

IMCA DP Station Keeping Bulletin 03/18

August 2018

The following case studies and observations have been compiled from information received by IMCA during 2018. To ensure anonymity all vessel, client and operational data has been removed from the narrative.

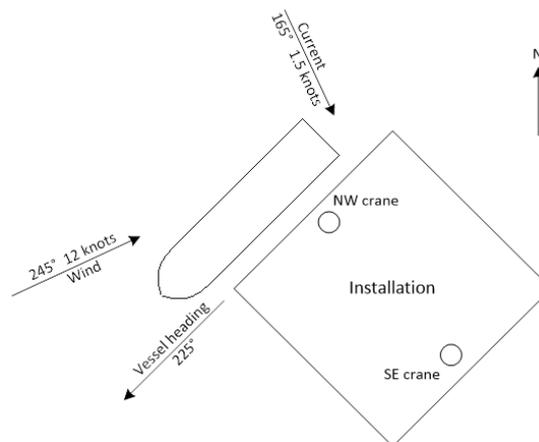
Vessel managers, DP operators and DP technical crew should consider if these case studies are relevant to their own vessel DP operation so that they can be used to assess and assist the safe operation of the vessel.

Any queries regarding this bulletin should be directed to Andy Goldsmith (andy.goldsmith@imca-int.com), IMCA Technical Adviser – Marine. Members and non-members alike are welcome to contact Andy if they have experienced DP events which can be securely analysed and then shared anonymously with the DP industry.

Case study 1 – Switching to manual mode caused loss of position

Case narrative

A DP2 platform supply vessel was set up on auto DP engaged in cargo operations inside the 500m zone of a fixed platform. The DP design concept of the vessel was such that there were two redundant groups and the vessel was set up with power generation and thruster supplies equally split across each redundant group with main bus ties open. Weather conditions were acceptable based on the capability of the vessel and the vessel was undertaking cargo offload on the north west side of the platform on a “blow on” position due to unavailability of the south east side platform crane.



The port aft azimuth developed a failure that led to it tripping out of DP control and its main circuit breaker opened. As the vessel was being operated within its environmental envelope and the thruster failure did not exceed the designed worst case failure, the vessel maintained position.

However, as redundancy had been compromised cargo operations were immediately suspended and the instruction was given to leave the 500m zone for thruster investigation. The DPO, in consultation with the master, decided to deselect auto DP control mode and selected manual control mode, at which point the vessel became unable to maintain its position and light contact was made with the platform before vessel control was regained. The decision was made to return to port for investigation.

Investigation highlighted that when auto DP is deselected, all thruster setpoint references move to zero for the deselected surge, sway and/or yaw axis therefore when the DPO selected the vessel to manual control all thrusters effectively stopped producing force leading to the loss of position.

The standard operating procedure for the DP system was dictated by the vessel's DP operations manual and the vessel was set up for DP operations accordingly. The vessel had two redundant groups and the redundancy concept was such that the groups were operated separately. The vessel did not experience a failure worse than its designed worst case failure and it maintained position post thruster failure.

Lessons learned

1. The decision to switch out of auto DP control in order to manoeuvre the vessel out of the 500m zone resulted in the vessel's position loss and contact with the platform. This decision was incorrect and the DPO had a lack of knowledge regarding how the system should perform. Had DP control been maintained, the vessel could have been manoeuvred away from the platform without harm.
2. The DP operations manual did not explicitly state what actions should be taken in the event of a major DP system component failure nor did it explain the consequences on station keeping during DP control mode changes. Guidance: IMCA M 220 – *Guidance on operational activity planning*.

Considerations of the IMCA Marine DP Committee

This case study demonstrates the importance of good understanding of the DP system and its redundancy concept such that in the event of a failure, sound judgement can be taken. The vessel in question was a platform supply vessel and by nature spends a much higher percentage of time in transit/port than in field in auto DP mode. In this type of scenario, it is vital that the DP crew are exposed to annual DP trials and regular DP exercises and drills so that experience and confidence in the system is gained during normal and failure condition. Familiarisation and training of change of thruster control mode should be a regular part of on board training. Guidance: IMCA M 117 – *The training and experience of key DP personnel*.

Case study 2 – Switching from auto DP to IJS (independent joy stick) mode caused loss of control

Case narrative

A vessel collided with the working platform on a wind turbine transition piece. The incident occurred during worsening weather conditions. The vessel was on auto DP, when it was decided to pull off. Whilst moving away from the turbine, the DP operator switched from auto DP to independent joy stick (IJS) mode. The thrusters' set point went to zero for the deselected surge, sway and/or yaw axis the moment the change was made, leaving the vessel without axis control, approximately 120m from the turbine.

