



TECHNICAL AND OPERATIONAL GUIDANCE (TECHOP)

**TECHOP (P-01 - Rev1 - Jan21)
PART 2**

**COMPETENCY REQUIREMENTS FOR
DP SMEs**

JANUARY 2021

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SUMMARY

This MTS TECHOP provides general guidance on subjects with which prospective DP SMEs should become proficient in order to be effective in contributing to the delivery of incident free DP operations with predictable outcomes.

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ABBREVIATIONS

ASOG	Activity Specific Operating Guidelines
CAM	Critical Activity Mode
IJS	Independent Joy Stick
IRM	Inspection Repair and Maintenance
MDAT	Mapping Delivery Ability Tool (now known as PDDP2)
OCIMF	Oil Companies International Marine Forum
PDDP2	Professional Development of DP Personnel (formally MDAT)
PMOE	Principal Marine Operations Engineer
PRS	Position Reference Systems
SIMOPS	Simultaneous Operations
SMEs	Subject Matter Experts
TAGOS	Thruster and Generator Operating Strategy
TAM	Task Appropriate Mode
TECHOP	Technical and Operational Guidance
WSOG	Well Specific Operating Guidelines

1 DP SME COMPETENCE OVERVIEW

1.1 COMPETENCE

1.1.1 Competence can be described as the appropriate combination of skill, knowledge, experience and behaviours. This guide describes technical competence requirements for those undertaking the role of Subject Matter Expert (SME) for Dynamic Positioning (DP) or aspiring to be a SME for DP.

1.2 PROFICIENCY SCALE

1.2.1 The purpose of the proficiency scale is to provide a consistent framework that enables those responsible for ensuring competence to, assess and provide feedback to those undertaking the role of DP SME.

1.2.2 There are three levels of proficiency described as:

- Knowledgeable
- Skilled
- Mastery

1.2.3 **Knowledgeable:** This level allows questions to be asked of specialists. Work can be undertaken with assistance.

1.2.4 **Skilled:** At this level, skill allows assigned tasks to be undertaken with a minimum of assistance.

1.2.5 **Mastery:** This level permits diagnosis, troubleshooting and complex problem solving. Development and implementation of best practice, standards and guides. Ability to objectively evaluate alternate proposals with a strong emphasis on predictable outcomes.

1.2.6 There are two further levels which may be assigned during the assessment which are Aware and Not Aware. Neither of these levels is considered to contribute to the competency required to be a DP SME.

1.3 DISTRIBUTION OF PROFICIENCY LEVELS

1.3.1 DP SMEs must have 9 core competencies at the following levels or higher:

- 4 Mastery
- 3 Skill
- 2 Knowledgeable.

1.3.2 Of the four competencies required at the level of Mastery, the following three are mandatory:

- Deliverables / decision support tools.
- DP guidance.
- Barrier philosophy.

1.4 PROOF POINTS

1.4.1 Table 1-1 provides a more detailed guide to the expectations at each proficiency level.

Table 1-1 Detailed Proof Points

What can be expected from a DP SME at each skill level:

Level	Proof Points
Knowledge	<ul style="list-style-type: none"> • Able to interpret and evaluate information and advice from experts in an area of expertise. • Able to use the correct terminology (vocabulary) of the area of expertise. • Able to hold an informed debate with experts in the area of expertise. • Able to ask questions that test the viability of proposals in an area of expertise. • Able to carry out some of the activities with help.
Skill	<ul style="list-style-type: none"> • Able to perform consistently and satisfactorily the majority of activities of an area of expertise. • Able to translate guidelines and standards for the area of expertise into practical actions. • Able to solve imaginatively, common technical/operational problems in the area of expertise. • Able to guide and advise others in technical/operational aspects of the areas of expertise.
Mastery	<ul style="list-style-type: none"> • Troubleshoot / adapt / evaluate alternate and / or novel solutions objectively. • Be able to diagnose and resolve significant complex, non-routine problems in the area of expertise. • Able to creatively solve significant, complex, non-routine problems in the area of expertise. • Able to adapt practices from other markets or countries for use in the area of expertise. • Able to generate substantial improvements to local practices and procedures for the areas of expertise. • Demonstrate experience in applying technical and operational expertise to achieve business objectives safely and predictably. • The ability to objectively evaluate proposals (including alternate solutions) or offer alternative solutions and risk mitigations to resolve DP-related issues.

*NOTE: It is acknowledged that all the required competencies would be difficult for one individual to demonstrate proficiency at a Mastery level. It is expected that gaps in proficiency levels if identified could be closed through access to competent personnel in possession of documented competencies at the appropriate level of proficiency. It is anticipated that the above would be applicable to practitioners tasked with **management of DP activities**. As such a conclusion of competence can only exist while access to competent resources remains. (It is expected that personnel delivering in-depth technical support would possess the identified competencies commensurate with the stipulated proficiency level).*

2 CORE DP COMPETENCIES

2.1 DEFINITIONS

2.1.1 There are 9 core DP competencies. These are:

1. Deliverables and decision support tools.
2. Barrier philosophy & defense in depth.
3. DP concepts.
4. DP guidance & basis of requirements.
5. Verification and validation.
6. In execution support.
7. Impacts on station keeping on the industrial mission.
8. Impacts of the industrial mission on station keeping.
9. Defining, identifying and managing interfaces relevant to DP station keeping.

Note 1: *Items in RED font above are competencies that require a mandatory level of Mastery for a DP SME. One other must be obtained at level Mastery.*

Note 2: *Competence on scale level of Mastery includes the ability to objectively evaluate alternate proposals with a strong emphasis on predictable outcomes (applicable to all 9 competencies).*

2.2 ELEMENTS OF COMPETENCE

2.2.1 Within each competence there are three elements which indicate the ability to:

- Assess / Evaluate.
- Define / Specify.
- Execute.

Detailed definitions for the 9 core DP competencies are given in Appendix A.

2.3 ASSESSMENT OF COMPETENCE

2.3.1 Competence will be assessed through a combination of:

- Interview – this document.
- Observation.
- Formal written assessment (for SMEs desiring to be assessed on technical competence) – Separate Exercise on Review of DP Redundancy Concept. Available from the PMOE.

2.3.2 Details of the interview process are given in Appendix A.

2.3.3 Note: This competence assessment is heavily weighted towards technical competence and not limited to behavioural competence. One of the two assessors is expected to have the necessary depth and breadth of technical and operational knowledge to undertake an effective assessment.

2.4 PREPARATION

2.4.1 Candidates are expected to receive coaching and mentoring during their day to day work and undertake self-study using the Professional Development of DP Personnel (PDDP2) Tool provided in Appendix B and relevant MTS TECHOPs where applicable.

2.4.2 NOTE: Topics listed in the tables as Coaching and Mentoring will be facilitated through a TECHOP (to be generated and published through MTS DP G&S subcommittee).

3 DEFINITIONS

3.1 COMP 1. DELIVERABLES AND DECISION SUPPORT TOOLS

3.1.1 Definition

3.1.1.1 Deliver as a subject matter expert and provide guidance on the following decision support tools and elements of such tools:

- Activity Specific Operating Guidelines (ASOG).
- Critical Activity Mode (CAM).
- Task Appropriate Mode (TAM).
- Criteria (Post failure capabilities, rationalization of yellows etc.)
- Configuration (Permissible configurations of DP system - Power generation, distribution, propulsion, position reference sensors, external interfaces, external influences etc.)
- Modes and features required for industrial mission.
- Thruster and Generator Operating Strategy (TAGOS).

3.1.2 Assess / Evaluate

3.1.2.1 Ability to review and identify issues associated with the scope and depth of ASOGs.

3.1.3 Define / Specify

3.1.3.1 Identify the level of detail required to be embedded in decision support tools.

3.1.4 Execute

3.1.4.1 Be able to create an ASOG for any type of DP vessel and activity.

3.1.4.2 Evaluate contractor provided ASOGs for completeness and identify the remedial work required if necessary.

NOTE: The ability to create an ASOG could be supplemented by access to competent personnel. (Demonstrated to be competent by this process)

3.2 COMP 2. BARRIER PHILOSOPHY - DEFENSE IN DEPTH

3.2.1 Definition

3.2.1.1 Knowledge and application of 'Barrier Philosophies' for risk management evaluation of effective training, contingency plans and defense-in-depth of barriers (pertinent to DP station keeping).

3.2.2 Assess/ Evaluate

3.2.2.1 Evaluate the suitability of barriers already in place such as:

- Barriers to prevent loss of position.
- CAM.
- Operate within Post Worst Case Failure Capability.
- Use of IJS.
- Barriers to prevent IRM on DP equipment.
- Operational restrictions as a barrier.
- Provisions for positioning standby.
- The need for and imposition of project specific simulator requirements.

