This section contains information on the following topic areas as defined by the Nautical Institute.

Core Module DP Regulations & Guidance
IMO - Introduction, purpose, highlights including IMO MSC/Circ. 645 and IMO Circ 1580
IMCA - Introduction, purpose, highlights
MTS - Introduction, purpose, highlights
MSF - inc, GOMO / MSF182
Class Rules - Introduction, purpose, highlights
Flag State - Introduction, purpose, highlights
Regulatory updates in the last 12 months
New or update publications and bulletins in the last 12 months
Management of change - The importance, lessons learned through station keeping events.
IMCA DP Station keeping Event Reporting Scheme
Lessons learned from DP Station Keeping Events
DP Emergency Drills and Scenarios - Rules, guidance, purpose, results criteria, (examples annually)
Roles & Responsibilities of Key DP personnel (according to M117)

IMO - INTRODUCTION, PURPOSE, HIGHLIGHTS INCLUDING IMO MSC/CIRCULAR 645 AND MSC/CIRCULAR 1580

THE IMO – INTRODUCTION AND PURPOSE

IMO – the International Maritime Organization – is the United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine and atmospheric pollution by ships.

As a specialized agency of the United Nations, IMO is the global standard-setting authority for the safety, security and environmental performance of international shipping. Its main role is to create a regulatory framework for the shipping industry that is fair and effective, universally adopted and implemented.

IMO measures cover all aspects of international shipping – including ship design, construction, equipment, manning, operation and disposal – to ensure that this vital sector for remains safe, environmentally sound, energy efficient and secure.

IMO treaties need to be implemented into national law so that they can be applied on ships flying the flag of a particular country and so that those countries can implement effective Port State Control and comply with other obligations under the specified IMO instruments.

IMO AND DYNAMIC POSITIONING

There are four main IMO conventions that refer to dynamic positioning:

1. STCW;
2. IMO MSC.1/Circular 738/Rev.2;
3. IMO MSC/Circular 645 Guidelines for Vessels with Dynamic Positioning Systems – (Adopted on 6 June 1994);
4. IMO MSC/Circular 1580 Guidelines for Vessels with Dynamic Positioning (DP) Systems – (Adopted on 16 June 2017)

1. STCW INTERNATIONAL CONVENTION ON STANDARDS OF TRAINING, CERTIFICATION AND WATCHKEEPING FOR SEAFARERS

It may surprise you to learn that the IMO's standards for the training and experience for personnel operating dynamic positioning systems are in section B of STCW, the guidance section (see page 329 of STCW). That is, there is no MANDATORY requirement for any flag state to implement training for personnel operating dynamic positioning systems laid out in STCW. The guidance recommends that training and experience for personnel operating dynamic positioning systems cover the following components of a DP system:

.1 DP control station;

.2 power generation and management;

.3 propulsion units;

.4 position reference systems;

.5 heading reference systems;

.6 environmental reference systems; and

.7 external force reference systems, such as hawser tension gauges.

2. IMO MSC.1/CIRCULAR 738/REV.2 GUIDELINES FOR DYNAMIC POSITIONING SYSTEM (DP) OPERATOR TRAINING

However the IMO released circular 738 in June 2017 that requested all Member States to bring an IMCA document, ***IMCA M 117 Rev.2 "Training and Experience of Key DP Personnel"*** to the attention of all parties concerned. This document identifies training programmes, levels of competency and experience for the safe operation of DP vessels and is covered later in this Learning Manual.

3. IMO MSC/CIRCULAR 645 GUIDELINES FOR VESSELS WITH DYNAMIC POSITIONING SYSTEMS – (ADOPTED ON 6 JUNE 1994)

This document is valid for vessels and units constructed on or after 1 July 1994 but before 9 June 2017

The purpose of this set of guidelines is to recommend **design criteria, necessary equipment, operating requirements, and a test and documentation system** for dynamic positioning systems to reduce the risk to personnel, the vessel, other vessels or structures, sub-sea installations and the environment while performing operations under dynamic positioning control.

The responsibility for ensuring that the provisions of this set of guidelines are complied with rests with the **owner** of the DP vessel.

These guidelines have a preamble and five chapters:

Preamble

1. *General*
   This includes definitions that we will explore in detail in later modules.
2. *Equipment Classes*
   A very important chapter that defines how components and systems should act together to achieve reliable position keeping capability. The larger the consequence, the more reliable the DP-system should be and to achieve this philosophy the requirements have been grouped into three equipment classes. We will explore the capabilities of each equipment class in later modules.
3. *Functional Requirements*
   Another very important chapter that is broke down into six sub chapter. Each sub chapter contains guidelines for the design, construction, and testing of components in a DP system as follows.
   3.1 General
   3.2 Power system
   3.3 Thruster system
   3.4 DP-control system
   3.5 Cables and piping systems
   3.6 Requirements for essential non-DP-systems
   We will explore the guidelines for the design, construction, and testing of these components later.
4. *Operational Requirements*
   This chapter offers guidance on checking the vessels DP set up before DP operations according to a vessel specific “location" check list to make sure that the DP-system is functioning correctly and that the system has been set up for the appropriate equipment class.
5. *Surveys, Testing and the Flat State Verification and Acceptance Document (FSVAD)*
   The requirements for four separate surveys are defined in this chapter
   1 Initial
   2 Periodical
   3 Annual survey
   4 Post defect, accident, repair, alteration survey

4. IMO MSC/CIRCULAR 1580 GUIDELINES FOR VESSELS WITH DYNAMIC POSITIONING (DP) SYSTEMS – (ADOPTED ON 16 JUNE 2017)

These guidelines apply to vessels and units constructed **on or after 9 June 2017** (vessels and units constructed on or after 1 July 1994 but before 9 June 2017 may continue to apply IMO MSC/Circular .645 however it is recommended that section 4 of the present Guidelines be applied to all new and existing vessels and units, as appropriate.

As with IMO MSC/Circular. 645 the purpose of this set of guidelines is to recommend ***design criteria, necessary equipment, operating requirements, and a test and documentation system*** for dynamic positioning systems to reduce the risk to personnel, the vessel, other vessels or structures, sub-sea installations and the environment while performing operations under dynamic positioning control.

The responsibility for ensuring that the provisions of this set of guidelines are complied with rests with the **owner** of the DP vessel.

These guidelines have a preamble and **SIX** chapters:

Preamble

1. *General*

This includes definitions that we will explore in detail in later modules.

2. *Equipment Classes*

A very important chapter that defines how components and systems should act together to achieve reliable position keeping capability. The larger the consequence, the more reliable the DP-system should be and to achieve this philosophy the requirements have been grouped into three equipment classes. We will explore the capabilities of each equipment class in later modules.