The wind was 28 knots. The action of the environmental forces started to drift the vessel back towards the turbine. The crew attempted to gain control of the vessel using the IJS. They were ultimately successful in regaining control of the vessel but were unable to prevent collision with the transition piece and its work platform.

Note: after the incident the vessels DP, IJS and manual thruster control systems were extensively tested. An additional FMEA test was carried out. All systems were found in good working condition without any technical defects found.

What went wrong

The following points were noted:

- ◆ Officer of the watch handover procedure was unclear to those involved;
- ◆ The decision to change over in a position in close proximity to the transition piece was inconsiderate;
- ◆ The master misjudged how the systems would perform during the transition from DP to independent control.

What were the causes

- ◆ Poor judgement of situation by the vessel master;
- ◆ The vessel was already moving against an increasing wind and was still within the wind farm boundary;
- ◆ Insufficient awareness of DP system handover procedures and the adverse effects in the actual situation.

Actions

- ◆ Revision of DP operations manual to fully cover changeover procedures;
- ◆ Revision of DP familiarisation process to include better verification;
- ◆ Introduction of recordable in field passage planning.

Lessons learned

- ◆ Full understanding on changeover procedures and relationship between (DP) systems;
- ◆ Full understanding of vessels DP systems and verification thereof (no DP system is the same, despite naming);
- ◆ Bridge resource planning, especially transiting between work areas should be improved.

Considerations of the IMCA Marine DP Committee

IMCA seeks to raise awareness of the importance of detailed operational activity planning both in the offshore renewable energy sector and in the offshore oil and gas sector. Within an offshore wind farm there are many fixed assets which present a high risk to the navigator. It is considered that detailed planning and care is required to ensure safe operations. Guidance: IMCA M 220 – *Guidance on operational activity planning*.

Note that this case study has been issued within IMCA Safety Flash 15/18

Case study 3 – DPO certification deception

Case narrative

A new senior DPO had been appointed to a DP equipment class 2 vessel via a crewing agent. It was found after joining that his experience and certification were not as previously communicated.

The vessel master first met the new crewmember whilst waiting for a taxi to join the vessel and he seemed to be a nice fellow. Once on-board the master checked his certification, and all seemed in order for the position he was to serve following handover. The master reminded him that he still needed to present his discharge book and DP logbook which he had withheld/forgotten.

The discharge book, together with a new DP logbook were presented to the Master prior to departure. The discharge book had entries from the same vessel from 2015 onwards and the DP logbook was blank. He informed the master that he had lost his other discharge book and DP logbook.

The master wanted to see evidence of his DP experience and therefore became concerned. On closer examination, the new crewmember's DP certificate appeared very worn and therefore not consistent with it being a new issue, as stated. The title of the certificate was suspicious and, when measured, the length of the row on an existing crewmember's card which stated 'offshore unlimited' was 3mm shorter and there was evidence that a previous title had been obscured/rubbed off.

The master observed the new crewmember complete a DP periodical checklist and questioned him about his DP experience and technical knowledge. The new crewmember confirmed that his certificate was unlimited and denied that he had tampered with it.

Suspensions were raised and the vessel master liaised with the vessel manager and crewing agent to instigate a full investigation into the new crewmembers certification.

The Nautical Institute (NI) confirmed that the certificate was recently issued and was a DP limited certificate, meaning it was valid for DP1 vessels only. The institute also confirmed that the DPO had applied using 30 DP2 days sea time for familiarisation, and 33 DP2 days sea time for watchkeeping however, all subsequent DP sea time within the application after July 2015 had been completed on DP1 vessels. The DPO was only entitled to hold a limited certificate.

When confronted, the new crewmember pleaded that he didn't know the difference between a limited or unlimited certificate. He also admitted that he had never used the manufacturer's DP system before or operated a DP2 vessel in automatic DP control.

