IMCA DP Station Keeping Bulletin 02/19

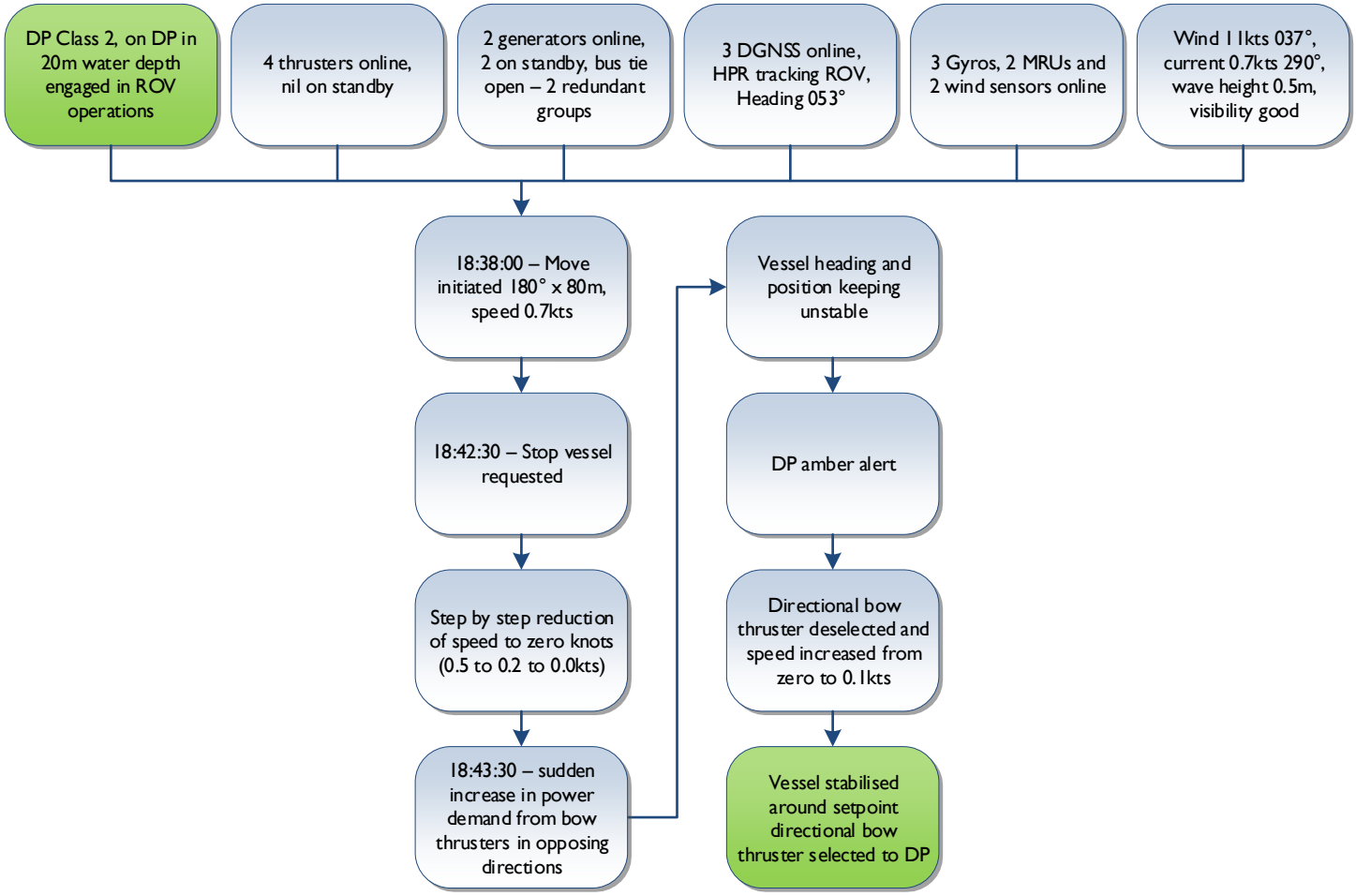
June 2019

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.