NOTE: Principles of CAM and operating within post failure capability are considered to be hard barriers to loss of position where as operational restrictions are considered as a soft barrier. Additional management is required for soft barriers to be effective.

3.2.3 Define / Specify

- Specify the type of barriers required for a particular activity.
- Specify when project specific simulators are required for intended activities.
- Evaluate project specific simulator proposals for meeting intent and objective.
- Engage with relevant SMEs for input into project specific simulator training.

3.2.4 Execute

3.2.4.1 Create robust activity / mission specific barriers.

3.3 COMP 3. DP CONCEPTS**3.3.1 Definition**

3.3.1.1 Knowledge and application of DP Concepts - Deliver as a subject matter expert and knowledge resource on essential concepts associated with dynamic positioning:

- Dynamic Positioning Theory and Practice.
- Basis of Confidence.
- DP Redundancy.
- Seven Pillars.
- Post failure capability.

3.3.2 Assess/ Evaluate

3.3.2.1 Be able to articulate the concepts listed above and below and their importance to DP. Evaluate the extent to which others are able to understand these concepts and the significance of their ability or inability to do so.

- Basic principles of dynamic positioning
- Drift off
- Drive off
- Force off
- Fault Tolerance
- Redundancy
- Reliability
- Resilience
- Predictability
- Fail safe
- Performance
- Protection
- Detection
- Cross connections
- External interfaces
- External influences
- Independent performance validation.

3.3.3 Define / Specify

3.3.3.1 Define and specify which of these concepts are required to be emphasized for specific industrial missions.

3.3.4 Execute

3.3.4.1 Be able to determine who should have an adequate understanding of these concepts within vessel crews and owner's organization.

3.3.4.2 Be able to use the following MTS gap analysis tools:

- DP System FMEA.
- DP FMEA proving trials.
- DP Operations Manual.
- Annual DP trials.
- RP D102 System FMEA gap analysis tool.

3.3.4.3 Be able to mine and extract relevant DP related information from diverse sources (Example: MTS DP committee, IMCA, Marine Forums, Recommended Practices, OCIMF etc.)

3.4 COMP 4. DP GUIDANCE**3.4.1 Definition**

3.4.1.1 Knowledge of:

- Company DP standards / requirements (when available).
- OCIMF DP Assurance Framework.
- Industry guidance - IMO, MTS & IMCA Guidance.

3.4.2 Assess/ Evaluate

3.4.2.1 Be able to use industry guidance documents to assess levels of implementation, application or adherence to guidance and good practice contained therein. In particular, the SME should be fully familiar with the concepts described in:

- Company DP standards / requirements (when available)
- OCIMF DP Assurance Framework
- IMO MSC 645 & 1580
- DNVGL RP E307
- DNVGL RP E306
- PROFESSIONAL DEVELOPMENT OF DP PERSONNEL (PDDP2) TOOL
- DNVGL RP D102
- IMCA M190 (When specifically referenced IMCA M190 revision June 2011)
- IMCA M191 (Now incorporated into M190, (When specifically referenced IMCA M191 revision Feb 2008)
- IMCA M220
- IMCA M225
- IMCA M182
- IMCA M166
- IMCA M117
- ALL TECHOPs (DP Incident Investigation TECHOP Specifically Emphasized).

Note: The written examination (SMEs - Technical Focus) covers relevant principles contained within the above documents.

3.4.3 Define / Specify

3.4.3.1 Be able to specify requirements pertinent to the industrial mission and consequences of a loss of position.

3.4.4 Execute

3.4.4.1 Be able to evaluate the extent and efficacy of the implementation of the relevant guidance as stipulated in the requirements.

3.5 COMP 5. VERIFICATION AND VALIDATION**3.5.1 Definition**

3.5.1.1 Be fully familiar with the purpose, objectives and practice of the verification and validation activities applied in the management of DP vessels including:

- Annual DP Trials.
- FMEA Proving Trials.
- Post Event Verification Trials.

3.5.1.2 In particular, proficiency in the objective evaluation of:

- DP system FMEA.
- DP system FMEA gap analysis.

3.5.1.3 Understand:

- Purpose of FMEA proving trials.
- Purpose of annual DP trials.
- Findings categorizes and significance.
- Differences between and requirements for 'Soak test' & 'Stress Test'.

3.5.1.4 Be proficient in:

- Effective onboard vessel engagements.
- Validation of efficacy of implemented processes.
- Evaluation of critical sparing philosophy of DP equipment.

3.5.2 Assess / Evaluate

3.5.2.1 Be able to assess the degree of completeness with which Annual DP trials, FMEA proving trials and post event trials have been performed. In particular, whether or not they achieved their objectives.

3.5.3 Define / Specify

3.5.3.1 Requirements for effective review of DP FMEAs, DP FMEA proving trials and post event / return to work authorization process.

3.5.3.2 Requirements for review and acceptance of effective gap closure proposals.

3.5.4 Execute

- Perform effective engagements with DP vessel crew and owner's organization.
- Evaluate results of DP FMEA reviews, DP FMEA proving trials and post event / return to work authorization process.
- Evaluate results of post event / return to work authorization process.

3.6 COMP 6. IN EXECUTION SUPPORT

3.6.1 Definition

3.6.1.1 Deliver as a subject matter expert and knowledge resource in response to requests for assistance related to:

- Marine Operations involving DP station keeping.
- Incident investigations involving DP station keeping.

3.6.1.2 In particular:

- Response to 'yellows' and 'reds' as triggered by the ASOG/WSOG.
- Specifying analytical / engineering work relevant to impacts on station keeping.
- Return to work authorization.
- Responding to and resolving dilemmas.

3.6.2 Assess / Evaluate

3.6.2.1 Evaluate the relevance and applicability of the advice provided by other subject matter experts.

3.6.3 Define / Specify

3.6.3.1 Define engagements with other subject matter experts. Develop questions that need to be asked and answered.

3.6.4 Execute:

3.6.4.1 Provide in-execution support when requested. Engage with other relevant subject matter experts, vessel crew, project teams and owner's organization in order to resolve issues and progress the execution of marine operations and the industrial mission.

3.6.4.2 Perform DP incident investigations.

3.7 COMP 7. IMPACTS OF INDUSTRIAL MISSION ON STATION KEEPING

3.7.1 Definition

3.7.1.1 Identify, understand and communicate those elements of the industrial mission being undertaken which impact upon DP station keeping.

3.7.2 Assess / Evaluate

3.7.2.1 Evaluate the suitability of the DP system functions and features for the specific activity to be undertaken.

3.7.2.2 Determine whether aspects of the activity to be undertaken will impact the performance of the DP system.

- Heavy lifting operations.
- Riser pull-in.
- Hold back vessels.
- SIMOPS.
- Shadowing of PRS.
- Relative PRS and target vessel motions.
- Gangway connected operations.
- Impact of external forces on DP station keeping (Example: Moorings and Automatic Thruster assist, hydrodynamics of leg length, forces imparted through legs on touching bottom etc.)

3.7.2.3 Evaluate the need for particular types and combinations of position reference systems.

3.7.3 Define / Specify

3.7.3.1 Define and specify industrial mission specific modes and features and any other requirements. Develop questions (pertinent to impacts of industrial mission on station keeping) that need to be asked and answered.

3.7.3.2 Be able to specify remedial actions.

3.7.4 Execute

3.7.4.1 Supervise activities requiring special DP station keeping modes functions and features and advise on the conduct of the operations with reference to the stability of the DP system and the security of the industrial mission.

3.8 COMP 8. IMPACTS OF STATION KEEPING ON INDUSTRIAL MISSION**3.8.1 Definition**

3.8.1.1 Identify, understand and communicate the impacts of DP station keeping requirements on the execution of the industrial mission.

3.8.2 Assess / Evaluate

3.8.2.1 Assess whether the activity is suitable for execution using DP station keeping, consequences of loss of position, thruster wash, gangways, walk to work, shallow water operations, automatic thruster assisted moorings.

3.8.2.2 Identify other options for carrying out the activity that might be more suitable.

3.8.3 Define / Specify

3.8.3.1 Specify, modes, functions and features for the activity to be undertaken using DP station keeping, e.g. external force compensation, heavy lift mode, automatic thruster assisted moorings, additional barriers if applicable.

