IMCA DP Station Keeping Bulletin 03/19

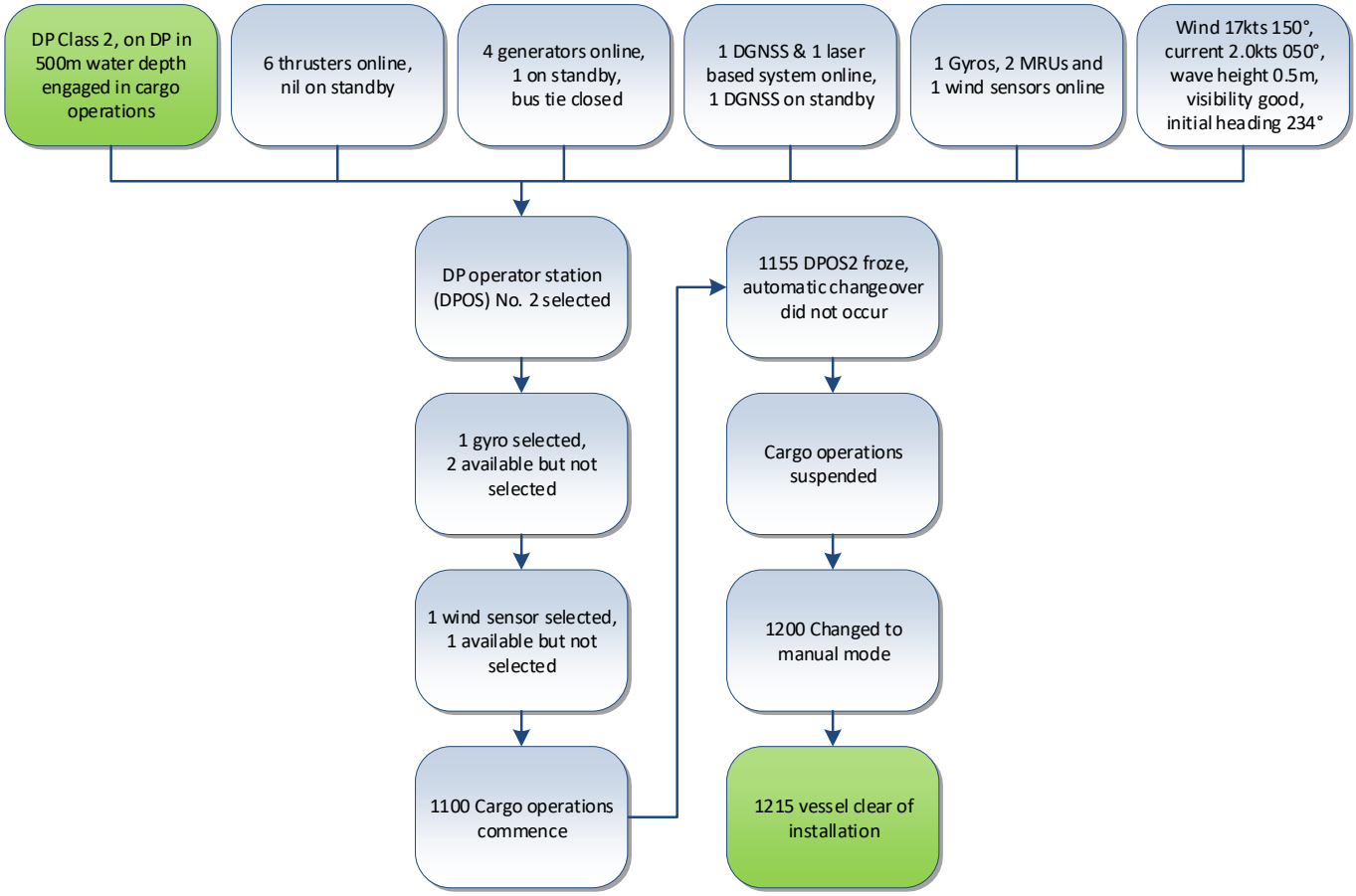
September 2019

The following case studies and observations have been compiled from information received by IMCA during 2019. 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.

