

# **Guidelines for The Training and Experience of Key DP Personnel**



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## **IMCA M 117 Rev. 2**

This document has been developed for IMCA under the direction of its Marine Division Management Committee. The review of the document has been conducted by an industry stakeholder group to ensure that the guidance contained has broad consensus within the DP community.

It has been referenced as an industry standard by IMO and, if revised, the Maritime Safety Committee must be informed.

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January 1996	Initial publication	
February 2006	To reflect current best practice	Rev.1
September 2016	To reflect current best practice and changes to the operating environment	Rev.2

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# The Training and Experience of Key DP Personnel

IMCA M 117 Rev. 2 – September 2016

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## I Executive Summary

This guideline reflects the recognised industry standard for the training, competence and experience required of all key DP personnel on dynamically positioned (DP) vessels.

In June 1996, the Maritime Safety Committee (MSC) of the International Maritime Organization (IMO) issued circular MSC/Circ.738, which noted that IMCA had prepared a publication on the “*Training and experience of key DP personnel*” and invited member governments to bring that publication to the attention of the bodies concerned and apply the guidelines to the training of key DP personnel.

A reference to the publication was also made in the 1989 Mobile Offshore Drilling Unit (MODU) Code. The committee invited IMCA to keep IMO informed of future amendments to the IMCA guidelines as appropriate. The subsequent Rev. I document was submitted to the MSC and has been used as a reference by that body and it is intended to submit this latest version to the MSC also.

This document was revised by IMCA during the 2015/2016 period to reflect current industry practice and changes to the operating environment since the previous review and clearly identifies the key personnel required to safely and efficiently operate a DP vessel. It also recognises that there are a number of DP training schemes available and various organisations that offer DP operator (DPO) certification. Section 10 is dedicated to the concept of continuous professional development seen as an essential tool for promoting and maintaining competence. This revision has led to some reorganisation and renumbering of sections.

The guidelines are designed for vessels engaged in DP operations where the inability to maintain position could potentially cause one or more of the following: loss of life, severe pollution, major damage and economic loss.

This document provides guidance for competence assurance and assessment requirements in the industry. Its benefits can be increased if it is used in combination with [IMCA C 002 – Guidance on competence assurance and assessment – Marine Division](#).

## 2 Glossary of Terms and Abbreviations

Approved training centre	A training centre given approval by an industry recognised training scheme provider
ASOG	Activity specific operating guidelines
Assessor	The assessor should be a company supervisor or manager (or other person approved by the company) with the necessary knowledge and experience to be able to judge the competence being assessed. For further guidance, see <a href="#">IMCA C 007 – Guidance on assessor training</a>
BOP	Blowout preventer or basic operating panel
CAM	Critical activity mode
CDPA	Company DP authority
Controlled document	A document controlled and updated by the vessel owner/operator
CPD	Continuous professional development
DP system	All systems and sub-systems that directly or indirectly affect the dynamic positioning of a vessel, comprising the following: power system, thruster system and DP control system
DP training scheme	A mix of training courses including simulator based skill training elements and consolidation periods onboard vessels where appropriate levels of practical DP experience can be acquired and may include assessment and examination elements
DPO	<p>(Role) – A DP Operator is defined in these guidelines as the second person on a DP watch</p> <p>(Rank) – A certificated DPO is defined in these guidelines as a DP operator who has successfully completed an industry recognised DPO training scheme and is in possession of a valid DP operator certificate. A junior DPO is defined in these guidelines as a person participating in an industry recognised DPO training scheme and not in possession of a valid DP operator certificate</p>
ECR	Engine control room
ESD	Emergency shutdown
Established vessel	A vessel that has been operational with the same organisation and in the same sea area for six months
Familiar vessel	A vessel with a familiar control system
FMEA	Failure modes and effects analysis
HAZID	Hazard identification analysis
HAZOP	Hazard and operability study
HV	High voltage – electrical voltage in excess of 1kV
Industry recognised DP training scheme	A structured scheme formulated in consultation with training providers, DP industry trade associations and professional associations which is reviewed, revised and audited according to a strict schedule
Installation	Unit visited by a vessel such as a fixed offshore structure, a live pipeline, a drilling unit, an accommodation unit, a floating production or storage unit

JDPO	A junior DPO is defined in these guidelines as a person participating in an industry recognised DPO training scheme and not in possession of a valid DP operator certificate
Key DP personnel	The essential personnel considered necessary to safely and effectively operate a DP vessel (see section 5)
MoC	Management of Change
MODU	Mobile offshore drilling unit
MRU	Motion reference unit
NMD	Norwegian Maritime Directorate
PA System	Public address system
PMS	Power management system
PRS	Position reference system
SDPO	A senior DPO is defined in these guidelines as the lead DP watchkeeper
SIMOPS	Simultaneous operations
SMS	Safety management system
SOLAS	International Convention for the Safety of Life at Sea
STCW Code	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
TAM	Task appropriate mode
Touch drills	A method of exercising emergency procedures in training and drills, by touching, but not activating, controls to simulate the required actions
Unfamiliar vessel	A vessel with an unfamiliar control system
UPS	uninterruptible power supply
VRU	Vertical reference unit
WCF	Worse case failure
WSOG	Well specific operational guidelines

## 3 Introduction

### 3.1 Background

The application and complexity of DP systems has significantly expanded since the last revision of this document. DP systems are used on vessels in all the major maritime regions of the world and the result of this expansion and diversity has meant that the challenges of ensuring key personnel have the competency to perform their roles has never been greater. All vessel owners/operators require suitably qualified and experienced DP personnel for safe and commercially successful operations. It is a broadly accepted principle that a formal DP training scheme is part of the process necessary for DPOs to gain a DP operator certificate and, equally, that technical personnel have compatible training pathways through specific and general technical training courses. Thereafter, it is a requirement that experience is needed to consolidate the knowledge acquired while under training. After an appropriate amount of experience is gained, a person can become 'operationally' competent such that they are able to adequately perform their role without the direct assistance of another person. Advancing technology now facilitates formal training using shore-based facilities and/or onboard, using simulator systems or the vessel itself. It is also accepted that vessel-specific training and experience is essential on both efficiency and safety grounds. Some vessel owners/operators have benefited through the formal use of simulators and simulated exercises for practical training onboard.

Lessons learnt from DP station keeping events are of invaluable benefit to all DP personnel. Reported events and the causes and lessons learnt should be made available to training establishments, vessel owners/operators and DP professionals. Use of this information for training purposes and risk assessment will assist in reducing the occurrence of future DP incidents.

- ◆ DP events result from human factors, process, procedural, equipment failure or poor design.
- ◆ DP events should be fully investigated to determine the root cause.
- ◆ Investigation should result in remedial actions which should be monitored through an effective 'close out' procedure.
- ◆ Personnel should be able to report errors and faults without fear of adverse vessel owner/operator or client reaction. It is highly recommended that all stakeholders encourage the reporting of DP station keeping events to avoid deceptive behaviours which may mask potentially serious shortcomings in the DP system.

IMCA's DP station keeping event reporting scheme (see Appendix 7) is a widely accepted procedure for reporting DP station keeping events. Relevant reporting forms are available from IMCA. The information collected is used by IMCA to publish reported errors, faults and lessons learnt in an anonymous form, without reference to owner/operator, client, vessel(s) names, location or dates.

The importance of good team management should not be overlooked by vessel owners/operators and suitable procedures should be put in place as required by the International Convention for the Safety of Life at Sea (SOLAS) and the International Convention on Standards of Training, Certification & Watchkeeping for Seafarers (STCW) Code. The concept of continuous professional development is to be encouraged for DP bridge and technical personnel.

### 3.2 Operational Conditions

Vessel owners/operators should be enabled by clients and charterers to allocate time in their DP vessels' schedules for training and drills; clients should encourage this as suitable opportunities arise. This should include drills which involve both bridge/DP control and machinery control room teams.

DP personnel should not only be competent to operate their vessel's DP system, but they need to be able to work together and communicate effectively. The importance of bridge and engine room team management abilities and training has been recognised as a key enabler to improving operating effectiveness and safety.

Operational imperatives need to be set against the need to maintain skill levels. Commercial arguments alone should not defer the conduct of planned 'full team' drills.



Logistical matters such as limitations of bed space, helicopter flights sometimes obstruct or interrupt verbal handovers between key DP relief personnel. A system should always be agreed prior to the event to ensure a proper handover. It should be considered to be a key safety mitigation process for vessel owners/operators and clients to facilitate handovers without interrupting the progress of work.

DP personnel should be fully aware of the project plan and its requirements and their role in delivering it. When necessary this will include an understanding of the details contained in the form of hazard identification analysis (HAZID) and hazard and operability studies (HAZOP) and simultaneous operations (SIMOPS).

As with a failure modes and effects analysis (FMEA), any training or operating manuals should be treated as 'living' documents so that they are updated and amended as required, for example as a result of lessons learnt following a DP station keeping event.

For a new vessel, or a vessel that is new to a particular owner/operator, special arrangements such as a pre-operation 'work up' period might be necessary to bring the key DP bridge and technical personnel to an adequate standard of vessel familiarisation, experience and expertise.

## **4 Aim and Objectives**

### **4.1 Aim**

The aim of these guidelines is to improve the safety and efficiency of DP operations, by defining minimum industry guidelines for:

- ◆ training, qualification and competence levels of key DP personnel;
- ◆ developing and sustaining competence through continuous professional development (CPD) for key DP personnel.