3.8.4 Execute

3.8.4.1 Advise on the suitability of DP station keeping as a means of carrying out the specified activity.

3.8.4.2 Advise on additional measures/ mitigations needed if DP station keeping is essential.

3.9 COMP 9. INTERFACE MANAGEMENT**3.9.1 Definition**

3.9.1.1 Delivery of incident free DP operations is dependent on effective interface management across a diverse group of stakeholders including non-DP domain stakeholders. Thus, interface management has been identified as a key competence as it effects two other competencies impacts of station keeping on industrial mission and impacts of industrial mission on station keeping.

3.9.2 Assess / Evaluate

3.9.2.1 Identify interfaces that need to be managed.

3.9.2.2 Evaluate impacts to the delivery of DP operations.

3.9.2.3 Evaluate, develop and implement engagement plan (plan to identify extent and time of engagement)

3.9.2.4 Evaluate the need to engage specialist resources and other subject matter experts:

- Vendor engagement.
- Requesting and managing specialist vendor support.
- Identifying need for and requesting/managing other subject matter experts (Not only those with direct interfaces but also those that could influence outcomes).

3.9.3 Define / Specify

3.9.3.1 Identify, define, specify impacts to or from station keeping from industrial mission in consultation with relevant non-DP domain SMEs (Example Logistics-Aviation, Offshore coordination team lead, OIM, Completions & Intervention Superintendents, Drilling superintendents, Construction superintendents, Project Engineers, Business Opportunity Managers, etc.)

3.9.4 Execute

- Engage with and oversee the activities of specialist vendors and subject matter experts.
- Communicate pertinent information to relevant stakeholders.
- Minimize escalation of unforeseen events.
- Rationalize DP specific requirements against an integrated risk management strategy based on system's thinking - Professional Development of DP Personnel Tool (PDDP2).
- Manage station keeping risk by balancing against overarching business / venture risk in consultation with diverse and pertinent stakeholders.

4 MISCELLANEOUS

Stakeholders	Impacted	Remarks
MTS DP Committee	✓	To track and incorporate in next rev of MTS DP Guidance Documents
USCG	✓	MTS to communicate
ABS	✓	MTS to communicate
DNV GL	✓	MTS to communicate
Equipment vendor community	X	MTS to engage with suppliers.
Consultant community	✓	MTS members to cascade/ promulgate.
Training institutions	✓	MTS members to cascade/ promulgate.
Vessel Owners/Operators	✓	Establish effective means to disseminate information to Vessel Management and Vessel Operational Teams.
Vessel Management/Operational teams	✓	Establish effective means to disseminate information to Vessel Operational Teams.

APPENDICES

APPENDIX A EXAMPLE ASSESSMENT PROCESS

A.1 Example Assessment Interview

Note: This Appendix A contains an example assessment process. It is envisaged that companies will develop their own assessment processes that meet their needs and client's expectations.

- The DP SME Competence Assessment is designed to assess whether the nominated candidate will be able to discharge the functions of a DP SME effectively in support of the businesses objective of managing DP Station keeping risk. It is an assessment to be conducted before a nominated individual is placed in the role of a DP SME. It is not meant to replace the due diligence performed in selecting an individual for nomination.
- After all scoring, has been completed; please indicate the final result **here** for data entry purposes:

Overall Result (Tick One)

Competence gaps identified Competent

- This assessment template includes a comprehensive assessment over a broad range of identified DP competencies and each may include several possible questions. The assessment questionnaire is designed to be flexible and allows the assessor to use the questions judiciously to evaluate the skill level on the described scale. Assessors may also add questions to the template in order to explore the candidate's depth of understanding of the subject matter.
- It is emphasized that the assessment is not designed to test what the candidate does not know. On the contrary, it is designed to surface and build on what the candidate does know.
- The subject matter contained in the assessment provides a road map for developing required competencies for candidates aspiring to be DP SMEs.
- The topics addressed in the assessment template include the nine identified competencies required of a DP SME.

A.2 Example Assessment Overview

- Candidates are asked to prepare for this assessment in advance using the Professional Development of DP Personnel Tool in Appendix 2. The Candidate will be asked to come prepared to discuss their competence and skill set as it relates to managing DP Station Keeping risks, including the various Industry guidance documents and company requirements on the subject matter.
- Through appropriate answers to the structured questions, the Candidate should be able to demonstrate the necessary competence and skill per the described scale to demonstrate ability to function as a DP SME.
- The aim is to assess the individual in the nine identified areas and to ensure skill level can be consistently applied in the management of DP station keeping risk.

A.3 Suggested Assessor Instructions

- Two assessors should conduct the assessment. Assessors should be required to complete Company Assessor Training prior to use of this assessment.

Before Interview

Preparation:

- Familiarize yourself with the structure of the assessment process.
- Review the questions and rating scales.
- Determine whether additional assessors are needed.
- Agree to assessor roles.

During the Interview

Collect Relevant Evidence from Candidate:

- Welcome the Candidate – develop rapport.
- Introduce yourself and describe the assessment structure and process.
- Ask clear, precise, and relevant questions, using follow-ups to get full responses.
- Take notes – be an active assessor.

After the Interview

Evaluate Candidate on Relevant Elements:

- Review your notes – classify your evidence to the evaluation dimensions.
- Rate the Candidate.

A.4 Opening the Exercise

- Spend 5 minutes setting up the interview and ensuring the Candidate is clear on the process.
- Greet the Candidate, stating your name and role in the DP community.
- Ask the Candidate to do the same (name and role).
- Give an overview of the exercise plan, duration and process.
- State that you will be taking notes. Explain these notes will be used to ensure the ratings are accurate and will not be retained for other purposes.
- Ensure that the Candidate is clear on the process.
- Ask if they have any initial questions.
- Remind the Candidate of the following points:
 - they will try to discuss previous specific experience that they have been in, trying wherever possible to keep to one situation per question.
 - you may ask situational questions to explore DP SME competence: if the Candidate has not encountered such experiences, they should advise the assessor.
- Ask if the Candidate has any final questions before beginning.

A.5 Asking Questions

- Ensure you dedicate sufficient time to obtain evidence on the technical and operational depth possessed by the candidate.
- Remember, you may need to ask follow-up questions to fully explore an issue. Some questions may have already been answered in the initial presentation from the Candidate, so be careful not to repeat them unnecessarily.

- Politely interrupt and re-direct the Candidate if the information they are providing is not relevant to the assessment.
- Remember, you need to ensure they provide the information relevant to the scoring.
- Spend as much time as is necessary to build confidence in the competence of the Candidate.
- At the end, thank the Candidate.

A.6 Closing the Exercise

- Allow 5-10 minutes to close the interview.
- Indicate that you have reached the end of your questions.
- Ask the Candidate to take a moment to consider whether they would like to add any further information.
- Advise the Candidate that you will advise them of the outcome of the interview within the next five working days. The interviewers will require time to review notes and ensure agreement is reached on the outcome.
- Please evaluate the interview as soon after completion as possible following the guidance on the following page.

A.7 After the Exercise

- After the exercise, review the evidence and complete the Evaluation Forms.

A.8 Evaluating Evidence

1. Look through the scale as listed on the rating matrix and tick the appropriate position on the scale. Skill is rated in terms of five bands of performance.
2. To determine the overall score for a dimension, look at the position of the **majority** of the ticks.

As a rough guide:

Not aware	Most of the ticked responses are in the 1st column
Aware	Most of the ticked responses are in the 2nd column
Knowledgeable	Most of the ticked responses are in the 3rd column
Skilled(>K,<M)	Most of the ticked responses are in the 4th column
Mastery	Most of the ticked responses are in the 5th column

Avoid errors associated with halo/horns effect, central tendency, recency and stereotyping. In addition, when evaluating evidence gained during an interview do not be influenced disproportionately by the Candidate's ability or inability to talk persuasively and articulately though the ability to communicate effectively is an essential skill for a DP SME.

See also **Guide to Assigning Skill Levels on the Basis of Answers** in the following section.

A.9 Question, Response and Scoring

Guide to assigning skill levels on the basis of answers:

Always start by asking the main question which is generally broad in scope. No more than nine questions should be required in each competency to arrive at a conclusion regarding competence levels.

MASTERY - A candidate with mastery in the subject competency will speak fluently and be able articulate all the main concepts associated with a particular subject without prompting or recourse to asking follow-on questions. (that is to say they will mention many of the issues which are the subject of the follow-on questions). The candidate will demonstrate that they understand all or most of the issues at a **conceptual, philosophical and practical level** – Mastery may be awarded on the basis of such a performance alone but further confidence in the appropriateness of the categorization may be gained from the answers to follow on questions.