3. *Functional Requirements*

Another very important chapter that is broke down into six sub chapter. Each sub chapter contains guidelines for the design, construction, and testing of components in a DP system as follows.

3.1 General
3.2 Power system
3.3 Thruster system
3.4 DP control system
3.5 Cables and piping
3.6 Requirements for essential non-DP systems
3.7 Independent joystick system

We will explore the guidelines for the design, construction, and testing of these components in later modules.

4. *Operational Requirements*

This chapter ideally applies to ALL DP vessels regardless of when they were built. It goes beyond the need for DP operations set up checks and introduces decision support tools such as an Activity Specific Operation Guide (ASOG) in order to make sure that the DP system is functioning correctly and that the system has been set up for the appropriate mode of operation. It also requires the production of DP capability polar plots to demonstrate position keeping capacity for fully operational and post worst-case single failure conditions. We will explore ASOGs and DP capability polar plots in later modules

5. *Surveys, Testing and the Flat State Verification and Acceptance Document (FSVAD)*

The requirements for four separate surveys are defined in this chapter

1 Initial
2 Periodical
3 Annual survey
4 Post defect, accident, repair, alteration survey

as well as the need for an FMEA in equipment class 2 and 3 vessels

6. TRAINING

Personnel engaged in operating a DP system should have received relevant training an practical experience in accordance with the provisions of the 1978 STCW Convention, as amended, the STCW Code, as amended, and the Guidelines for Dynamic Positioning System (DP) Operator Training (MSC/Circ.738, as amended).

This is an additional chapter and is quoted above in its entirety. Note that it takes us back to STCW, and to IMO MSC/Circ. 738 that requested all Member States to regard IMCA document, IMCA M 117 Rev.2 "Training and Experience of Key DP Personnel" we will explore IMCA M 117 later.

PRACTICAL ONBOARD EXERCISE

Download the Keelson Dynamic Positioning app by visiting Google Play or Apple App Store and searching for ***Dynamic Positioning***, or scanning this QR code. Here you will find all the industry documents that you will need to for this CPD programme EXCEPT any IMCA related documents that are restricted to IMCA members only. If you do not want to download this app we recommend that you create your own DP Document 'brief case' by creating a folder on your computer and saving the documents via the links provided as you work through this document.

ABOVE AND BEYOND

Remembering that Keelson's DP CPD programme will take you above and beyond the Nautical Institutes CPD for revalidation requirements you will notice that the app contains links to a wide range of industry documents, not just these reference in the Nautical institute DP CPD revalidation standard. We are NOT asking you to read or regurgitate all of these documents now! We will guide you through their use in the following sections.

This Learning Manual is designed to support our online formative assessment processes you should have already logged into Cirrus and taken the first base line assessment and received your initial report.

Look at you report now. Remember you are not expected to move all of the dials all in one go, rather choose one or two areas to explore. You can do this alone, in partnership with a crew mate, or in your on-board departmental teams as part of a training matrix. Take one or two sections from the documents listed on your reports to look at and: -

- read it
- question it
- apply it to your vessel and experiences
- argue about it
- argue WITH it!

All the time you will be learning about it. If you learn one more thing, you will get at least one more question right next time and gradually, incrementally you will improve.

IMCA - INTRODUCTION, PURPOSE, AND HIGHLIGHTS

IMCA – INTRODUCTION AND PURPOSE

The International Marine Contractors Association (IMCA) is a trade association representing contractors and the associated supply chain in the offshore marine construction industry worldwide.

IMCAs purpose is to enable the development of the world's marine energy resources – safely and sustainably. Their mission is to improve performance in the marine contracting industry.

To achieve this they hold conferences, seminars, and a network of committees. They represent their members with other industry bodies, regulators, oil companies and renewable energy companies.

IMCA AND DYNAMIC POSITIONING

IMCA's marine DP committee co-ordinates work items relating to dynamic positioning. They provide expert advice in all matters pertaining to dynamic positioning and are responsible for managing all IMCA DP guidance documents and initiatives.

IMCA PUBLICATIONS

IMCA's technical library represents a considerable body of work but the intellectual property rights belong to its members. IMCA's Board has determined that IMCA's documents, "developed by our members for our members", should no longer be available for purchase by non-members. Your company may be an IMCA member. If they are it is your company who will supply you with access to IMCA documents. For a list of the documents you are not allowed to see unless you, or your company, are a member click here.

PRACTICAL ONBOARD EXERCISE

Ask your employer if they are a member of IMCA. If they are, ask them how you, as a DP practitioner can access IMCA's technical library. If your employer is not an IMCA member, ask them how they can support you in accessing IMCA's technical library. You will need to access these documents to progress with the Nautical Institute DP CPD standard.

MTS - INTRODUCTION, PURPOSE, HIGHLIGHTS

The Marine Technology Society is a trade association like IMCA, promoting awareness, understanding, and the advancement and application of marine technology. It brings together businesses, institutions, professionals, academics, and students who are ocean engineers, technologists, policy makers, and educators.

Their mission is to facilitate a broader understanding of the relevance of marine technology to wider global issues by enhancing the dissemination of marine technology information. They promote and improve marine technology and related educational programs. Their vision is to be the leading authority and advocate for marine technology and resources while promoting member success and public understanding.

The DP Committee was established in 1996, with the objective of promoting a greater international understanding of Dynamic Positioning and related issues.

The Dynamic Positioning Committee's mission is to encourage exchange of information, discussion of technology, training and education, foster improvement of DP reliability, develop guidelines, and address any other issues pertinent to dynamic positioning that facilitate incident free execution of DP operations.

Like IMCA, MTS also produce DP industry guidance, but unlike IMCA this is freely available. Keelson's DP CPD is not only accredited by the Nautical Institute for DP CPD revalidation but it is also recognised as meeting the needs of MTS PDDP 2.

MARINE TECHNOLOGY SOCIETY GUIDANCE FOR PROFESSIONAL DEVELOPMENT OF DP PERSONNEL (PDDP2)

PDDP 2 is MTS's version of IMCA's M 117. The aim is to:

> *to address the People element. It is focused on enabling the development of DP awareness, knowledge and skills of multi-disciplinary Vessel Operational teams and by doing so facilitates delivery of incident free DP operations.*

PDDP2 identifies nine roles or ranks onboard DP vessels and identifies the three levels of learning within them.