Operating Outside DP Equipment Class 2 Requirements – DP Incident



Comments from the report:

Although DP checklists were completed, the availability of the standby operator station was not confirmed. The most probable cause for DPOS2 to freeze and not auto changeover was traced to a faulty IO controller on DPOS2. The vessel replaced the controller with a spare held on-board. At the time of the loss of DPOS2, Gyro feed was not available in any one of the controllers. Various position reference systems (PRS) and sensors were deselected and that caused the vessel to go in 'dead reckoning' when losing the IO controller on DPOS2.

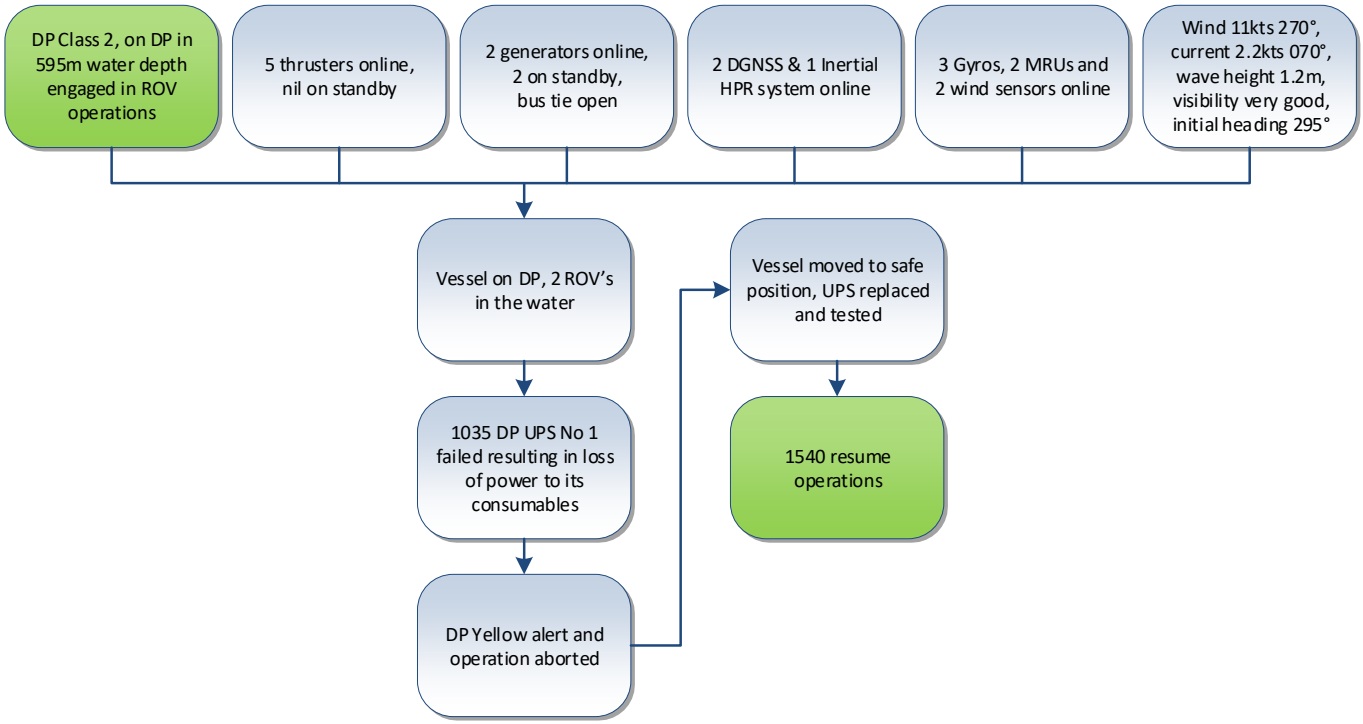
Gyro 1 and 3 were both serviced at the next port call. Vessel simulated auto changeover of the DP Operating system and bump-less transfer was confirmed after maintenance

Considerations of the IMCA Marine DP Committee from the Above Event:

- There were not enough PRSs or sensors online to meet requirements for equipment class 2 DP operations.

- The setup of the vessel and the content of the incident report suggests insufficient understanding and training for both the DP control system and the DP operation.
- There seems to be some confusion about ‘operator station’ and ‘controller’.
- The report states that the possible reason that the DP operator stations did not automatically change-over was a faulty I/O controller. A faulty I/O controller should have activated an alarm.
- If the single gyro online was not available to the DP controllers, it is unlikely that the controller/operator station will change-over to a controller that also does not have an available gyro input. This depends on the system architecture and the DP control system FMEA should have been used as part of the investigation process.
- Test of the changeover function between DPOS consoles and DPC controllers should be part of the field arrival check list.
- The report is inconclusive and suggests that further investigation and testing is required.