SKILLED - A candidate who is skilled in the subject competence is likely to demonstrate a **sound understanding of the practical issues in the main question** but may be less able to articulate the philosophical and conceptual issues in the main question and may need to be prompted to expand their answer to allow their understanding of the conceptual and theoretical issues to be assessed. The score awarded to such a candidate is likely to be influenced by their performance in the follow-on questions.

KNOWLEDGEABLE – A candidate who is knowledgeable in a particular competence may give a **fairly limited response in reply to the main questions** but will be able to demonstrate the scope of their knowledge by correctly answering most of the follow-on questions in a manner that gives confidence they understand the practical importance of the issues raised by the questions.

AWARE – A candidate who is only aware of issues within the subject competence is **likely to need significant prompting and use of follow-on questions** to gain an understanding of their knowledge. Their answers may be at a superficial level. They may struggle to answer the main question. They may not be able to answer all the follow-on questions.

NOT AWARE – A candidate who is not aware will likely ask for the main question to be repeated in a different way or be expanded or may state they have no knowledge of a particular subject.

NOTE – FAILURE TO ACHIEVE MASTERY – When it becomes clear during the oral exam that a candidate is not going to achieve Mastery in the four competencies required to be a DP SME, the examiners should use the follow-on question to help develop a study plan to address the gaps and assist the candidate in achieving the required competencies at the next opportunity.

SUMMARY – **The nature of the answer provided to the Main Question is likely to influence the assignment of a particular skill level most strongly** – The follow-on questions will typically reinforce that assessment or improve the score of a candidate who did poorly in the main question.

APPENDIX B PROFESSIONAL DEVELOPMENT OF DP SMES

B.1 The Professional Development of DP Personnel

Information on the use of the professional development of DP personnel tool can be found in the publication of the DP committee of the Marine Technology Society titled, 'Guidance For Professional Development of Personnel Engaged In DP Operations using the Professional Development of DP Personnel Tool (PDDP2)' - (PDDP2 was formerly known as MDAT).

The sections that follow provide tables for each of the nine core competencies that enable self-study. Each table provides study guidelines in the form of lists of DP related subjects, associated industry guidance and important terms and concepts with which the prospective DP SME should become familiar and proficient.

Each table contains the following columns:

Competence 1 - Deliverables and Decision Support Tools							
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / principles	Actions

Themes	Broad concept or subject.
Description	A brief overview of the concept or subject to be studied. The information is sufficient to allow the prospective DP SME to seek out more information on the subject or start a conversation with colleagues.
Key Subject Matter	Important terms, concepts and vocabulary.
Reference	Where more information can be found. Typically, industry guidance or other publications.
Competence Scale	Prospective DP SMEs are encouraged to assess their own competence levels. Two columns are provided. In the first column, the DP SME may assign their own estimate. The second column may be used to record the estimate based on conversations with mentors or from feedback given in the assessment process.
Evidence	The evidence column is used to collect evidence of competence. This may be experiential, or a record of study undertaken to gain familiarity and competency in a particular subject.

Competence 1 - Deliverables and Decision Support Tools							
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
ASOG / WSOG	<p>1. Activity Specific Operating Guidelines (ASOG) are a form of decision support tool designed to assist crew in safely managing the conduct of the DP operation. The same tool is titled Well Specific Operating Guidelines (WSOG) for use on MODUs.</p> <p>2. Information is presented in a two or four column format where each column is associated with 'traffic light' colours indicating DP system status.</p> <p>3. The four-column 'Criteria' section supports decision making in response to events, observation and environmental limits. The user is guided to advise stakeholders, continuing or suspend operations and implement contingency plans.</p> <p>4. Green – Normal operations.</p> <p>5. Blue – Abnormalities exist or limited are being approached.</p> <p>6. Yellow – Redundancy has been lost or is at defined operational limits.</p> <p>7. Red – Position is being lost or contingency plan is in operation.</p> <p>8. The two-column 'configuration' section is a go-no-go for being in Critical Activity Mode configuration.</p> <p>9. Green – Normal operations.</p> <p>10. Blue – Risk assess and inform.</p> <p>11. An ASOG requires the following five elements:</p> <ul style="list-style-type: none"> i. CAM and TAM configuration ii. Yellow status rationalization iii. Suitable modes and features iv. Position reference systems v. Manage the vessel's worst-case failure capability 	ASOG / WSOG	MTS DP Ops Pt2 Appendix 1 Section 4.8				
		Watch circles	MTS DP Ops Pt2 Appendix 1 Section 4.8				
		Riser analysis	API RP16Q & Company Riser Analysis doc				
		What-breaks-first?	API RP 16Q & Company Riser Analysis doc				
		SIMOPS	MTS DP Ops Pt2 Appendix 1 Section 4.8				
		Worst Case Failure Design Intent	MTS DP DesignSection 4.13				
		Worst Case Failure	MTS DP Design Section 4.13				
		Post failure DP Capability (key ASOG element)	MTS DP Design Section 4.13				
		Capability plots	MTS DP Design Section 6,2				
		Footprints	MTS DP Ops Sec 1.2.12				
		ASOG Development Process	MTS DP Ops guidance document				
		Statement of Verification	If required / stipulated by Company				
		Process for ASOG implementation	Coaching and Mentoring as per Company standards				
		Title Block – Background & Why	Coaching and mentoring (Future TECHOP - in development)				
		Triggers for Yellow and Red	MTS DP Ops Pt2 Appendix 1 Section 4.8				
		Position References Sensors (key ASOG element)	TECHOP (D-09 - Rev1 - Jan21) PRS AND DPCS HANDLING OF PRS				
		Modes and features (key ASOG element)	MTS DP Design Section 17.7				
		Offset from wellhead	MTS DP Ops Pt2 Appendix 1 Section 4.7				
		Drive off to drift off conversion	DP Training Course / Company Requirement				
		DP Alert / Traffic Lights – Colours (For ASOG)	MTS DP Ops Appendix C				
		Fault tolerance	MTS DP Design Section 2				
		Station keeping integrity	MTS DP Design Section 4.3				
		Loss of position & position excursion	MTS DP Design Section 6.2				
		Industrial mission	MTS DP Design Section 6.0				
		Contingency plans and recovery measures	Coaching and mentoring (Future TECHOP - in development)				
		Positioning standby	MTS DP Ops Pt2 Appendix 1 Section 4.8				
		Proactive yellows	Coaching and mentoring (Future TECHOP - in development)				
		Legacy blues	Coaching and mentoring (Future TECHOP - in development)				
		ASOG refresh	Coaching and mentoring (Future TECHOP - in development)				
		Question Tracking Sheet (QTS)	Coaching and mentoring (Future TECHOP - in development)				
Vessel Overview Document	Coaching and mentoring (Future TECHOP - in development)						
Back to work (Return to work authorization / Reinstatement of failed / serviced equipment)	As required / stipulated by Company						
Escape routes	MTS DP Ops Pt2 Appendix 1 Section 4.8						
Manning	MTS DP Ops Pt2 Sec 4.14						
Cross Connections	TECHOP (D-01 - Rev1 - Jan21) ADDRESSING C ³ EI ² TO ELIMINATE SINGLE POINT FAILURES						
External Interfaces and influences	TECHOP						

Competence 1 - Deliverables and Decision Support Tools							
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
CAM	CAM - The configuration of the DP systems required to conduct operating in Critical Activity Mode. This is the configuration that provides the highest level of station keeping integrity.	CAM & CAMO (Legacy SMO)	TECHOP (O-03 - Rev1 - Jan21) DEFINING CRITICAL OPERATIONS REQUIRING SELECTION OF CRITICAL ACTIVITY MODE				
		CAM is default for any operation					
		Activities requiring CAM					
		Post failure capability and criteria to establish same. (Example Based on WCF)					
		Default open busties					
		Requirements for Closed Bus CAM in MODUs					
TAM	TAM – Task Appropriate Mode is a risk based DP system configuration that provides acceptable levels of station keeping integrity appropriate to the risk of a loss of position. TAM may offer other advantages such as higher post failure DP capability.	TAM	TECHOP (O-03 - Rev1 - Jan21) DEFINING CRITICAL OPERATIONS REQUIRING SELECTION OF CRITICAL ACTIVITY MODE				
		Post failure capability based on one generator and/or one thruster					
		Risk based mode – Consequences of LOP					
		Risk Assessment – HEMP used to justify TAM					
Criteria	Trigger points for change of DP system status including thrust and power levels, the existence of abnormality or following loss of redundancy or equipment in defined DP related subsystems	Weather	MTS DP Ops Pt2 Appendix 1 Section 4.8				
		Sea state & tidal current					
		Equipment failures					
		Anomalous behaviour					
		Power and thrust levels					
Configuration	The configuration of the DP system including marine auxiliary systems and power distribution. The setup of the DP control systems. The condition of PRS and vessel sensors and associated targets types etc.	Valves in marine auxiliary systems	MTS DP Ops Pt2 Appendix 1 Section 4.8				
		Circuit breakers & tie lines					
		Diodes and DC to DC convertors					
		Modes and features					
		DP control system settings					
TAGOS	Thruster and Generator Operating Strategy – For vessel with complex or highly configurable power distributions systems – recommended combination of thrusters and generators to achieve redundancy	Transferable thrusters and generators	MTS DP Ops Pt2 Appendix 1 Section 4.8				
		Thrust allocation					
		Thrust against power curves					
		Thruster types					
		Rudders in DP					

