knowledge. There has to be a structured way of using the vendor's representative and in these circumstances the DP log book can be used to record this instruction. Ideally the vendor's representative should stay to cover a crew change or a relief cover the next set of key DP personnel. It is also good DP practice for the vendor's representative to run a training session for the non-normal users. For example the PMS and ICMS for the engine room watch keepers to use is frequently available to DPO for information. There is no reason why they should not be shown the capabilities and limitations of the system, even though they are unlikely to operate it. The same principle applies for engineers and the DP control system. Many vessel owners carry out this sort of training. Some also go one step further and send a qualified instructor, which has advantages in that the training will be more structured and supported by documentation.

Training by a service engineer when on board to fix or overhaul a particular item of equipment is not always possible because the service engineer may only know about a specific fault on the equipment he is sent to work on. Frequently, however, the opposite is true and the engineer may also spend days waiting to carry out his work. On a few occasions the Master or Chief Engineer does organise a couple of training sessions and of course the curious will always ask questions. The problem however is that while asking questions is encouraged, showing ignorance is never simple. A structured talk on an item of equipment or system on the basis that little is known about it serves the following purpose:

- clears up simple misconceptions
- opens up communication between user and the service engineer
- promotes questions during and at the end of the session but also later, on a one-to-one basis.

The other advantage of this "ad hoc" training is that it is free.

Training by experienced key DP personnel of new personnel joining the vessel from another DP vessel or a non-DP vessel has been written about frequently and the reference that should be used is the IMO MSC 738 or IMCA M117 as amended in 2006. However the personnel department arranging the logistics hold the reins in this area in spite of what might be written in guidance or company policy documents. So often for on board training and familiarisation to take place somebody has to stay on board longer than planned. Nevertheless several management organisations do provide the overlap needed particularly for Master and Chief Engineer. Provision for overlap of electricians is less frequent but equally as important.

Where only a few companies impress it in the methodology used for this on board training and the way in which it is signed off as having been completed. The minimum necessary is as follows:

1. An assessment of the areas where training is needed (all areas will need some but the amount will be different for each new individual).
2. A programme of training in terms of time and responsibility.

3. A sign off of competence by the trainer and a verification by a department head.

This is the best DP practice and it is done on some vessels. The more usual result of on board training is that the new arrival knows very well about most of the things that regularly go wrong but knows very little about systems that are generally reliable. This is not a bad result but the overview to understand the whole is also important on a DP vessel

### **Risk Assessment**

For most marine operations there is a risk assessment somewhere. Even for operations that are common it is likely that at one time there would have been a risk assessment. These are mostly carried out ashore but sometimes on board and depending on circumstances may or may not include key DP personnel from the DP vessel (or vessels) in question. The operations manual for a DP vessel should, and usually is at least in part, the result of one or more risk analysis. This is normal good practice. The weakness however is that quite often none of the key DP personnel on board has been involved. Most projects always try and involve the Master or OIM and this is good practice. It is also good practice for the results and methodology of this type of analysis to be discussed on board the DP vessel. Not only is this good for understanding why certain operations are carried out in particular ways, it is also good for understanding this type of assessment. On board, when circumstances on a project become outside what was planned, this knowledge is invaluable. It is always a great boost when one of the key DP personnel attending a risk assessment on board argues a point based on practical knowledge and experience. The idea that because others attending the risk assessment are shore based or specialists or project engineers and therefore know best is not a good assumption. It is good DP practice to involve key DP personnel and give them the confidence to contribute effectively. For this to work well the following needs to be done:

1. Risk assessment documentation needs to be given and read by key DP personnel.
2. Prior to a risk assessment the basis has to be given to the key DP personnel with time for them to read it.
3. The risk assessment needs to start with an outline of the work that can capture the attention of the attendees and motivate them to get involved.

When these assessments have been carried out with key DP personnel involved early in a project these same engineers and mariners are better placed to do similar assessments later in the project when circumstances are different because of equipment failure or an unforeseen problem occurs.