Failure of DP UPS – DP Undesired Event



Comments from the Report:

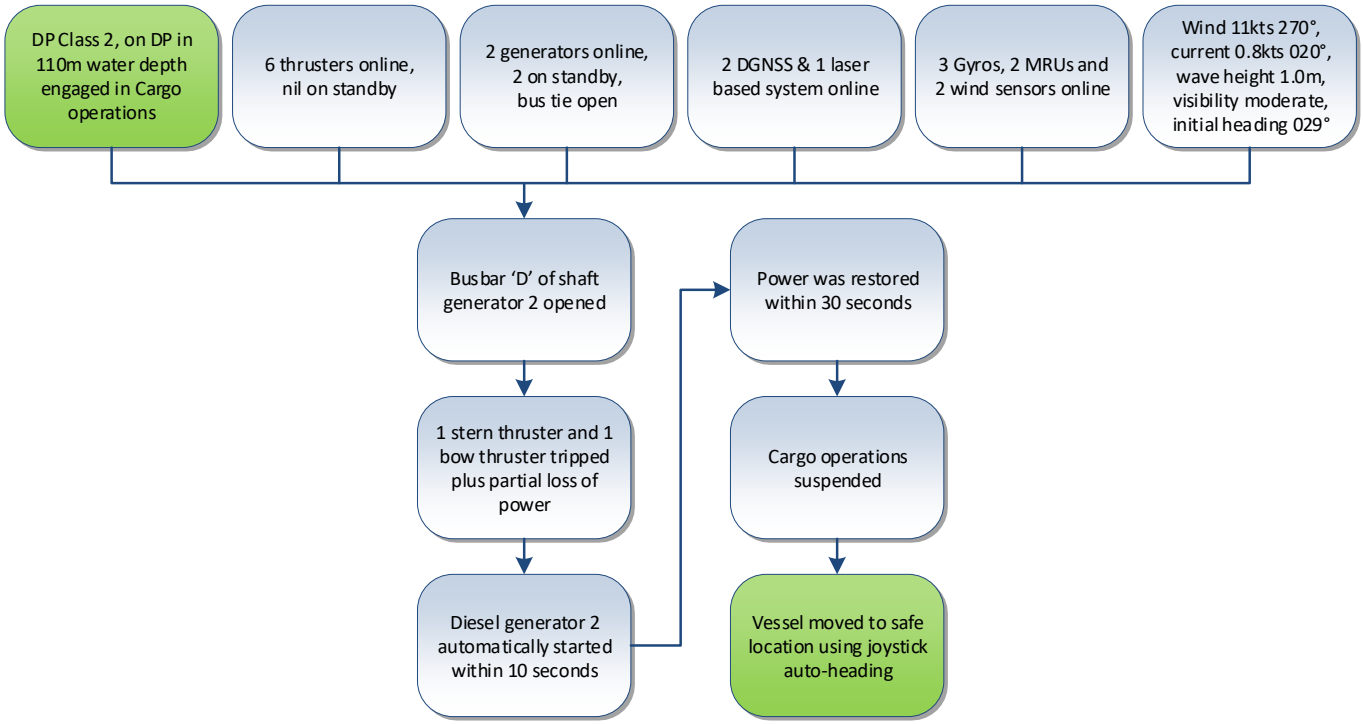
The vessel maintained position but DP equipment class 2 capabilities were compromised. It was noticed that there was a strong burning smell from the UPS. The UPS was still powered up from the ships supply but it was in internal bypass. Tests were carried out and it was noted that there was no voltage or frequency output. The voltages on the eight external batteries were checked and all but one had 12+ Volts. One of the batteries had 10 volts.

The replacement unit was tested extensively, and it operated satisfactorily.

Considerations of the IMCA Marine DP Committee from the Above Event:

- The status of the UPS should be verified on pre-operational checklists.
- Battery and UPS tests should be part of the DP annual trial programme and subject to regular maintenance.
- It should be noted that with one diesel generator on each bus, a partial black-out may occur in case of failure. This should be included in the operational activity planning.
- It appears the vessel responded as designed and the situation was well handled by the vessel crew.