Competence 2 - Barrier Philosophy – Defense in Depth							
Themes	Description	Keywords	Reference	Competence Scale		Competence Scale	
				Self-Assessment	Self-Assessment	Theory / Principles	Actions
Barrier Philosophy	'Barriers' is the term used to describe the means by which the risk of loss of position or another defined hazard occurring is reduced. Barriers may be physical or procedural.	Principles of CAM and TAM and operating within post failure capability.	TECHOP (O-03 - Rev1 - Jan21) DEFINING CRITICAL OPERATIONS REQUIRING SELECTION OF CRITICAL ACTIVITY MODE				
		Hard and soft barriers	Coaching and mentoring (Future TECHOP - in development)				
		HEMP	Coaching and mentoring (Future TECHOP - in development)				
		Bow tie analysis	Coaching and mentoring (Future TECHOP - in development)				
		Swiss cheese model	Coaching and mentoring (Future TECHOP - in development)				
		Redundancy	MTS DP Design Section 2				
		Predictability	MTS DP Design Section 4				
		Seven pillars	MTS DP Design Section 4				
		Performance, Protection and Detection	MTS DP Design Section 4.16				
		Use of IJS and independent positioning display	DP Training course / As per Company requirements				
		Barriers to prevent IRM on DP equipment	As per Company requirements				
		Provisions for positioning standby	MTS DP Ops Pt2 Appendix 1 Section 4.8				
		Defense against errors in user configurable settings	TECHOP (D-09 - Rev1 - Jan21) PRS AND DPCS HANDLING OF PRS				
		Well control – Barriers used in drilling	Coaching and mentoring (Future TECHOP - in development)				
Simulator training	Coaching and mentoring (Future TECHOP - in development)						
Defense in Depth	Defense in depth is an aspect of barrier philosophy related to the process of assuring the suitability and integrity of the barriers deployed to mitigate the risks in any DP operation	Principles of defense in depth	Coaching and mentoring (Future TECHOP - in development)				
		Defense in Depth - Demonstrating barrier integrity is being maintained	Coaching and mentoring (Future TECHOP - in development)				

Competence 3 - DP Concepts							
Themes	Description	Keywords	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
Basis of Confidence	The basis of confidence is all the activities that are undertaken to ensure predictable outcomes leading to delivery of incident free DP operations	By Design – Seven Pillars	MTS DP Design Section 4				
		By Operations - Validation and verification efforts	MTS DP Design Section 25				
		Operating within post failure DP capability	MTS DP Design Section 6.5				
		Demonstrating attributes of performance, protection and detection	MTS DP Design Section 4.16				
		Positioning Standby	Coaching and mentoring (Future TECHOP - in development)				
		Effects of inspection repair and maintenance in determining post failure capability	MTS DP Design Section 25				
		Training of crew in vessel specific equipment	PROFESSIONAL DEVELOPMENT OF DP PERSONNEL TOOL				
		Industrial mission	MTS DP Ops guidance				
		Contingency plans – Point of initiation & no-return	MTS DP Ops guidance & Coaching and mentoring (Future TECHOP - in development)				
DP Redundancy	Redundancy is the ability of a system to remain in operation following a failure. DP redundancy is the ability of a DP system to maintain position and heading following the worst-case failure. Active redundancy uses the idle capacity is surviving equipment to continue positioning when the failure has occurred. Fault tolerance depends upon each redundant group having the required performance to maintain position on its own, the necessary protection system to reject erroneous data, make system fail safe and to isolate faults that might propagate between redundant groups causing more severe failure effects.	Fault tolerance	MTS Design Guidance & Seven pillars				
		Redundancy	MTS Design Guidance & Seven pillars				
		Reliability	MTS Design Guidance & Seven pillars				
		7 - Pillars - Resilience	MTS Design Guidance & Seven pillars				
		Predictability	MTS Design Guidance & Seven pillars				
		Fail Safe	MTS DP Design Section 3.3				
		Performance	MTS DP Design Section 3.16				
		Protection	MTS DP Design Section 3.16				
		Detection	MTS DP Design Section 3.16				
		Cross connections	TECHOP (D-01 - Rev1 - Jan21) ADDRESSING C ³ EI ² TO ELIMINATE SINGLE POINT FAILURES				
		External influences	TECHOP (D-01 - Rev1 - Jan21) ADDRESSING C ³ EI ² TO ELIMINATE SINGLE POINT FAILURES				
		External interface	TECHOP (D-01 - Rev1 - Jan21) ADDRESSING C ³ EI ² TO ELIMINATE SINGLE POINT FAILURES				
Seven Pillars	The seven pillars are desirable attributes in the design of a DP system – Together they contribute to predictable outcomes and deliver incident free DP operations. Predictability is:	Provided by:	Compromised by:				
		Autonomy	Centralized control systems				
		Segregation	Cross connections between main machinery				
		Independence	Cross connections between redundant groups				
		Differentiation	Common equipment types and measurement principles				
		Fault tolerance	Single point failures				
		Fault resistance	Poor choice of components				
		Fault ride through	Poor design				

Competence 3 - DP Concepts							
Themes	Description	Keywords	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
Post failure Capability	Post failure DP capability defines a vessel's ability to maintain position and heading following the worst-case failure. Post failure capability may be documented by a series of capability plots showing the maximum wind envelope for a range of sea currents. The worst-case failure may be heading dependent. The worst-case failure may change depending on the failure criteria.	Capability plot	MTS DP Design Section 6				
		Drift off, drive off, force off	Company Riser analysis document				
		Watch circles – Yellow and Red	MTS DP Ops Pt2 Appendix 1 Section 4.8				
Basic principles of Dynamic Positioning	Dynamic Positioning is a method for maintaining the position of a vessel with respect to a point on the sea bed by means of vectored thrust.	Six - degrees of freedom	Company DP SAFE course Module 2				
		Surge Sway & Yaw	MTS DP Ops Pt2 Appendix 1 Section 3.13				
		Position references	MTS DP Design Section 18				
		Vessel sensors	MTS DP Design Section 18				
		Power system	MTS DP Design Section 11, 13				
		Thrust allocation & barred zones	MTS DP Design Section 17.7				
		Thruster, azimuthing, tunnel, main propellers, rudders	MTS DP Design Section 9				
		Power available for thrust & Spinning Reserve	Coaching and mentoring (Future TECHOP - in development)				
		Mathematical model	MTS DP Design Section 17				
		Sideways speed tests	Coaching and mentoring (Future TECHOP - in development)				

Competence 4 – DP Guidance								
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence		
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions	
Company Standards	Company standards which specify the types of equipment, decision support tools and minimum performance levels required to conduct DP operations safely on board a dynamically positioning vessel. These may be based on Industry guidance and standards from bodies like IMCA / MTS / OCIMF.	Design engineering manual	As per Company / Client requirements for specified activities					
		General requirements						
		Philosophy						
		Applicable Industry guidelines						
		Big rules						
		Technical and Operations Management						
		Verification process						
		Newbuild vessels						
		Manning						
		FMEAs and Trials						
		Fires in Machinery Spaces						
		ESD, F&G						
		PRS						
		Tools Simulations, analysis, special modes and features						
		Modes and Busties configurations						
		Data logging and alarms						
		DP Status						
		Documentation						
		Operational guidelines						
		DP SIMOPS						
Pre-Field arrival checks								
Reporting								
Simulator Training								
PRS								
OCIMF DP Assurance Framework	The oil companies' international marine forum published a 'risk-based' dynamic positioning assurance framework. This framework sets out sound DP assurance practices and minimum requirements for DP subject matter experts	DP Assurance Category Identification (ACID)	Sec 3.5					
		Qualifications, experience and competency	Sec 2					
		Shore-based DP personnel	Sec 2.1					
		DP vessel-based personnel	Sec 2.2					
		Vessel handling skills	Sec 2.3					
		DP assurance framework aims	Sec 3.5					
		Loss of position and consequences	Sec 3.2					
		Risk-based approach	Sec 3.3					
		DP assurance management and records	Sec 3.4					
		Use of manual mode to manage external forces	Sec 4.2					
		Modes on a DP vessel	Sec 4.1					

