The following case studies and observations have been compiled from information received by IMCA. All vessel, client, and operational data has been removed from the narrative to ensure anonymity. Case studies are not intended as guidance on the safe conduct of operations, but rather to assist vessel managers, DP operators and DP technical crew in appropriately determining how to safely conduct their own operations. Any queries should be directed to IMCA at dpreports@imca-int.com. Members and non-members alike are welcome to contact IMCA if they have experienced DP events which can be shared anonymously with the DP industry.

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1 Know your vessel capabilities and when to stop!

1.1 Overview

With all engines and thrusters engaged, a DP equipment class 2 pipe supply vessel (PSV) was operating in open bus configuration. The vessel was engaged in cargo operations with a larger DP pipelay vessel (PLV) during adverse weather conditions.

1.2 What happened?

The supply vessel had been engaged in cargo transfer operations for 25 minutes prior to the DP incident occurring. The weather at the time of the cargo operations was described as adverse with wind gusts of approximately 40knots and a swell of 2m.

Upon arrival alongside the pipelay vessel, on the leeside, the Master of the supply vessel confirmed that they were in position but also made comment that the thrust wash from the pipelay vessel was strong and requested the bridge of the pipelay vessel to reduce the wash in some way. The pipelay Bridge acknowledged the request and cargo operations commenced.

10 minutes later, the supply vessel's Master informed the pipelay Bridge that they were using too much thrust to stay in position and were up to 70% power capacity with the thrusters at 77% capacity. The pipelay Bridge acknowledged and said they would try to reduce thruster wash.

A further 15 minutes later, the supply vessel suffered a loss of one thruster, and due to the vessel operating outside of the DP equipment class 2 station keeping capabilities, was forced off position by the high thrust wash of the pipelay vessel.

The Master of the supply vessel immediately informed the pipelay vessel Bridge however there was not enough time to disconnect the load on the hook and a container was dragged from the deck of the supply vessel and into the water, as the supply vessel was forced off position. Fortunately, there was no damage to equipment, and no-one was harmed.

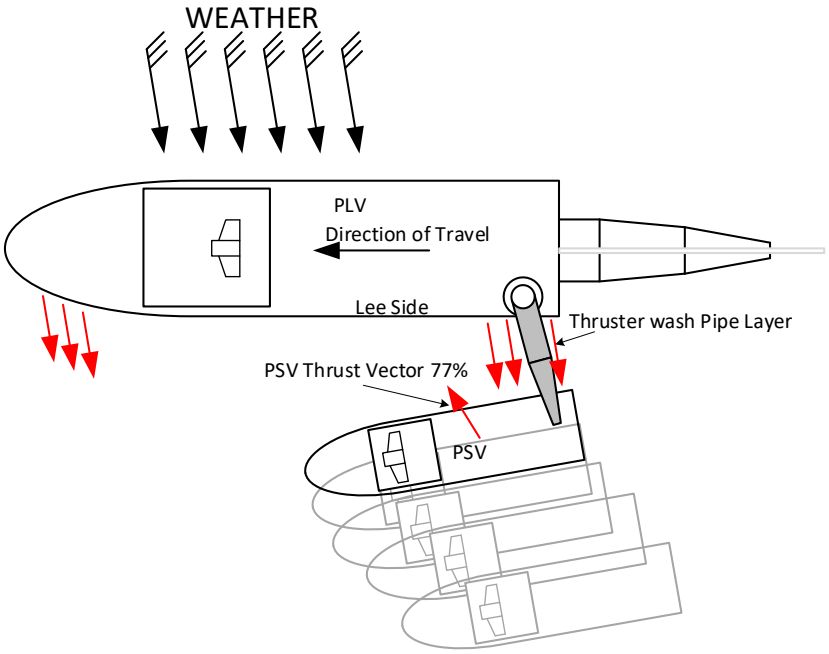

Figure 1 – Force off

1.3 Findings

Following investigation, the following was found:

- Sudden gusts of wind of around 40 knots created an increased wind load on the pipe layer, causing an increased thruster wash towards the PSV which caused the PSV to lose position.
- The failure of the PSV's azimuth thruster contributed to the loss of position.
- The operational limits of PSVs operating alongside other vessels were not considered in the Activity Specific Operating Guidelines (ASOG).
- No-one stopped the job: the operation was not stopped despite alarms indicating the PSV was outside defined operational limits.

