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DP Operations & Risk Management Tools (CAMO-ASOG)

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Abstract

Historical records show that structured operational limits criteria were first formally used in Europe with the WSOG (Well Specific Operating Guidelines) and in Brazil with the degraded status criteria. Establishment of structured operational limits criteria are very important to support incident free and efficient DP Operations. Critical Activity Mode of Operation (CAMO) is how to configure the vessel's DP system, including power generation and distribution, propulsion and position reference systems. Activity/Well Specific Operating Guidelines (ASOG/WSOG) sets out the operational, environmental and equipment performance limits considered necessary for safe DP operations whilst carrying out a specific activity. DP DST is new software that supports the ASOG/WSOG/CAMO and applies this engineered process, transforming it to a new level by actively and digitally interfacing the ASOG/WSOG/CAMO around the vessel/rig and shore side support.

Keywords

CAMO (Critical Activity Mode of Operation)

ASOG (Activity Specific Operating Guidelines)

WSOG (Activity Specific Operating Guidelines)

TAM (Task Appropriate Mode)

DP (Dynamic Positioning)

Introduction

Dynamic positioning system is the complete installation necessary to maintain the vessel's position and heading within predefined limits, consisting of the following main subsystems: power system, propulsion system and dynamic positioning control system.

Although DP FMEAs shall cover the analysis of all such subsystems, they may not specify the complete configuration of the DP system. Bus ties configuration is always included, however many other important equipment and system configurations maybe omitted or not clearly defined. For example:

- Minimum quantity of generators connected per SWB section.
- Maximum generators or switchboards load.

With the industry growth in DP vessels, technology advances with more complex designs, along with a decline in experienced and trained operators, means that often the DP redundancy and fault tolerance is defeated by the operator by incorrect application of the operational design criteria.

Establishment of structured operational limits criteria are very important to support incident free and efficient DP Operations and is now in use globally with outstanding results providing reduced DP incidents.

In addition to providing structured limitations, there is a requirement to share the information/limitations to all users and invested parties. When an operational limitation occurs, the information must be communicated to all parties, by applying the successful ASOG/WSOG/CAMO in a digital/software environment, it ensures that all parties are provided with the live and current fault tolerance.

History

In 1982 one of the first DP semi formal documents by the UK Department of Energy was issued, although limited, it highlighted the necessity of effective operational limits to be defined for DP drilling (Adamson and Abrahamsen, 2006).

The use of risk management tools for DP operations started with the WSOG in the late 90's. The first issue of a WSOG was the Ocean Alliance campaign between 1997 and 1998 (Adamson and Abrahamsen, 2006).

In 2004 Shell introduced the ASOG process for project vessels, but their use of the ASOG/WSOG has developed now to all DP vessels and DP MODUs.

In Brazil, with the Petrobras DPPS (Dynamic Positioning Safety Program), and their proactive policy, one of the concepts introduced in 1995 was the Degraded Status Criteria for all DP drilling rigs. According to Pallaoro (2005), the Degraded Status Criteria describes the minimum equipment and system configuration necessary for normal station keeping and also the general limit values for alarms in each stage of position loss, including all kind of operations performed by the rig. Nowadays the degraded status criteria is in use with the DP drilling rig, DP production rigs and DP shuttle tankers.

The ASOG/CAMO was first introduced as part of an international industry guideline by the MTS (Marine Technology Society), through the DP Operations Guidance, published in 2010.

The first oil major's to introduce the WSOG as part of their internal procedures was Statoil in 2000 (Adamson and Abrahamsen, 2006). Since then, the WSOG/ASOG/CAMO has been included in several oil major's DP procedures, such as, Shell, BP and Chevron.

Risk Management Tools

The risk management methods that have been increasingly used through the offshore industry are the CAMO, TAM and ASOG/WSOG.

IMCA M220 establishes clear definitions on such tools, as follows:

CAMO – Critical Activity Mode of Operation: sets out the most fault tolerant configuration for the DP system and associated plant and equipment. For DP Class 2/3 vessels usually defines the most robust fault tolerant configuration of the DP system ensuring that a single point failure does not exceed the vessel's identified worst case failure (IMCA M220, 2012).

CAMO is applied to all critical activities. CAMO is also referred as **SMO (Safest Mode of Operation)** in the MTS DP Operations Guidance first revision.