Competence 4 – DP Guidance							
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
IMO MSC 645 (113 IMO)	This is the high-level document which defines IMO guidance for vessels and units with dynamic positioning systems.	DP Equipment Class	Section 2				
		Failure criteria	Section 2.2				
		Physical separation A60 & WT	Section 2.2.3				
		Active components	Section 2.2.2.1				
		Passive components	Section 2.2.2.2				
		Power system configuration (Busties)	Section 3.2				
		Fail safe condition of thrusters	Section 3.3				
		Consequence analysis	Section 3.4.3.4				
		Ergonomics	Section 3.4.1				
		Inadvertent acts (maloperation)	Section 2.3				
		Backup DP control system	Section 3.4.2.6				
		PRS operational requirements	Section 3.4.3.1				
		Number and diversity in PRS	Section 3.4.3.3				
		Vessel sensors	Section 3.4.4				
		Cable and pipe routes	Section 3.5				
		Non-DP related systems	Section 3.6				
Initial, annual & periodic surveys	Section 5.1						
FSVAD DPVAD	Section 5.2						
DNVGL RP E307	This is the DNV GL version of the MTS DP Vessel Operations guidance	Activity operational planning	DNV GL RP E307, 'DP Operations Guidance' – All Parts				
		ASOG, WSOG					
		Competence & manning					
		Capability plots and foot prints					
		Logistics vessels					
		Project and construction vessels					
		MODUs					
		DP Incidents					

Competence 4 – DP Guidance								
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence		
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions	
DNVGL RP E306	This is the DNV GL version of the MTS DP Design Philosophy guidelines	Time to terminate	DNV GL E306 'DP Vessel Design Philosophy Guidelines' – All Parts					
		Redundancy concept						
		Post WCF DP capability						
		Critical and non-critical redundancy						
		Low Loss Redundancy Concept (LLRC) also known as Low Impact Failure Effects (LIFE)						
		Defending the redundancy concept						
		Key elements of redundancy concept						
		Autonomy and decentralization						
		Diversity and differentiation						
		Modelling						
		Management of change						
		Propulsion						
		Marine auxiliary systems						
		Power generation & Power station concept						
		Power distribution						
		Power and vessel management						
		Blackout recovery						
		Networks and serial lines						
		Uninterruptable power supplies						
		DP control systems						
		Sensors						
		External Interfaces						
		Safety systems						
Ergonomics								
Alarm management								
Communications								
Inspection repair and maintenance								
Commissioning and testing								
FMEA specification								
PROFESSIONAL DEVELOPMENT OF DP PERSONNEL TOOL	Mapping Delivery Ability Tool – A self-assessment process developed for use by the DP community	Design, Operations, Process and People	DYNAMIC POSITIONING CONFERENCE October 15-16, 2013, 'Leveraging MTS PROFESSIONAL DEVELOPMENT OF DP PERSONNEL TOOL for the Development of Marine Risk Staff Professionals'					
		Enabling						
		Leveraging						
		Behaviours						
		Recognizing challenges		MTS 'Guidance for Professional Development of Personnel Engaged in DP Operations Using the Mapping Delivery Ability Tool (PROFESSIONAL DEVELOPMENT OF DP PERSONNEL TOOL)' – All parts				
		Critical success factors						
Roll out and implementation methodology								

Competence 4 – DP Guidance							
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
RP D102	DNVGL's Recommended Practice for FMEA of Redundant Systems – This is the minimum requirement for DP systems FMEAs referenced in the Company standards	FMEA of Systems with redundancy	DNV 'Recommended Practice for FMEA of Redundant systems', RP D102 – all Parts				
		Redundancy verification table					
		Redundancy design intent					
		Single failure propagation analysis					
		Unit and subsystem FMEA					
		FMEA table					
		Redundant systems with physical separation					
		Inspection and tests					
		FMEA report and compliance statement					
		Failure modes in systems with closed busties					
IMCA M166	Guidance on FMEAs	FMEA methodology	IMCA M166 'Guidance on FMEAs'				
IMCA M117	Training and experience of key DP Personnel	Competence	IMCA M117 Training and Experience of key DP Personnel				
IMCA M190	Guidance for developing and conducting annual DP trials programs for DP vessels	Development of Annual DP trials programs	IMCA M190 'Guidance for developing and conducting annual DP trials programs for DP vessels' – All Parts.				
		Difference between annual and proving trials					
		Competence of persons developing the trials programs					
		Lifetime management of trials					
		Conduct of trials					
		Independent witness					
		Findings					
IMCA M191 (Now incorporated into M190)	Guidelines for annual DP trials for DP mobile offshore drilling units	Continuous trials for MODUs	IMCA M191 – 'Guidelines for annual DP trials for DP mobile offshore drilling units' – all Parts (Now incorporated into M190)				
		Objectives					
		Annual verification					
IMCA M220	Guidance on operational activity planning	CAMO	IMCA M220 – 'Guidance on Operational Activity Planning' – All Parts				
		TAM					
		ASOG					
		Operational activity planning					
IMCA M225	Example redundancy concept and annual DP trials for a DP class 3 construction vessel	Linking redundancy concept to trials	IMCA M225 'Example Redundancy Concept and Annual DP Trials for a DP Class 3 Construction vessel' – All Parts				
		Performance					
		Protection					
		Detection					
		Use of planned maintenance					
IMCA M182	International guidelines for the safe operation of dynamically positioned offshore supply vessels	Crew competence	IMCA M182 - International guidelines for the safe operation of dynamically positioned offshore supply vessels – All Parts				
		Supply vessel manning					
		Rolling trials for PSVs					

Competence 4 – DP Guidance							
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
Incident Investigation	TECHOP (G-04 - Rev1 - Jan21) CONDUCTING EFFECTIVE AND COMPREHENSIVE DP INCIDENT INVESTIGATIONS	Fish Bone Structure	TECHOP (G-04 - Rev1 - Jan21) CONDUCTING EFFECTIVE AND COMPREHENSIVE DP INCIDENT INVESTIGATIONS				
		Short, Medium & Long Term Actions					
		Causal and contributory factors					
		Data gathering					
		Learning from Incidents (LFIs)					
TECHOPs	TECHOP (D-01 - Rev1 - Jan21) ADDRESSING C ³ EI ² TO ELIMINATE SINGLE POINT FAILURES	Cross connections in control power supplies	TECHOP (D-01 - Rev1 - Jan21) ADDRESSING C ³ EI ² TO ELIMINATE SINGLE POINT FAILURES – All Parts				
		Failure modes of diodes					
		TECHOP (G-04 - Rev1 - Jan21) CONDUCTING EFFECTIVE AND COMPREHENSIVE DP INCIDENT INVESTIGATIONS					
		Grounding strategies					
		Cross connections created by ground faults					
		Dual supplies – Mitigating failure effects					
		Auto-changeovers					
	TECHOP (D-07 - Rev1 - Jan21) PROVING FAULT RIDE-THROUGH CAPABILITY OF DP VESSELS WITH HV POWER PLANT	Case for action	TECHOP (D-07 - Rev1 - Jan21) PROVING FAULT RIDE-THROUGH CAPABILITY OF DP VESSELS WITH HV POWER PLANT – All Parts				
		Requirements					
		Attributes to be verified					
		Expertise					
		Practical considerations					
		Model validation					
		Alternative forms of testing					
	TECHOP (O-02 - Rev1 - Jan21) ANNUAL DP TRIALS AND GAP ANALYSIS	Review of DP systems FMEA	TECHOP (O-02 - Rev1 - Jan21) ANNUAL DP TRIALS AND GAP ANALYSIS - All Parts				
		Proving the integrity of the redundancy concept					
		Fail safe condition of thrusters					
		Control mode tests					
		Performance tests					
		Testing protective functions					
		Testing switched or standby redundancy					
		Testing physical separation					
		Testing control modes					
		Group redundancy tests					
		Findings					
		Annual DP Trials Gap Analysis					
		TECHOP (D-03 - Rev1 - Jan21) BLACKOUT RECOVERY		Design objectives	TECHOP (D-03 - Rev1 - Jan21) BLACKOUT RECOVERY - All Parts		
Desirable and undesirable features							
Testing blackout recovery							