### **4.2 Objectives**

The completion of the following objectives supports the achievement of the aim:

- ◆ to develop internationally accepted guidance for the training and competence levels of key DP personnel;
- ◆ to recommend onboard training, familiarisation programmes and maximise potential of simulators and other advanced training technologies;
- ◆ to describe a recommended verification process for assessing the level of competence of key DP personnel, enabling owners/operators to manage change effectively and efficiently;
- ◆ to encourage open DP station keeping event reporting including 'near misses';
- ◆ to promote the principle of the sustainment of competence for key DP personnel as being integral to a vessel's safety management system;
- ◆ to recommend the establishment of a DP authority to oversee all DP related matters within owner/operator companies;
- ◆ to recommend definitions of terminology for use in describing the status of key DP personnel.

## **5 Key DP Personnel Identified**

### **5.1 Master/OIM**

The master or offshore installation manager (OIM) has overall responsibility and authority for the safety of the vessel, all onboard and for the protection of the marine environment.

### **5.2 Senior DP Operator (SDPO)**

The person fulfilling the role of senior DPO is the lead DP watchkeeper with responsibility for the navigational safety and the DP control required to achieve the effective and efficient progression of the industrial mission of the vessel during the period of time on duty.

### **5.3 DP Operator (DPO)**

The person fulfilling the role of DPO is the second person on a DP watch and is not in charge of the watch. The DPO is responsible for fulfilling their duty as a DP control system operator during their time on watch to the extent enabled by their level of training, vessel DP system knowledge and experience.

### **5.4 Chief Engineer**

The chief engineer is the head of the technical department onboard and is responsible for ensuring all the mechanical and electrical systems of the vessel are operated and maintained in a safe and efficient manner in order to support the safe navigation and operation of the vessel.

### **5.5 Senior Engine Room Watchkeeper**

The person fulfilling the role of senior engineer on watch is responsible for ensuring that all machinery and systems necessary to maintain the DP status of the vessel are functioning correctly. They should also ensure that effective communication channels to the bridge are available.

### **5.6 Engine Room Watchkeeper**

A second engine room watchkeeper may assist the senior watchkeeper to the extent enabled by their level of knowledge and experience.

### **5.7 DP Electrical and Electronics Technicians**

Personnel fulfilling the role of electrical and electronics technicians are responsible for carrying out maintenance, repairs and replacements to systems and components with reference to the manufacturer's approved operation and maintenance procedures.

### **5.8 Company DP Authority**

The company DP authority (CDPA) is the nominated person(s) in the vessel owner/operator company with the responsibility and authority to develop and implement procedures for the training and development of all key DP personnel.

## 6 DP Training

### 6.1 Types of Training

Training of key DP personnel is essential and can take several forms:

- ◆ shore-based training courses including use of simulator systems;
- ◆ onboard training as operations permit and under the supervision of a qualified instructor or an experienced operator with a vessel owner/operator issued endorsement to train other DP personnel (for guidance on assessor training see [IMCA C 007](#)), for example senior DPO or senior engine room watchkeeper;
- ◆ onboard DP simulator instruction and exercises – scenario-based specific to the operations expected. One of the methods of doing this is through the use of ‘touch drills’, where switches and controls are not actuated only touched to indicate operation and simulation;
- ◆ onboard instruction and continuation training to mitigate for skill fade;
- ◆ supervised operation of the control systems;
- ◆ manufacturers’ training ashore and onboard;
- ◆ seminars with open discussions on vessel operation;
- ◆ vessel owner/operator training schemes relevant to the specific DP operations;
- ◆ refresher courses, both theory and simulator;
- ◆ computer (including web) based training.

All training should be given by suitably qualified and experienced personnel. Vessel owners are advised to provide training for their senior DP personnel to enable them to deliver effective training and mentoring.

### 6.2 Training Records

Evidence based training records should be kept and maintained by all key DP personnel. This can then be produced as evidence of competence training for vessel audits, human resource administration and professional development.

The amount of training and experience necessary for key DP personnel should depend on the type of vessel and the consequences of any position loss during their work. For vessels subject to the International Safety Management (ISM) Code, in accordance with SOLAS Chapter IX, vessel owners/operators are required to maintain training records onboard for individuals and to keep records of the training and experience of key DP personnel. The company DP authority should ensure that DP training programmes and records are developed, maintained and appropriately managed.

For recording development and sustainment of competence an individual record of training using a suitable logbook is the most convenient system. DPO training schemes will usually incorporate a logbook with training objectives, comprising a series of tasks to be completed by the trainee. Whichever DP training scheme is followed it is necessary to demonstrate continued development of competency through operational DP practice. An essential part of that process is to record the details of operational DP time and this record can be kept in the *IMCA dynamic positioning logbook*, which can be used by all key DP personnel. These logbooks are available to purchase from the IMCA website ([www.imca-int.com/competence-and-training/imca-logbooks](http://www.imca-int.com/competence-and-training/imca-logbooks)).

In addition to recording DP operational experience, attendance at training activities should be recorded in the IMCA DP logbook and drills recorded in the vessel’s permanent records. As part of a managed, continuous professional development process, vessel owners/operators should establish a structured programme for their employees to participate in DP system drills and training appropriate to their role (see section 10). The frequency of such drills should be as determined by a formal training needs analysis and be part of the safety management system (SMS)<sup>1</sup>. It is recommended that a system exists to verify

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<sup>1</sup> ISM Code Part A Article 6.5 requires that the ‘Company should establish and maintain procedures for identifying any training which may be required in support of the safety management system and ensure that such training is provided for all personnel concerned’

that all key DP personnel conduct onboard drills or equivalent shore based training events at least once every 12 months.

### **6.3 Training Courses & Certification for DPO Personnel**

For the DPO role, there are various training schemes available and others are likely to be developed. These schemes are structured and approved by recognised industry bodies, which review, revise and audit them according to a strict schedule. Schemes may use different criteria to meet a qualifying certification standard, but the methodologies of the scheme should be consistent with the principles outlined in these guidelines to enable the DP vessel operating stakeholders to readily recognise equivalency.

The structure of the current DPO training schemes designed to certify DPOs do vary, however they all have the same goal of producing a certificated DPO trained to a recognised level of ability. It is necessary that schemes progress the trainee through a series of different levels of experience, gained both ashore and at sea, onboard a DP vessel. The importance of practical training including handling and manoeuvring the vessel on manual, joystick and automatic control and changing between modes of operation is to be stressed in the training scheme. In some situations, such as on floatels, or on drilling operations which often have long periods of static DP operation, with the unit on the same heading and in the same position for several months, other options may need to be considered.

All current schemes require the candidate to attend a DP induction course. The course provides an introduction to the functions and use of a DP system and it should be based around the content outlined in Appendix 1 and in accordance with the guidelines in Appendix 4.

Further progression requires the candidate to attend more advanced DP training followed by a formal assessment of their skills appropriate to the stage of training they have reached. To progress to this advanced DP training stage, trainees are normally expected to complete a period of onboard assessment during which time DP operator performance tasks are signed off by a certificated DPO and endorsed by the master/OIM. This supervised DP experience onboard a DP vessel should be properly documented. It is fundamental that the individual gains practical onboard experience in the use of DP systems prior to attending more advanced DP training, where consolidation of this experience can be achieved through appropriately demanding simulated training scenarios. While existing schemes require experience to be gained onboard a DP vessel, a certain amount of 'equivalent' experience can also be gained on a DP simulator approved by the scheme to reduce the amount of actual DP sea time needed to gain qualification.

The advanced element of DP training schemes gives trainees the opportunity to apply lessons learnt from their experience gained during supervised DP training at sea. Advanced DP courses can provide training in the use of different DP control systems, including simulated emergency operations, and should be based on the content outlined in Appendix 1 and in accordance with the guidelines in Appendix 4.

DPO certification is obtained by successfully completing all elements of an industry recognised DPO training scheme. This includes theoretical and practical assessment and examination at appropriate stages during the scheme.

Once all the criteria of the scheme are met a candidate is qualified as a certificated DPO. In line with STCW principles certification as a DPO is time dependent and the validity of a DPO certificate should be no more than five years. Provided certain prescribed criteria, set by the certification body, is met the DPO certificate is revalidated and reissued for a further maximum of five years.

The successful completion of any DPO certification process by an individual is a statement that a level of knowledge and proficiency has been achieved as a DPO. It should not be taken as an affirmation that such an individual is operationally ready to be a DPO capable of handling any DP situation on any vessel. For example, DP product specific training courses required for vessel familiarisation could be appropriate. The next elements of the competence requirement are the acquisition of sufficient experience to become fully operational as a DPO and to maintain the required level of competence throughout the validity period of the certificate. This responsibility is with the owner/operator and the vessel's master.

## **6.4 Training Courses for Key Technical DP Personnel**

A good understanding of the DPO's responsibilities by technical DP personnel and onboard familiarisation with the DPO's task in controlling specific DP operations will aid quick and appropriate response to problems associated with any equipment that affects DP. It is recommended that engineers and electrical and electronics technicians attend a structured DP familiarisation course either arranged onboard or at a recognised training establishment. Details of a generic DP familiarisation course is given in Appendix 3.

All training should be appropriate to the vessel the individual works on and may include subjects covering vessel control systems, high voltage (HV) safety, DP maintenance, power management systems (PMS), fire and gas detection, emergency shutdowns (ESD) and emergency drills. Electrical technicians on vessels with HV systems should attend a course in the safe operation of HV systems<sup>2</sup>.