CAMO - Critical Activity Mode of Operation		
M/V LLA DST		
This setup applies when the vessel is carrying out Operations while on DP		
Vessel to be set up and stabilized on DP before entering the 500m zone.		
Condition	GREEN	ADVISORY
Notify Master, Chief Engineer, Client Rep, and other vessels in area	NO	YES
Action	CONTINUE NORMAL OPERATIONS	INFORMATIVE / CONSULTATIVE STATUS (RISK ASSESS)
Switchboard set up	6.6kV bus tie open 480V bus tie closed	Any other set up
Shaft generators	Tested at 100% on field arrival or within the last 6 months	Not tested at 100% on field arrival or within the last 6 months or problems found
Shaft generators	SG1 and SG2 online.	Any other set up
Auxiliary Diesel Generators	DG1 and DG2 online.	Any other set up
Gyros	All Gyros Enabled	Any Gyro unavailable
DP Control System	Available	Unavailable

Fig. 1: CAMO Sample (Partial)

TAM – Task Appropriate Mode: Risk-based operating mode in which the DP vessel may be set up and operated, accepting that a single point failure could result in exceeding the vessel’s identified worst case failure (IMCA M220, 2012).

TAM is applied to less critical activities where position loss is found acceptable before the project/operation.

ASOG – Activity Specific Operating Guidelines: sets out the operational, environmental and equipment performance limits for the location and the specific activity the vessel is undertaking (IMCA M220, 2012).

ASOG - Activity Specific Operating Guidelines M/V LLA DST				
Condition	GREEN	ADVISORY	YELLOW	RED
Notify Master, Chief Engineer, Client Rep, and other vessels in area	NO	YES	YES	YES
Action	CONTINUE NORMAL OPERATIONS	INFORMATIVE / CONSULTATIVE STATUS (RISK ASSESS)	PREPARE TO ABORT OPERATIONS	ABORT OPERATIONS
DP Checklists (Location, Bridge and ECR)	Completed	Not completed or abnormalities noted		
Current and predicted weather conditions	Within Operating limits, both intact and after worst case failure (Verify capability plots)	Approaching operating limits	Exceeding operational limits	
Prevailing weather force	Not towards asset	Weather changing towards asset	Towards Asset	
DRIVE OFF or DRIFT OFF	All systems operating correctly	Difference in vessel position between Survey, Navigation and DP	Immediately when recognized by DPO	Unable to bring vessel under control
Main Propulsion Load	<45%	Approaching 50%	Any >50%	

Fig. 1: ASOG Sample (Partial)

WSOG – Well Specific Operating Guidelines: Same as the ASOG, for a vessel/rig undertaking drilling operations. Developed for a specific well or drilling activity.

All the risk management tools are presented in a tabulated format, where the columns indicate the operational DP status:

- **Green** : Normal operations.
- **Blue** : Advisory Status. Risk asses to safely continue the operation with proper mitigation or move to yellow. An issue that has no immediate risk.
- **Yellow** : Stop the operations in a controlled manner and commence contingency plan. Loss of redundancy or if the vessel has exceed the operational limits.
- **Red** : Emergency situation. Immediately stop the operations.

Actual Use of Risk Management Tools

Recognizing the importance of the ASOG/CAMO, BP has defined it at the centre of their Upstream processes and mandated the requirement through a Close Approach and Dynamic Positioning defined practice. The ASOG/CAMO implementation process has begun with the development of standard templates and following a Management of Change process roll out will be completed by 2014.

The WSOG has been included in the Statoil DP drilling requirements since 2000. Shell has implemented the ASOG/CAMO since 2004 with a successful record of safe DP operations with limited position loss. Petrobras has the Degraded Status Criteria implemented within their drilling units through the DPPS. Chevron has included in their Upstream Marine Standard that all DP vessels or units shall comply with the current version of MTS DP Operations Guidance and Appendices as a global DP operating requirement.

DP Rules and Guidelines

DP vessels are currently governed by rules, regulations and guidelines that include the design, operation, training and manning subjects. Rules and regulations are prescribed by:

- Classification Societies (Design)
- Nautical Institute (DPOs Training)
- Flag States (DPOs Training, Manning and DP vessels/units requirements and recommendations)

Guidelines are currently delivered by:

- IMO (Design and Operation)
- IMCA (Design, Training and Operation)
- MTS (Design and Operation)

The Brazilian Navy was the first flag state to include the DPOs manning as part of a Safe Manning, that covers not only the Brazilian DP vessels, but every foreign DP vessel or rig operating in Brazilian waters. This has been a step forward on the delivery of the necessary training to the deck officers, especially for the offshore supply vessels segment.

USCG announced in 2012, by the Federal Register Notices, their expectation for the DP rigs operating in American waters of voluntary compliance with the MTS DP Operations Guidance.