> *AWARE: Able to explain, describe, discuss, identify, locate and report on the area of knowledge and its relevance, potential impact and consequences to the operations associated with the industrial mission.*
>
> *KNOWLEDGEABLE: Able to demonstrate understanding of the terminology and vocabulary in the area of knowledge. Able to demonstrate understanding of the operations associated with the industrial mission and potential impact, consequences. Able to execute planned procedures. Able to plan, prioritize and adapt to evolving situations.*
>
> *SKILLED: Able to translate guidelines and standards in the area of knowledge and its relevance to the operations associated with the industrial mission and potential impact, consequences into practical actions. Able to develop, review and modify procedures in the area of knowledge. Able to evaluate, differentiate, discriminate, validate and communicate solutions to common technical and operational problems. Provide mentorship and training in the area of knowledge, relevant to the industrial mission.*

It is the aim of Keelson's DP CDP to raise all DP practitioners to a SKILLED level. Remember our CPD programme will take you above and beyond the requirements for the Nautical Institutes revalidation requirements.

MTS DOCUEMNTS

MTS guidance addresses is constructed on the *three legged stool* concept of design, operations and people. This is supplemented with a wealth of technical and operational guidance notes. We will refer to these documents throughout this Learning Manual, and your DP CPD base line assessment report will also require you to engage with them.

These documents are freely available by clicking in the table below, the MTS website, and via the Dynamic Positioning app.

Design	Operations	People
DP Vessel Design Philosophy Guidelines April 2021	DP Operations Guidance - Part 1	Guidance for Professional Development of DP Personnel (PDDP2)
DP Vessel Design Philosophy Guidelines Appendix B DP Shuttle Tanker Redundancy Concept Philosophy Document April 2021	DP Operations Guidance - Part 2 - Appendix 1 - MODUs	
	DP Operations Guidance - Part 2 - Appendix 2 - Project Construction Vessels	
	DP Operations Guidance - Part 2 - Appendix 3 - Logistics Vessels	

MTS have also produced documents they categorise as 'Technical and Operational Guidance Notes' referred to as 'TechOps' allocated to 4 section – General (G), Design (D), Operations (O), People (P)

For access to the web page – click here

GENERAL (G)	TECHOP (G-01 - Rev1 - Jan21) - TECHOP PHILOSOPHY
	TECHOP (G-02 - Rev1 - Jan21) - Power Plant Common Cause Failures
	TECHOP (G-03 - Rev1 - Jan21) - Continuous Trials for DP MODUs
	TECHOP (G-04 - Rev1 - Jan21) - Conducting Effective and Comprehensive DP Incident Investigations
DESIGN (D)	TECHOP (D-01 - Rev1 - Jan21) - ADDRESSING C^3EI^2 TO ELIMINATE SINGLE POINT FAILURES
	TECHOP (D-02 - Rev1 - Jan21) - FMEA Testing
	TECHOP (D-03 - Rev1 - Jan21) - Blackout Recovery
	TECHOP (D-04 - Rev1 - Jan21) - Evaluation of Protection Systems
	TECHOP (D-05 - Rev1 - Jan21) - FMEA Gap Analysis
	TECHOP (D-06 - Rev1 - Jan21) - DGNSS Position Reference Sensors
	TECHOP (D-07 - Rev1 - Jan21) - A Method for Proving the Fault Ride-Through Capability of DP Vessels with HV Power Plant
	TECHOP (D-08 - Rev1 - Jan21) - Software Testing
	TECHOP (D-09 - Rev1 - Jan21) - PRS AND DPCS HANDLING OF PR)
	TECHOP (D-10 - Rev1 - Jan21) - DNV RP D102 FMEA GAP ANALYSIS)
	TECHOP (D-11 - Rev1 - Jan21) - REDUNDANCY CONCEPT PHILOSOPHY DOCUMENT – in progress
OPERATIONS (O)	TECHOP (O-01 - Rev1 - Jan21) - DP Operations Manual
	TECHOP (O-02 - Rev1 - Jan21) - Annual DP Trials and Gap Analysis
	TECHOP (O-03 - Rev1 - Jan21) - Defining Critical Operations Requiring Selection of Critical Activity Mode
PEOPLE) (P)	TECHOP (P-01 - Rev1 - Jan21) - Part 1 - DP SME and FMEA Practitioner Competency Elements
	TECHOP (P-01 - Rev1 - Jan21) - Part 2 – Competency Elements for DP Professionals – DP SMEs / DP FMEA Practitioners –
	TECHOP (P-01 - Rev1 - Jan21) - Part 3 - Competency Elements for DP Professionals - DP SMEs / DP FMEA Practitioners –

PRACTICAL ONBOARD EXERCISE

Make sure you have access to all the above named MTS documents either by way of the Keelson Dynamic Positioning app or via the MTS website.

ABOVE AND BEYOND

Access MTS PDDP 2 and refer to section 3.9 Enabling Effectiveness of this Guidance and PDDP2 and read section 3.9.4. Compare the rationale of this CPD programme with behaviours encouraged in this section.

Look at your role and rank onboard in the PDDP2 Tool and check the levels of learning required for each of the knowledge areas.

MSF - INC, GOMO / MSF182

The Marine Safety Forum is a non-profit-making organisation that started as the North Sea Marine Affinity Group in 1997. It actively promotes safety within the marine sector of the offshore energy industry. The membership comprises ship-owning / managing companies, logistics companies, energy sector operators, marine consultants and other interested parties (e.g. port authorities, trade associations, governmental agencies, ship-brokerages)

MSF AIMS

to improve safety within the marine sector of the offshore energy industry

MSF OBJECTIVES

- *To air marine safety issues in an open forum of service users and providers*
- *To highlight areas of particular concern and reach consensus on action required to minimise risk of major incidents.*
- *Take pre-emptive action on minor issues which have the potential to escalate*
- *To represent marine concerns within the "Step Change in Safety" initiative.*
- *To work together with industry to share safety information and good practice.*

The MSF has several publications applicable to DP practitioners that are freely available from the table below, the MSF website, and via the Keelson Dynamic Positioning app. The most notable of these is MSF 182, or "GOMO - *Guidelines for Offshore Marine Operations"* which although is mostly refers to only in the North Sea area is of interested to globally serving DP practitioners. It was created in conjunction with IMCA.

International Guidelines for the Safe Operation of Dynamically Positioned Offshore Supply Vessels	Delivering Quality Potable Water to Offshore Installations – Rev 03	The Carriage of Methanol in Bulk Onboard Offshore Vessels
500m Safety Zone Marine Operations – 500m Zone	Delivering Quality Bulk Marine Gasoil to Offshore Installations	Tandem Loading Guidelines

PRACTICAL ONBOARD EXERCISE

Make sure you have access to all the above named MSF documents wither by way of the our Dynamic Positioning app or via the MSF website.

ABOVE AND BEYOND

Access GOMO and refer to section 3.3 Key DP Personnel Continuous Professional Development. Consider how this is being implemented in your present company and what improvements could be developed to better meet MSF's aims.