Key DP electrical and electronics technicians responsible for maintaining the DP control system should attend a manufacturer approved DP control system maintenance course. Guidelines covering the content of a course designed to enable understanding of the control system and the procedures necessary for fault finding is given in Appendix 2. Training on vessel-specific equipment is necessary if the equipment is sufficiently unique that training on similar equipment does not provide an adequate level of skill, knowledge and ability. It is in the interest of the vessel owners/operators to continuously improve the ability of the relevant personnel to fault find and repair the control system.

Effective training should enable key DP technical personnel to respond quickly and appropriately to equipment failures and faults that may result in DP incidents and to effectively recover the vessel to a safe DP equipment state. When considering the training requirements, the importance of a team response to situations should be taken into account. Vessel owners/operators are advised to have onboard at least one person who has received appropriate maintenance training on the vessel's DP control systems.

## **6.5 Training Courses for Other Personnel Involved in DP Operations**

In general, all key DP personnel and others with a need to have an understanding of DP operating procedures should have a good understanding of each other's tasks and responsibilities. It is further recommended that other personnel involved in operations on DP vessels, such as diving supervisors, construction superintendents, senior drilling personnel, and anyone who needs familiarisation on DP operations attend a structured DP familiarisation course. This course can be arranged onboard or at a shore based training establishment. Details of a generic DP familiarisation course are given in Appendix 3.

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<sup>2</sup> In vessels to which the STCW Convention applies HV training is a mandatory requirement for certain personnel

## 7 Qualification and Knowledge Requirements of Key DP Personnel

### 7.1 Master/OIM

The master/OIM of a DP vessel is defined in these guidelines as having overall responsibility and authority for the safety of the vessel. The master/OIM will hold either a formal qualification as master to current STCW Convention standard or flag state equivalent, or an OIM certificate, and if it is a requirement for them to operate the DP control system they should also hold a current industry recognised DP operator certificate.

Competence for navigational watches is covered by the STCW Code. Further guidance is available in [IMCA C 002](#).

The master/OIM should understand the need for and implement good communications between the bridge and engine control room and have a comprehensive knowledge of the vessel's operations manuals including the FMEA and related FMEA trials as currently updated. Additionally, they should be competent to conduct annual trials, lead DP drills, direct the training of new and existing DP personnel (see Appendix 6 for examples of types of drills).

If it is a requirement for them to operate the DP control system, they should have greater or equivalent DP operational knowledge to the senior DPO (see section 7.2).

The master's knowledge and experience, relevant to the vessel, should also include:

- ◆ DP station keeping event investigation and reporting;
- ◆ full knowledge of the vessel's activity specific operating guidelines (ASOG)/well specific operating guidelines (WSOG), including the critical activity mode (CAM), task appropriate mode (TAM) and worst case failure (WCF);
- ◆ comprehensive understanding of the DP computer/control system(s), including changing between systems and the various modes of operation;
- ◆ knowledge of other appropriate systems, such as, but not limited to, vessel management systems, PMS, fire, gas and ESD;
- ◆ detailed knowledge of emergency procedures and actions due to failures of:
  - generator/power
  - thrusters
  - sensors
  - input systems
  - computer
  - commands
  - feedback
  - any other systems/equipment relevant to dynamic positioning;
- ◆ detailed knowledge of emergency procedures and actions that have impact on the DP operation as defined in the emergency/contingency procedure manual;
- ◆ if appropriate, assessor level in the understanding, setup, functionality, failure modes and use of any equipment and system associated with DP operations on the vessel;
- ◆ the ability to plan, execute and lead DP drills including blackout recovery.

The Master/OIM should actively participate in HAZID/HAZOP and SIMOPS meetings as part of the planning for the industrial mission of the vessel.

The Master/OIM should have knowledge of relevant IMCA documentation. A list of referenced documents can be found in Appendix 8.

## 7.2 Senior DPO

The person fulfilling the role of the SDPO is defined in these guidelines as the lead watchkeeper with responsibility for the navigational safety and control of the DP system necessary to achieve the effective and efficient progression of the industrial mission of the vessel whilst on watch. The SDPO should hold a formal qualification as a deck officer in accordance with current STCW Convention standard or flag state equivalent and also hold a valid, industry recognised, DP operator certificate.

The SDPO will have satisfied vessel owner/operator requirements to undertake the role of lead DP watchkeeper and should have been assessed by the master as having the experience, knowledge and competence to take sole charge of a DP watch. They should also be capable of providing supervision to other DPOs, for any DP operation that the particular vessel may be engaged in.

Competence for navigational watches is covered by the STCW Code. Further guidance is available in [IMCA C 002](#).

SDPOs will have all of the qualifications of a certificated DPO (see section 7.3.1;) and in addition their knowledge and operational experience should also include:

- ◆ familiarity of the vessel's industrial mission including the specific hazards associated with the mission and performing it using the vessel's DP system;
- ◆ effective management of the DP control/bridge team
- ◆ the ability to investigate and report DP station keeping events;
- ◆ full knowledge of the vessel's ASOG/ WSOG, including the CAM, TAM and WCF;
- ◆ training on any other appropriate system, such as, but not limited to, vessel management systems, PMS, fire, gas and ESD;
- ◆ assessor level in the understanding, setup, functionality, failure modes and use of any equipment and system associated with DP operations on the vessel.

## 7.3 DPO

The person fulfilling the role of DPO is defined in these guidelines as the second person on the watch and is therefore not in sole charge of the watch. Their required experience and knowledge will depend on the type of DP vessel and the complexity of the current industrial mission of the vessel. Vessel owners/operators should consider the critical nature of the industrial mission, the ASOG or its equivalent and take a risk based approach to determine the level of experience, knowledge and competence required by the DPO. The person fulfilling the role of SDPO should be in the same work space and maintain continuous oversight of the activities of the DPO.

Vessel owners/operators should take every opportunity to train DPOs to be capable of taking charge of the DP watch during DP operations. Two recognised categories of DPO can fulfil the role of the second person on the DP watch.

### 7.3.1 Certificated DPO

A certificated DPO is defined in these guidelines as a DP operator who has successfully completed an industry recognised DPO training scheme and is in possession of a valid DP operator certificate. Although competent to be part of a DP watch a DPO acting in this role might not yet be expected to take sole charge of the DP watch.

Competence for navigational watches is covered by the STCW Code. Further guidance is available in [IMCA C 002](#).

A certificated DPO's knowledge and experience should include:

- ◆ controlling the vessel using manual and joystick controls;
- ◆ changing operational modes between auto DP to joystick to manual controls to autopilot and vice versa;
- ◆ principles and planning of DP operations in depth;



- ◆ awareness of industrial mission failures that might affect DP operations;
- ◆ being part of the DP control/bridge team;
- ◆ DP information input systems;
- ◆ detailed understanding of the DP computer/control system(s), including changing between systems and the various modes of operation;
- ◆ Detailed understanding of the setup, configuration and operation of all position reference systems;
- ◆ thruster units and associated systems;
- ◆ DP system power supplies;
- ◆ knowledge of the vessel's ASOG/WSOG, including the CAM, TAM and WCF;
- ◆ equipment redundancy, availability and maintenance requirements;
- ◆ operational capabilities and footprints;
- ◆ comprehensive knowledge of system functional specifications, simplified line diagrams, equipment operator manuals and the vessel's operations manuals;
- ◆ comprehensive knowledge of the vessel's communications systems;
- ◆ effective communication with the engine control room;
- ◆ knowledge of emergency procedures and actions due to failures of:
  - generator/power
  - thrusters
  - sensors
  - computers
  - commands
  - feedback
  - any other systems/equipment relevant to the DP;
- ◆ knowledge of the vessel's FMEA and an understanding of the implications of all identified failure modes;

If the DPO does not form part of the navigational watch, then they need not have a navigational watchkeeping qualification to current STCW Convention standard or flag state equivalent (this enables engineers and DP electrical and electronics technicians to be DPOs).

### 7.3.2 Junior DPO

A junior DPO is defined in these guidelines as a person participating in an industry recognised DPO training scheme managed and/or certified by a recognised industry body and not in possession of a valid DP operator certificate. The junior DPO is to be suitably supervised while on watch by a certificated DPO.

Competence for navigational watches is covered by the STCW Code. Further guidance is available in [IMCA C 002](#).

A junior DPO's knowledge and experience should include:

- ◆ controlling the vessel using manual and joystick controls;
- ◆ changing operational modes between auto DP to joystick to manual controls to autopilot and vice versa;
- ◆ principles and planning of DP operations;
- ◆ awareness of industrial mission failures that might affect DP operations;
- ◆ being part of the DP control/bridge team;

- ◆ basic knowledge of the practical operation of DP control system, including changing between systems and the various modes of operation;
- ◆ basic understanding of the setup, configuration and operation of all position reference systems;
- ◆ communication with the engine control room;
- ◆ knowledge and use of reference systems and other peripheral equipment;
- ◆ system redundancy, alarms and warnings;
- ◆ knowledge of vessel systems and their limitations;
- ◆ knowledge of DP alarm sequences and communications with reference to operational condition;
- ◆ knowledge of the vessel's operations manuals and communications system;
- ◆ knowledge of the vessel's FMEA and its implications;
- ◆ training on any other systems relevant to the DP system.

If a junior DPO does not form part of the navigational watch, then they need not have a navigational watchkeeping qualification to the current STCW Convention standard or flag state equivalent (this enables engineers and DP electrical and electronics technicians to be junior DPOs).