Considerations of the IMCA Marine DP Committee

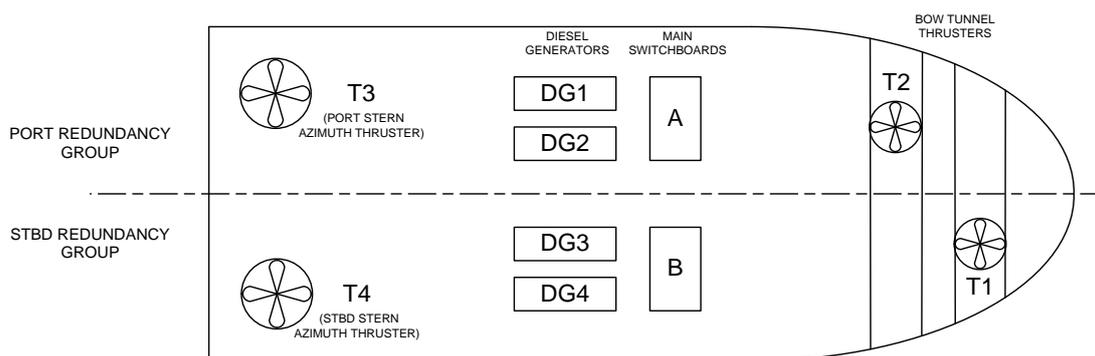
This event happened on a vessel being operated by a well-respected IMCA member. The consequences of having inexperienced and untrained personnel in key positions on any type of vessel and particularly DP vessels working in critical situations could be catastrophic. There is concern that this type of event could be repeated anywhere. Vessel personnel and shore management are reminded to be vigilant and that the authenticity of certificates can at any time be verified through the NI's website and where concerns still exist directly with NI staff.

Case study 4 – Load sharing imbalance caused loss of position

Case narrative

A DP2 pipelay vessel was set up on auto DP engaged in pipelay operations, inside the 500m zone of a fixed platform. The DP design concept of the vessel was such that there were two redundant groups that could only operate as a common system with bus tiebreakers closed.

The vessel was set up with power generation and thruster supplies equally distributed across each redundant group as shown in the below example.



The bus ties between the redundant groups were closed creating a common power and propulsion system and DG1, 2 & 3 were online, DG4 on standby. The weather was typical for the area: wind speed 4kts, current 3.0kts and wave height 1.5m.

The engineer on watch noticed a developing load imbalance across the online engines. DG1 and 3 dropped load quite rapidly, leading to them both being tripped on reverse power protection, leaving only DG2 online. The PMS automatically instigated a standby start of DG4. However, before DG4 was up to speed and synchronised, DG2 tripped on overload, leading to a blackout. DG4 connected to the switchboard as part of the blackout recovery process and the engineers worked to bring DG1 & 3 back online.

The DPO regained control of the vessel 35m away from the original position. The pipe being laid remained connected to the vessel but was buckled. The decision was made to abandon the pipe and move the vessel to a safer location for detailed investigation.

An investigation found that the DG2 governor had experienced a mechanical failure, leading to excessive fuel supplied to the engine. The engine therefore 'grabbed' load from the otherwise healthy online machines forcing them to trip on reverse power. The generator protection and power management systems had no way of identifying the faulty machine although the PMS did generate load imbalance alarms prior to blackout.

The standard operating procedure for the DP system was dictated by the vessel's DP operations manual and the vessel was set up for DP operations accordingly. The vessel had two redundant groups and the redundancy concept was such that they could only be operated as a common system (bus ties closed).

Review of the DP system failure modes and effects analysis (FMEA) showed that it failed to consider the specific failure modes associated with closed bus tie operations despite the analysis stating that it was 'industry compliant'.

Lessons learned

1. The failure modes and effects analysis did not consider all the potential operating modes. In this case the FMEA did not properly analyse the common and hidden failures associated with closed bus operations, nor did it properly identify the vessel's worst-case failure. There was no clear statement regarding the critical activity mode of operation (CAM) for the DP systems configuration. Furthermore, the FMEA had not been revised for many years and therefore there had been no possibility to improve and further the analysis in light of industry lessons learned since original production. Failures of this nature are well understood and have been well documented in IMCA and other industry guidance for many years. Guidance: IMCA M 166 – *Guidance failure modes and effects analysis (FMEA)*; IMCA M 247 – *Identifying DP system components and their failure modes* (due to be published in Q3 2018).
2. There were no specific operating guidelines for the operation. The DP operations manual was lacking in specific operations data. However, it was acknowledged that the poor level of detail maybe because of a poor quality FMEA and the lack of different operational modes analysed within the FMEA. Guidance: IMCA M 220 – *Guidance on operational activity planning*; IMCA M 166 – *Guidance on failure modes and effects analysis*.

Considerations of the IMCA Marine DP Committee

This case study demonstrates the importance of the FMEA. The FMEA is a key component to the input of DP operation, activity specific procedures, annual DP trials, and exercises and drills. Therefore, it is vital that this analysis is kept up-to-date and current, considering all possible DP operating modes of the vessel. Although stating compliance with a variety of IMCA guidance, this well-known failure mode had not been captured.