

[Return to Session Menu](#)



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RELIABILITY

Use of the Marine Technology Society Gap Analysis
TECHOPS

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Use of the MTS Gap Analysis TECHOPS

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Introduction

- It is a fact that there is a wide variation in the quality and scope of the four documents covered by the MTS gap analysis tools – DP System FMEAs, FMEA Proving Trials, Annual DP Trials and DP Operations Manuals.
- There is a significant amount of guidance available on the relevant topics and industry is starting to see a welcome convergence in guidelines emanating from the relevant bodies.
- One method available to DP industry stakeholders with an interest in the continuous improvement of these key documents is the use of the standardised gap analysis tools.
- Proper use of the gap analysis tools can help to eliminate the varying scopes and author subjectivity which can be prevalent in many document 'reviews'.

Why Gap Analysis?

- In the case of DP system FMEAs, IMCA M178 (FMEA Management Guide) recommended the use of a gap analysis based on IMCA M04/04 as part of the verification process back in 2005.
- The ISM Code requires valid documents that make up the safety management system to be in place and that these are regularly reviewed.
- Field and vessel operators need to have a high degree of confidence that the target documents provide a sound basis for developing operational procedures, identifying the correct configurations for CAM or TAM activities and developing ASOGs or WSOGs.
- Gap analysis can play an important role in the continuous review and improvement of safety critical documents.

Development of the Gap Analysis Tools – the Relevant Standards

- In order to create an objective set of tools, each of the gap analysis checklists has been derived from existing industry rules and guidelines including:

Development of the Gap Analysis Tools – the Relevant Standards

- Relevant class society rules
- Recommended Practice for FMEA (DNV RP-D102)
- Guidance on FMEA (IMCA M166)
- Methods of Establishing the Safety and Reliability of DP Systems (IMCA M04/04)
- DP Vessel Design Philosophy Guidelines (MTS)
- A Guide to DP Electrical Power and Control Systems (IMCA M206)
- Guidance on Annual DP Trials for DP Vessels (IMCA M190)
- Guidance on Annual DP Trials for MODUs (IMCA M191)
- Guidelines on the Design and Operation of DP Vessels (IMCA M103)
- Guidelines for Vessels With DP Systems (IMO MSC 695)
- Guide to DP Related Documentation for DP Vessels (IMCA M109)
- DP Vessel Operational Guidance (MTS)

Use of the Gap Analysis Tools – When?

- When should the analysis tools be used?
 - At any time in the target document's lifecycle.
 - During the development of the document.
 - During periodic review.

Use of the Gap Analysis Tools – How?

- Full instructions and guidance are included in each of the TECHOPs.
- Use is intuitive and each of the tools are broadly similar.
- It would be expected that the analyst would produce a narrative report to accompany the completed checklist, summarizing the scope and conduct of the work and highlighting any apparent critical deficiencies.

Use of the Gap Analysis Tools – FMEA

A.2 REVIEW OF CONTENT

DP FMEA GAP ANALYSIS - FMEA DOCUMENT NUMBER AXXXX-X										
DESCRIPTION				APPLICATION				GAP ANALYSIS		
SYSTEM	SUB SYSTEM	ITEMS FOR ANALYSIS	ID NO.	CLOSED BUSTIE OPERATION	OPEN BUSTIE OPERATION	DP CLASS 3	FAIL SAFE	CROSS REFERENCE TO FMEA	YES / PARTIAL / NO / NOT APPLICABLE GREEN / YELLOW / RED / GREY	CONCERN
Marine Auxiliary Systems	Fuel	Document reference with revision numbers.	1	✓	✓	✓				
		Location for DP Class 3.	2			✓				
		Description of fuel system and redundancy concept.	3	✓	✓	✓				
		System configuration for DP.	4	✓	✓	✓				
		Analysis identifies redundant groups in fuel system.	5	✓	✓	✓				
		Analysis identifies common points between redundant groups.	6	✓	✓	✓				
		Analysis identifies all failure effects that can propagate from one redundant group to the other.	7	✓	✓	✓				
		Analysis identifies any protective functions upon which redundancy depends to prevent failure effects propagating.	8	✓	✓	✓				