## 7.4 Chief Engineer

The chief engineer is defined in these guidelines as the person responsible for ensuring the mechanical and electrical systems of the vessel are operated and maintained in a safe and efficient manner. The chief engineer will hold a professional qualification as chief engineer to current STCW Convention standard or flag state equivalent, and have completed the manufacturer/supplier approved operator training course on the integrated DP/power management control system. In addition, if the vessel has an HV system, they should hold a certificate for operating an electrical HV system and have had instruction on the HV system installed. The chief engineer should have appropriate experience, knowledge and competence to take charge of an engine room watch during DP operations.

Competence for engineers is covered by the STCW Code. Further guidance is available in [IMCA C 002](#).

The chief engineer should understand the DP operational requirements of the vessel, the consequences of failures and the optimisation of the redundancy available in equipment such as:

- ◆ power generation;
- ◆ power distribution;
- ◆ thruster units, electrical power and sensors;
- ◆ thruster units and associated systems;
- ◆ network;
- ◆ power management/logic;
- ◆ power and uninterruptible power supply (UPS) systems;
- ◆ Position reference systems;
- ◆ DP control system interfaces;
- ◆ DP control system hardware;
- ◆ DP control system software;
- ◆ computer functions, tests and fault finding.

The chief engineer should understand the need for and implement good communications between the bridge and engine control room and have a comprehensive knowledge of the vessels operations manuals including the FMEA and related FMEA trials as currently updated.

The chief engineer's knowledge and experience, relevant to the vessel, should also include;

- ◆ the ability to recover from and reinstate systems and components after failure;
- ◆ assessor level in the setup and use of all DP related systems operated by the technical department;
- ◆ detailed knowledge of emergency procedures and actions that have impact on the DP operation as defined in the emergency/contingency procedure manual;
- ◆ able to plan, execute and lead emergency drills including blackout recovery;
- ◆ full knowledge of the vessel's ASOG/ WSOG, including the CAM, TAM and WCF;
- ◆ the ability to investigate and report DP station keeping events.

## **7.5 Senior Engine Room Watchkeeper**

The person fulfilling the role of senior engine room watchkeeper is defined in these guidelines as the person responsible for the safe and efficient running of mechanical and electrical systems whilst on watch. The senior engine room watchkeeper will hold a formal, appropriate and current qualification to an approved STCW Convention standard or flag state equivalent, and have completed the manufacturer/supplier approved training course on any integrated DP/power management control system. In addition, if the vessel has an HV system, they should hold a certificate for operating an electrical HV system and have had instruction on the HV system installed.

Competence for engineers is covered by the STCW Code. Further guidance is available in [IMCA C 002](#).

The senior engine room watchkeeper should have sufficient knowledge, experience and competence to take charge of a watch in the engine control room (ECR) or equivalent during DP operations, and understand the operational requirements of the vessel and the consequences of various failures in equipment of importance to DP operations such as:

- ◆ power generation;
- ◆ power distribution;
- ◆ thruster units and associated systems;
- ◆ power management/logic.

The senior engine room watchkeeper's knowledge and experience, relevant to the vessel, should also include;

- ◆ the ability to recover from and reinstate systems and components after failure;
- ◆ detailed knowledge of emergency procedures and actions that have impact on the DP operation as defined in the emergency/contingency procedure manual.

The senior engine room watchkeeper should understand the need for and implement good communications between the bridge and engine control room and have the ability to investigate and report DP station keeping events. They should have comprehensive knowledge of the vessel's operations manuals, including the FMEA and related FMEA trials as currently updated, with respect to the significance of machinery redundancy.

## **7.6 Engine Room Watchkeeper**

Vessel owners/operators should consider the critical nature of the industrial mission, the ASOG or its equivalent and take a risk based approach to determine the level of manning, qualification and experience needed in the engine room during DP operations. The person fulfilling the role of second engine room watchkeeper, if required, should hold formal, appropriate and valid qualification to an approved STCW Convention standard or flag state equivalent. They should understand when and what work is safe and sensible to carry out, have appropriate understanding of the vessel's current FMEA and implement good communication with the bridge and other technical persons onboard. Vessel owners/operators should take every opportunity to train engine room watchkeepers to be capable of taking charge of an engine room watch during DP operations.

Competence for engineers is covered by the STCW Code. Further guidance is available in [IMCA C 002](#).

## **7.7 DP Electrical and Electronics Technicians**

DP electrical and electronics technicians are technical personnel under the authority of the chief engineer with responsibility for maintaining the ships DP electrical and electronic systems and equipment. Depending upon the size and complexity of the vessel, these roles could be fulfilled by a variety of personnel including engineering officers, electrotechnical officers, electrical engineers or other persons carried onboard for these purposes. For the purposes of this document a DP electrical and/or electronics technician is the person undertaking the role(s) regardless of the job title or rank of that person. The DP electrical and electronics technician could be the same person, however in these guidelines they are considered separately.

Guidance covering the competence of electrical and electronics personnel is included in the STCW Code. Further guidance is available in [IMCA C 002](#).

If the DP electrical and electronics technician is responsible for maintaining the DP control system, they should have attended the relevant DP control system manufacturer's maintenance course.

### **7.7.1 Electronics Technician**

The person fulfilling the role of electronics technician should be experienced and sufficiently competent to maintain the DP control system and associated systems. The electronics technician should be able to carry out tests and effect maintenance, repairs and replacements to electronic systems and components with reference to the manufacturer's approved operation and maintenance procedures. They should understand when such work is safe and sensible to carry out, have appropriate understanding of the vessel's current FMEA and implement good communication with bridge and engine control locations.

If they are also electrical technicians, they should satisfy requirements set out under section 7.7.2.

### **7.7.2 Electrical Technician**

On a DP vessel where the person fulfilling the role of electrical technician is responsible for the DP control system hardware and software, they should meet the requirements set out in section 7.7.1. In addition, if the vessel has an HV system, they should hold a certificate for operating and maintaining an electrical HV system and have had instruction on the HV system installed.

Electrical technicians should possess a complete understanding of operational theory and troubleshooting techniques for all electrical generation, distribution, protective relays, and control systems used on all critical electrical and ventilation equipment on the vessel.

*Note: When appropriate shipboard instruction from manufacturers/suppliers can be replaced by instruction from experienced ship's personnel, that is, for example, personnel who are certified by their company to conduct such training on the relevant equipment.*

## **7.8 Company DP Authority**

A vessel owner/operator may appoint or nominate a person(s) to act as the lead for DP training and other related business. This may be a shore based appointment within the vessel owner/operator company and is intended to be the first point of contact within a company to enable employees, clients, certifying authorities and other interested parties to enquire about the experience, knowledge and competence of key DP personnel. This will facilitate the requirement to verify DP sea time of the company's DP personnel. The person or persons fulfilling the role as the company DP authority should be suitably qualified and experienced to fulfil their terms of responsibility and have a general knowledge of relevant IMCA guidance documentation. A list of possibly relevant documents can be found in Appendix 8.

## 8 Recommended Vessel Experience of Key DP Personnel

Key DP personnel should acquire operational experience commensurate with their position or role in the vessel's DP operations, in order to become competent. IMCA's definition of competence is described as *"The combination of appropriate training, current skills, knowledge, and experience so that a person consistently applies them to perform tasks safely and effectively"*. For key DP personnel, companies can determine their own description of what constitutes competence. However, for the purposes of these guidelines, personnel may be deemed to be competent when they are assessed by a supervisor or more competent person, to have the ability to effectively and safely perform in their role without continuous supervision or instruction from another professionally qualified person. This assessment should be through a formal process deemed appropriate by the vessel's owner/operator company. Continued familiarity with a role (currency) is not to be confused with competence, but as an essential part of sustaining it. Hence IMCA, and most other industry bodies, recognise the need to revalidate qualifications and conduct familiarisation when new circumstances arise in order to provide personnel with sufficient experience in the new conditions.

The vessel owner/operator should ensure that all key DP personnel have received any necessary additional training and experience appropriate to their role onboard and have completed the appropriate vessel familiarisation. Consideration needs to be given to the experience and knowledge of the complete vessel crew, including those on leave, to ensure there is always an adequate level of experience and knowledge onboard the vessel. The vessel owner's/operator's SMS should identify the amount and type of DP experience or vessel specific training required to achieve the level of competence expected of DP personnel. This should be done through a formal, structured company process and may require personnel to be transferred to other similar vessels to gain familiarisation before starting in their designated role onboard their own vessel. The experience of key DP personnel is governed by the amount and type of DP operational time they are able to acquire on a vessel. While experience alone should not be the only criterion used to define the suitability of a person to perform key DP tasks, for a guide as to what experience might be considered appropriate, the following could be of assistance.

For the purposes of these guidelines, if the vessel is not brand new or newly converted and has been working in DP for an acceptable period after initial trials (recommended as not less than six months), then it may be considered to be an 'established vessel,' for which the guidance in section 8.1 applies. For all other vessels, defined as 'new or unfamiliar vessels,' the guidance in section 8.2 applies.

Thus, for the purposes of crewing a vessel with appropriate experienced key DP personnel, it can be useful for companies to consider vessels as either an **Established DP Operational Vessel** (see section 8.1) or a **New or Unfamiliar Vessel** (see section 8.2).

### 8.1 Recommended Minimum Experience on an Established DP Operational Vessel

The vessel owner is responsible for the safe operation of the vessel.<sup>3</sup> Ideally key DP personnel working on an established DP operational vessel will have vessel experience as described in Table 1. When a vessel changes owners and/or operators, or is deployed in a new area, it may be difficult to crew the vessel with adequately experienced DP personnel.

