



DYNAMIC POSITIONING CONFERENCE

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Operations and Procedures

WSOG – History & Future. A summary of the Development & Worldwide use of Well-Specific Operating Guidelines

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Title: WSOG – History & Future. A summary of the development and worldwide use of Well Specific Operating Guidelines.

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Introduction

This paper discusses the issue of operational limit setting used in DP operations. It traces the history of the WSOG (Well Specific Operating Guidelines) since 1998. The paper also examines the reasons behind its widespread use in DP drilling & other operations.

Modern WSOG in the form we are familiar has its origins with the Ocean Alliance campaign in the late 90's on the Nyk High, Vema Dome and Helland Hansen prospects in the Norwegian Sea. The WSOG principle was further developed during the commissioning of the drillship West Navion between 1998-2000. WSOG became a cornerstone of the Statoil DP work requirements document which became the principle Corporate DP requirement document, TR1029 in 2000. Since then, a number of other major Operators have introduced corporate DP requirements, all of which contain WSOG as the chosen regime for limit setting offshore.

This paper discusses the European approach to deepwater drilling risk management in terms of limit settings. The paper also discusses 2 incidents. One where WSOG worked as intended and one where WSOG failed in its objectives. A comparison is undertaken.

The paper concludes with a summary of the reasons WSOG has had such widespread use, its benefits and introduces challenges to the industry to ensure its continued effective use.

The presentation at MTS in October 2006 will also include a survey among the attendees in the auditorium. The author will pose a number of pointed questions to the audience in an attempt to generate immediate feedback into the use of WSOG. This survey will provide the MTS DP committee with valuable insight into whether the existing WSOG process does indeed hold worldwide appeal to the industry.

MTS DP Conference 2000 – Reliability Session, a look back 6 years

The subject of degraded status is certainly not new. Included is a quote from the conclusions of the session on 'Degraded Status' given to MTS in 2000.

DP vessels will frequently be operating with some equipment that is essential for DP class 2 or 3 unavailable. This can however mean that it is safe to continue working. Thus it is important to make sure each DP vessel has good vessel specific guidelines to manage a degraded situation and that the key DP personnel have enough understanding of the complete design to determine the status correctly. This understanding must enable logical discussion particularly when several relatively minor items are unavailable because their sum could be very significant.

C. Jenman, Chairman, Global Maritime

What is WSOG ?

WSOG stands for Well Specific Operating Guidelines. The WSOG document is used to define actions to be taken by a DPO in the event of certain changes to the DP units capability. The WSOG also serves as a DP emergency response primer and ‘ready-reckoning checklist’ for DP Operators. A sample form is included herein.

The WSOG, in a number of forms, is used widely across the DP drilling industry today. The large majority of the worlds DP drilling contractors are making use of the WSOG in the format discussed in this paper. All DP drilling activities on the Norwegian Shelf are conducted using the WSOG regime, and it is the primary method of conducting the station keeping HAZOP and limit setting exercise.