1.4 Conclusion

The PSV was clearly operating outside of the vessel's environmental capabilities and there was no ASOG written for ship to ship cargo operations. The ASOG set out the operational, environmental and equipment performance limits necessary for safe Dynamic Positioning (DP) operations while carrying out a specific activity. Reference IMCA M220 *Guidance on operational planning.*

ASOG are used to:

- Ensure the safe and efficient operation of DP vessels.
- Provide a quick reference for DPOs during operations.
- Document the operating parameters for DP vessels.
- Communicate the DP requirements to all stakeholders.

The content of an ASOG will vary depending on the specific activity being carried out, but it will typically include the following information:

- The equipment performance limits that must be met.
- The operational procedures that must be followed.
- The contingency plans that must be in place.

With clear operating procedures in place the Master or DPOs have the confidence to stand up and say “No, stop the job” when their vessel reaches the operating limits.

2 Duty/not duty, which is the question?

2.1 Overview

This DP event occurred on an FPSO. The FPSO is fitted with one bow tunnel thruster and two stern azimuth thrusters; however, at the time of the event the starboard aft thruster was out of operation due to an ongoing upgrade project and the forward thruster had been stopped and isolated due to diving operations occurring at the time.

Diving was being undertaken from a light diving craft (LDC). The FPSO was lying with the wind to its side in order to shelter the LDC during the diving operations. The FPSO turret was locked in line with the diving isolation matrix.

2.2 What happened?

The engineer on duty was completing planned maintenance and had a routine job to grease the port azimuth thruster steering gear pump, 2.

The engineer went down to the local controls of the port azimuth thruster, the steering pump that was due to be greased was running and set up as the duty pump, so the engineer switched the control over to place pump 1 as lead steering pump. As he switched the duty pump over pump 2 stopped and pump 1 started, as per the logic; however, the pressure dropped after stopping the running steering pump and the low-pressure alarm did not clear within the time limit set in the logic. The system shut down running pump 1 as a protective measure, leaving the port azimuth thruster with no steering. Pump 2 did not auto-start.

With no steering control of the port azimuth thruster, and no other thrusters operational, the heading of the FPU could not be maintained.

The Central Control Room (CCR) directly notified the LDC diving supervisor that they had lost power on one thruster and the diving operations were aborted. The divers were able to safely return to the surface without incident, whilst the LDC coxswain monitored the FPSO heading.

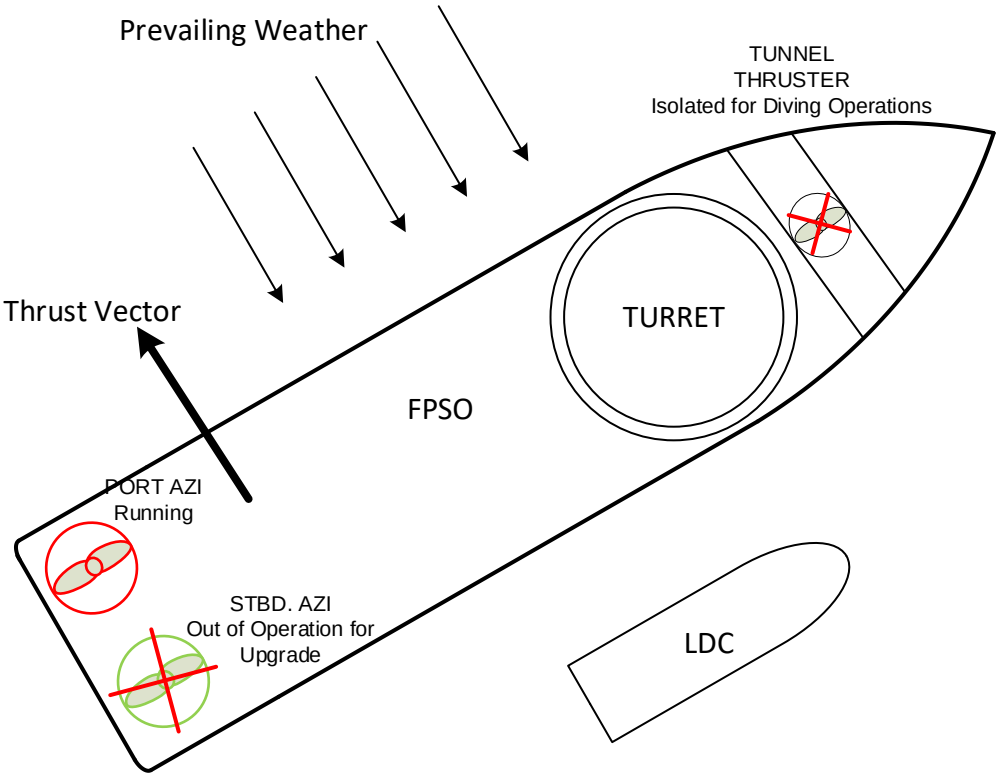

Figure 2 – Setup prior to loss

2.3 Findings

Investigation of the event concluded that:

- The quick response of the CCR to notify the LDC meant for a swift recovery of the divers to the craft with no incident; however, at the time of the event the CCR were not actually aware of whether the divers were in the water or onboard the LDC.
- The CCR did not relay the entire severity of the incident. No alarm was raised onboard the vessel.
- Due to the routine nature of the planned maintenance, insufficient risk assessment had been conducted. There was no consideration for if a failure were to occur and how this would affect the heading control.
- A thorough risk assessment of the diving operations had not been considered, including emergency preparedness.

2.4 Conclusion

This case shows the importance of clear communication between all departments when diving or any SIMOPS (Simultaneous Operations) are taking place.

Prior to diving operations, a thorough risk assessment and clear toolbox talk should be undertaken with all parties and all shifts involved. Maintenance on critical equipment must be risk assessed to ensure whether safe to proceed. If in doubt, wait!

No redundancy was in place on the FPSO during critical operations.

3 You've got the ASOG, so now you've got to follow it

3.1 Overview

This case study examines an DP incident that occurred on an equipment class 2 MODU, during well intervention operations. The unit was operating in open bus configuration with all four thrusters operational and four of the six generators connected, two on either side of the bus.

3.2 What happened?

There had been reports of noise and heavy vibrations coming from a sea water cooling pump, allocated to Thruster No.1, therefore the engineers requested the DPOs to deselect and stop Thruster No.1 from the DP system, so investigations could be carried out. The DPOs agreed to the request, reducing the available thruster capacity on the portside to 50%.

Approximately half an hour later, a blackout on the starboard power system resulted in the loss of Thruster Nos. 2 and 3.

The DPOs took immediate action and changed over to Manual control, facilitating disconnection of equipment by the crews between the MODU and the platform. The DPOs were able to maintain MODU position on the one remaining thruster, thruster 4, from the port redundancy group. Starboard side power was restored and Thrusters 2 and 3, were running and accepted back into the DP control system within 7 minutes.

The crew were instructed to continue the disconnection and once all end-user equipment was safely removed, the MODU commenced its passage out of the 500m zone. The starboard redundancy group experienced a second blackout whilst transiting out of the safety zone and the MODU was again left with only one thruster to complete the move beyond the 500m zone.

The crew were able to safely transit the MODU to a nearby anchorage where they then undertook further diagnostics and remediation of the failures.