Risk Management Guidelines

Industry first documented the importance of structured operational limits criteria by the MTS DP Operations Guidance in 2010.

Understanding the importance of the MTS document, in 2011, DNV endorsed the MTS Operational Guidance by issuing the DP Systems Operation Guidance – Recommended Practice.

In 2012 IMCA issued the Guidance on Activity Operational Planning that exclusively provides a brief overview on risk management tools: CAMO, TAM and ASOG.

Increase in the Operational Safety

Proven and measurable records of the correct application using the risk management tool highlights the importance of the ASOG/CAMO.

Patterson (2011) presented during the MTS DP Conference, Shell outstanding records of incident free DP operations with the use of the ASOG/CAMO tools. From 2004 to 2011, 171 ASOGs/CAMOs were issued by Shell. DP incident free operations were conducted from 2005 to 2008 and in 2010. From 2004 to 2011, there were only three recorded loss of position incidents. The cause of two of the recorded incidents, one in 2009 and one in 2011, was the failure to follow ASOG/CAMO. The other incident recorded in 2011 occurred with vulnerabilities identified, consequences understood and accepted.

Concerns

An effective CAMO and ASOG is dependent on a detailed engineered assessment of the vessel configuration and the accurate establishment of the operational limits required for the intended DP operations.

One of the most important factors to the CAMO is the quality of the DP FMEA. DP FMEAs may have incorrect or missing analysis that must be further assessed for the correct development of the CAMO. Although today a great number of rules and guidelines are available, the DP FMEAs are still prepared and approved under different levels of quality. One key issue is that there are still different interpretations and assumptions for such rules and guidelines.

Assessments shall also include Client specific requirements, such as minimum quantity of relative reference systems or splitting of DGPS differentials.

It shall also be noted that different operations and locations will require different setups and limits. DP operating mode alongside turret moored FPSOs shall not be the same as with fixed platforms. As previously defined, ASOG is delivered for different activities or locations.

Crew training is essential for the success on the implementation of the tool, as they will be managing the use of tools on board during the execution of the DP operations.

There is no mandatory training for Engineers working on board DP vessels. Although IMCA has issued a guideline, IMCA M117, where it is recommended some minimum requirements for the training of the Engine Room personnel, most of the Engineers usually did not undergo any formal DP training. The ASOG and CAMO has an important role for the Engineers, as they make very clear the correct configuration and limits of the machinery systems for DP operations and also provide the proper response to faults and failures.

Weather Conditions Criteria

Besides other operational limitations and any pre-determined values, other important factors have also to be used to determine a DP vessel's weather condition limitation:

- Thrusters Load (Not pitch or RPM).
- Generators Load.
- Worst case design failure effect.
- Position and heading excursions.

All such criteria are included in the ASOG/CAMO tools.

Solutions

An efficient implementation of the ASOG/CAMO tools will deliver the following solutions for safer DP operations:

- Establishes the complete DP system configuration.
- Establishes the DP operational limits.
- Identify and establish the response levels to faults and failures.
- Coordination during SIMOPS.
- Guidance for management of changes
- Increase the operability of the DP vessel/unit within the designed limitations.
- Increase the knowledge or understanding of the DP system by the vessel's crew, vessel's operator and Client.

DP DST

DP DST is new software that supports the ASOG/CAMO and applies this engineered practice, transforming it to a new level by actively and digitally interfacing the CAMO/ASOG around the vessel/rig (DP Station, Engine Control Room, Master, Client Office/Cabin, Dive Control, Drill floor, Toolpusher, Rig Manager, ROV or any requested location). In addition onshore remote locations are provided with Condition Based Monitoring allowing access to the current status the vessel is operating in. If the DP station or the Engine Control Room changes status all other remote stations will be automatically updated, therefore all departments will be aware of the status of the DP integrity. All events changes are further data logged.

With the ever expanding application of rules, guidelines and procedures required for risk management, too often DPOs, Engineers and Shoreside Management are not made aware of all the tools available to them such as DP FMEA, DP Operations Manual, DP Capability Plots, IMCA, MTS etc, DP DST digitally interfaces all DP documentation to the DST, providing Awareness, Training and Value to operators and the industry. DP DST offers a step change in the safe operation of DP vessels and is just right for today's expanding DP sector. It is an easy to use electronic tablet format that not only supports all operators in decision making, it communicates these decisions instantly to where they need to go.