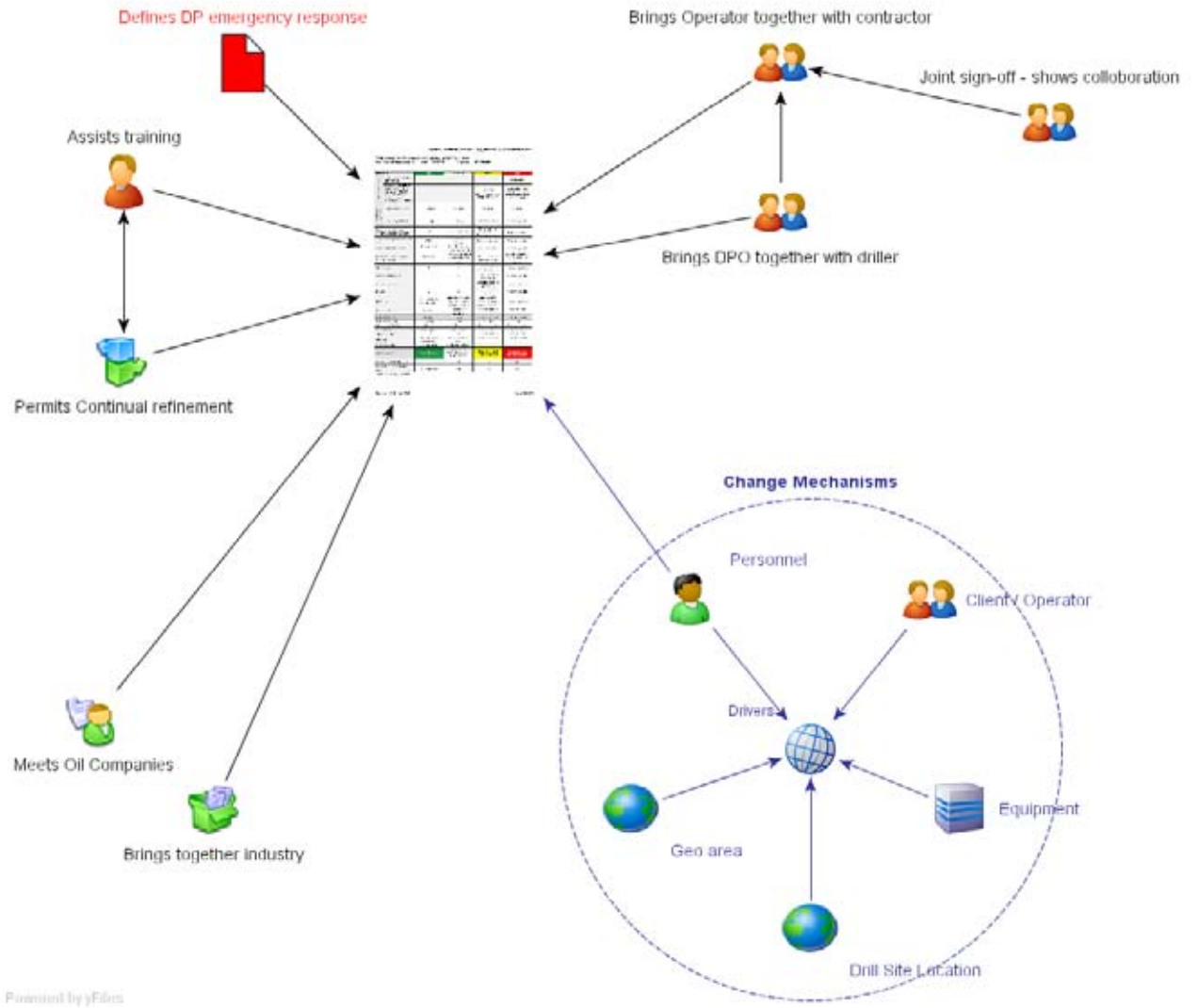
The central tenet of WSOG is that it clearly defines, prior to operations, the 4 different DP operating status conditions against known possible failure modes. WSOG brings together the rigs design basis, changes during design, personnel, clients and so forth.

WSOG is effectively a purpose built ‘HAZOP’ for DP drilling which, because of its design simplicity, has had a great deal of take-up around the world. As well as being a simple and effective tool, it provides the following advantages:-

- DP Emergency response matrix is defined
- Assists training of Key personnel without the need to re-train across contractors
- Brings together driller and DPO (drilling and marine)
- Brings together contractor and client
- Shows that the contractor has a credible system
- Demonstrates a ‘case’ of operational risk management
- Allows for and is designed for handling change i.e.
 - New personnel, new equipment, change of site, geographic location & client