Competence 4 – DP Guidance							
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
		Specification for blackout recovery systems					
TECHOPs	TECHOP (G-03 - Rev1 - Jan21) CONTINUOUS TRIALS FOR DP MODUS	Maintaining MODU redundancy concept by continuous trials	TECHOP (G-03 - Rev1 - Jan21) CONTINUOUS TRIALS FOR DP MODUS				
		Developing continuous trials					
		Performance, Protection & Detection					
		Crew training opportunity					
		Planned maintenance					
		Tests of opportunity					
		Charterers batch trials					
	TECHOP (D-01 - Rev1 - Jan21) ADDRESSING C ³ EI ² TO ELIMINATE SINGLE POINT FAILURES	Cross connections for reliability and maintenance	TECHOP (D-01 - Rev1 - Jan21) ADDRESSING C ³ EI ² TO ELIMINATE SINGLE POINT FAILURES - All Parts.				
		Fault propagation paths					
		Closed busties					
		Auto-changeovers					
		Dual AC supplies					
		Load sharing lines					
		Switchboard control power and synchronizing lines					
		Marine auxiliary services					
		Networks					
		Influence of CAM in TAM					
	Identifying cross connections						
	TECHOP (O-03 - Rev1 - Jan21) DEFINING CRITICAL OPERATIONS REQUIRING SELECTION OF CRITICAL ACTIVITY MODE	Concepts of CAM & TAM	TECHOP (O-03 - Rev1 - Jan21) DEFINING CRITICAL OPERATIONS REQUIRING SELECTION OF CRITICAL ACTIVITY MODE - All parts				
		Drivers for operating in TAM					
		Default is CAM					
		Examples of critical and non-critical activities					
	TECHOP (D-06 - Rev1 - Jan21) DGNSS POSITION REFERENCE SENSORS	Impacts of design, operations and people	TECHOP (D-06 - Rev1 - Jan21) DGNSS POSITION REFERENCE SENSORS - All Parts.				
		Antenna location					
		Weatherization					
		Lightening protection					
		Interfacing					
		Principles					
Corrections							
Inertial navigation systems							
Over reliance on DGNSS							

Competence 4 – DP Guidance							
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
TECHOPs	TECHOP (O-01 - Rev1 - Jan21) DP OPERATIONS MANUAL	Expected content for DP operations manuals	TECHOP (O-01 - Rev1 - Jan21) DP OPERATIONS MANUAL - All Parts				
		The importance of the redundancy concept					
		The configurations that are required to support the redundancy concept					
		The role of defined individuals in maintaining / defending the redundancy concept					
		A clear understanding of post failure capability					
		Content and use of ASOG / WSOG					
	TECHOP (D-04 - Rev1 - Jan21) EVALUATION OF PROTECTION SYSTEMS	Classification of protective functions - what purpose do they serve	TECHOP (D-04 - Rev1 - Jan21) EVALUATION OF PROTECTION SYSTEMS - All Parts				
		Good practice in the design of control, monitoring and protective functions.					
		The disadvantage of combining protection and control					
	External Interfaces – ESD F&G safety shutdown systems, VMS interface such as draught sensors etc. and other IM interfaces	DP Incidents caused by external interfaces	Covered in main MTS design philosophy document				
		Identifying, analysing and improving external interfaces					
		F&G and ESD systems					
		External force compensation					
		Draught sensors					
		Power control for industrial consumers					
		Power distribution for industrial and hotel loads					
		Firefighting systems					
		Communication and navigation equipment					
		Roll stabilization					
	TECHOP (D-05 - Rev1 - Jan21) FMEA GAP ANALYSIS	Why perform a DP FMEA gap analysis?	TECHOP (D-05 - Rev1 - Jan21) FMEA GAP ANALYSIS - All Parts				
		Purpose of gap analysis					
		Meaning of colour codes					
		First stage gap analysis					
		Second stage gap analysis					
TECHOP (D-02 - Rev1 - Jan21) FMEA TESTING	The need for testing	TECHOP (D-02 - Rev1 - Jan21) FMEA TESTING - All Parts					
	What, when, where and why to test						
	How to test						
	Acceptance criteria and scope						
	Unacceptable test results						
	Gap Analysis of DP FMEA proving trials						

Competence 4 – DP Guidance							
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
TECHOPs	Technical and Operational Guidance (TECHOP)	TECHOP ODP	Technical and Operational Guidance (TECHOP) – All Parts				
		TECHOP Gen					
	TECHOP_ODP_00_(O)_(High Level Philosophy)	Identifying DP as a Safety Critical Element	TECHOP_ODP_00_(O)_(High Level Philosophy)				
		Additional information to be incorporated in Operations Manual					
		Establishing a Vessel Specific Drive off to Drift off strategy					
		Reinstatement of equipment post failure					
		Drive off to drift of strategy					
	TECHOP (G-02 - Rev1 - Jan21) POWER PLANT COMMON CAUSE FAILURES	Common cause failures	TECHOP (G-02 - Rev1 - Jan21) POWER PLANT COMMON CAUSE FAILURES – All Parts				
		Common control power supplies					
		Common backup supplies					
		Lack of excitation support					
		Severe voltage dips					
		Selectivity					
		Default to factory settings					
		Effects of regeneration					
		Load acceptance and rejection					
		Poor power factors					
		Environmental conditions					
		Contamination of fuel and combustion air					
		Fouling of cooling water systems					
		Common software errors					
		Common sensor principles					
		Inappropriate combinations of sensor principles					
		Harmonic distortion and inrush transients					
		Fuel and excitation control failures					
		Broken conductors and single phasing					
		HIL Testing TECHOP		The need for software testing	In development		
	Hardware in the loop testing (HIL)						
Software in the loop testing (SIL)							
Endurance testing							
Independent and dependent HIL							

Competence 4 – DP Guidance							
Themes	Description	Key Themes / Subject Matter	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
TECHOPs	TECHOP (D-09 - Rev1 - Jan21) PRS AND DPCS HANDLING OF PRS	Golden rules for all PRS	TECHOP (D-09 - Rev1 - Jan21) PRS AND DPCS HANDLING OF PRS - All Parts				
		Functional objectives of PRS and DPCS handling of PRS					
		Choices of PRS and Modes to suit industrial mission					

Competence 5 – Verification & Validation							
Themes	Description	Keywords	Reference	Competence Assessment		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
Classification society rules	Classification society rules represent the minimum standard to which DP vessels should be constructed. Vessel owners may specify a higher standard based on industry guidance.	International Association of Classification Societies	Coaching and mentoring (Future TECHOP - in development)				
		Classification societies and recognized organizations	Coaching and mentoring (Future TECHOP - in development)				
		Class notations	Coaching and mentoring (Future TECHOP - in development)				
		Type approval	Coaching and mentoring (Future TECHOP - in development)				
		Inspection and sea trials	Coaching and mentoring (Future TECHOP - in development)				
		Plan approval	Coaching and mentoring (Future TECHOP - in development)				
Annual DP Trials	Annual survey of all-important equipment associated with the DP system is performed within a three-month window either side of the anniversary date of the DP FMEA proving trials. The trials report should demonstrate that the DP system is in good order and it responds correctly to single failures.	Proving the system operates as intended	113 IMO				
		Proving the DP system is intact and well maintained	113 IMO				
		The effects of single failures	113 IMO				
		Rolling and continuous trials	IMCA M190 & M191 (Now incorporated into M190)				
		Role of Independent witness	IMCA 190				
		Findings - Categories	IMCA 190				
		Use of planned maintenance	IMCA M225				
FMEA Proving Trials	The DP FMEA proving trials are intended to confirm the findings of the DP system FMEA and are one of the document submissions which, together with the FMEA, contributes to the approval process for the appropriate DP notation.	Proving the conclusions of the DP system FMEA	DNV RP D102				
		Proving system complies with rules and guidelines	113 IMO				
		New knowledge and lessons learned	TECHOP (D-02 - Rev1 - Jan21) FMEA TESTING				
		Opportunity for improvements	TECHOP (D-02 - Rev1 - Jan21) FMEA TESTING				
		Exploratory testing	TECHOP (D-02 - Rev1 - Jan21) FMEA TESTING				
		Categories for concerns or findings	TECHOP (D-02 - Rev1 - Jan21) FMEA TESTING DNVGL RP E306				
Post event trials	These trials or related activities are performed in order to establish the basis of confidence that the DP vessel has the expected station keeping integrity following an incident	Back to work criteria	As per Company / Client requirements				
		Reinstatement of equipment					
		Stress test					
		Soak tests					
		Vendor support					
Project specific simulator requirements	Training carried out to allow crews to practice unusual operations. Particularly useful with SIMOPs when crews of several vessels may practice together	Simulator Training	As per Company / Client requirements				
Effective onboard engagements	A primary function of DP SMEs to ensure communication of requirements	Engagements	Coaching and mentoring (Future TECHOP - in development)				