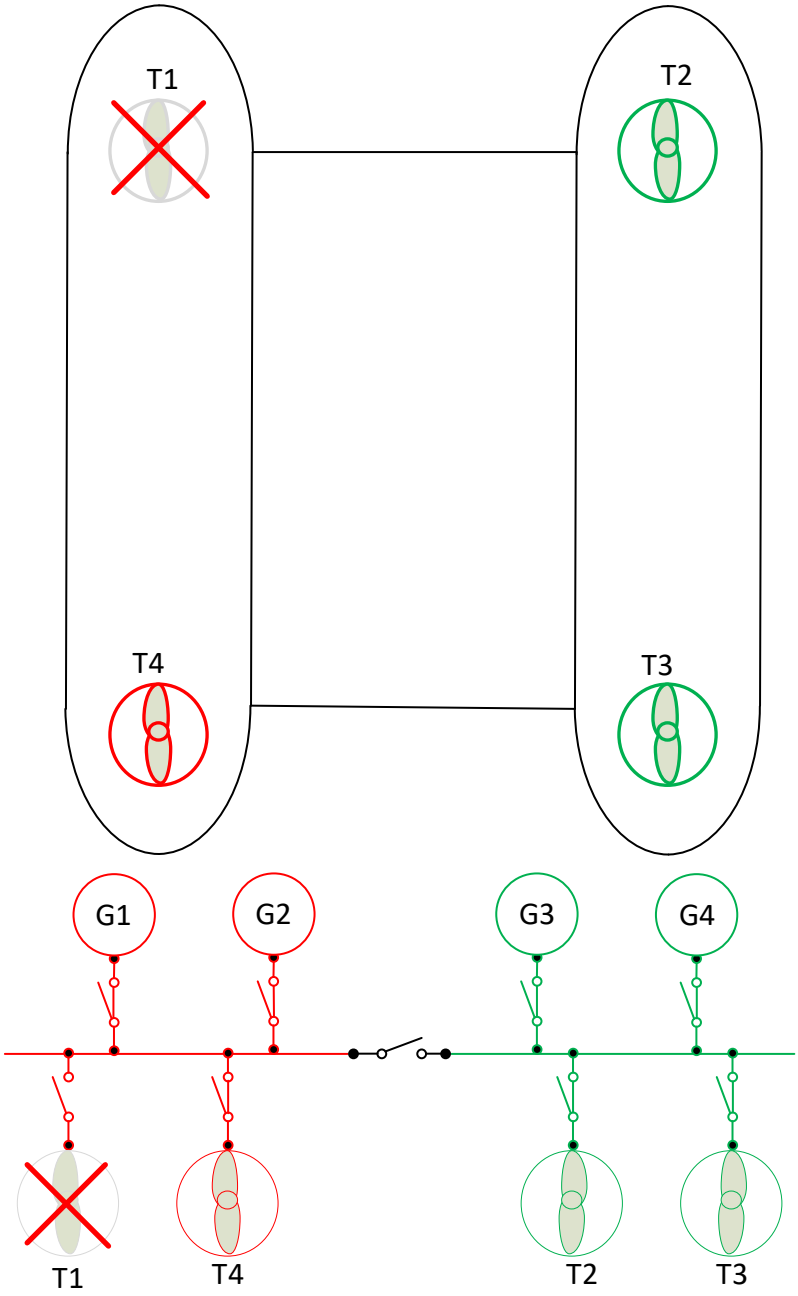

Figure 3 – Simplified power & thruster allocation

3.3 Findings

Investigation of the event concluded that:

- The failure of Thruster 1 sea water cooling pump was due to shaft bearing damage.
- Blackout of the starboard power system was due to the malfunction of a running diesel generator control module; this produced an incorrect signal to the AVR and consequently affected both connected diesel generators.
- ASOG had not been adhered to during operation inside 500m zone. Any loss/failures of any DP related equipment should trigger yellow status and all parties should be informed.

- There was poor communication between Bridge, engine room and third-party contractors
- Any activity related to the operation needs to be approved by the Bridge and cascaded to all personnel onboard.
- Regular checking on engine room needs to be complied at all times. Any unusual or suspicious conditions of machineries or equipment should be informed immediately.

3.4 Conclusion

This may at first glance, seem like a DP undesired event caused by a power failure.

The removal of Thruster 1 from the DP system as a result of the mechanical failure of the seawater pump is the initiating event in this instance.

The loss of two more thrusters as a result of power failure was the main cause; however, human factor was the secondary (Triggering) cause that ultimately resulted in the outcome.

When the DPOs shut down Thruster No.1 this caused the vessel to lose required redundancy. The vessel continued to operate alongside the asset, without relaying the reduced status to all parties and was actually operating outside of its post worst case failure DP capability. It was no longer single fault tolerant and therefore not DP Class 2 compliant.

The Master should have ceased operations and exited the 500m zone, in accordance with the approved ASOG.

4 Prepare for 2025 Solar Activity

4.1 Overview

This case study covers events that occurred on the same vessel, 8 months apart. The DP equipment class 2 vessel is fitted with six position references systems, 3 DGNSS, 2 HPR and 1 laser based. At the time of the DP Incident the vessel was employed in subsea operations with two ROVs and a deck crane and operating with only two DGNSS position references systems selected into the DP control.

4.2 What happened?

Late one evening the DPO noted instability of the DGNSS differential signal and shortly after DGNSS 1 and 2 both dropped out of DP control. When the systems were accepted back into DP control the vessel had made a 30m uncontrolled movement.

This was not however an isolated event and over the next four-month period whilst the vessel was engaged on that specific project the DPOs regularly experienced unstable DGNSS differential signals between the hours of 18:30hrs and 22:45hrs. On occasions the vessel was left in a dead reckoning mode for several minutes, therefore after consideration and a risk assessment being undertaken the vessel had to suspend all critical operations during these hours.