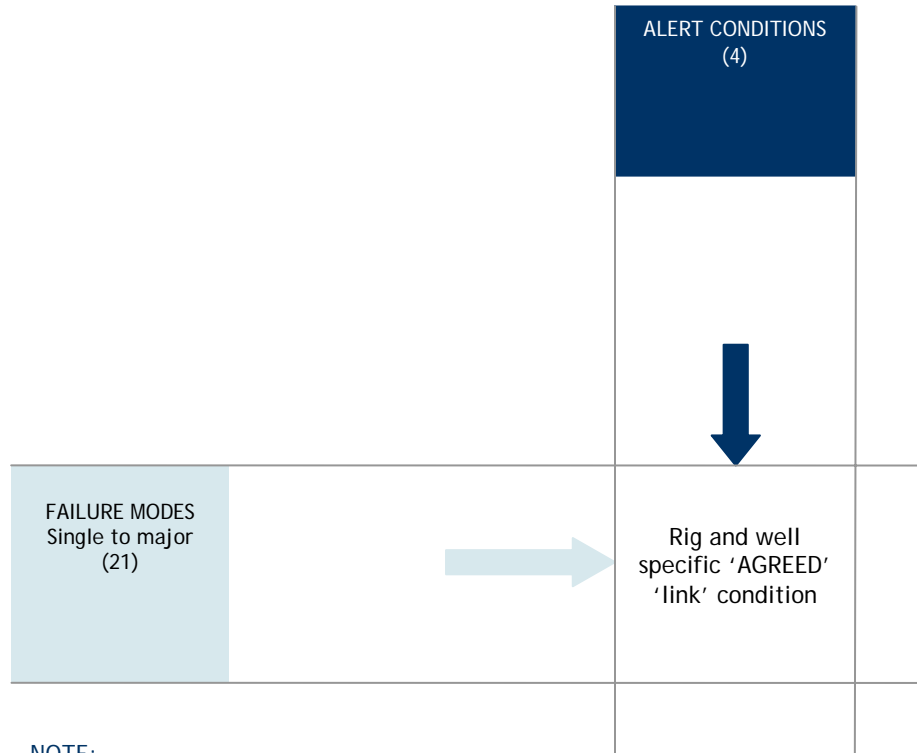
One of the major benefits to the DP drilling industry is that drilling supervisors should be able to build a body of experience when operating on different DP units across different contractors. This was seen by Statoil as a great advantage early on.

WSOG is, effectively, a link between known failure events & operating conditions of different type of actions. Each ‘action’, green, advisory, yellow and red have defined, agreed responses. The WSOG form can be amended and/or expanded to capture additional conditions. The WSOG is also valid for use in HAZOPs for operations such as DST and dual activities where additional safeguards may need to be applied. The diagram below shows why the WSOG process works so well.



Map of what WSOG manages to achieve offshore

WSOG - What does it do?



NOTE:
There are 84 conditions in a typical common WSOG

A brief History of Well Specific Operating Guidelines

One of the first semi-formal guidance documents for DP drilling was produced by the UK Department of Energy in March 1982. It came out at a time when the first 'Pelican Class' DP ships were occasionally drilling in the UK Sector. This document was very basic by today's standards but did highlight the need for effective operational limits to be defined.

The concept of well specific limits was included in the document.

Ocean Alliance conducted a drilling campaign in the Norwegian Sector in 1997 and 1998. A great deal of risk analysis was carried out prior to the rig operating. The first version of the Ocean Alliance WSOG was contained in 4 pages and clearly defined the use of the Advisory condition to allow for reporting of events which may lead to higher alert status levels.

The wells drilled by Ocean Alliance during the campaign were:-

1997: Ormen Lange (886m, Norsk Hydro/BP). Original Ormen Lange gas field discovery.
Wellbore Entry date 27.07.97. Exit 07.10.97

1997: Vema Dome (1,238m, Operator: Statoil)
Wellbore entry date 12.10.97 Exit 22.03.98

1998: Helland Hansen Prospect (684m, Norske Shell)
Wellbore Entry date 28.03.98. Exit 04.07.98


Source: PSA


Statoil development - 1998

The challenge in 1998 was the acceptance and compliance issues surrounding the entry into service of the Class 3 drillship ‘West Navion’. Within Statoil, a review process began during 1998 following the Ocean Alliance DP campaign. The DP related verification work including the Ocean Alliance Joint Venture Project (Norway) Doc. 1.0 22/09/97 was used as the start point. During late 1999, the station keeping case for West Navion was accepted by the regulator and the WSOG was used from the beginning on operations on the vessel.

Statoil DP Requirements Rev 1

B&B-TB-10-20E DP Requirements were issued on 20 January 2000, approved 21 February 2000. The first revision of the Statoil DP Requirements document mandated an early version of the WSOG.

