



MARINE
Safety Forum

DP Assurance

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What is DP Assurance?

Review of a vessel's DP documentation, usually on behalf of the vessel charterer prior to ensure it meets the charters requirements.

Review of:

- DP FMEA
- Last Annual / 5-Yearly Trials
- CAM & ASOG
- DP Operations Manual
- DP Capability Plots





Why do we do DP Assurance?

IMCA Station Keeping Events:

Percentage of DP incidents compared to the total amount of reports received had increased from 2019.

*“Of the events reports submitted to IMCA, data showed that **DP operations had become less safe since 2019**”.*

IMCA DP Conference 2022 – Report, July 2022



Percentage of DP incidents per year of reporting



DP Assurance Overview

Desktop Review of the following:

DP FMEA:

- Reviewed within last 5 years
- Clearly states DP configuration of all sub-systems
- Clearly states WCFDI & WCF
- Contains description and failure analysis of all DP-related sub-systems.
- Look for common points (e.g. dual supplied thruster, closed bus ties) and ensure analysis is robust.

Last Annual / 5-Yearly Trials:

- Within date
- Simulates WCF
- Review findings
- Tests are in accordance with IMCA M190.



DP Assurance Overview

Desktop Review of the following:

CAM & ASOG:

- Configuration of systems are the same as stated in DP FMEA.
- In line with IMCA M220.

DP Operations Manual:

- Vessel specific.
- In line with IMCA M109.

DP Capability Plots:

- Configuration is same as stated in DP FMEA
- Shows intact and post-WCF.
- In line with IMCA M103 / M140.

Common Findings – DP FMEA

- Configuration for DP not clearly stated.
 - Vessel complexity increasing (power system 4-split, 3-split, 2-split, closed bus, hybrid battery systems, dual fuel systems, dual supplied thrusters).
- WCFDI incorrect.
- No failure analysis of common points between DP redundancy groups, such as:
 - Dual supplied thrusters.
 - Closed bus ties.
 - Dual-supplied consumers, such as gyros.
- No analysis of network storms (IMCA M259).
- Five year review not performed.

Table 8-6 Failure Analysis of the DPC-3 Main DP Control Cabinet

Failure Modes	Failure Effects	Detection	Effect on other Redundancy Groups	Effect on DP Capability
1. Failure of a UPS supply into DPC-3 cabinet.	All three RCUs and all I/O modules are dual supplied by two UPS supplies. Failure of one supply will not affect the functionality of the main DP control system; however, there will no longer be redundancy.	Alarm on DP.	None.	No loss of position or heading.
2. Failure of an RCU.	If this RCU was operating as master, there will be a bumpless transfer to one of the redundant RCUs, which should maintain the vessel's position and heading. If the RCU was operating as slave, the master RCU will continue to control the vessel's position and heading without interruption.	Alarm on DP.	None.	No loss of position or heading.
3. Failure of an Ethernet connection.	Each RCU is connected to Ethernet networks A and B. Failure of the connection to net A would cause the RCU to use net B, and vice versa.	Alarm on DP.	None.	No loss of position or heading.
4. Failure of an RMP module.	The digital or analogue inputs that are connected to the affected RMP module will not be available to the main DP control system. As shown in Table 8-5, this will not result in loss of any DP equipment, however it will result in loss of monitoring of a DP UPS.	Alarm on DP.	None.	No loss of position or heading.
5. Failure of an RSER module.	The serial inputs which are connected to the affected RSER module will not be available to the DP control system. As shown in Table 8-5, this would result in loss of an MGC, wind sensor and DGPS to the main DP control system. This should not lead to a loss of position or heading as the vessel should remain on DP using the other online position references and environmental sensors.	Alarm on DP.	None.	No loss of position or heading.
6. Failure of an RHUB module.	Failure of an RHUB module will cause loss of RHUB redundancy; however, the redundant RHUB module will continue to operate as normal. The RCUs will still receive data but only from either RBUS A or RBUS B. There will be no loss of sensors or position reference systems.	Alarm on DP.	None.	No loss of position or heading.
7. Failure of an RBUS rail.	Each RBUS rail provides power to the snap-on I/O modules and carries data from the RMP units to the RHUB. Failure of one RBUS rail (RBUS A or RBUS B) will result in loss of communication on the affected rail; however, the redundant rail should remain fully functional.	Alarm on DP.	None.	No loss of position or heading.
8. Failure of a RedNet connection.	This will result in a RedNet next or previous alarm being issued by the DP control system but no loss of DP control system functionality.	Alarm on DP.	None.	No loss of position or heading.

Common Findings – DP Trials

Inadequate number of position reference systems and environmental sensors tested.

IMCA M190:

“A – For Immediate Attention: *An inadequate number of successfully tested reference sensors or position reference systems to meet minimum DP equipment class requirements.*

“B – For Action When Reasonably Convenient: *PRS over and above the equipment class requirement were found faulty or were not available for test”.*

For DP2 & 3 vessels, 3 PRS based on 2 measurement principles should be tested at each DP Annual Trials.



Common Findings – DP Trials

Failure of variable pitch thruster control loops not tested.