Key DP Personnel	Previous DP Vessel		Current DP Vessel	
	DP Hours	Weeks onboard	DP Hours	Weeks onboard
Master/OIM	250	10	100	4
Senior DPO	250	10	150	2
DPO	150	3	50	1
Chief Engineer	250	10	100	4
Senior Engineer Watchkeeper	100	4	50	2
Engineer Watchkeeper	50	2	50	2
DP Electrical and Electronics Technician	250	10	100	4

Table 1 – Recommended minimum experience for key DP personnel

<sup>3</sup> ISM Code Paragraph 1.4 requires every company to develop, implement and maintain a safety management system which includes "instructions and procedures to ensure safe operation of ships and protection of the environment in compliance with relevant international and flag State legislation".

Table 1 gives the basis for an established vessel's key DP personnel's experience for any class 1, 2 or 3 DP vessel operating worldwide.

'DP hours' means the amount of time the person was on duty and involved in the DP operation during the time the vessel was operating on DP.

'Weeks onboard' are the total weeks onboard whether the vessel is on DP or not. When considering key DP personnel, a person can be considered experienced when they have, as a minimum, the DP hours and weeks in that role shown for a previous DP vessel and the current vessel.

There will be occasions when the requirements set out in Table 1 are not fulfilled, such as when new personnel join the vessel or when a person is promoted into a new role. In these instances, vessel owners/operators should carefully consider the risks and adopt suitable management of change (MoC) arrangements to cover the period until the new person is considered to be competent by the master/OIM.

Where personnel do not have the requisite previous experience in their rank or rating, a period of enhanced familiarisation for that person may be required. The procedure for such familiarisation would need to be flexible to cope with the vessel's specific operational requirements and the individual's existing knowledge and experience. The goal of such enhanced familiarisation would be to achieve a level of knowledge and skill equivalent to what would be gained by the experience listed in Table 1.

When considering the key DP personnel and in particular for critical operations such as diving support, drilling or prolonged operations close to installations in addition to the experience indicated in Table 1 the vessel's key DP personnel should have the qualification and knowledge described in section 7.

## 8.2 Recommended Minimum Experience on a New or Unfamiliar Vessel

A new or unfamiliar vessel is a new or different vessel to some or all of its key DP personnel. Key DP personnel joining a new or unfamiliar vessel should undergo a structured familiarisation programme. An essential part of this is a supervised programme of onboard training followed by assessment. A brand new or converted vessel has generally had owner's/operator's acceptance trials as well as commissioning and FMEA trials, all of which may provide an opportunity for key DP personnel to complete assessment tasks and become suitably experienced in less time than when the vessel enters service. The minimum period of familiarisation that has been found to be satisfactory in the past is set out in Table 2.

Where possible, previous DP vessel experience (see section 8.1) and instruction from manufacturers/suppliers is provided onboard during the following time periods or previously at the manufacturers/suppliers facilities.

Familiarisation procedures are covered in section 9.

Key DP Personnel	Minimum Familiarisation Period	
Master/OIM	50 DP hours	7 days at sea
Senior DPO	50 DP hours	7 days at sea
DPO	50 DP hours	7 days at sea
Chief Engineer	21 days	including 7 at sea
Engineer Watchkeepers	14 days	including 7 at sea
DP Electrical or Electronic Technician	21 days	including 7 at sea

*Table 2 – Recommended minimum period of familiarisation on a new or unfamiliar vessel*

The 'Minimum Familiarisation period (DP hours)' above means the amount of time that the person was on duty whilst the vessel was on DP. The time may be reduced if a DP control system simulator is available, particularly if it enables virtual operational experience to be gained. It is not intended that simulators fully replace actual vessel experience but depending on the quality of the simulator, vessel owners may consider reducing the minimum vessel experience requirement. Simulator time should not replace more than half the required minimum vessel experience.

The familiarisation period required for technical personnel allows for time to be spent both in port and/or on passage becoming familiar with the vessel's engineering systems and their control.

When personnel move from a class 1 to a class 2 or 3 vessel their experience should be considered using the requirements for a new or unfamiliar vessel.

### 8.3 Minimum Period of Familiarisation on a Familiar Vessel

A familiar vessel is considered in these guidelines as one that has the same DP control system, or the same type of engines and switchboard configuration and is or has been engaged in similar operations. If the equipment supplier is the same, this will not necessarily mean that the control system is 'familiar' because third and fourth generation DP control systems are likely to be quite different to operate, although the concept of operation may be the same. It can be helpful if vessel owners/operators indicate to clients those systems which are similar within their fleet.

For new personnel joining a vessel with a familiar control system that carries out critical operations such as diving support, drilling or operations close to installations, there should be a minimum period of familiarisation, as outlined in Table 3. This familiarisation activity should include a structured plan comprising a supervised programme of onboard familiarisation followed by assessment through a company authorised procedure.

Key DP Personnel	Minimum Familiarisation Period	
Master/OIM	24 DP hours	3 days at sea
Senior DPO	24 DP hours	3 days at sea
DPO	24 DP hours	3 days at sea
Chief Engineer	24 DP hours	3 days at sea
Engineer Watchkeepers	24 DP hours	3 days at sea
DP Electrical and Electronics Technician	24 DP hours	3 days at sea

*Table 3– Recommended minimum period of familiarisation on a familiar vessel*

The 'Minimum Familiarisation period (DP hours)' above means the amount of time the person was on duty whilst the vessel was on DP.

*Note 1: If DP operations are not in progress, 3 days of overlap with a vessel experienced person of the same position and discipline.*

*Note 2: If DP operations are not in progress, then an equivalent level of training could be provided by simulator training. See comments in section 10.2 regarding simulators and Appendix 4.*

*Note 3: Whilst the above general guidance on key DP personnel experience in section 8 is the product of industry practice, such familiarisation procedure may need to incorporate some flexibility to cope with the variation in individual key DP personnel's competence and ability, together with the vessel's operational requirements.*

## 9 DP Vessel and Industrial Mission Familiarisation

### 9.1 Procedure

The vessel's SMS should require all key DP personnel joining any DP vessel to have a structured familiarisation procedure which includes the reading of appropriate manuals, DP incident and station keeping event reports, FMEAs, DP operations manual and any documented DP history, e.g. annual DP trials reports, checklists etc. [IMCA M 109](#) – *A guide to DP-related documentation for DP vessels* – describes the documentation that should be available. Vessel familiarisation requirements should be controlled onboard to ensure relevant manuals and familiarisation routines are completed. An example DP vessel familiarisation checklist is included in Appendix 5.

The vessel owner/operator is responsible for establishing, issuing and maintaining controlled documents onboard the vessel. The overall responsibility for the conduct of the familiarisation procedure lies with the vessel's master or OIM. The master or OIM is also responsible for the correct implementation of the familiarisation programme. The vessel owner/operator is responsible for checking that the procedure is followed.

#### 9.1.1 All Personnel

On arrival onboard the vessel, a guided tour and general familiarisation routine should be completed by all personnel. Guidance can be found in [IMCA S&L 003](#) – *Guidance on the initial and refresher familiarisation of vessel crews*. In addition, personnel should be made aware of:

- ◆ job descriptions;
- ◆ restricted practices;
- ◆ instruction on controlled documents;
- ◆ reporting forms;
- ◆ personnel management system;
- ◆ familiarisation of client procedures;
- ◆ the importance of good, clear and early communications between control stations including the bridge and engine room in the event of any changes to the normal mode of vessel's operating capabilities.

#### 9.1.2 DP Operators

In addition to section 9.1.1, operators of the DP control system should receive instruction which will familiarise them with the following, which should include, but not necessarily be limited to:

- ◆ being conversant with all of the vessel's DP standing instructions and operating procedures concerning normal and emergency operations;
- ◆ the vessel CAM, TAM, ASOG (WSOG) and WCF;
- ◆ the importance of working as part of a team using sound bridge/engine room team management principles;
- ◆ control of the vessel's movements about a set point using manual controls;
- ◆ control of the vessel's movements about a set point using DP and independent joystick controls;
- ◆ switching and changing between modes of operation;
- ◆ general understanding of the DP system installed on the vessel;
- ◆ setting up the vessel on DP;
- ◆ understanding reasons for procedures;
- ◆ use of reference input systems and the vessel-specific limitations;



- ◆ power supplies for DP computers and thruster control units;
- ◆ emergency power supplies;
- ◆ alarm sequence and signals (e.g. blowout preventer (BOP) controls, DP status lights etc.);
- ◆ use of DP control computers;
- ◆ system configurations – thruster/main engine/sensors expected in normal and emergency situations, and which changeovers are manual or automatic;
- ◆ use, understanding and location of position reference sensors;
- ◆ use, understanding and location of:
  - gyros
  - motion reference unit (MRU)
  - vertical reference unit (VRU)
  - anemometers
  - other data input systems;
- ◆ the vessel's power generation, distribution and propulsion together with fire and watertight sub-division;
- ◆ understanding of functions, operation, FMEAs and limitations of the vessel, including the vessel's capability plots;
- ◆ use and understanding of the consequence analysis, both for present operation and for planning purposes;
- ◆ features of the DP control system unique to the vessel;
- ◆ knowledge of the most recent annual DP trials report;
- ◆ operational limits for all DP equipment (weather, power, rotation, etc.);
- ◆ effects of environment and operations on operating limits in conjunction with machinery set-up.