		Rev. 3	Date 21.02.00	Page 31 of 36
DP REQUIREMENTS FOR DRILLING OPERATIONS		Made 18.01.00	Reviewed 18.01.00	Approved 21.02.00

 DRILLING OPERATIONS DP OPERATIONAL GUIDANCE FORM				
CONDITION	GREEN <small>Figures need be guidance only</small>	ADVISORY	YELLOW	RED
UNIT OFFSET DEVIATION (WD <350m)	Ref. § 4.4.4 & 4.4.5			
UNIT OFFSET DEVIATION (WD 350-500m)	<3m	5m <small>NOE <</small>	10m <small>NOE <</small>	20m <small>NOE <</small>
UNIT OFFSET DEVIATION (WD 500-1000m)	<4m	10m <small>NOE <</small>	20m <small>NOE <</small>	35m <small>NOE <</small>
UNIT OFFSET DEVIATION (WD >1000m)	<5m	15m <small>NOE <</small>	25m <small>NOE <</small>	50m <small>NOE <</small>
POWER CONSUMPTION EACH HV NETWORK	<50%	50%	>70% or consequence alarm whichever occurs first	Situation specific
THRUST CONSUMPTION EACH ONLINE UNIT	<50%	Any sudden change	>70% or sudden change	Situation specific
DP POSITION FOOTPRINT (5 min. AVERAGE RADIUS FROM SETPOINT)	<2m	5m	Situation specific	Situation specific
DP HEADING FOOTPRINT (5 min. maximum FROM SETPOINT) <small>NOE 1</small>	<3°	7°	12° depth dependant	If threat to position
POSITION REFERENCE AVAILABILITY (<350m WD)	3 independent	Any failure or loss of performance in any system	2, if same type is DGPS	If threat to position
POSITION REFERENCE AVAILABILITY (>350m WD)	3 independent	Any failure or loss of performance in any system	2, if same type ie DGPS	If threat to position
ONLINE POSITION REFERENCE TYPE REQUIREMENTS	3 ONLINE DURING CONNECTED DRILLING	Any failure or loss of performance in any system	2, if same type ie DGPS	If threat to position
DP CONTROL SYSTEM	3	2	1	0
WIND SENSORS	3	2	1	If threat to position
MOTION SENSORS	3	2	1	If threat to position

Statoil WSOG Rev 1 – Feb 2000

Statoil Rev 2

Following further involvement within worldwide asset teams, Statoil published the 2nd edition of the corporate requirements document, entitled WR0581, Version 4 on 29.08.2001.

Statoil Rev 3

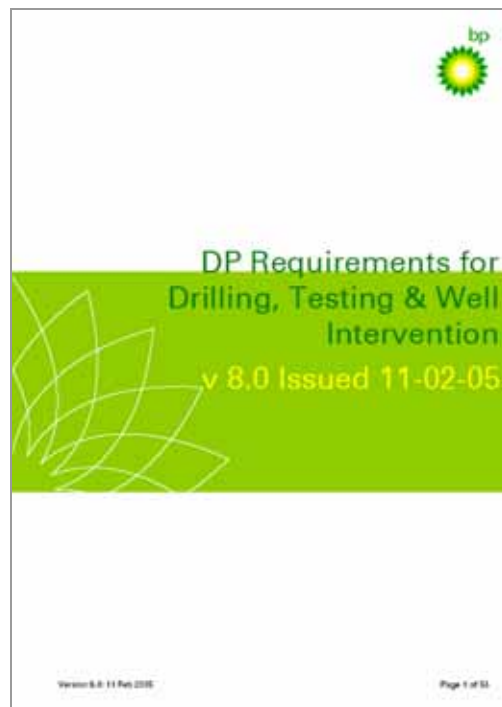
Statoil re-published the DP requirements as ‘TR1029’ Technical requirements on early 2002.

Other operators such as Norsk Hydro and in 2005, BP, have since issued corporate requirements for DP drilling and well intervention.

It should be noted that all corporate DP requirements issued by Oil majors use the same WSOG process as the principle means of establishing alerts through the definitions of green, advisory, yellow and red alert.