### **Safest Mode of Operation**

It is good DP practice to always operate a DP vessel in the safest mode, irrespective of whether the vessel is DP Class 1, 2 or 3 according to a certificate or letter of compliance. At a first pass this could be said to mean that the vessel has to have all equipment on line and active, but this is not necessarily the safest mode of operation. Running all diesel generators at low load is unlikely to be the safest mode on many DP vessels. This area has been closely studied on some vessels and the safest mode is defined for one, two or even three levels of environmental loading. These might be described as 2-split, 3-split and 4-split because this refers to different switchboard arrangements. This is documented and followed by all Masters and Chief Engineers. This contrasts dramatically with other DP vessels where the safest mode of operation seems to change with the Chief Engineer or Master or both. The idea that any DP vessel can operate in a mode that is not the safest is clearly wrong; there can only be one safest mode for the environmental conditions prevailing. The philosophy of the safest mode of operation should be the product of a

risk analysis and the methodology used to arrive at this mode will be of direct use for the situation when one diesel generator or one of the thrusters is not available. DP drilling usually has these scenarios worked out and decided in advance by the WSOG, but there are still combinations of equipment availability that can cause a change in the set up for the safest mode of operation.

If position references are considered then it is easy to say that to be in the safest mode all position references must be on line and accepted by the DP control system. This is true if:

- They add to the quality of the fix.
- Their use is sensibly continuous.
- They will not distort the weighting.

In other words, if five independent position references can be selected then they should be. On some vessels this is the practice. It will never be adequate to state that a particular position reference was not used because there was not power supply available, or it is not as good as DGPS, or there are three position references anyway. Several vessels particularly dive support vessels use five position references. To use more than five can be argued as unnecessary and this is a valid reason to move from the concept that more is better; there will come a point when more has negligible impact on the quality of the fix. At this point the safest mode of operation philosophy is met.

### **Check Lists**

DP guidance has required check lists for a long time it is rare to find a DP vessel without them. A few vessels do not have them for the ECR or have them but they are mechanical rather with no electrical content. The styles of these check lists vary greatly from those produced for all vessels in a fleet of different vessels to those produced on board so they are very vessel specific and potentially different to a sister vessel. Some are designed so that they can be used for both location and watch keeping (6 hourly) checks. Some are a tick-the-box exercise that does not require the watch keeper to leave the bridge or ECR. Others not only require leaving the control location but ask for actual numbers to be given (rather than ticks) which has the advantage of requiring more thought. The best practice is for the company to provide an example and for the vessel to use this model to make a vessel specific set of check lists designed to make the key DP personnel think and check off all key parameters. The vessel should also have the freedom to change the check list based on experience, provided this does not go outside the philosophy set by DP guidance and the company example. The best test of a check list is to find out about the most recent DP incident or event and read any lessons learned. If these lessons are reflected in the check list then the lesson is learned. This does happen on some vessels.

### **FMEA and Trials**

Much guidance has been produced on the methodology and management of DP FMEA reports. From this the good DP practice can be summarised as:

1. Every redundant DP vessel should have an FMEA.
2. The FMEA should be proven by a trial.
3. The FMEA should be a living document (kept up-to-date).

To this list one could add that if the document is not of interest to and understood by the key DP operators on board the DP vessel it has failed in one of its objectives.

The best practice is where the vessel owner or vessel management company takes charge of the FMEA and makes sure that it is read and kept up-to-date. The most enlightened approach is one where the key DP personnel make comments and suggest changes to the FMEA because of mistakes, modifications to equipment or practices. These can be passed to the surveyor prior to the annual trials such that the changes can be proven, as necessary, and the FMEA updated as part of the annual trials. This is good practice and efficient.

In recent years many DP Class 1 vessels have been required by clients or other commercial pressure to carry out an FMEA and trials when this is not required by IMO MSC 645 or Class. However, it is good practice to carry out an FMEA if the DP1 vessel has and markets its redundant qualities. If the designer intended the redundancy to be effective it should be stated and proved.

### **Watchkeeping**

There are normally two DPOs on the bridge and two engineers in the engine room with one in the ECR when on DP. The watch on the DP desk is normally no longer than one hour. This is not the case in the ECR where the change over is more fluid. Of the two DPOs one has been on shift 6 hours longer than the other. This system is frequently operated for the engine room watchkeepers as well and this is normal good DP practice. Other systems are operated and it is difficult to say they are unacceptable if they take account of the main objective, which is to keep the duty watchkeepers alert. For the watchkeeping engineer there is usually enough for him to attend to. For the DPO it depends on the DP vessel and the work it is engaged in. Certainly on a DP DSV an hour on the desk can pass almost unnoticed, whereas on a DP MODU it can drag on for ages. These systems assume that all watchkeepers get on and work together well. This is not always the case and it is good practice to take these human factors into account. It is normal for the new watchkeeper to be given a handover from the watchkeeper going off shift. The status of the equipment is normally then checked, using the watchkeeping check list, by the man coming on watch.