Accidental Breaker Trip – DP Undesired Event



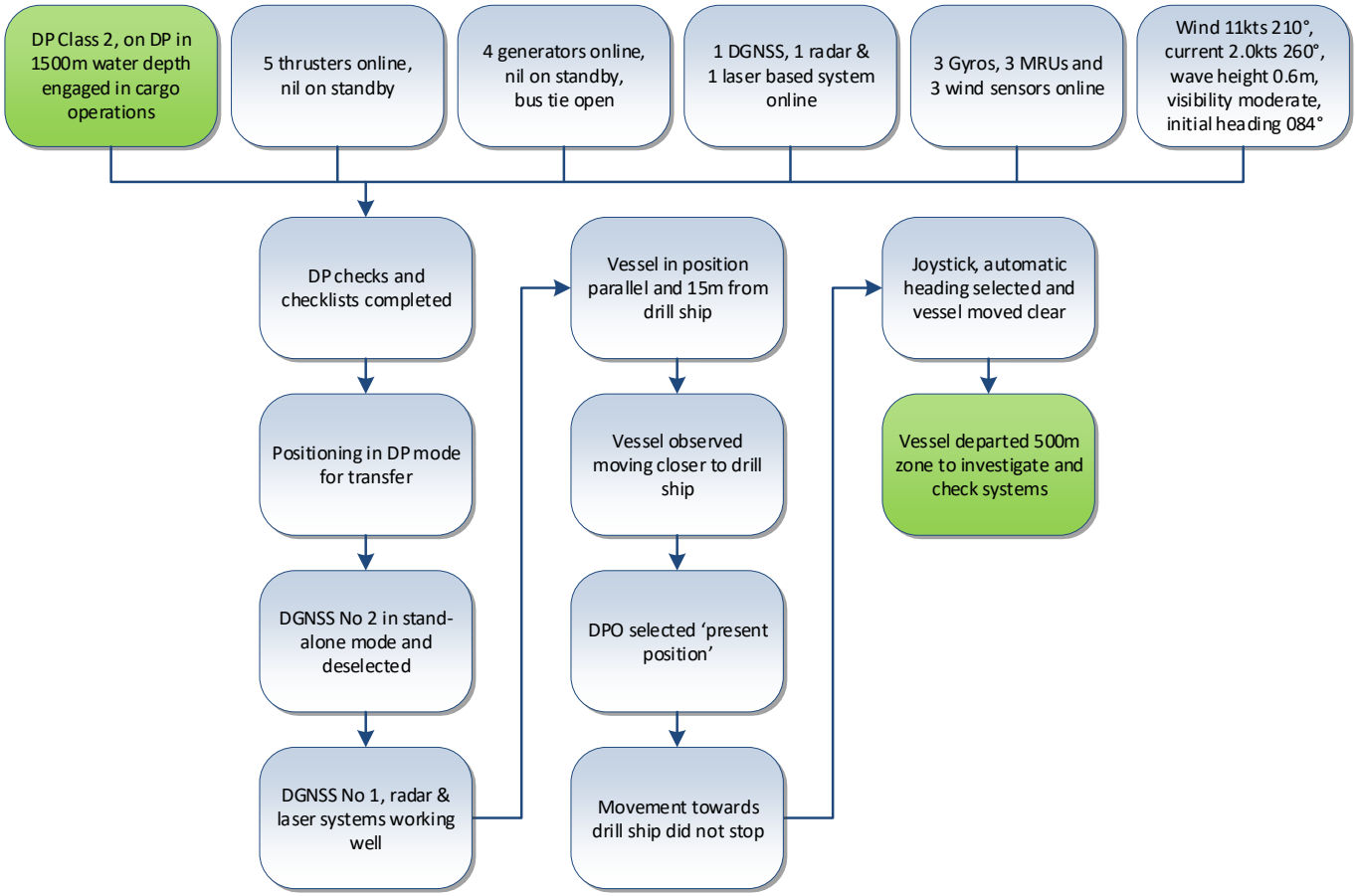
Comments from the Report:

The vessel was experiencing heavy rolling and pitching. The watch keeping engineer lost his balance and his hand made contact with the No. 2 shaft generator breaker push button, thus opening the breaker and causing the loss of power. The vessel has installed transparent covers over vulnerable breaker push buttons to avoid re-occurrence.