### 9.1.3 DP Technical Personnel

In addition to section 9.1.1, DP technical personnel should receive instruction which will familiarise them with the following, including but not necessarily limited to:

- ◆ being conversant with all of the vessel's engine room standing instructions and operating procedures concerning normal and emergency operations;
- ◆ the importance of working as part of a team using sound bridge/engine room team management principles;
- ◆ correct configuration of equipment in the normal mode of operations;
- ◆ location and means of operating fuel, lubricant, cooling water, compressed air and other essential services isolation and changeover valves and actions required on loss of essential services;
- ◆ correct configuration of equipment to allow changed operation to auxiliary units on any single failure, including both automated and manual operation;
- ◆ switchboard configuration, including operation of bus section switches and bus ties and reconfiguring electrical supply arrangements in the event of equipment failures;
- ◆ understanding the potential consequences of electrical faults such as short circuits and earth leakage;
- ◆ alarm equipment and the consequences of such alarms;
- ◆ handling of blackout situation;
- ◆ start up from dead ship to all thrusters running and available by manual operation;

- ◆ handling of ESD;
- ◆ FMEAs;
- ◆ Knowledge of the most recent annual DP trials report
- ◆ the vessel CAM, TAM, ASOG (WSOG) and WCF.

## 9.2 Current Project Familiarisation

### 9.2.1 Operational

Key DP personnel should be familiar with the risk assessments and SIMOPS pertinent to a particular operation and consider hazards arising from operational activities connected with the project. The need to provide information to the vessel concerning procedures and safety management of the project prior to the commencement of activities is vital. It is essential that the experience and knowledge gained through operational activity is retained. To ensure that the continuity of operational and project experience is not lost through the rotation of personnel the key DP personnel should have knowledge of:

- ◆ all relevant formal risk assessments;
- ◆ ASOG relating to this operation;

and should have undertaken:

- ◆ project familiarisation;
- ◆ worksite familiarisation;
- ◆ vessel familiarisation;
- ◆ DP system familiarisation.

Continuity of operational knowledge can be assured by:

- ◆ project and work scope briefing;
- ◆ staggering of crew rotation;
- ◆ overlapping shift rotation;
- ◆ providing information regarding local environmental conditions; soliton, squalls, swell, etc.;
- ◆ allocating time for training and familiarisation.

The vessel owner/operator has a responsibility for establishing and maintaining a system whereby operational knowledge and procedures are retained throughout the project in the event of personnel rotation. The vessel owner/operator should also ensure that familiarisation takes place if there is a change of management system, operating manual, or any other change in situation that affects DP operations.

Personnel responsible for diving safety, ROV operations or other mission related activities dependent on a DP capability, should also be included in familiarisation processes and training appropriate to the requirements of their jobs. Diving supervisors in particular have a clear need to understand the nuances of the DP system on which they are operating from and how emergency situations will be managed.

## **10 Key DP Personnel Continuous Professional Development (CPD)**

### **10.1 CPD Definition**

For the purpose of these guidelines CPD is the systematic maintenance, improvement and broadening of knowledge, understanding, personal qualities and skills throughout the individual's working life.

Typical CPD activities include:

- ◆ attending training courses;
- ◆ work-based learning;
- ◆ distance learning and private study;
- ◆ preparation and delivery of lectures and presentations;
- ◆ writing DP related industry papers;
- ◆ attending lectures, seminars or conferences;
- ◆ acting as a mentor or instructor.

The benefits of CPD include:

- ◆ realising an individual's potential;
- ◆ improved morale and motivation;
- ◆ improved company performance;
- ◆ smarter crew appraisal processes.

CPD programmes should be an integral part of the vessel owner/operator SMS and should establish the assessment and training periods for key DP personnel and whether this is conducted onboard or ashore.

### **10.2 DP Competency and CPD**

The interrelationship between qualification, experience, maintaining competence and the principle of revalidation is described in section 8. The development, maintenance and retention of such skills can be assured by:

- ◆ Continuous regular performance of DP operations:
  - All key DP personnel should maintain a record of their experience gained on DP vessels;
- ◆ Regular training and practice of DP skills:
  - Structured training plans should be developed by companies to ensure that all personnel have the best preparation to respond efficiently and effectively to all anticipated normal, potential abnormal and emergency DP operations;
- ◆ Refresher training:
  - The risk of skill fade can be mitigated by periods of formal refresher training. Refresher training is a fundamental requirement for all DP personnel;
- ◆ Mentoring:
  - Mentoring is an effective way to develop junior personnel into better and more effective crew members. It is now accepted that people learn in different ways and understanding the character of those being mentored is key for those mentoring others. Companies should provide a structured mentoring process including issuance of guidance and objectives to mentors;
- ◆ Regular performance assessments and setting of objectives:
  - In order to mitigate the risk of skill fade, those involved in key DP roles should undergo regular performance assessment. The establishment of performance objectives and setting of other goals should be considered at annual career appraisals where used;

- ◆ Preparation for future technology and operational innovations:
  - CPD can facilitate the introduction of new technology, improved practices and procedures in a safe, timely and effective manner.

### 10.3 DP Refresher Training

The following should be considered when assessing whether refresher training is required:

- ◆ changes to operational conditions and circumstances;
- ◆ performance assessment or a periodic crew appraisal indicates a need for re-training;
- ◆ employment on a vessel engaged in an extended operation, for example, on a drilling unit or a floatel, which spends prolonged periods in one location.

### 10.4 Maintaining Personal Performance

The three main issues affecting DP personnel performance are:

- ◆ the individual's DP experience;
- ◆ the operational requirements of the DP vessel;
- ◆ the vessel specific DP system.

The following is recommended for key DP personnel:

- i) Persons who have not operated a DP system for more than two years should attend a formal DP system refresher course or otherwise demonstrate their competency. DPOs should additionally complete 12 hours of simulator training or alternatively operate the DP system onboard under supervision prior to standing a watch (see Note 1 below).
- ii) All effort should be made to ensure key DP personnel new to the vessel attend DP trials when these are undertaken by the vessel.
- iii) Attendance at DP trials should be recognised as a positive learning experience and incorporated into the training schedules of key DP personnel to ensure as far as possible that they attend a minimum of one annual DP trial in a three-year period (see Note 2).
- iv) If the vessel has not conducted DP operations for a period of 90 days or more, adequate re-familiarisation should be completed by DP personnel prior to re-commencing DP activities. This can be reduced by half if 12 hours of simulated DP system operations spread over a period of three days is completed.
- v) For personnel returning to a vessel on which they served on more than two years previously, with or without DP experience in between, a minimum period (see vii) of familiarisation training is recommended (see Note 3).
- vi) For recommended periods of familiarisation for key DP personnel, see section 8.
- vii) The above assumes that a familiarisation procedure is in place and that personnel have time to operate equipment prior to the vessel starting work.
- viii) After three years since last operating a particular type of DP system, or not operating any DP system, a DPO should be deemed to be joining a vessel with an unfamiliar DP system, guidance is provided under section 8.2.
- ix) In addition to vii, a DPO who has not operated a DP control system for five years or more should re-join their DPO training scheme or otherwise undergo a special refresher course designed for such personnel.
- x) If DP reference input systems have been changed or upgraded, training is to be conducted to ensure DP personnel are familiar with the new systems and are aware of any changes made to the FMEA.

*Note 1: For DP training there are basically two types of simulators in the industry – the onboard simulator and the simulator found in a shore-based training centre. On the shore-based simulator it is usually possible to input a full range of variables, including errors and failures. The inclusion of the DP simulator into a full mission bridge simulator, where the trainee has the entire bridge to manage, including the DP system with all its inputs. Companies should consider what options are available and appropriate.*

*Note 2: Whilst these guidelines are the product of industry good practice, such practice may need to incorporate some flexibility to cope with the variation in individual key DP personnel's competence and ability, together with the vessel's operational requirements.*

*Note 3: If DP operations are not in progress, then an equivalent level of training could be provided by simulator training. See the comments in Note 1 regarding simulators.*

## DPO Training Course Guidelines

The following guidelines aim to provide an overview of the expected content of DPO training courses that when incorporated within an industry recognised DPO training scheme will lead to issuing a DP operator certificate. While the details of training scheme structures may vary, in general they are divided into simulator based skill training elements (ashore or onboard) and consolidation periods onboard vessels where appropriate levels of practical DP experience can be acquired.

### Induction Training Course

The induction training course should provide the trainee with:

- ◆ a knowledge of the principles of DP, including redundancy;
- ◆ a knowledge of the rules, regulations and guidelines relevant to DP and where these can be obtained;
- ◆ the ability to set up and operate DP equipment and position reference sensors;
- ◆ the ability to recognise alarms and warnings;
- ◆ a knowledge of the total DP system including control, power and propulsion systems;
- ◆ an understanding of DP capability plots and DP footprints;
- ◆ appreciation of the importance of being able to control the vessel manually and in joystick mode.