IMCA M190: *“For vessels with variable speed thrusters of proven reliability, it may be acceptable to carry out the control loop wire break tests on a rolling programme where all tests are carried out over a five-year period. **Controllable pitch propellers should be tested annually**”.*

- IMCA Station Keeping Events:

“the largest percentage of the Main Cause’s reported for 2022 was thruster/propulsion at 39% (67); this continues to be the most reported Main Cause since 2012”.

IMCA M261, Dynamic Positioning Station Keeping Review – Incidents and Events Reported for 2022

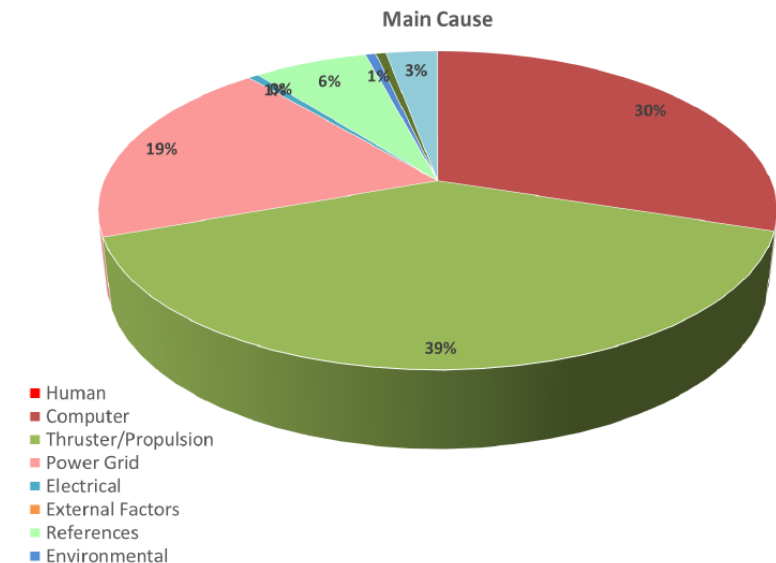
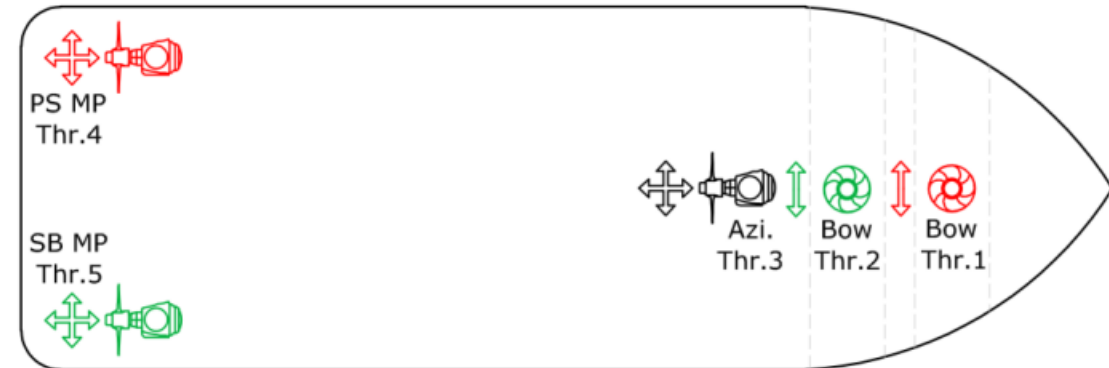


Figure 4 – Main Cause – Percentage of all DP station keeping events

Common Findings – DP Trials

Findings not correctly categorised.

- On a DP2 PSV:



CATEGORY C FINDING

“Loss of both main propulsion azimuth thrusters when the Nav DGPS was powered down”.

- IMCA M190: **“A – For Immediate Attention:** Any single failure which exceeds the worst-case failure identified in the FMEA. Any single failure which causes a loss of position or heading”.
- No details of how the finding was closed.