Competence 6 – In Execution Support							
Themes	Description	Keywords	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
Marine Operations	Provide in-execution support when requested. Engage with other subject matter experts, vessel crew, project teams and owner's organization in order to resolve issues and progress the execution of marine operations and the industrial mission.	Response to yellows and reds	As per Company / Client requirements				
		Specifying analytical / engineering work relevant to impacts on station keeping	Coaching and mentoring (Future TECHOP - in development)				
		Return to work authorization	As per Company / Client requirements				
		Responding to and resolving dilemmas	Coaching and mentoring (Future TECHOP - in development)				
		Follow the sun support	Coaching and mentoring (Future TECHOP - in development) – In service support				
Incident investigations	Perform incident investigations.	TECHOP (G-04 - Rev1 - Jan21) CONDUCTING EFFECTIVE AND COMPREHENSIVE DP INCIDENT INVESTIGATIONS	TECHOP (G-04 - Rev1 - Jan21) CONDUCTING EFFECTIVE AND COMPREHENSIVE DP INCIDENT INVESTIGATIONS – All Parts				
		Organize specific vendor support, analysis and testing					
		Creating LFIs					

Competence 7 – Impacts of Industrial Mission on Station Keeping							
Themes	Description	Keywords	Reference	Competence level		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
Modes and features	DP control system require certain special modes and features to perform some type of industrial mission.	Relative and absolute PRS	MTS DP Design Section 17.7				
		Heavy lift mode					
		External force compensation					
		Suspended loads					
		Three axis and two axis control					
		Pipelay mode					
		Follow target					
		Weather vane					
		Fire monitor compensation					
		Draught sensors					
Environmental forces at work location	The nature of the work to be carried out may require working in a less favourable location with respect to weather and the risk of contact with surface assets and other vessels in the case of blackout or insufficient thrust. Extreme environmental weather phenomena may also require consideration.	Drift off, Drift on scenarios	MTS DP Design Section 17.4, MTS DP Design Section 4				
		Solitons					
		Tropical storms					
		Lightning strikes					
Heavy lifting operations	Heavy lifting operations include the transfer of topsides to jackets. The lifting of modules on to production platforms. Takes account of the effects of the load transfer on the mass of the vessel and the additional lateral force, normally by reducing gain and relaxing the DP controller.	Side forces – Destabilization of DP	DP Design Pt 2 Section 4.25, 17.7, 2.4 MTS DYNAMIC POSITIONING CONFERENCE – Nils Albert Jensen October 7 - 8, 2008 Operations 'On the Use of Safety Moorings in DP Operations' Coaching and mentoring (Future TECHOP - in development)				
		Suspended loads					
		Deselecting DP at touch down					
		Wind profile and model					
Riser pull-in or handover	This is typical of operations in which a DP vessel will transfer a load to another DP vessel or surface assets.	External Forces	As per Company / Client requirements Coaching and mentoring (Future TECHOP - in development)				
Subsea obstructions		Working / diving within anchor patterns	Coaching and mentoring (Future TECHOP - in development)				
External force compensation	Where the measured external force acting on the vessel, which is separate from the environment, is included in the DP calculation and treated as a force feed forward. This mode is used to account for pipe tensions in a pipe layer and hawser tension in a shuttle tanker.	Design of inputs to DP - Manual input	MTS DP Design Sec 14.20, TECHOP (D-01 - Rev1 - Jan21) ADDRESSING C ³ EI ² TO ELIMINATE SINGLE POINT FAILURES				
		Need for systems engineering approach in design of interface. Fault tolerance in interface and redundancy					

Competence 7 – Impacts of Industrial Mission on Station Keeping							
Themes	Description	Keywords	Reference	Competence level		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
Hold back vessels	The practice of using a tug or other DP vessel as a safety mooring to reduce the risk of a loss of position. This practice is potentially hazardous and may have unintended consequences.	Interaction leading to instability	MTS DP Conference, 2008. 'On the use of Safety Moorings in DP Operations'				
SIMOPS	Operations involving several vessels.	SIMOPS tools	As per Company / Client requirements MTS DP Conference 2005 Operations II Case Study of DP Vessels Performing SIMOPS Xiaobing Shi Diego Martinez Doug Phillips				
PRS Hazards	interference, shadowing, loss of line of sight and other hazards associated with the industrial mission. For example, the view of the sky from DGNSS antennas may be obscured by decks of surface assets or by project equipment.	View of the sky	TECHOP (D-09 - Rev1 - Jan21) PRS AND DPCS HANDLING OF PRS				
		Thermoclines					
		Noise in the water column					
		Swinging loads through line of sight					
		Ex rated equipment					
Relative PRS and target vessel motions	Absolute PRS provide a position references with respect to a fixed point on the earth surface. Relative PRS provide a reference from a non-earth refenced object which may be moving object (typically range and bearing). If the object to which the reference moves too much it may not be possible to use that reference in Auto Position.	Follow target modes	TECHOP (D-09 - Rev1 - Jan21) PRS AND DPCS HANDLING OF PRS				
		Analysis of target vessel motions					
		Redundant relative PRS Competence 9					
Gangways	Gangways re used to allow transfer of personnel and equipment from one DP vessel to a surface asset such as a production platform or FPSO.	Walk to work	Coaching and mentoring (Future TECHOP - in development), As per Company / Client requirements				
		Instrumented gangways as PRS					
		Active – Heave compensated - gangways					
		Risk of loss of position to gangway vessel and to surface asset					

Competence 8 – Impacts of Station Keeping on Industrial Mission							
Themes	Description	Keywords	Reference	Competence Scale		Evidence	
				Self-Assessment	From Competence Assessment	Theory / Principles	Actions
Consequences of loss of position	Before commissioning a DP vessel to carry out a particular industrial mission it is necessary to evaluate the consequences. If the consequences of loss of position are unacceptably high. It may be necessary to create additional barriers or find an alternative way of performing the work.	Barriers required	TECHOP (O-03 - Rev1 - Jan21) DEFINING CRITICAL OPERATIONS REQUIRING SELECTION OF CRITICAL ACTIVITY MODE				
		CAM & TAM					
Range and water depth restriction	Position reference systems have range restrictions including distance to target and water depth restrictions.	Limitations	TECHOP (D-09 - Rev1 - Jan21) PRS AND DPCS HANDLING OF PRS				
Diving	Single stern thruster design not to be used for diving.	Poor transient response following WCF	As per Company / Client requirements				
Decision points	When certain go-no-go points are reached.	Time to terminate	As per Company / Client requirements				
		Time for which positioning standby can be applied / is effective	As per Company / Client requirements				
Modes and Features	Requirements & need for 'Systems Engineering Approach'.	PRS	As per Company / Client requirements				
		Industrial Mission	TECHOP (D-09 - Rev1 - Jan21) PRS AND DPCS HANDLING OF PRS				
DP Capability	DP vessels have a static and a dynamic positioning capability. Both may need to be considered for some types of industrial mission. DP vessel can be equipped with different types and combinations of propulsion including tunnel thrusters, azimuthing thrusters, main propellers and rudders. Not all arrangements are suitable for all types of industrial mission.	Stat cap	MTS DP Design Section 6				
		Dyn cap					
		Foot prints and position excursion					
		Thruster wash					
		Barred Zones					
		Thruster arrangements					

Competence 9 – Defining Identifying & Managing Interfaces Relevant to Station Keeping						
Themes	Description	Keywords	Self-Assessment	From Competence Assessment	Evidence	
					Theory / Principles	Actions
DP SME role	DP SME role in managing business risks	Business / project objectives Stakeholder management Interface management	Coaching and mentoring (Future TECHOP - in development)			
Balancing risks	Determining when to allow operations to continue in Yellow status. Deciding which side of bow-tie to address risk.	Enterprise risk Process safety risk Bow ties	Coaching and mentoring (Future TECHOP - in development)			
Developing and creating barriers and compensating measures	Barriers and compensating measures initiated when operations continue in yellow status	Barrier philosophy	Coaching and mentoring (Future TECHOP - in development)			
Strategies – Business risk V DP station keeping risk	Strategies and approaches to manage overarching business / venture risks in conjunction with managing station keeping risk	Business / venture risk Commercial risks Reputation risk	Coaching and mentoring (Future TECHOP - in development)			
Interface management	There are many stakeholders who may be impacted or who may have an impact over DP operations. The DP SME may be required to establish dialog with these stakeholders.	Stakeholders	Coaching and mentoring (Future TECHOP - in development)			