Both DGNSS receivers were of the same type and model. The OEM was contacted, and the support team clarified that the issues they were experiencing were caused by excessive ionospheric disturbances in the area – scintillation.

Initial recommendation to switch one DGNSS receiver to another correction service provided a short-lived response until ionospheric activities increased further and then both satellite correction services were both affected again.

The next step was for the vessel to upgrade the receivers to the most up to date model, which has been designed to track not only GPS and GLONASS, but also Galileo and BeiDou constellations, and is also capable of receiving signals on L2, L3 and L5 frequencies, thus the impact of ionospheric jamming could be reduced.

Four months after the receiver upgrades the vessel witnessed two simultaneous GNSS losses, due to satellite dropout. On this occasion the vessel-maintained position on the remaining position reference system GNSS 3, which was a different manufacturer. The vessel sought advice from the OEM and subsea operations were suspended until stable GNSS positions could be maintained.

4.3 Findings

Following the most recent DP incident, the OEM of GNSS 1 & 2 were contacted and solar interference was again confirmed as the problem for the dropouts and that many other vessels operating in the same area were also experiencing technical problems.

Having already upgraded the hardware of the two receivers the OEM support advised the update of firmware and Quantum software in both GNSS receivers. Following the updates, final checks and tuning were completed along with DP checklists and the vessel was able to resume the subsea operations.

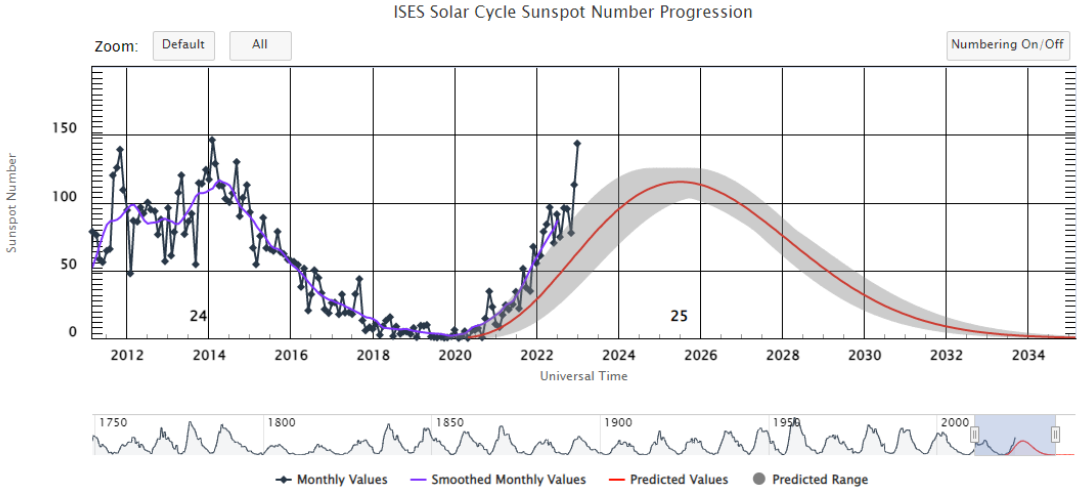

Figure 4 – Predicted Sunspot Activity

4.4 Conclusion

Cases like the ones described above are becoming increasingly common as we move rapidly towards 2025.

The ionosphere is a region in Earth's upper atmosphere, and it is where solar radiation causes ionization, creating a layer of electrons that can affect various Earth systems including our communications and navigation.

We are currently in the 25th solar cycle and are approaching its peak, which is expected to occur between 2025 and 2028, this is when the interference to our technologies will be at their highest.

It is therefore imperative for all vessel operators and ships crew to be aware of the risks involved in over reliance of the DGNSS position reference systems.

Follow the manufacturers' advice on updates of hardware, firmware or software that are designed to aid through these increased solar activity periods.

The following IMCA Guidance would be relevant to this case study:

- IMCA M117 – Code of practice for the training and experience of key DP personnel
- IMCA M220 – Guidance on operational planning
- IMCA M252 – Guidance on position reference systems and sensors for DP operations
- Information Note 1634 – Increasing Solar Activity and the Effect on GNSS Positioning
- Information Note 1663 – Enhanced GNSS Differential Corrections for Dynamic Positioning (DP) Operations

5 DP Drill Scenario

DP emergency drill scenarios are included to assist DP vessel management and DPOs / Engineers and ETOs to conduct DP drills onboard. The intent is that the template can be used on any DP vessel, so specific details regarding the technical outcome are not included. The benefit of using this template is to monitor and learn from the human reactions of key DP personnel. It is also important that the crew are familiar with various DP system set-ups including their failure modes.