Common Findings – CAM & ASOG

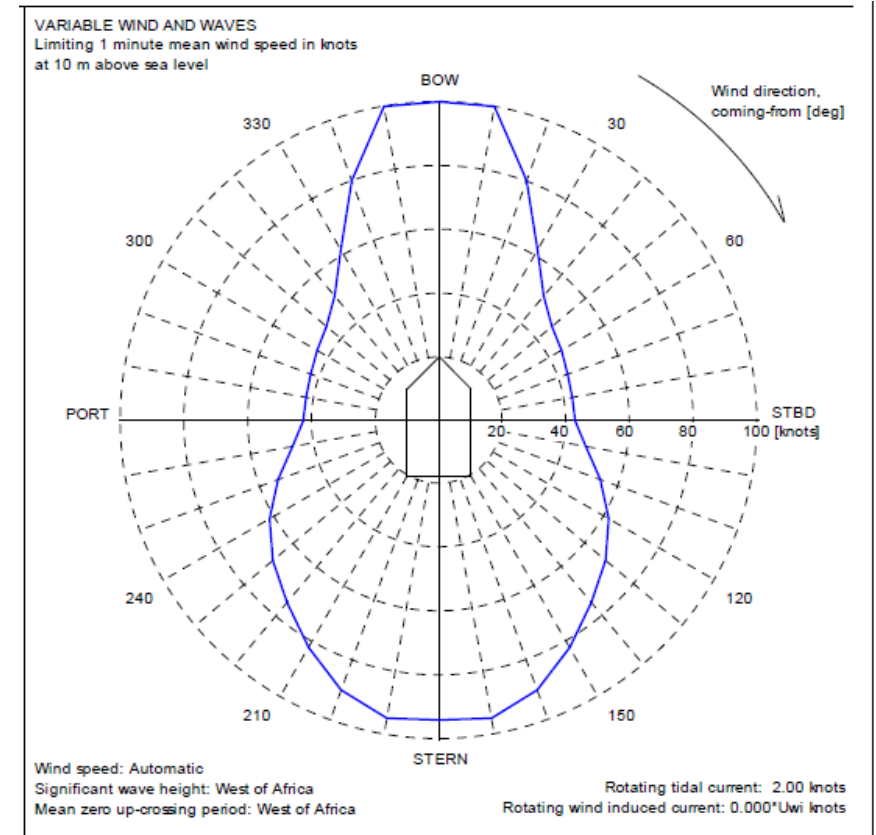
- Generally of a good standard due to good industry guidance available (IMCA M220).
- Standard layout used, consistent across the industry.
- CAM configuration is different to the FMEA.

Condition	Green	Advisory
Notify Master, Chief Engineer and all other senior project critical personnel	No	Yes
Action	Continue normal operations	Informative/consultative status (risk assess)
Switchboard configuration	All bus ties open	Any other configuration
SG1, SG2, DA1 and DA2 (testing)	Tested at 100% on field arrival or within last 6 months	Not tested to 100% within 6 months or problems present
SG1, SG2, DA1 and DA2 configuration	SG1 and SG2 online, DA1 and DA2 stand-by	Any other configuration or problems present
Emergency generator	Auto-start selected and available for use. Auto start/connect tested prior to arrival on field	Any other configuration or know problems that reduce redundancy
Blackout drill (single fuel system)	Blackout drill conducted for all DPOs and engineers. Procedures in place	Any DPOs or engineers not performed blackout drill within the last 6 months
DP power supply	All UPS functional and load tested for 30 mins 24 hours prior to field arrival. Note: Batteries to be at optimum charge before entering 500 m zone	Any other configuration or known problems that reduce redundancy. Not tested for 30 mins prior to field arrival
24 Vdc power systems (load test)	All fully functional with crossover breakers DC 10 and DC 20 open. 30 min battery tests performed and at optimum charge before entering 500 m zone	Any other configuration or known problems that reduce redundancy. Not tested for 30 mins prior to field arrival

Condition	Green	Advisory	Yellow	Red
Notify Master, chief engineer and all other senior project critical personnel	No	Yes	Yes	Yes
Action	Continue normal operations	Informative/consultative status (risk assess)	Prepare to suspend operations and initiate contingency plan (be ready to move off)	Stop operations Disconnect/bell recovery/DP reliant operation to stop
Current and predicted weather conditions	Within operating limits	Approaching operating limits	Exceeding operating limits	
Checklists: 6 hr; watch; 500 m zone	Completed	Not completed or abnormalities noted		
Drive off	All systems operating correctly	Difference in vessel position between visual, navigation and DP	Immediately when recognised by the DPO	Unable to bring vessel under control
Drift off	All systems operating correctly	Difference in vessel position between visual, navigation and DP	Immediately when recognised by the DPO	Unable to bring vessel under control
Vessel footprint/weather related excursion	No position alarms or warning	If warning position limits reached (>3 m)	If alarm position reached (>5 m)	
Heading loss	No heading alarms or warning	If heading warning limit reached (>3°)	If heading alarm limit reached (>5°)	
Heading and position control (thrustor load/DP feedback limits)	Heading and position control achieved (<45%)	Approaching 50%	More than 50%	

Common Findings – DP Capability Plots

- Generally of a good standard due to good industry guidance available (IMCA M103 / M140).
- Standard layout used, consistent across the industry.
- Doesn't always include intact and post-WCF for all DP modes.



How are Findings Closed?

- Update FMEA
- Perform additional trials.
- Change the power system configuration
(e.g. from closed bus to open bus).
- Isolate dual-supplied consumers (cross-connections).
- Update CAM/ASOG.
- Produce new DP capability plots.
- Closing findings can be costly and severely disrupt vessel schedule.





Considerations

- Vessel owners could check DP documentation on a regular basis - prior to submitting to vessel charterer for review. This can allow findings to be actioned at a more convenient time to fit vessel schedule.
- IMCA DP Practitioner Accreditation scheme:
 - Aims to set an industry recognised level of knowledge for DP Practitioners responsible for developing, witnessing and reporting of DP Trials.
 - Are any vessel owners or charterers requesting IMCA Accredited DP Trials surveyors?



Summary

- DP incidents are still occurring and according to the statistics from IMCA, they are increasing.
- DP assurance provides an additional barrier to prevent a DP incident.
- Raised awareness of common findings.





Thank You

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