For the engine room watchkeeper, each must have a watchkeeping certificate. For the bridge the DPOs should each have a DP certificate and the norm today is that they both have watchkeeping certificates as well. The demand for DPOs has outstripped the supply, so often the second watchkeeper does not have a DP certificate. Some flexibility has been necessary, but the second watchkeeper should have at least done his simulator training if he is to be left unsupervised. It is also good practice to give DPOs training on the use of the DGPS and acoustics. The set up of each can be complicated and for each there is a need for:

- general training on the principles of each
- vessel specific training on the set up on board

Many marine contractors with DP vessels send DPOs for position reference training but it can be done on board.

DPOs have the time to record and report anomalies with the DP system, and it is good practice to:

- log the occurrence and do a screen dump (even if there is not a recording facility)
- discuss the occurrence with others
- send data to vendors of equipment for explanation if knowledge is not on board
- summarise all such events in handover notes

Generally DPOs do this; such practices are less common for engine room watchkeepers because problems are usually handed over verbally to the electrician or the day work engineer to fix. However anomalies with the PMS or ICMS are often accepted and worked round rather than changed. If external help is required the problem is passed to the Chief Engineer for action. One of the most important set of handover notes are those written by the electrician. It is not uncommon for him to have the least amount of spare time to write these notes comprehensively.

While the intention on all DP vessels is for each crew to have a similar breadth of knowledge and experience and, for example, each electrician to be familiar with all areas of the electrical installation, this is frequently not exactly the case. Each will of course have an overall understanding, but then tend to deal with areas that the other electrician tends to ignore. In these circumstances the handover notes are sometimes not given the attention they deserve.

Watchkeepers should know, understand and use all the control modes and combinations available, but not while undertaking DP operations. During operations the most relevant mode or modes should be selected. Thus it is essential that all watchkeepers have the time and opportunity to use all the control facilities available. This has in the past been called 'play time' but it is better called competence enhancement. The need for such DP time has been well understood for many years and there have been clauses in long term contracts to allow for this familiarisation and training process. The use of simulators helps but is not completely the same as using the vessel in a real environment. The best example of formally making time available in the DCAP programme developed for shuttle tankers in Norway.

## **DP Capability**

Most DP vessels have DP capability plots but only a few have full-scale tests to prove the capability is as calculated. It takes one period of bad weather to check a sector of 180° and effectively benchmark a set of environmental conditions. This process can be confusing if there is a significant current but this does not make the test invalid. The benefits of proving the DP capability are:

1. Demonstrates to clients that the vessel is performing as well as expected.
2. Shows operators that there are limits.
3. Finds problems with respect to the vessel's model.

DP footprints are sometimes confused with DP capability plots. Footprint was the term divers gave to the disturbance the clump weight made on the sea bed during diving operations. Divers judged the weather and the quality of the DP system by the size of the footprint. Some vessels were described by divers as terrible because they had such a large footprint in good weather. DPOs should know and record the DP footprint for various weather conditions, headings and water depths. This has the following benefits:

- Benchmarks performance.
- Shows that the DP control system is working well.
- Shows that the thrusters are delivering thrust as expected by the DP control system.

This is good DP practice particularly for vessels that work close to platforms like flotels and DSVs.

## Annual Trials

Many DP vessels carry out an annual DP trial in accordance with IMO MSC 645 guidance. There is no doubt about what was meant in this guidance because the practice of annual DP trials had started in 1992 and the success of this concept was an input into the drafting of IMO MSC 645 in 1993. The general acceptance of the annual trial, instead of numerous trials throughout the year, was a great benefit to the industry. It is good DP practice to carry out an annual DP trial.

The best annual trial practice seen by the author is where:

1. The vessel owns the trial programme.
2. The key DP personnel give input to and change the trials to cover problem areas they have recently found.
3. Priority is given to the annual trials for 24 hours.
4. The close out of any recommendations is actioned as soon as possible after the trials.

The benefits of such an approach:

1. The DP culture is right.
2. Key DP personnel learn from the trials.
3. Each annual trial is interesting and stimulating.
4. The DP vessel is more reliable.

## Conclusions

There is no barrier to good DP practice except those created by human factor problems.

There is no significant cost in good DP practice and once it is in place, there are only cost benefits.

There are always going to be unforeseen events that will mean normal good practice cannot be followed, but if the shortfall is discussed and mitigated it might be possible to continue the work safely and this would be good DP practice.