Refer to IMCA M117 Code of practice for the training & experience of key DP personnel, Appendix 6

EXERCISE SCENARIO	**RECOVERY FROM FULL BLACKOUT**
Objective: To familiarise all vessel crew with what actions are required in order to recover the vessel into a controllable condition.	
Method: This test does not have to be a live test unless a safe manageable situation presents itself. A workshop should be conducted onboard.	
1) Discuss what would be the first reaction upon blackout. ♦ How was the Blackout Triggered, this may change how the recovery is conducted? ♦ What operations are being conducted. ♦ Will personnel be directly at risk. ♦ Are there still full communications. ♦ Can operations be terminated. 2) Recovery – ECR - Restore Power ♦ Is there a flow chart in the ECR that can be followed. ♦ Will generators auto start and connect? ♦ What machinery is locked out. ♦ How are Generators and thrusters re-set – there any auxiliaries that require re-setting as part of start permissive? 3) Recovery - Bridge – Secure Vessel Position & Minimise Excursion ♦ Where is the vessel drifting? ♦ What coms remain live most important ECR-Bridge? ♦ Is there a flow chart on the Bridge that can be followed. ♦ What is required in order to start the thrusters? ♦ Are thrusters automatically selected into DP Control or manually. ♦ Is there a clear escape route. 4) Mission Personnel – Prevent Uncontrolled Damage to Personnel, Environment and assets. ♦ Considerations as to how the mission personnel react to secure their equipment and communicate with Bridge. ♦ How does the mission equipment upon power up (clamps/brakes etc.)	

EXERCISE SCENARIO	RECOVERY FROM FULL BLACKOUT

Observations During Workshop:

1) Is the DP emergency drill procedure being followed?
2) Are those individuals directly involved in the exercise reacting appropriately given their assigned duties?
3) Are those individuals indirectly involved reacting in an appropriate manner?
4) Is the degree of participation and diligence as expected?

Discussion Points (Post exercise):

Human Factors

- What are the potential risks due to "multi-tasking" during DP operations that may directly lead to the scenario outlined during this drill? (Examples include managing / monitoring deck operations, radio traffic, etc.)
- What are the potential risks due to distractions in the workspace (i.e., Bridge, Engine Room) that may directly lead to the scenario outlined during this drill? (Examples include routine maintenance procedures, social media, personnel interactions, etc.)
- 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?
- Following a review of the simulated exercise and the vessel and crew's reaction, what different operator (Bridge and/or ECR) reaction(s) might be warranted if faced with a similar situation during operation?

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/DP 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, any suggestions for follow up including any corrective actions deemed appropriate should be accurately detailed and managed to close out.

Handling of power system failures in the correct manner requires knowledge of the DP specific critical equipment required for vessel control, how the DP system reacts to multiple failures and alarms and the human intervention required if necessary to ensure station keeping. Items to consider include:

- Awareness of the power system segregation (following the redundant groups)
- DP system reaction to multiple failures
- Mission equipment reaction to power loss and power up

EXERCISE SCENARIO	RECOVERY FROM FULL BLACKOUT
♦	Appropriateness of communication
♦	Training requirements

6 News in Brief from the DP Committee

- M140 Specification for DP capability plots is being updated.
- M166 *Guidance on failure modes and effects analysis (FMEA)* has been updated and released as a Code of Practice (M166 Rev. 3 May 2024).
- Information Note No.1683 Non-Compliance with M190 Categorisation and Recording of Findings issued. Copy in Appendix.

6.1 Station Keeping Events STATS

The information below is a snapshot of the DP Station Keeping Events to date for 2024.

How many in 2024	What type	Bus Configuration
♦ 98 reported to date	♦ 14 Observations ♦ 62 Undesired events ♦ 22 Incidents	♦ 84 Open ♦ 10 Closed ♦ 4 Unknown

Main Cause (Overall Effect)	Secondary Cause
♦ 0 Human	♦ 12 Human
♦ 14 Computer	♦ 9 Computer
♦ 41 Thruster/Propulsion	♦ 4 Thruster/Propulsion
♦ 29 Power	♦ 3 Power
♦ 5 Electrical	♦ 34 Electrical
♦ 1 External Factors	♦ 4 External Factors
♦ 5 Position References	♦ 6 Position References
♦ 0 Environmental	♦ 1 Environmental
♦ 2 Mechanical	♦ 18 Mechanical
♦ 1 Sensors	♦ 6 Sensors

The percentage of DP incidents (loss of position/heading) reported per year has increased since 2019, a year before the pandemic, which is a concerning trend. The 2022 figures showed that the percentage of incidents had decreased, and this was encouraging. However, 2023 showed an uptick, so far this year the rate is down, however this is only representative of 98 reports to date.