CLASS RULES - INTRODUCTION, PURPOSE, HIGHLIGHTS

A ship classification society is a non-governmental organization that establishes and maintains technical standards for the construction and operation of ships and offshore structures. Classification societies certify that the construction of a vessel comply with relevant standards and carry out regular surveys in service to ensure continuing compliance with the standards.

Currently, more than 50 organizations describe their activities as including marine classification, twelve of which are members of the International Association of Classification Societies.

CLASS AND DP

Most classification societies use the IMO MSC/Circ. 645 or IMO MSC/Circ. 1580 principles of equipment class and redundancy requirements as the basis for their own DP rules.

The table below provides an overview of three major classification societies DP class notations and the equivalent IMO DP equipment classes.

Description	IMO DP Class	ABS DP Class	LRS DP Class	DNV DP Class
Manual position control and automatic heading control under specified maximum environmental conditions.		DPS-0	DP (CM)	DPS 0 DYNPOS-AUTS
Automatic and manual position and heading control under specified maximum environmental conditions.	Class 1	DPS-1	DP (AM)	DPS 1 DYNPOS-AUT
Automatic and manual position and heading control under specified maximum environmental conditions, during and following any single fault excluding loss of a compartment. (Two independent computer systems).	Class 2	DPS-2	DP (AA)	DPS 2 DYNPOS-AUTR
Automatic and manual position and heading control under specified maximum environmental conditions, during and following any single fault including loss of a compartment due to fire or flood. (At least two independent computer systems with a separate back-up system separated by A60 class division).	Class 3	DPS-3	DP (AAA)	DPS 3 DYNPOS-AUTRO

Many of 12 IACS Classification Societies issue certificates to DP vessels. Although each set of rules are based on IMO MSC/Circ. 645 or IMO MSC/Circ. 1580 they will have differences. The table below provides links to the DP documentation of each of these class societies (others are available via the internet).

ABS	LRS	DNV
Guide for Dynamic Positioning Systems	Rules and Regulations for the Classification of Ships.	Rules and Standards Explorer

BV

Rules for classification of steel Ships NR467 – July 2023 (Part F – Ch 11 Sec 5)

To obtain the documentation from DNV it is necessary to sign in to 'Veracity' by creating a User name and password.

Note that DNV has also a set of notations DPS-1, DPS-2 and DPS-3 these are similar to the main notations but allow for thrusters to stop and restart following a fault.

Most of the societies now have 'enhanced' notations recognising where vessels may be over and above the minimum standards required. For example, below is the relevant extract from ABS:

> *The notation includes provisions for standby start, closed bus operation and transferable generators. These are beneficial to the overall environment, operational flexibility and system maintainability.*
>
> *Four separate enhanced notations are provided as follows:*
>
> - *Enhanced Electrical System (EHS-E): This notation covers the requirements for the electrical and power management systems that are beyond those for the DPS series notations.*
> - *Enhanced Power and Thruster System (EHS-P): This notation covers the requirements for the power system and thrusters that are beyond those for the DPS-series notations.*
> - *Enhanced Control System: (EHS-C): This notation covers the requirements on the DP control systems including control computers, position reference systems and sensors, which are beyond the minimum requirements for DPS-series notations.*
> - *Fire and Flood Protection System (EHS-F): This notation covers the requirements for fire and flood protection considering the risk level of the areas. This is a supplement for a DPS-2 system. It is not necessary for a DPS-3 system, since a DPS-3 system has higher requirement in this regard.*
>
> *The separate enhanced system notations provide the Owner with the flexibility of selecting an individual EHS notation or combined EHS notations that best fit the design intent.*

Also note that generally it will be the rules published at the time the vessel was built that will apply to your specific vessel. The rules may have been revised or updated and therefore the 'current' rules may be different.

An example is that some years ago two gyros was acceptable for some class societies DP2 equivalent, whereas now all would require three etc.

PRACTICAL ONBOARD EXERCISE

What classification society certificated your current DP vessel and what is it's class notation? We will be asking you to apply requirements disused in later sections directly to your vessel so it is important that you complete this exercise.

ABOVE AND BEYOND

Access the appropriate class rules for your vessel and save them on your computer for future reference.

FLAG STATE - INTRODUCTION, PURPOSE, HIGHLIGHTS

As well as their normal flag state responsibilities towards vessels under their jurisdiction MSC/Circ. 1580 requires them to issue a Dynamic Positioning Verification Acceptance Document (DPVAD) when a DP vessel is verified to be compliant. A DPVAD is valid for five years.

In practice, classification societies implement these requirements on behalf of flag state administrations as 'organisations duly authorised' but remember that it is the ultimate responsibility of the flag state or "Administration".

MSC/Circ. 1580 lists four different types of survey or testing requirements as follows:

1. *an initial survey which should include a complete survey of the DP system and FMEA proving trials for DP classes 2 and 3 to ensure full compliance with the applicable parts of the Guidelines. Furthermore it should include a complete test of all systems and components and the ability to keep position after single failures associated with the assigned equipment class. The type of tests carried out and results should be recorded and kept on board;*

2. *a periodical testing at intervals not exceeding five years to ensure full compliance with the applicable parts of the Guidelines. A complete test should be carried out as required in paragraph 5.1.1.1. The type of tests carried out and results should be recorded and kept on board;*

3. *an annual survey should be carried out within three months before or after each anniversary date of the Dynamic Positioning Verification Acceptance Document1. The annual survey should ensure that the DP system has been maintained in accordance with applicable parts of the Guidelines and is in good working order. The annual test of all important systems and components should be carried out to document the ability of the DP vessel to keep position after single failures associated with the assigned equipment class and validate the FMEA and operations manual. The type of tests carried out and results should be recorded and kept on board; and*

4. *a survey, either general or partial according to circumstances, should be carried out every time a defect is discovered and corrected or an accident occurs which affects the safety of the DP vessel, or whenever any significant repairs or alterations are made. After such a survey, necessary tests should be carried out to demonstrate full compliance with the applicable provisions of the Guidelines. The type of tests carried out and results should be recorded and kept on board.*

For equipment class 2 and 3 vessels MSC/Circ. 1580 also requires an FMEA to be carried out. Equipment classes and FMEAs are explored in subsequent sections of this Learning Manual.

PRACTICAL ONBOARD EXERCISE

Look at your vessels DPVAD and see who the issuing authority is.

Access MSC/Circ. 1580 section 5 - SURVEYS, TESTING AND DYNAMIC POSITIONING VERIFICATION ACCEPTANCE DOCUMENT (DPVAD) and read the requirements. According to MSC/Circ. 1580 section 5 when does a DPVAD cease to be valid?

ABOVE AND BEYOND

Access MTS DP Vessel Design Philosophy Guidelines (Rev2 - Apr21) section 4 and familiarise yourself with the stakeholders commonly involved in operating a DP vessel.