Unfamiliarity with DP System Leads to – DP Undesired Event



Comments from the report:

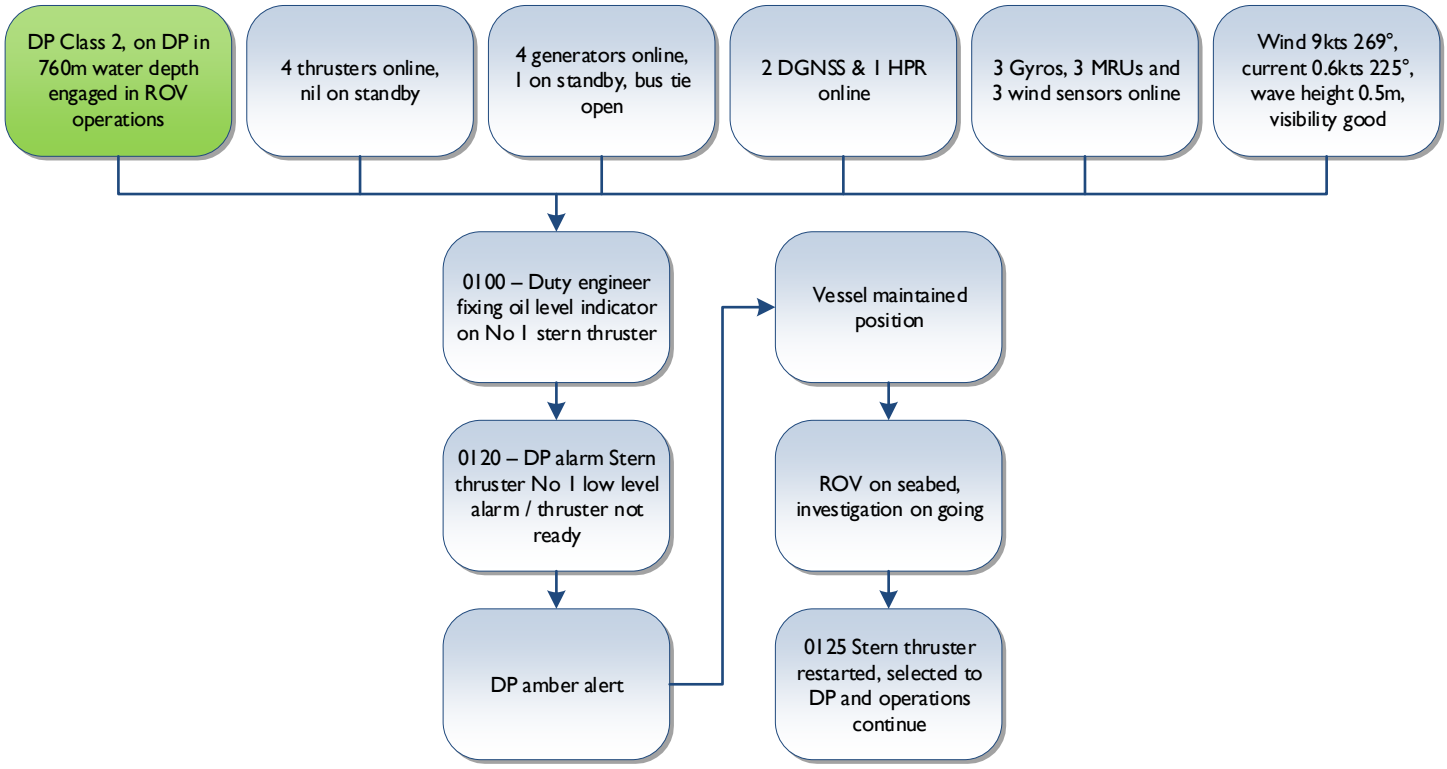
Both DPOs had several years' experience but with a different DP control system where it is common to stop the vessel during a move by reducing speed to 0.0kts. However, on the system fitted to this vessel a retardation factor is used so speed is reduced automatically when the stop request is made.