Considerations of the IMCA Marine DP Committee from the Above Event:

- Although the incident could have been avoided by better protecting the breaker push-button, the DP system responded as designed.
- Most regulatory authorities require covers to be fitted on emergency stops which have the potential to impact operations.
- The vessel could have moved clear while still on Automatic DP, instead of changing to joystick control.
- With only one generator on-line on each bus, failure of one may cause a partial black-out. It is assumed that this was included in the operational philosophy and activity specific planning.

Mix of Absolute and Relative Position Reference Systems – DP Incident



Comments from the Report:

It was considered that the movement towards the drill ship could have been caused by a combination of position reference system degradation and interaction from the Drill ship's thrusters. There was an advisory regarding service disruption from the DGNSS supplier in force at the time. It was stated that the DPO initially selected 'present position' to remove any doubt that he/she had entered an incorrect step movement for a change of position.

It was further noted that selecting 'present position' is not following DP watch-keeping procedures and is a fundamental error. Selecting 'present position' resulted in the thruster demand being reset with the momentum of the vessel still being in the same direction

Considerations of the IMCA Marine DP Committee from the above event:

- Operating on DP alongside a mobile platform which also provides the reference(s) for the PRS needs to be planned carefully. It is recommended that relative PRSs are used.
- Surface movement of the drill ship, position moves, and thruster interaction should be carefully considered during operational planning and in the decision support tool (ASOG).
- IMCA have received a number of reports this year where it has been noted that the DP Operator selected the 'present position' button as the best option for halting an unplanned move. It should be noted that this action resets the wanted position and therefore does not assist the DP System to maintain the original wanted position.

DP3 Drillship Switchboard Blacked Out – DP Undesired Event

Case Narrative:

A DP 3 6th generation drillship was set up on automatic DP engaged in plug and abandonment operations in field. 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 at the time of the event were acceptable based on the capability of the vessel and there was at least one generator on standby on both Port and Starboard 11kV switchboards.