Table 3-1 Stakeholder Verification and Validation Responsibilities, consider column three 'Remarks' and create a further column applicable to your vessel.

REGULATORY, NEW OR UPDATE PUBLICATIONS, AND BULLETINS IN THE LAST 12 MONTHS

This DP Learning Manual is intended to be used in conjunction with Keelson's FREE DP APP. The app is routinely updated with regulatory, new, or updated publications, and bulletins.

Simply search for Dynamic Positioning on the Google Play store or on Apple's App Store or scan this QR code.

FIGURE 4 - KEELSON APP

PRACTICAL ONBOARD EXERCISE

Download and register on the free app

ABOVE AND BEYOND

Take the DP CPD Just for Fun quiz

MANAGEMENT OF CHANGE - THE IMPORTANCE

An effective management of change process is critical at all stages of the DP vessels design construction and operation.

MANAGEMENT OF CHANGE IN DESIGN (MOC)

The MTS DP Vessel Design Philosophy Guidelines (Rev2 - Apr21) (chapter 8) advise that a robust management of change process should be established at the concept phase, implemented systematically and followed diligently throughout the build life cycle.

Keelson Observation - During the operational life of the vessel the same principles of MoC should be used to assess any changes including software updates to ensure there is a formal review process of any possible impacts it may have on the FMEA, and to impose sufficient testing ensuring the redundancy concept has not been breached.

The MoC process should be in place prior to finalizing the redundancy concept for the vessel and any changes to the redundancy concept should be subjected to the MOC process.

Critically, the integrity of the MOC process should be maintained, communicated and used effectively and it is essential that all stakeholders should have ownership in the process.

MTS DP Vessel Design Philosophy Guidelines - Section 8 Management of Change in Design (MoC):

8.1.3 Any changes to the redundancy concept should be subjected to the MOC process.

8.1.4 While changes to the redundancy concept are relatively rare it is critical that they are subjected to the MOC process as when they do occur, they can have a broad effect on vessel design.

For example:

- *Changes to the vessel industrial mission.*
- *Changes to the desired post failure capability of the vessel that changes the redundancy split say from a two-way split to a four-way split (to reduce the impact of the worst case failure).*

MoC should identify all the design changes required so that the vessel's revised design will comply with the existing or new redundancy concept.

Changes in the design that violate the redundancy concept are more common. Diligent application of the MOC process could aid in avoiding such violations.

Configuration changes to DP control systems and other equipment with software (e.g. automatic power management systems) are examples of failure to apply the MOC process.

MTS DP Vessel Design Philosophy Guidelines offer sone examples of management of change

- *Vessel moves to a new work location where a different setup is required for the acoustic position references to accommodate SIMOPS with several vessels (Wide band). Failure to control the change in working location under the MOC process could result in degraded position reference status in that location.*
- *A drilling vessel was originally equipped with two DGNSS. Modifications were made to add several more DGNSS without understanding the consequence of relying so heavily on the DGNSS as a reference to the detriment of the hydro acoustic references.*
- *To solve an unrelated reliability problem, a thruster drive manufacture adds an under- voltage trip to a thruster variable speed drive without fully understanding the consequences for the redundancy concept. This modification removed the drive's voltage dip ride through capability leading to multiple loss of thrusters when short circuit fault occurred in the power distribution system.*
- *An ESD system was fitted to a MODU without a systems engineering approach resulting in a design which introduced single point failures. A blackout occurred when the ESD system failed.*

- *Operational impact of working in shallower water depth not understood and appropriate barriers (equipment and procedures) not implemented.*

The MSF's Guidelines for Offshore Marine Operations explains that a management of change (MOC) process should be in place for all tasks.

4.2.4 ***Activity Specific Operating Guidelines (ASOG)***.

> *The ASOG contains information pertinent to the vessel's station-keeping ability, taken from operational procedures that were developed to execute the industrial mission.* ***Any changes to procedures, should be assessed*** *to determine whether they may also affect the ASOG and so avoid conflicting requirements. The ASOG may be modified whilst on location, subject to the full agreement of the master, and in strict accordance with the Company's Management of Change procedure.*

Experience has shown that major incidents have occurred when changes have been made to procedures, equipment, activity, approved practice, organisational structure, or personnel without proper evaluation of the potential impact of those changes. Failure to identify and manage significant change may compromise safe and efficient operations. Operational changes of all kinds may pose a hazard and increase risk exposure, requiring a reassessment of control measures to maintain acceptable levels of safety, to prevent equipment damage, and to prevent or limit environmental and health impacts.

Management of Change (MoC) is the process by which potential changes, both permanent and temporary, are analysed, their likely effects reviewed, consequences mitigated, and their implementation executed, tested and communicated. Effective MoC is essential to ensure that hazards and risk arising from change are dealt with properly.

IMCA has developed IMCA HSSE 001 August 2020, covering how to manage operations which deviate from the original execution plan in a systematic and effective way, and providing assistance for members in the requirements for the application of a formal MoC process.

Each owner/organisation will adopt their own MoC as part of their HSE quality process. There are many examples available via the internet, on the following page is a typical MoC process.

Note that some changes may require many documents to be changed such as FMEA, DP operations manuals, ASOG etc. Some may even require class approval. In reality cost will be a big driver in the decision making, but the reason for change may mean that a change MUST be implemented to solve a serious underlying fault.