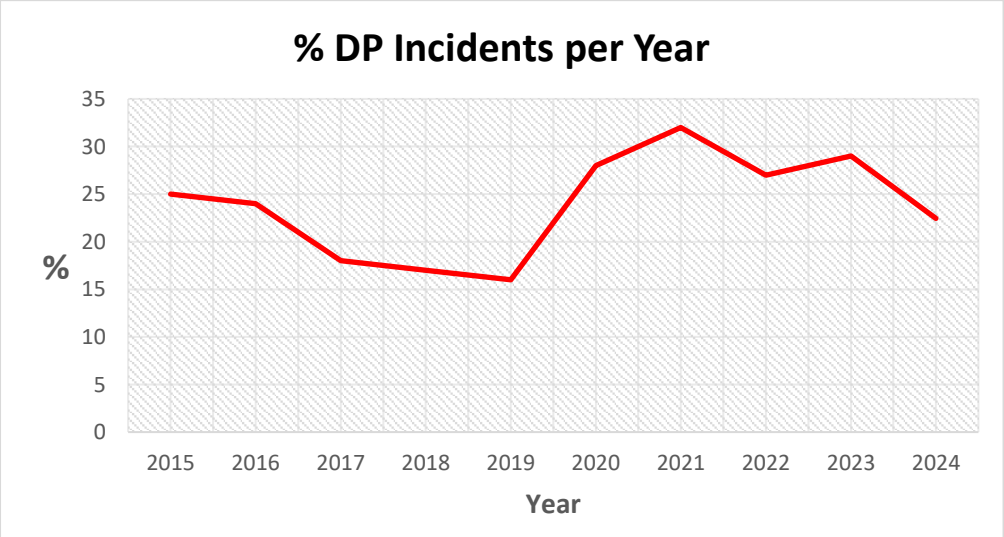

Figure 5 – Percentage of DP Event Reports received resulting in DP Incidents (loss of position/heading)

Dynamic Positioning Station Keeping Review – Incidents and Events Reported for 2023 can be downloaded from our website.

If you are employed by an IMCA member company, you can register on the website using your company domain email address. Once registered, you will be given direct access to the members area including all guidance and publications. This also applies to Bridge, ECR or Rank email addresses onboard vessels.

The IMCA DP reporting form available here. You may want to consider using this form for your vessels. Please forward reports to dpreports@imca-int.com.

6.2 Continuous Professional Development (CPD)

Following the announcement from the Nautical Institute (NI) about the new requirements for revalidating the DPOs Certificate, a Key DP Personnel continuing professional development (CPD) learning programme has been developed by IMCA and the Nautical Institute to provide valuable CPD learning to DPOs who perform a safety critical role onboard offshore DP vessels.

The learning programme is accessible to all Key DP Personnel to ensure that their technical knowledge of the latest industry practices is up to date and measured though questions delivered through an application available on desktop and on mobile devices. This will ensure professional currency with the latest IMCA / industry guidance, DP safety bulletins, DP exercise and training drills, and help prevent knowledge and skill fade in the various DP related roles on vessels,

The content has been designed for use on mobile devices. The delivery of the content is through the EdApp application software which is a mobile device learning management software. The application is available across a wide range of operating systems, for example, IoS and Android, and the app functionality provides offline capability meaning the content remains available without internet connection, a crucial factor for seagoing personnel.

Registration and payment for the app is undertaken via the NI Alexis Platform which is accessible by all Key DP Personnel who wish to purchase the CPD programme.

Find out more @ https://www.imca-int.com/certification/dp/cpd/

Appendix 1 – Non-Compliance with M190 Categorisation and Recording of Findings

[Information Note 1683 – July 2024]

Introduction

It has come to the attention of the International Marine Contractors Association (IMCA) that there have been reports of non-compliance with IMCA M190 Code* of practice for developing and conducting DP Annual Trials programmes concerning the categorisation and recording of findings, particularly those classified as 'A' findings. This note addresses the significance of adhering to these guidelines, the responsibilities of DP practitioners, vessel operators and clients, and the impact of failing to comply with these standards.