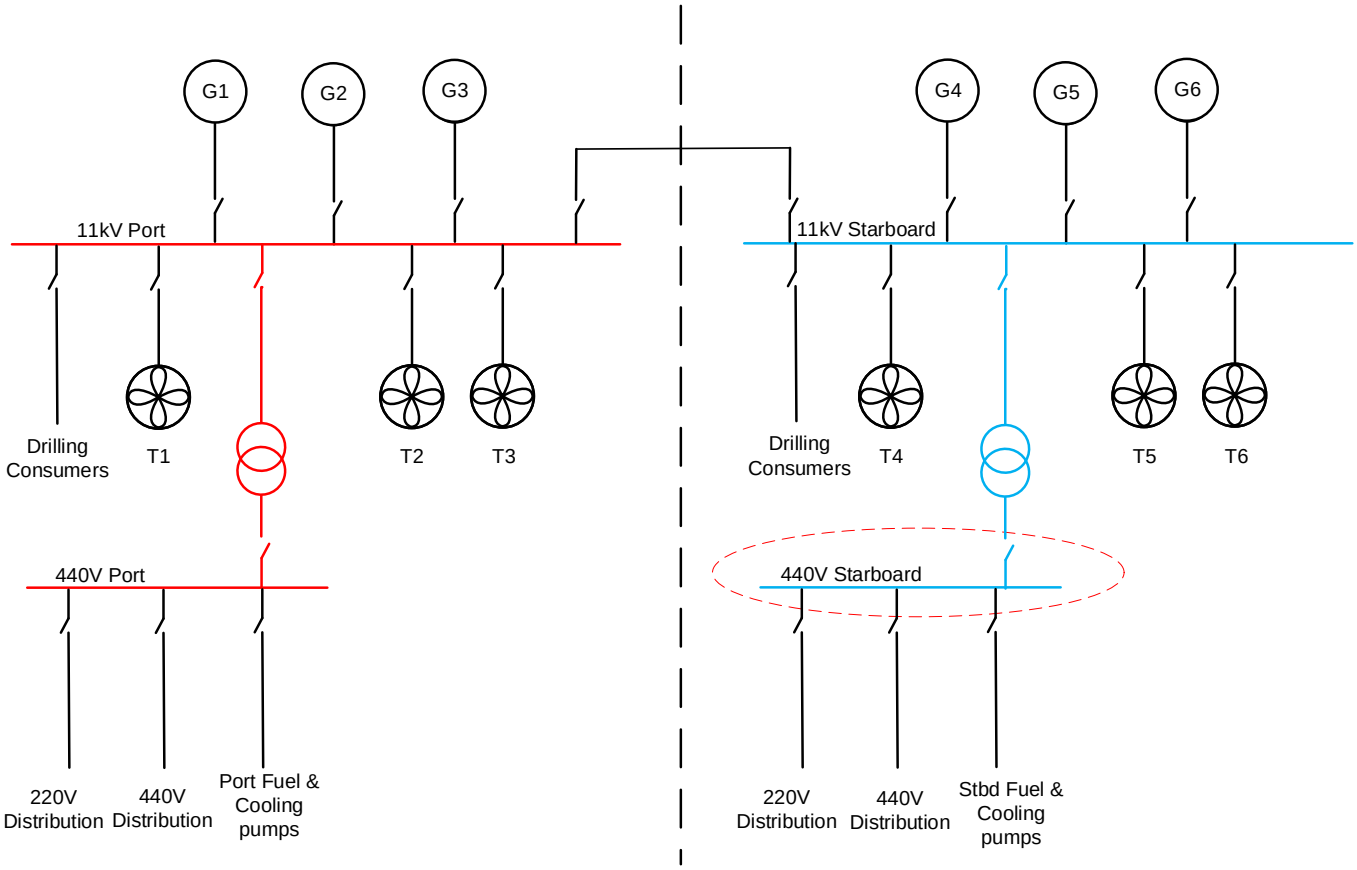


Figure: Simplified sketch of vessel's power system

Without warning, the Starboard 440V switchboard blacked out leading shortly after to the 11kV switchboard blacking out resulting in loss of power to all the respective main thruster drilling and auxiliary consumers. The Port switchboard remained online, and the vessel remained in position. Drilling operations were immediately suspended, and safety measures were actioned while the blackout was investigated, and power fully restored.

Investigation revealed that the loss of power generation on the 11kV switchboard leading to its blackout was caused by fuel pump failure and subsequent fuel starvation on the online Starboard engines. Fuel pump failure (and cooling water auxiliaries) was caused by the initial 440V starboard switchboard failure. The fuel starvation also meant that automatic blackout recovery measures (standby starting of offline generators) were unsuccessful.

The root cause of the loss of power to the Starboard 440V switchboard was found to be a faulty under voltage coil in the main supply circuit breaker. The fault causing the circuit breaker to open.

The Lessons:

The investigation noted that the main circuit breakers on the 440V switchboards were obsolete and no longer supported by the original equipment manufacturer. Although a spare was sourced onboard the vessel, the event triggered a full review of onboard critical spares and the implementation of a regular third-party inspection and

testing regime over and above normal crew maintenance routines. The investigation also noted that budgets were being worked on for full replacement of all 440V main circuit breaker at the next SPS docking.

Although fitted, the air powered emergency fuel pump provided no benefit during the main power supply failure. The investigation revealed that the pumps operation was not as analysed within the vessel's DP FMEA and a programme of testing was planned at the soonest opportunity to ensure correct functionality/operation. The findings of such testing would feed back into the vessel's DP FMEA and any other relevant operations manuals and checklists.

The investigation considered drilling consumer supplies and noted that drilling variable speed drives were not segregated in line with the vessel's redundancy concept meaning that 50% of the drive cooling system were cross connected. The effect of this during the event was only unnecessary loss of consumers to the drilling system. In different circumstances, this cross connection may have impeded safety precautions being implemented or brought unnecessary risk to the DP system redundancy concept. The investigation report recommended that the drilling system distribution be reviewed with cross connections in mind and any enhancements actioned thereafter.

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, sufficient confidence in the system exists to permit a safe outcome with no loss of position.
- The case study also demonstrates the importance of a high quality FMEA and associated testing regime to not only ensure the redundancy concept is intact but also that backup and recovery systems operate appropriately.
- Finally, the importance of considering mission equipment integration in conjunction with the DP system redundancy concept should not be underestimated as the consequence of poor integration could be significant or greater than a loss of position.