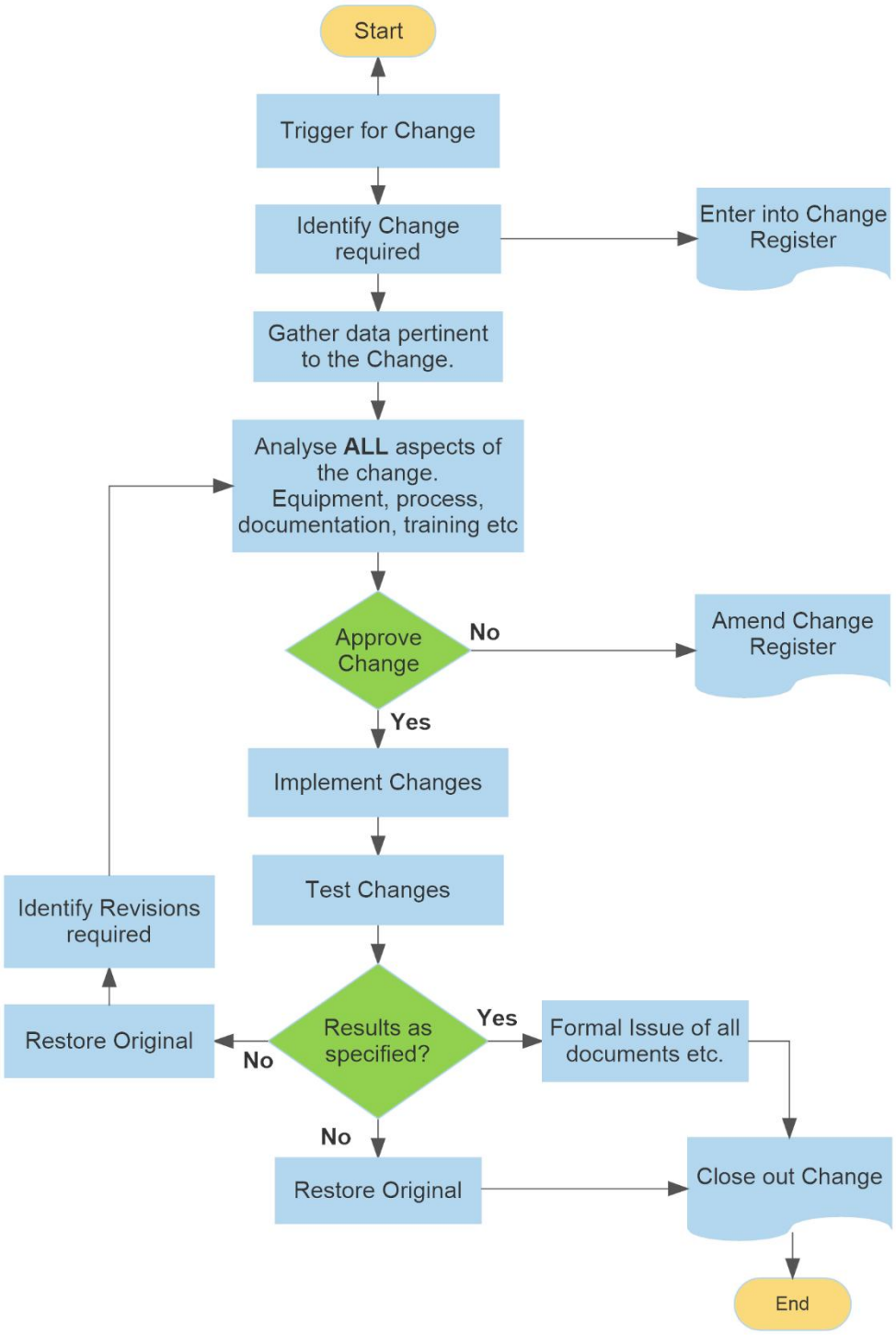

FIGURE 5 - TYPICAL MANAGEMENT OF CHANGE PROCESS

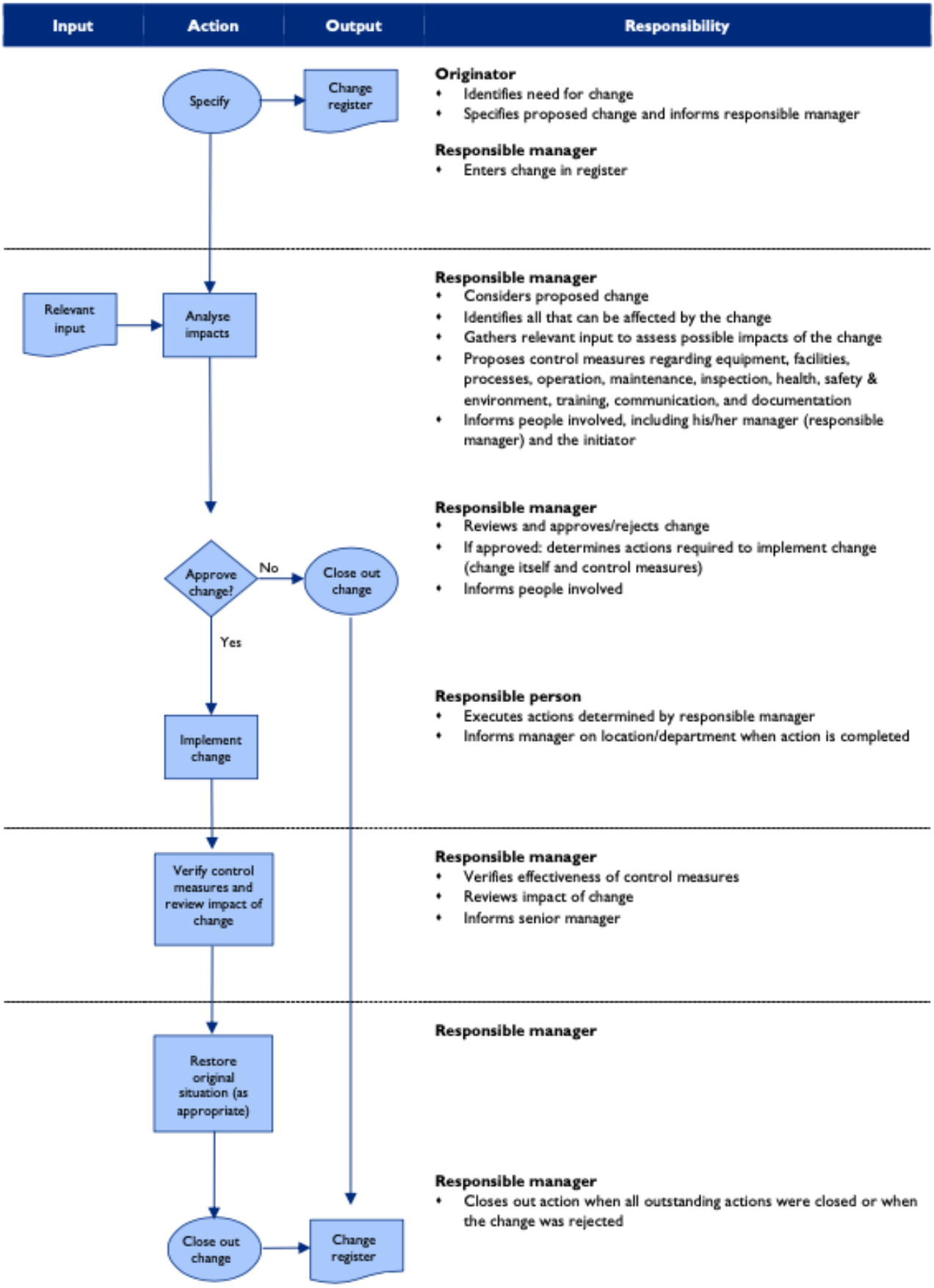

FIGURE 6 IMCA GUIDELINES FOR MANAGEMENT OF CHANGE IMCA HSSE 001 AUGUST 2020

LESSONS LEARNED THROUGH STATION KEEPING EVENTS.