The induction training course should detail the following:

- ◆ a definition of dynamic positioning, the six degrees of freedom and the DP control function;
- ◆ elements of a DP system; power generation, power distribution, power management, thrusters, DP control system, sensors, communications and the operators;
- ◆ details of elements of the DP control system including processors, control consoles, and position, heading, vessel and environmental sensors;
- ◆ the use of position reference sensors, input validation and error testing, e.g. pooling, voting, weighting;
- ◆ the principle of wind feed forward;
- ◆ the concept of power and thrust limiting by the DP control system, the PMS and the thrusters;
- ◆ the types of vessels using DP. Consideration of the various modes and functions available, e.g. joystick, DP, follow sub, track follow, weather vane bias, etc.;
- ◆ types of thrusters and manoeuvring systems; their configuration, capabilities and limitations;
- ◆ the principle of the action of DP control system controllers;
- ◆ the requirement and provision of redundancy in vessel's systems and DP class notations;
- ◆ applying risk analysis and safe working limits to various operations;
- ◆ the use of ASOG/WSOG, task appropriate mode (TAM) and critical activity mode (CAM) decision support tools;
- ◆ operational procedures including work site approach, planning DP operations and planning for contingencies and emergencies;
- ◆ procedures for operating the DP system including maintaining a logbook record, use of checklists, communications and manning levels;
- ◆ assessment of vessel capabilities with respect to environmental conditions, shallow and deep water etc. Use of the consequence analysis, when planning and during operations;
- ◆ FMEA, proving trials, annual trials and mobilisation trials;

- ◆ principles of set-up and operation of all commonly used position references, including failure modes and the combination of absolute and relative systems

## **Advanced Training Course**

The advanced training course should provide the trainee with:

- ◆ a practical knowledge of the planning, conduct and execution of DP operations;
- ◆ the ability to correctly use and interpret work site diagrams and plan in detail every stage of an operation, as well as planning for a variety of emergencies;
- ◆ the ability to demonstrate understanding and competence in a variety of simulated scenarios using a DP simulator. This will include the control of the vessel using automatic, joystick and manual control in normal operations as well as a variety of emergency failure modes.

The advanced training course should detail the following:

- ◆ a study of case histories in respect to vessel incidents and accidents, based on DP station keeping event data;
- ◆ construction and use of work site diagrams, charts and vessel templates for use in operations including ASOG/WSOG, CAM and TAM;
- ◆ preparation of plans for a projected DP operation, contingency plans for expected deviations and emergencies;
- ◆ participation in simulated situations in a variety of capacities while handling routine and emergency situations. The simulated situations should include failure modes drawn from industry experience;
- ◆ new developments in DP systems including position reference sensors and control systems;
- ◆ applying risk and defining DP equipment classes;
- ◆ differing types of DP applications and their particular requirements including pipelay, cable lay, shuttle tankers, etc.;
- ◆ a knowledge and handling of the types of DP incidents that have occurred including; drift off, drive off and other losses of position caused by human factors, process, procedural, equipment failure or poor design;

## DP Electrical and Electronics Technician Training Course Guidelines

Courses designed for DP electrical and electronics technicians with responsibilities of maintaining DP systems are provided by many institutions around the world. The course should follow requirements set by the DP system manufacturer/supplier, the following generic guidance constitutes the basic requirements of course content.

The training course should provide the trainee with:

- ◆ description of the DP system;
- ◆ a knowledge of the rules, regulations and guidelines relevant to DP and where these can be obtained;
- ◆ theoretical and technical training on DP control systems;
- ◆ practical experience on relevant equipment both new and historical;
- ◆ maintenance requirements including test equipment and support services.

The training course should detail the following:

- ◆ function and purpose of the DP control system main components;
- ◆ Identifying and replacing the DP control system main components;
- ◆ Wiring and network communication in the DP control system;
- ◆ software versions;
- ◆ operating principles;
- ◆ alarm indications and alarm system;
- ◆ sensors;
- ◆ position reference systems;
- ◆ the download and export of log files;
- ◆ cold and warm reboot of the DP control system;
- ◆ calibration of components, including the joystick;
- ◆ use of the user and maintenance manual;
- ◆ fault detection and implementation of solutions.



## DP Familiarisation Course Guidelines

A generic DP familiarisation course is primarily for personnel requiring an understanding and awareness of DP operations but who otherwise would not be expected to operate the DP control system.

The training course should provide the trainee with:

- ◆ an understanding of how the DP control system, vessel sensors and position references operate;
- ◆ an understanding of redundancy and the importance of the DP system's component parts;
- ◆ an understanding of how the DP system is tested and verified against the FMEA;
- ◆ a knowledge of the types of DP station keeping events that have occurred;
- ◆ an understanding of redundancy as applied to the DP system;
- ◆ a knowledge of the rules, regulations and guidelines relevant to DP and where these can be obtained.

The training course should detail the following:

- ◆ a definition of DP, the six degrees of freedom and the DP control function;
- ◆ elements of a DP system; power generation, power distribution, power management, thrusters, DP control system, sensors, communications and the operators;
- ◆ details of elements of the DP control system including processors, control consoles, and position, heading, vessel and environmental sensors;
- ◆ the use of position reference sensors;
- ◆ the concept of power and thrust limiting by the DP control system, the PMS and the thrusters;
- ◆ types of thrusters and manoeuvring systems;
- ◆ the requirement and provision of redundancy in vessel's systems and defining DP equipment classes;
- ◆ applying risk analysis and safe working limits to various operations;
- ◆ assessment of vessel capabilities with respect to environmental conditions, shallow and deep water etc. Use of the consequence analysis, when planning and during operations;
- ◆ FMEA, proving trials, annual trials and mobilisation trials;
- ◆ case histories, based on DP incidents that have occurred including; drift off, drive off, other losses of position caused by human factors, process, procedural, equipment failure or poor design;
- ◆ new developments in DP systems including position reference sensors and control systems.

## Suitability of DP Training Schemes

The training of key DP personnel is the responsibility of the DP vessel owner/operator. It is imperative that any chosen training scheme is properly assessed such that it meets the operating safety requirements of a vessel with a DP system.

Training schemes have been developed to meet the requirements within Part B of the STCW Code and Convention. When considering a suitable DP training scheme, the vessel owner should decide if the training scheme has been prepared in line with current industry good practice. For this to be the case it is likely that the scheme has been formulated in consultation with training providers, DP industry trade associations and professional associations which have a remit or interest in DP training.

Training schemes should be subject to an assurance process which includes accreditation by a recognised industry body. This process should include an independent auditing process conducted in accordance with a recognised standard such as ISO 19011 – *Guidelines for auditing management systems*.

All training should be given by suitably qualified and experienced personnel.

### DPO Certification

The DP vessel owner/operator is responsible to provide certificated DPOs. They should check if specific DPO certification is required by the vessel flag administration, the coastal state where the vessel is to operate or the client. If such a requirement exists, then the vessel owner/operator is advised to use an appropriate industry recognised DPO training and certification scheme.

## Example DP vessel Familiarisation Checklists

Upon arrival onboard the vessel, a guided tour and general familiarisation routine should be completed by all personnel. Guidance can be found in [IMCA S&L 003](#).

### General

Reference	Instructed by	Instructor's Signature
<b>All Personnel</b>		
♦ Job descriptions		
♦ Restricted practices		
♦ Instruction on controlled documents		
♦ Reporting forms		
♦ Personnel management system		
♦ Familiarisation of client procedures		
♦ Being aware of the importance of good, clear and early communications with bridge/control room in the event of any changes to normal mode of vessel's operating capabilities		
<b>DP Operators</b>		
♦ Control of vessel's movements about a set point using manual controls		
♦ Control of vessel's movements about a set point using DP and independent joystick controls		
♦ Switching and changing between systems		
♦ General understanding of the DP system installed on the vessel		
♦ Setting up the vessel on DP, understanding reasons for procedures		
♦ Ability to use DP panel whilst on DP		
♦ Use of desk facilities		
♦ Use of reference input systems and the vessel specific limitations		
♦ Power supplies for DP computers and thruster control units		
♦ Emergency power supplies		
♦ Alarm sequence and signals (e.g. BOP controls, DP status lights etc.)		
♦ Loading and general use of DP control computers		
♦ System configurations thruster/main engine/ sensors expected in normal and emergency situations, and if all changeovers are manual or automatic		
♦ Use, understanding and location of position reference sensors		
♦ Use, understanding and location of: <ul style="list-style-type: none"> <li>– gyros</li> <li>– VRU/MRUs</li> <li>– anemometers</li> <li>– other data input systems</li> </ul>		

Reference	Instructed by	Instructor's Signature
♦ Vessel's power generation, distribution and propulsion together with fire and watertight subdivision		
♦ Understanding of functions operation, FMEAs and limitations of the vessel, including vessel's capability plots.		
♦ Use and understanding of the consequence analysis, both for present operation and for planning purposes.		
♦ Features of DP control system unique to the vessel		
♦ Operational limits for all DP equipment (weather, power, rotation, etc.)		
♦ Effects of environment and operations on operating limits in conjunction with machinery set-up		
<b>Technical Personnel</b>		
♦ Being conversant with all vessel's engine room standing instructions concerning normal and emergency operations		
♦ Correct configuration of equipment in the normal mode of operations		
♦ Location and means of operating fuel, lubricant, cooling water compressed air and other essential services isolation and changeover valves and actions required on loss of essential services		
♦ Correct configuration of equipment to allow changed operation to auxiliary units on any single failure		
♦ Switchboard configuration, including operation of bus section switches and bus ties and reconfiguring electrical supply arrangements in the event of equipment failures		
♦ Understand the potential consequences of electrical faults such as short circuits and earth leakage		
♦ Alarm equipment and the consequences of such alarms		
♦ Handling of black-out situation		
♦ Handling of ESD		
♦ Recognise the vessel's FMEA and its importance to operations		

Name of person instructed: .....

Position of person instructed: .....

Instructor's signature: .....

Master's signature: .....

Date: .....

Vessel: .....

## DP System Emergency Drills

### Introduction

Emergency drill scenarios should be developed from the experience gained during the conduct of annual DP trials and FMEA reviews undertaken onboard the vessel. The annual trials and revised FMEA documents provide the background for specific vessel drills and these should always be readily available for information and reference by operational personnel. Drill scenarios can also be developed from DP station keeping events reported as part of the IMCA DP reporting scheme.