Setting a speed at 0.0kt led to an unstable situation. The master instructed DPOs to keep a minimum speed on DP of 0.1kts and not set speed to 0.0kts

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

- Vessel specific familiarisation programmes and operation manuals should capture and make allowance for crew members not being familiar with systems. Each system/vessel has peculiarities which must be taught and learned by the crew onboard.
- The DP system manufacturer should be involved as it should not be possible for the operator to apply a valid setting which then causes an unstable DP system.
- It is recognised practice to slow down during a move, but it is not considered good practice to use zero speed.
- The use of the present position would maintain the vessel in the wanted position.

Maintenance During DP Operations Leads to – DP Undesired Event



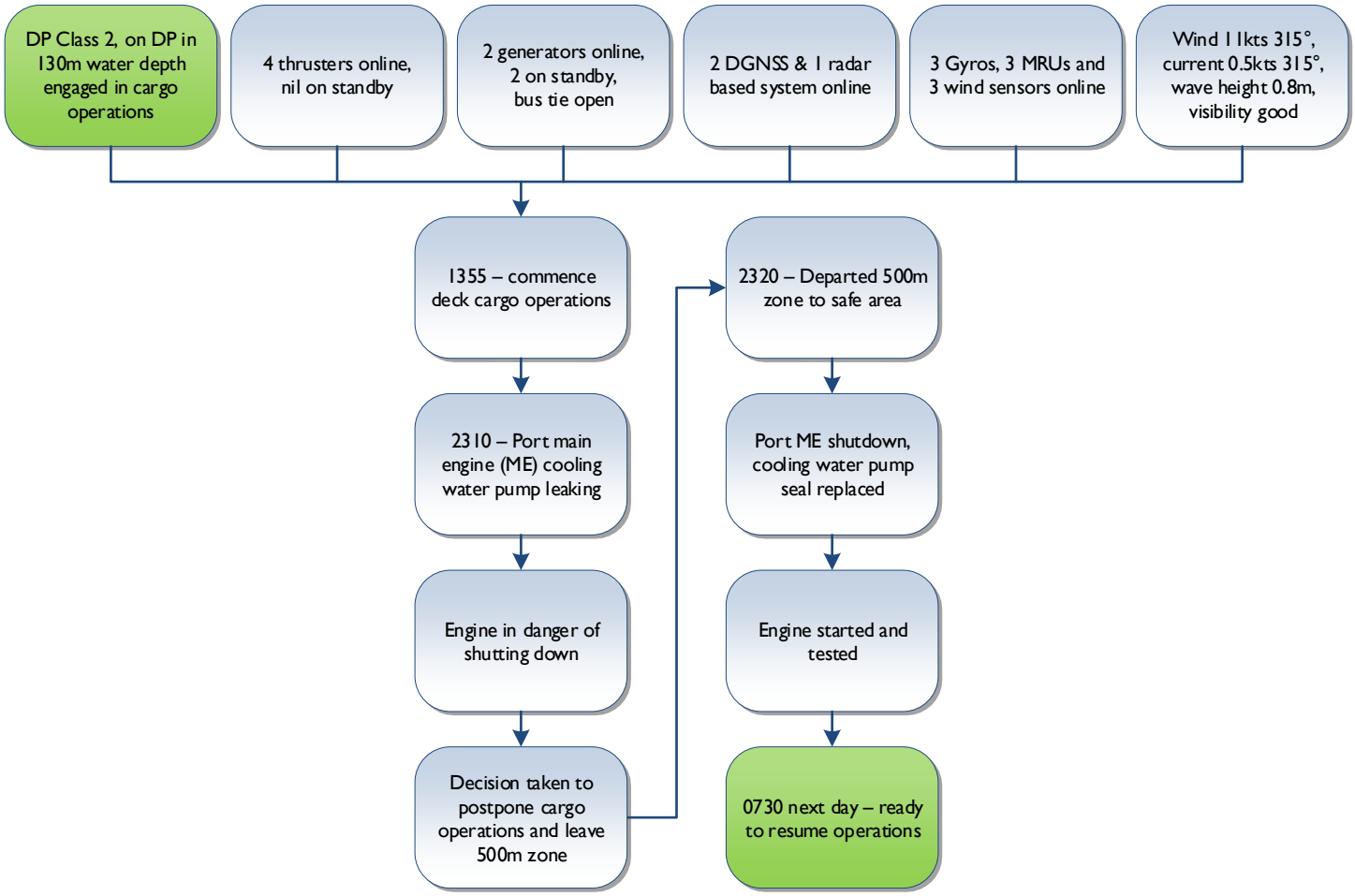
Comments from the report:

The oil level gauge was not reading the actual level. The duty Engineer did not inform Bridge/DPO`s of maintenance on the header tank of stern thruster. Future instruction was that the engine room would inform the bridge of scope of work of any maintenance to be carried out whilst the vessel was on DP operations.

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

- IMCA stresses the importance of sound operational activity planning, full understanding by all key DP personnel of the activity specific operating guidelines (ASOG) would have assisted in managing the operation.
- DP operations encompass the whole vessel and all personnel need to be trained as part of a team.
- Standing orders should stress that no maintenance is undertaken during DP operations.
- In exceptional circumstances and following a capability analysis maintenance could be considered. However, a permit to work (PTW) system should be used that involves and informs all departments.

Leaking Cooling Water Pump Leads to – DP Undesired Event



Comments from the report:

A leaking seal was observed on the Port ME cooling water pump; it was replaced, and the engine tested prior to returning to operations.

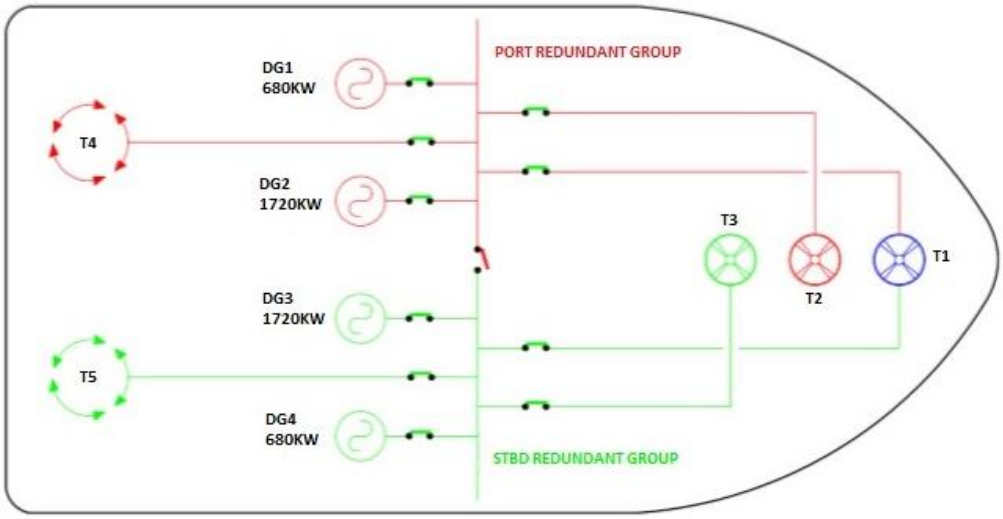
Considerations of the IMCA Marine DP Committee from the above event:

- The event report did not detail the application of any decision support tools such as an ASOG, however the actions taken demonstrated a good example of safe practice during DP operations.

Software Update Caused Loss of Generators in Separate Redundant Groups

Case narrative

A DP2 platform supply vessel (PSV) was set up on auto DP whilst conducting trials in open water after extensive upgrades. The redundancy concept was based on two redundant groups with power generation, thruster supplies, and all DP consumers equally split between them. Bow thruster 1 was supplied from a dual drive which can be supplied from either redundant group. Each redundant group has dissimilar sized generators as shown in the graphic below.