DP station keeping event bulletins are available online free of charge. IMCA state that "*DP station keeping event bulletins enhance the traditional reporting and analysis of dynamic positioning station keeping events and incidents. They ensure that the industry is provided with prompt feedback, including anonymous factual case studies of events reported to IMCA.*"

The critical notion is that these are read, discussed on board, APPLIED ONBOARD YOUR VESSEL, and that appropriate management of change procedures are followed as per your company SMS so that that you are SURE that these incidents cannot happen to you.

See section *Lessons learned from DP Station Keeping Events*

Note that often the Station Keeping events are a bit 'light' on details, however it is a useful exercise to review them identifying details that might have caused/contributed, or might have been a way to avoid the incident etc.

IMCA DP STATION KEEPING EVENT REPORTING SCHEME

Regardless of their publication fire wall IMCA encourage all, including non-members to contribute to their DP station keeping events and incidents so that lessons learnt can be used to raise the standards of safe and efficient operations throughout the industry.

The submission process involves completing a form and providing detailed information regarding the incident and casual factors and supplementary items such as sketches and actions taken.

Information gathered through this process may periodically be used in IMCA's DP Bulletins.

A DP incident is a major system failure, environmental or human factor which has resulted in loss of DP capability.

A DP undesired event is a system failure, environmental or human factor which has caused a loss of redundancy and/or compromised DP capability.

A DP observation is an event that has not resulted in a loss of redundancy or compromised DP operational capability but is still deemed worthy of sharing.

PRACTICAL ONBOARD EXERCISE

Access the Station Keeping Event Reporting Form here:- https://www.imca-int.com/resources/technical-library/dp-station-keeping-reporting/?pdf and familiarise yourself with the reporting requirements.

ABOVE AND BEYOND

MTS offer guidance on conducting effective and comprehensive DP incident investigations (2021). This TECHOP provides provide a structured approach to conducting comprehensive DP incident investigations and generating LFIs while facilitating standardization and consistency. It is designed as a **proactive measure** and suggests that "Learnings From Incidents" (LFIs) generated could be used proactively to reduce the potential for repeat incidents. This is compatible with the general principals of the IMS code and with CPD. It uses the 'fish-bone' structure of investigating to organise inputs and uses the sub-headings of design, operations, process, people to guide the investigation. The Techop also offers a completed example of a DP incident investigation which is worth a read.

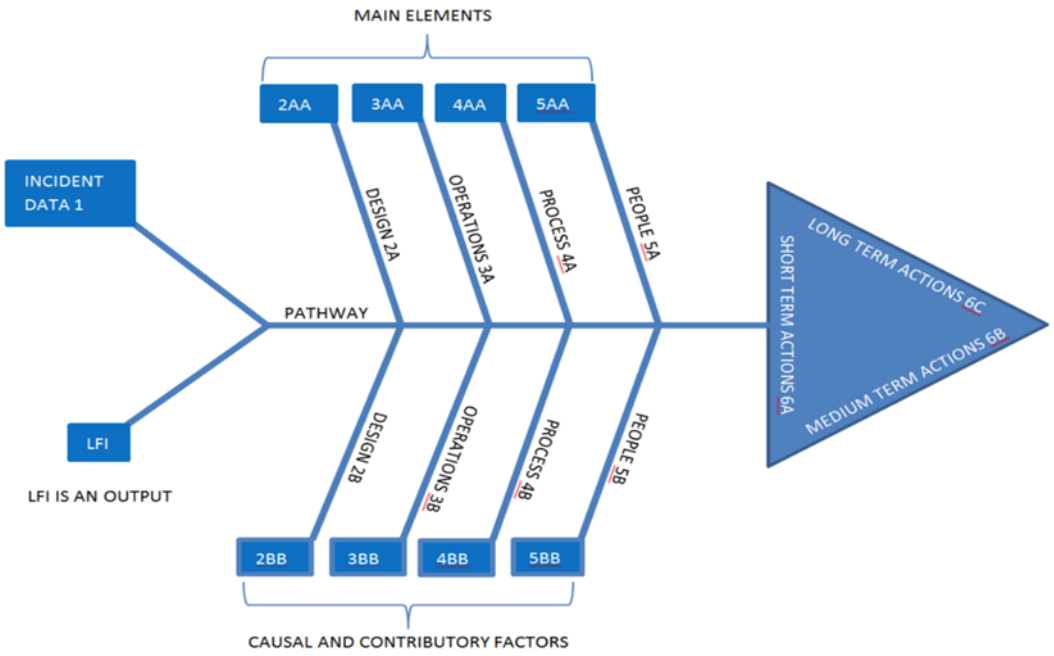

FIGURE 7 - TECHOP (G-04 - REV1 - JAN21) CONDUCTING EFFECTIVE AND COMPREHENSIVE DP INCIDENT INVESTIGATIONS

LESSONS LEARNED FROM DP STATION KEEPING EVENTS

It is critical that you visit IMCAs web site and access the latest DP event bulletins. Here is a summary starting at 2021 and complete at the date of issue of this document.

2021	
DP Event Bulletin	ITEMS
01/21 – March 2021	Human Factor caused a DP Incident
	Human Factor caused a DP Undesired Event
	DP2 Cargo Vessel DP Incident
	Drill scenario - Loss of seawater cooling pump redundancy
02/21 – June 2021	Computer Error Caused a DP Incident
	Human Factor Caused a DP Undesired Event
	DP2 Service Operations Vessel (SOV) DP Incident
	DP Emergency Drill Scenario
03/21 – August 2021	Worn Components Create Unwanted Thrust
	Environment Causes DP Incident
	DP2 Supply Vessel DP Incident
	DP Emergency Drill Scenario
	News In Brief
04/21 – December 2021	Action Error - Was an ASOG in Place?
	Swift action saved stress - Know your vessel
	Consequences of Decisions - Heading Change left too late
	Configuration - PRS's Hidden Common Failure
	DP Emergency Drill Scenario
	News in Brief

2022	
DP Event Bulletin	ITEMS
01/22 – April 2022	Case Study – Masking of PRSs – SIMOPS
	Case Study – Force off Position
	Case Study – Closed Bus Common Cause
	Solitons – Be Mindful
	DP Drill Scenario
	News in Brief
02/22 – August 2022	Case Study – Maintenance – Not a Good Idea During DP Ops
	Case Study – Importance of Units
	Case Study – Consequences of Not Following ASOG
	Relative PRS – A Reflection
	DP Drill Scenario
	News in Brief

2022	
DP Event Bulletin	ITEMS
01/23 – January 2023	Case Study – Closed Bus – Knowing the Risks
	Case Study – Vessel Degraded Capability
	Case Study – Open Bus Saved the Day
	Case Study – Closed Bus Ruined the Day
	DP Drill Scenario
	News in Brief

PRACTICAL ONBOARD EXERCISE

It is critical that you visit IMCAs web site and access the latest DP event bulletins.