* **IMCA Code of Practice** – A document produced by the Association, the uniform application of which is recognised as essential for the safe and efficient conduct of marine contracting projects. IMCA expects the highest level of compliance with this category of document from its Members.

Importance of Compliance with IMCA M190

IMCA M190 provides an industry-recognised framework for categorising and recording findings during DP Annual Trials. This Code of Practice is designed to ensure that any issues identified during Annual DP Trials are properly documented and addressed. This process is critical for maintaining the integrity and safety of DP systems. Categorising findings accurately, especially those that fall into the 'A' category, is essential for identifying serious deficiencies that could potentially jeopardise vessel safety.

Roles and Responsibilities

It is incumbent upon both the DP practitioner witnessing the trials and the vessel operator to issue and accept 'A' and 'B' findings in the spirit in which they are given. The DP practitioner plays a crucial role in objectively assessing the DP system and identifying any deviations from expected performance and documenting the findings in the DP Trials report. Meanwhile, the vessel operator is responsible for addressing these findings and implementing necessary corrective actions.

The categorisation of findings into 'A' (critical), 'B' (non-critical), or 'C' (observations) categories is a fundamental aspect of this process. 'A' findings denote significant issues that require immediate attention and rectification before the vessel can safely operate in DP mode. 'B' findings indicate issues that need to be addressed but do not pose an immediate threat to vessel safety. 'C' findings are observations that may not directly impact safety but still require attention.

When issuing a finding, the DP practitioner must clearly explain the reason for the non-conformity and whether the Code of Practice/Class Rule or IMO regulation has been violated. The assigning of a Finding must be evidence-based. IMCA DP practitioners and company DP authorities must follow the code of conduct associated with their professional accreditation. IMCA is monitoring this and may suspend accreditation for practitioners and company authorities who wilfully violate the code of conduct.

Pressure on DP Consultancies from Vessel Operators and Clients

It has been reported that some vessel owners/operators are pressuring DP consultancies to downgrade findings. This practice is highly detrimental to the safety culture that IMCA strives to

promote. DP consultancies should conduct their assessments without undue influence, ensuring that all findings are reported accurately, objectively and with integrity.

The pressure to downgrade findings stems directly from 'Commercial Pressure'. It flows from higher management to operations and then onwards. Vessel operators, clients, and DP practitioners must understand the true value of DP Trials being carried out independently, without fear or favour, and embrace and leverage the entire process for continuous safety improvement.

The integrity of the DP assurance process relies on the honest and transparent reporting of findings. Downgrading findings for convenience or to avoid inconvenience undermines the purpose of these assessments and can lead to serious safety hazards. Vessel owners must understand that findings are not criticisms but opportunities for improvement. Addressing these findings proactively enhances the overall safety and reliability of DP operations.

Benefits of Addressing Findings

Findings, especially those classified as 'A', must be viewed as critical opportunities to bolster the safety of DP operations. These findings highlight threats that compromise the redundancy concept or violate the protocols established in IMCA M190 as well as IMO/Class requirements. It is imperative to address these threats promptly and effectively to ensure operational integrity and safety.

The spirit in which findings are given and received is crucial. DP practitioners and vessel operators should view findings as constructive feedback to improve vessel safety standards. A culture of openness and continuous improvement is essential for maintaining high safety standards in the DP sector.

Conclusion

Adherence to IMCA M190 *Code of Practice for developing and conducting DP Annual Trials programmes* for categorising and recording findings is essential for maintaining the safety and integrity of DP operations. DP practitioners and vessel operators are responsible for ensuring that findings are accurately reported and addressed. DP consultancies must resist pressure to downgrade findings and conduct their assessments with integrity and objectivity.

We urge all stakeholders to commit to these standards and to view findings as opportunities for improvement. The collaborative effort of all parties involved is vital to enhancing the safety and efficiency of DP operations.

Your cooperation and commitment to these standards are highly appreciated. By working together, we can ensure that DP operations continue to meet the highest safety standards.

For more information, please contact richard.purser@imca-int.com.

Related Guidance

- IMCA M190 – Code of practice for developing and conducting DP annual trials programmes
- IMCA M191 – Code of practice for DP annual trials for mobile offshore drilling units
- IMCA M166 – Code of practice on failure modes and effects analysis (FMEA)