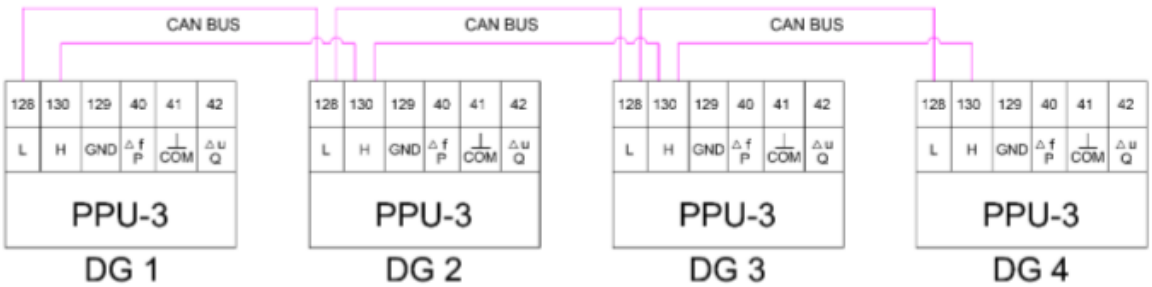


The vessel is designed to operate with open bus ties at all power levels. At the time of the incident, the main bus tie was open, separating the two redundant groups. All generators were online. The weather was fair and sea conditions were light with wind speed of 1 knot, current 2 knots and wave height of 1m.

The vessel was performing a turn when the DG2 breaker unexpectedly tripped, followed by DG4 breaker tripping a few seconds later. The DP operator received alarms indicating loss of the generators and engineers observed alarms for loss of generator protections in the engine control room. The vessel was able to maintain position due to the light sea conditions, but power limitations became active for thrusters in the port redundant group.

Subsequent investigation identified that DG2 breaker had tripped due to a defective Paralleling and Protection Unit (PPU). The PPU is a microprocessor-based protection unit containing all of the functions for protecting the generator. The PPU is set up to trip the generator in the case of over-current, under-voltage, short circuit, reverse power and excitation problems. It is important to note that a generator breaker will also trip if it's PPU loses power or reboots.

As well as generator protection, the PPUs were configured for load sharing, where the PPU will maintain the rated speed of the engine following an increase or decrease in generator load. The interface between the PPUs for active load sharing was via a 'daisy chained' CANBUS network as shown in the graphic below.



Further tests demonstrated that switching the power supply of DG2 PPU on and off would cause the screens of other PPUs to flash and reboot. This was observed to occur approximately fifty percent of the time. The flashing and reboot would cause the respective generator breaker to trip. It was noted that cycling the power of DG2 PPU could cause any other generator to trip, regardless of redundant group.

Analysis of the faulty DG2 PPU found that it had a defective power supply and a software error. An intermittent power supply fault had caused DG2 PPU to reboot during operation. A 'bug' in the software caused the PPU to boot up with the wrong communication settings and data was sent at the wrong speed to other PPUs over the CANBUS. Receiving data at the wrong speed caused errors in the other units on the CANBUS, causing breaker tripping. The root cause was a coding error in the boot loader software for the PPUs.

The defective software version had been installed by switchboard vendors during recent vessel upgrade work. The software updates were produced by the PPU manufacturer and downloaded from the internet. The switchboard vendors assumed that using the latest software version was safe and it was their company policy to update the software anytime work was done on the units.

The lessons

- Initial fault finding was hampered because the vendors had left no record of installing different software versions. A fleetwide review showed that the faulty software had been installed on other vessels. After the incident, software versions were recorded and documented in the FMEA.
- The control of software and those vendors involved with software needs to be managed as part of a formal management of change (MoC) process and the need/benefit of the version fully understood prior to its acceptance.
- Although testing of the PPU had been undertaken during FMEA proving trials, the hidden failure was only introduced during the software upgrade. The design of the CANBUS is being further analysed to determine the need for all PPUs to be connected together, rather than just those within each redundant group. The results of this analysis may allow the splitting of the CANBUS and the removal of any potential hidden failure in this system in the future.

This case study demonstrates the importance of software MoC on vessels. Although it is accepted that the best of MoC processes may not capture issues such as a bug left in the software by the producer of the software. In this case having such a process would have significantly aided the identification of the issue.

The best form of prevention of such a fault is not having unnecessary network links across redundant groups in the first place. Such that any maloperation of software cannot propagate between one redundant group to another.