Use of the Gap Analysis Tools – FMEA Proving Trials

TECHOP

DP FMEA PROVING TRIALS GAP ANALYSIS - TRIALS DOCUMENT NUMBER XXXXX REVISION X – REVIEW OF CONTENT										
APPLICATION				GAP ANALYSIS						CONCERNS
SUB SYSTEM	TEST DESCRIPTION	CONTENT	ID NO.	CLOSED BUSTIE OPERATION	OPEN BUSTIE OPERATION	DP CLASS 3	FAIL SAFE	CROSS REFERENCE TO FMEA	YES / PARTIAL / NO / NOT APPLICABLE GREEN / YELLOW / RED / GREY	
DP Control System	Software Audit	Record software and firmware versions of all relevant DP equipment	1	✓	✓	✓				
DP Sensors	Gyrocompass XX	Failure modes for the Gyrocompasses	2	✓	✓	✓				
DP Control System	Heading Control and Heading Out of Limits Alarms	Check heading control and alarm limits	3	✓	✓	✓				
DP Sensors	Wind Sensor XX	Failure modes for all Wind Sensors (Record location data)	4	✓	✓	✓				
DP Sensors	MRU (Type XX)	Failure modes for all Motion Reference Units	5	✓	✓	✓				
DP Sensors	Draught Gauges	Failure modes for Draught gauges	6	✓	✓	✓				
Position References	DGPS Failures	Failure modes for the Differential Global Navigation Satellite Systems	7	✓	✓	✓				

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23

Use of the Gap Analysis Tools – Annual DP Trials

TECHOP

D.3 REVIEW OF CONTENT

ANNUAL TRIALS GAP ANALYSIS - TRIALS DOCUMENT NUMBER AXXXX-A									
DESCRIPTION			APPLICATION				GAP ANALYSIS		
TEST CATEGORY	TEST DESCRIPTION	ID NO.	CLOSED BUSTIE OPERATION	OPEN BUSTIE OPERATION	DP CLASS 3	PLANNED MAINT	CROSS REFERENCE TO TEST NO.	YES / PARTIAL / NO / NOT APPLICABLE GREEN / YELLOW / RED / GREY	CONCERNS
Performance	Does the Annual DP Trials program identify and test all those elements of the DP systems that may exhibit deteriorating performance?	1	✓	✓	✓				Redundant elements must be present in number and capacity.
	Generator 100% test	2	✓	✓	✓	✓			Vessel may lose position on failure of one redundant machinery group because the other has insufficient power.
	Thruster 100% tests	3	✓	✓	✓	✓			Vessel may lose position on failure of one redundant machinery group because the other has insufficient Thrust
	Network throughput test	4	✓	✓	✓				If both networks are not capable of carrying all the traffic the vessel will lose position if one network fails