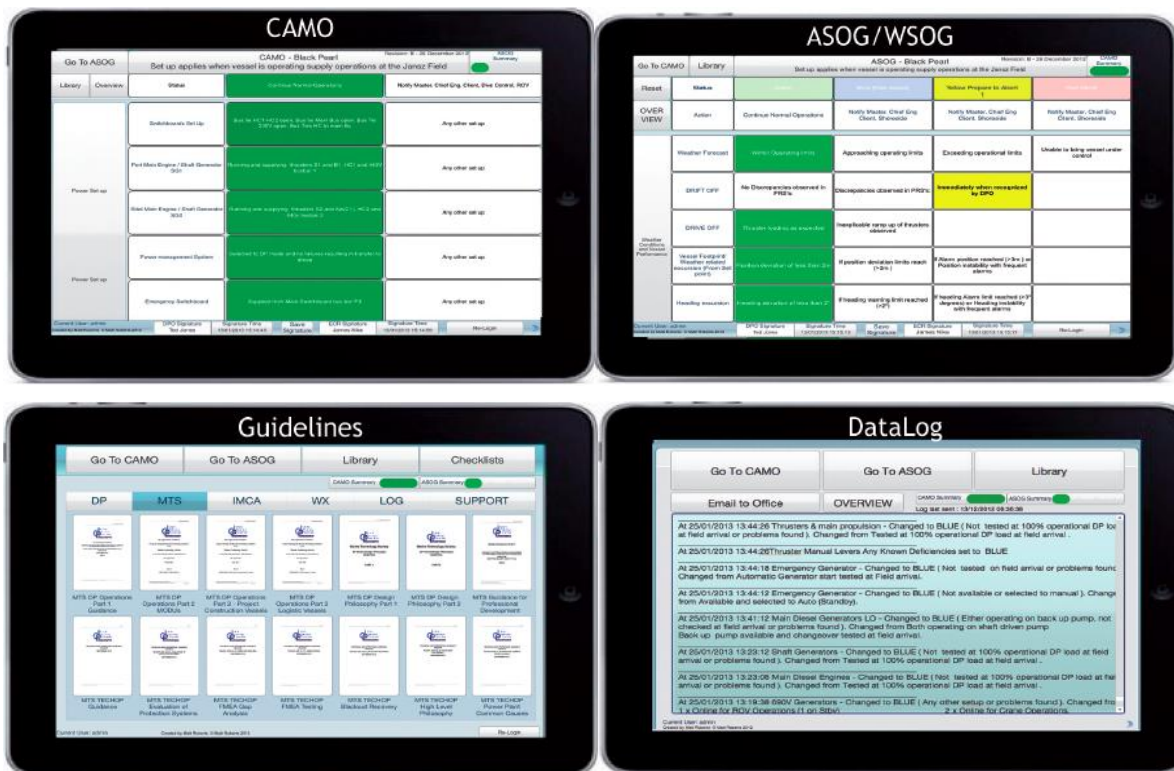
DP DST Applies IMCA M220 "Guidance on Operational Activity Planning" MTS Guidance "DP Operations" and DNV "RP E307 DP Operation Guidance".

Awareness: With the ever expanding application of rules, guidelines and procedures required for risk management, too often DPOs, Engineers and Shoreside Management are not made aware of all the tools available to them such as DP FMEA, DP Operations Manual, DP Capability Plots, IMCA, MTS etc, DP DST digitally interfaces all DP documentation to the DST, providing Awareness, Training and Value to operators and the industry. DP DST offers a step change in the safe operation of DP vessels and is just right for today's expanding DP sector. Its easy to use electronic tablet format not only supports all operators in decision making, it communicates these decisions instantly to where they need to go.

Training: DP DST provides training and development to the operators and all users. By providing the awareness of the tool, the operator shall become more experienced in DP FMEA, Critical Mode of Operation, Fault Tolerance, DP Capability, DP Risk Management, Company procedures and more

Value: Any tool must provide value for success, DP DST believes great value is provided as it requires minimal installation and cost. True value is applied from the training and awareness that it brings to all that use the tool.

DP DST offers a step change in the safe operation of DP vessels and is just right for today's expanding DP sector. It's easy to use electronic tablet format not only supports all operators in decision making, it communicates these decisions instantly to where they need to go.



Conclusion

ASOG and CAMO can be considered one of the most efficient tools available for the conducting of safe DP operations. This has been recognized by the industry with the increase in their use over the years by important oil majors and also by the delivering of industry guidelines.

Safe DP operations shall always consider the vessel configuration, vessel limitations and adequate response to failures.

Nevertheless, training is a key factor for the adequate use of tool.

ASOG links people, process and equipment (Muddusetti and Philips, 2010)

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