Drills should be relevant to operational activity (e.g. pipelaying, drilling, diving, floatel, etc.) and include scenarios based on the emergency procedures detailed in the DP system operating manual.

Guidance on drills are outlined below in a very brief format and are intended to provide the management team with examples of scenarios they may wish to build into their emergency drills for the marine and engineering teams. The scenarios can also serve to highlight particular items of concern or areas where, due to system upgrades, teams need to re-focus their contingency planning as a result of recent system modifications.

It is recommended that all emergency drills are carefully planned and conducted in accordance with a company approved training programme in order to make maximum use of available opportunities. Vessel teams should be fully familiar and proficient with all emergency procedures as required by the ISM code. Vessels not subject to the ISM Code are strongly recommended to conduct a systematic programme of training necessary to maintain the safety of the vessel, all personnel onboard their vessel and any adjacent installation/vessel and its personnel. Exercises should be planned so that all shifts cover all scenarios within one year and records kept of performance. It is recommended that personnel controlling or directing crew for exercises have suitable qualifications and experience. Drills can be conducted by different sections of the vessel or as a whole team event. The master, chief engineer and client should be in agreement as to the format, content and timing of any exercise to ensure they do not conflict with critical operations.

Emergency responses can also be exercised as table-top exercises and these should be conducted as a routine preparation for operational activity, especially high-risk operations, undertaken by a DP vessel. Table-top exercises should be held frequently, addressing different, relevant scenarios.

### Emergency Engine Control Room Drills

#### Preparation

1. Chief engineer in attendance.
2. ECR watchkeepers in attendance.
3. No other personnel allowed in ECR or switchboard during drills.
4. Technical assistance if required/as designated by chief engineer to be local to ECR.

#### Aim of Emergency Drills

The aim of emergency drills is to improve operating safety and the operational effectiveness of personnel.

#### Objectives of Emergency Drill

1. To improve operator competence in DP system emergency procedures.
2. To enhance system knowledge across the mechanical/electrical technical crew onboard.

3. To minimise recovery times following an emergency and safely resume operational activity.
4. To minimise the potential of damage to equipment, plant and harm to the environment.

### **Conduct of Emergency Drill**

1. Date and watch to be posted as pre warning.
2. Bridge to be notified five minutes prior to drill.
3. All necessary personnel advised that emergency drills are about to take place. (e.g. via vessel public address (PA) system).
4. Exercise to be initiated by chief engineer and/or senior electrical technician.
5. Actions and conduct of ECR operatives to be logged as an aid to debrief and remedial action.
6. Drill to be terminated by chief engineer on completion of restoration of normal line-ups or in the event of a real emergency or stalled drill due to ECR operator wrong actions.
7. End of drill when operators have configured relevant plant system(s) to achieve two goals:
  - stabilised in a temporary line-up with relevant plant cross-connections utilised;
  - restored plant to normal line-up associated with DP class.
8. Once drills have been completed inform all necessary personnel (e.g. via vessel PA system).
9. Record performance using a structured report process to facilitate debriefing/discussion.
10. Consider use of predetermined real emergency warning order/code word in case a real emergency of the same nature as the drill occurs.

### **Scenarios for Emergency Drills**

The following are example scenarios for inclusion in emergency drills:

1. Blackout – port or starboard side/fore or aft ends.
2. Loss of port or starboard 24VDC system bus distribution.
3. Loss of port or starboard 110VDC bus distribution.
4. Loss of thruster in CAM.
5. Loss of primary control system (e.g. fire in/adjacent to ECR).

ECR drills should be conducted on a regular basis as part of the continuous professional development programme for the vessel owner/operator company's engineering and technical personnel.

### **Emergency DP Operator Drills**

#### **Preparation**

1. Master in attendance at commencement and end of each drill.
2. DPO trainer/assessor present throughout the drill.
3. DPOs to be provided with scenario by the master/senior DPO trainer at a suitable time in the shift.
4. Drill period to be structured to enable debriefing of DPOs.
5. Appropriate technician to provide additional information/drawings/schematics.

## **Aim of Emergency Drills**

The aim of emergency drills is to improve safety and the operational effectiveness of personnel.

## **Objectives of Emergency Drill**

1. To improve operator competence in DP emergency procedures.
2. To enhance system knowledge of the DP and associated control system.
3. To minimise recovery times following an emergency and safely resume operational activity.
4. To minimise the potential of damage to equipment, plant and harm to the environment.
5. To promote collective understanding of DP emergencies and awareness of root cause of combinations of alarms.

## **Conduct of Emergency Drill**

1. Conduct table-top exercise prior to start of drills if necessary.
2. All necessary personnel informed that emergency drills are about to commence (e.g. via vessel PA)
3. Bridge to inform ECR which drill is about to commence.
4. Drill should not interfere with operational activities.
5. Use team approach/activity (i.e. maximise training opportunities for less experienced DPOs).
6. Record performance using a structured report process to facilitate debriefing/discussion.
7. Responsibility for vessel safety remains with master/lead watchkeeper.
8. DPO trainer to provide mentoring or direction as necessary to maintain momentum and training objectives.
9. On completion of drills inform all necessary personnel.
10. Consider use of predetermined real emergency warning order/codeword in case a real emergency of the same nature as the drill occurs.

## **Scenarios for Emergency Drills**

The following are example scenarios for inclusion in emergency drills:

1. Loss of power and the full recovery of the system to all thrusters back in DP and station keeping resumed.
2. Loss of DP control (including drive off) and reversion to manual (joystick) control.
3. Loss of primary control station and reversion to back up control station.
4. Loss of primary position reference system (PRS).
5. Risk of collision with another vessel.
6. Manual manoeuvring of the vessel using both the DP joystick, independent joystick and independent lever control is also a necessary part of DP training and should be undertaken by all DP personnel as part of their continued demonstration of continued proficiency.

It is recommended that each DPO (including the master/senior DPO) completes these drills at least twice a year as a minimum.

## **Planning**

It is the responsibility of the owner/operator, through the company DP authority to develop a structured training programme for each vessel and a coherent training plan. Planning of drills should be carefully thought through to ensure that maximum training benefit is gained without jeopardising safety or operational activity. A DP system emergency drill training plan should be used to control the start, content and ending of the drill procedure. Ad hoc drills are not recommended as the impact may have unexpected consequences. Consideration should be given at the planning stage to repeat the drill if, after debrief, the result of the drill is not as expected. This would give the participants a direct experience of achievement.



## DP Station Keeping Event Reporting

### Background

IMCA has been collecting DP station keeping event reports and publishing them as annual review reports since 1991. During this time, the format of the IMCA report has changed little although attempts have been made to encourage more reporting of DP station keeping events. In 2005 for instance, the IMCA Marine Division Management Committee (MDMC) reviewed the system and decided it would be better to replace the existing three reporting categories with five. The intention of including the two additional categories of 'DP near-miss' and 'DP hazard observation' was to allow for the reporting of more minor occurrences and to improve understanding about when to report a station keeping event and in which category it would fall.

### 2016 Review

A further review of the scheme was conducted in 2016. The main focus of the review was to encourage participation, including the reporting of minor DP events that might lead to more serious incidents and to ensure the DP industry has the information available to learn from DP station keeping events.

The review recognised that some DP events had been reported that constituted inclusion in the two additional categories introduced in 2005, however it was also noted that these two categories had never been used. It was therefore concluded that the scheme should have a maximum of three well defined categories and, so as to encourage the reporting of all events, not just incidents, the scheme would be renamed 'IMCA DP station keeping event reporting'.

The three categories are listed below:

- ◆ DP incident – A major system failure, environmental or human factor which has resulted in total loss of DP capability;
- ◆ DP undesired event – A system failure, environmental or human factor which has caused a loss of redundancy and/or compromised DP capability;
- ◆ DP observation – An event that has not resulted in a loss of redundancy or compromised DP operational capability but is still deemed worthy of sharing.

The reporting form has been revised to incorporate the three categories above and will include clear instruction for completion. The annual review of DP station keeping events will be maintained and improved by formulating the initiating event and causes into a table that will highlight them to the reader. It is recognised that DP station keeping events provide the ideal opportunity for key DP personnel to learn. IMCA will publish DP station keeping learning opportunities through a series of regular DP event bulletins.

DP station keeping event report forms are available from IMCA – [www.imca-int.com](http://www.imca-int.com)

## List of Referenced Publications

Reference	Document Title
IMCA M 103	<i>Guidelines for the design and operation of dynamically positioned vessels</i>
IMCA M 109	<i>A guide to DP-related documentation for DP</i>
IMCA M 119	<i>Fires in machinery spaces on DP vessels</i>
IMCA M 149	<i>Common Marine Inspection Document</i>
IMCA M 166	<i>Guidance on failure modes and effects analysis (FMEAs)</i>
IMCA M 206	<i>A guide to DP electrical power and control systems</i>
IMCA M 220	<i>Guidance on operational activity planning</i>
I82 MSF	<i>International guidelines for the safe operation of dynamically positioned offshore supply vessels</i>
IMCA C 002	<i>Guidance on competence assurance and assessment: Marine Division</i>
IMCA C 007	<i>Guidance on assessor training</i>
IMCA S&L 003	<i>Guidance on the initial and refresher familiarisation of vessel crews</i>
-	Annual IMCA DP incident review reports
-	IMCA DP station keeping event bulletins