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29

Use of the Gap Analysis Tools – DP Operations Manual

TECHOP

7.3 GAP ANALYSIS CHECKLIST

DP OPERATIONS MANUAL GAP ANALYSIS - DOCUMENT NUMBER AXXXXX REV. Y DATED dd/mm/yyyy					
THE MANUAL SHOULD ADEQUATELY INCLUDE AND/OR COVER THE FOLLOWING ISSUES AS APPROPRIATE	ID NO.	SOURCE OF REQUIREMENT	CROSS REFERENCE TO DP OPERATIONS MANUAL	SUBJECT COVERED? YES / PARTIAL / NO / NOT APPLICABLE GREEN / YELLOW / RED / GREY	COMMENT / CONCERN
Management of DP Operations:					
Company policies. DP should be identified as a safety critical element.	1	MTS Ops Guidance Part 2 IMCA M109 Sec 3.2.4 IMCA M109 Sec 3.2.7 TECHOP ODP 05 Sec 4.1.2 TECHOP ODP 05 Sec 5.1.1			
Basic principles of DP including a functional overview of a DP system.	2	MTS Ops Guidance Part 2			
Vessel specific overview of the DP system and industrial mission equipment including different control modes (e.g. heavy lift, follow sub, pipelay, thruster bias, quick current etc.)	3	MTS Ops Guidance Part 2 IMCA M109 Sec 3.2.3 IMCA M109 Sec 1.5 TECHOP ODP 05 Sec 5.2.1 TECHOP ODP 05 Sec 5.5.3 ABS Guide to DP Systems- Sec 2 Ch 13			
Vessel specific DP philosophy to include reference to CAM / TAM; ASOG: system configuration (e.g. open / closed bus); worst case failure design intent (WCFDI) and worst case failure (WCF); environmental limits; station keeping capability. Vulnerabilities of the DP system should be discussed and configurations that may defeat the redundancy concept described.	4	MTS Ops Guidance Part 2 IMCA M109 Sec 3.2.5 IMCA M109 Sec 3.2.8 TECHOP ODP 05 Sec 4.1.2 TECHOP ODP 05 Sec 5.2.1 TECHOP ODP 05 Sec 5.5.1 ABS Guide to DP Systems- Sec 2 Ch 13			
Vessel specific philosophy for converting drive off to drift off.	5	MTS Ops Guidance Part 2 IMCA M109 Sec 3.2.6			
References to other relevant DP guidance and reference documents including but not limited to: DP system FMEA; equipment manuals; MTS guidance; IMCA guidance; technical and safety bulletins; Class Society rules, client specific requirements.	6	MTS Ops Guidance Part 2 IMCA M109 Sec 3.2.4 IMCA M109 Sec 3.2.7 IMCA M109 Sec 3.2.11 TECHOP ODP 05 Sec 5.3.1 ABS Guide to DP Systems- Sec 2 Ch 13			

TECHOP_OOP_05_(O)_DP OPERATIONS MANUAL_Ver2-02201413

17

Evaluating the Results

- A ratio of reds / yellows / greens will result.
- This gives an indication of the level of compliance....however....
- There is no 'pass / fail' conclusion. Not intended as a means to exclude vessels.
- A lack of transparency in the target document can and will lead to a large number of 'red flags' which may skew the 'score'.
- A lack of attention to the industrial mission will also generate a lot of 'reds'.
- However, this will direct the reviewer to address those issues by revisiting the source material.
- Part of continuous improvement cycle.
- The gap analysis of the FMEA, Proving Trials or Annual Trials is NOT an analysis of the DP system design! It is perfectly possible to have an excellent FMEA or trials programme which scores highly on gap analysis, written for a poor design or vice versa.

Experience to Date

- Being used by variety of stakeholders including oil majors, MODU and vessel operators.
- Several stakeholders have decided to develop new documents based on the results of gap analysis.
- Limited experience of use of the tools to revise documents (so far).
- Older documents which have not been subject to continuous review fare worse.
- Newer documents generally tend to be more in line with industry expectations.
- Process is improved if done as a series covering all four target documents.

Experience to Date – What Deficiencies is the Process Revealing?

- FMEA:

- Lack of clarity regarding power system configurations.
- Failure to look beyond benign failure effects.
- Failure to analyse external interfaces.
- Failure to analyse cross connections in sufficient depth.
- Failure to analyse protective functions in sufficient depth.
- Failure to analyse plant stability for closed bus operations.

Experience to Date – What Deficiencies is the Process Revealing?

- Proving Trials and Annual Trials:
- Unsurprisingly, similar to FMEA deficiencies i.e.:
 - Clarity of system configuration.
 - Insufficient testing of external interfaces, cross connections, protective functions and plant stability for closed bus operations.

Experience to Date – What Deficiencies is the Process Revealing?

- DP Operations Manual:
 - Lack of clarity regarding DP system configurations.
 - Little discussion of CAM / TAM.
 - Lack of mission specific guidance.
 - Apparent lack of input from vessel operational teams (Generic manuals).

Future Development of the Gap Analysis Tools

- Revision based on experience and feedback. FMEA a priority.
- Additional guidance contained within checklist?
- Spreadsheet filters to quickly tailor the checklists under development.
- Please use, review and provide feedback via MTS DP Committee website - http://www.dynamic-positioning.com/dp_ops_feedback.cfm

Conclusion

- Tools should provide a consistent, objective method of evaluating documents against current industry standards and expectations.
- Intended to contribute to a raising of standards to a high but achievable level.



Thank You.

Questions?

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