DP EMERGENCY DRILLS AND SCENARIOS

IMCA have created DP emergency drill scenarios that are freely available on their website here. The are designed to assist DP vessel management and DPOs / engineers and ETOs to conduct DP drills onboard.

Each suggested drill scenario follows the same proforma and mariners are encouraged to learn from this and, with practice, create their own.

- Objective
- Method
- Discussion points (pre-exercise)
- Observations during exercise
- Actual results witnessed
- Discussion points (post-exercise)
- Conclusion

DP DRILL PRACTICAL ONBOARD EXERCISE

Visit the IMCA website and quickly skim read all their published drill scenarios. Choose the one that is most applicable to you, your level of experience, and your role onboard. Ask your immediate line manger if this drill can be replicated as part of the vessels drill matrix.

If not, run the drill by yourself, or with a college AS A TABLETOP EXERCISE giving each stage careful consideration.

DRILL SCENARIO EXAMPLE[1]

Objective: *To familiarise all vessel crew with what actions are required in order to recover the vessel into controllable condition following a thruster failure to full thrust*

Method: *This test can be undertaken when the vessel is in a safe open space with no risk of excessive position excursion causing an unsafe condition. If the vessel has CPP Main thrusters carry out using CPP.*

1. *Settle vessel on auto DP*
2. *A second person to take the most powerful thruster into manual control*
3. *Ramp that thruster to 100% in a direction perpendicular (if azimuth thruster) to the Auto DP thrust. If carrying out for CPP, put CPP thrust in the opposite direction*

Observe effects Observations During Drill – Consider:

- *Does the DP Control system compensate?*
- *Is there an initial excursion?*
- *What action would the DPO take?*
- *Is the degree of participation and diligence of Key DP Personnel as expected?*

Discussion Points – Consider:

- *How are the thrusters placed on the vessel, where single skeg thrusters are fitted, what are the implications of this failing to full thrust - this failure may still be within the FMEA Stated WCFDI?*
- *Can a forward retractable azimuth thruster, counteract two bow tunnel thrusters?*
- *Powerful stern CPP Propellors - if one failed to full thrust is position compromised?*
- *Where Rudders are used for position control, consider if the prop fails to full thrust and the rudder still follows a DP command*

Human Factors – Consider:

- *What should the response of the DPO?*
- *What would be the worst-case scenario?*
- *Discuss the alternative actions/reactions that may occur in response to a similar scenario. Are there multiple paths to a successful resolution or is there a preferred solution? Why?*

[1] Taken from IMCA

Review of DPO and other key DP personnel reaction

- *What potential gaps in the existing DP Familiarisation program have been highlighted as a result of the exercise?*
- *What changes/revisions should be considered for the training and familiarisation procedures?*
- *Review the applicable checklists (ASOG CAM/TAM/D operations Manual/bridge and engine room checklists/*
- *FMEA/DP Annual Trials programmes/etc.)*
- *What additional necessary actions and considerations should be addressed? What potential changes should be made to make the checklists more appropriate? What additional necessary operating conditions and parameters should be considered? What potential changes should be considered to make Decision Support Tools more applicable to the vessel and her equipment?*
- *How would these changes improve/affect the vessel's capabilities and limitations?*

Conclusion: Based on the results of the exercise and related discussions before and after, make suggestions for change including:

- *any corrective actions deemed appropriate should be accurately detailed and managed to close out.*
- *Handling of thruster system failures in the correct manner requires knowledge of the DP vessel control, how the Up system reacts to failures and alarms and the human intervention required if necessary to ensure station keeping.*
- *awareness of the current thrust levels and directions*
- *DP system reaction to failures*
- *appropriateness of communication*
- *training requirements*

For all the Drills, it may be better to find a way to trigger the 'event' in a way that is more representative of a real DP incident, so in the above example the act of taking the thruster into manual would remove it from the DP (i.e. available would drop off) so this would indicate immediately which thruster was 'bad' ?

ROLES & RESPONSIBILITIES OF KEY DP PERSONNEL (ACCORDING TO M117)

In June 2017, the IMO released circular 738 that requested all Member States bring an IMCA document, ***IMCA M 117 Rev.2 "Training and Experience of Key DP Personnel"*** to the attention of all parties concerned. This document identifies training programmes, levels of competency and experience for the safe operation of DP vessels and will be covered in chapter two of this module.

This is the ONLY industry document that is linked to an IMO circular and as such it cannot be changed without the approval of the IMO's marine Safety Committee. The last revision was in September 2016.

We discus key features of IMCA M117 below but recommend that you download a copy to your briefcase or download the Keelson Dynamic Positioning app.

One of the most common barriers to onboard training and CPD is TIME. Note that IMCA M117, in 3.2 Operational Conditions states:

> *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.*

Remembering that the IMO has bought this to the attention of all member states and incorporating 5.6 of the ISM Code Resources and Personnel

> *5.6.5. The Company should establish and maintain procedures for identifying any training which may be required in support of the SMS and ensure that such training is provided for all personnel concerned.*

we can see that it is mandatory, and certainly not unreasonable, to expect companies and their clients to provide TIME for seafarers to complete CPD and training onboard. But IMCA M117 and the ISM code put the onus in providing training and CPD onto the owner and for that reason Keelson's CPD is designed to support shipping companies provide this for their personnel. If you are an independent practitioner shouldering the time and financial burden of this CPD programme alone, we salute you and suggest that your raise this with your employer.

IMCA M117 AIMS

IMCA M117 has two aims:

> *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.*

In chapter 7 of IMCA M 117 document identifies nine key DP personnel and defines their qualification and knowledge requirements. This CPD programme is differentiated to meet the specific needs of chapter 7. That is, a master/OIM will get harder questions than a DPO and different questions to that of a chief engineer. This is because Keelson's DP CPD is also aligned in MTS PDDP 2 with its three levels of learning as discussed earlier.

Note also that chapter 10 of IMCA M 117 is devoted to Key DP Personnel Continuous Professional Development (CPD) and clearly states that the provision of CPD lies at company level:

> *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.*

PRACTICAL ONBOARD EXERCISE

Look at IMCA M117 chapter 7 and identify your key DP personnel role onboard your current vessel; NOTE: you will have already done this to enrol on the correct DP CPD pathway with Keelson.

Examine the qualification and knowledge requirements for your role/rank onboard. For your two Keelson DP CPD assessments (base line and improvement assessment) you will be asked questions on the FULL RANGE of knowledge requirements for your role EVERY YEAR, not just the topics selected by the Nautical Institute for annual review as summarised in **Error! Reference source not found.** of this Learning Manual.

ABOVE AND BEYOND

Compare the requirements for your role or rank on board as defined in IMCA M117 and in MTS PDDP2.