BP Group

BP issued a set of Corporate DP requirements for drilling, testing & well intervention in late 2004. This finally became Version 8 and was issued in February 2005. The BP standard uses the same WSOG process as the earlier Statoil document. A version 9 is due to be released in the summer of 2006.



Industry Presentations

The WSOG process and wider verification model was presented at the IADC Northern Deepwater conference in Stavanger in May 2001. The technical paper presented at IADC used case studies to show how different Oil Operators and drilling contractors are adopting the processes begun in Norway for the benefit of proving an effective operational risk management case for their DP operations.

Influence on Industry

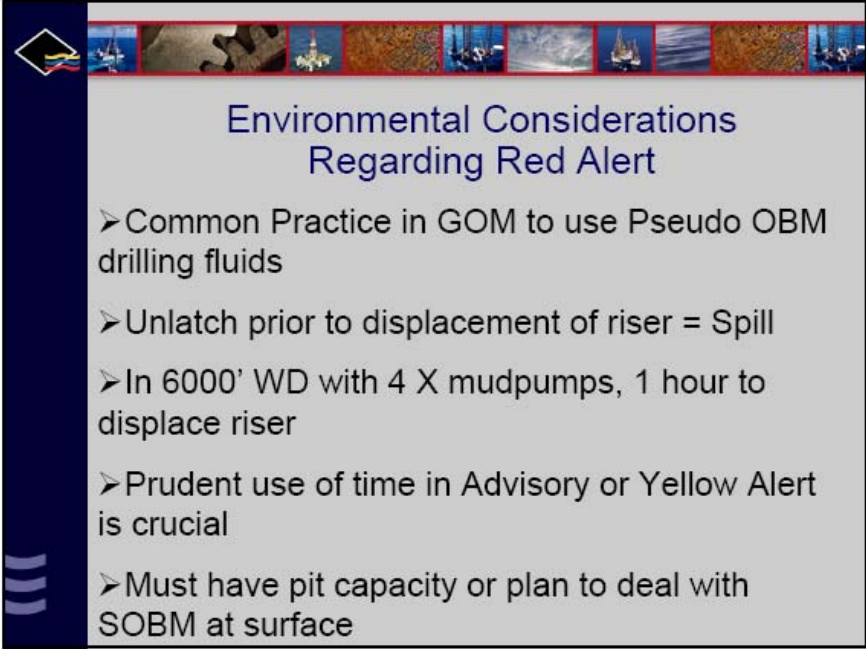
The WSOG model form has had a significant influence worldwide. On 15th November 2004, DNV prepared a report for the US MMS entitled, 'Guidance on safety of well testing' Ref. DNV 4273776/DNV. The report includes reference to WSOG in the form presently used.

Operators including Shell/Enterprise, BP, ExxonMobil, Conoco, Marathon, Amerada Hess, Elf Exploration Angola, Woodside, BHP, Apache have all made use of the WSOG form during their drilling campaigns. A number of drilling contractors have adopted this process, in one form or another, in their DP operations manuals.

Diamond Offshore

The following slide shows Diamonds approach. A presentation by Diamond was given at the AADE-DIG Meeting in May 2004. It shows that use of Advisory and Yellow Alert is crucial.

This slide reinforces the point



The slide features a dark blue vertical bar on the left with a white diamond icon at the top and three white horizontal bars at the bottom. The main content area is light gray with a title in blue and a list of five bullet points in black. The top of the slide has a horizontal strip of small images related to offshore drilling.

Environmental Considerations Regarding Red Alert

- Common Practice in GOM to use Pseudo OBM drilling fluids
- Unlatch prior to displacement of riser = Spill
- In 6000' WD with 4 X mudpumps, 1 hour to displace riser
- Prudent use of time in Advisory or Yellow Alert is crucial
- Must have pit capacity or plan to deal with SOBM at surface

Courtesy Diamond Offshore Drilling

A copy of a WSOG is included herein for sample:

DP REQUIREMENTS FOR DRILLING, TESTING & WELL INTERVENTION

Well Specific Operating Guidelines (WSOG) Category A, B, C, D

Unit/Vessel: Deepwater X Well: *SAMPLE* Operator: **BP GROUP**

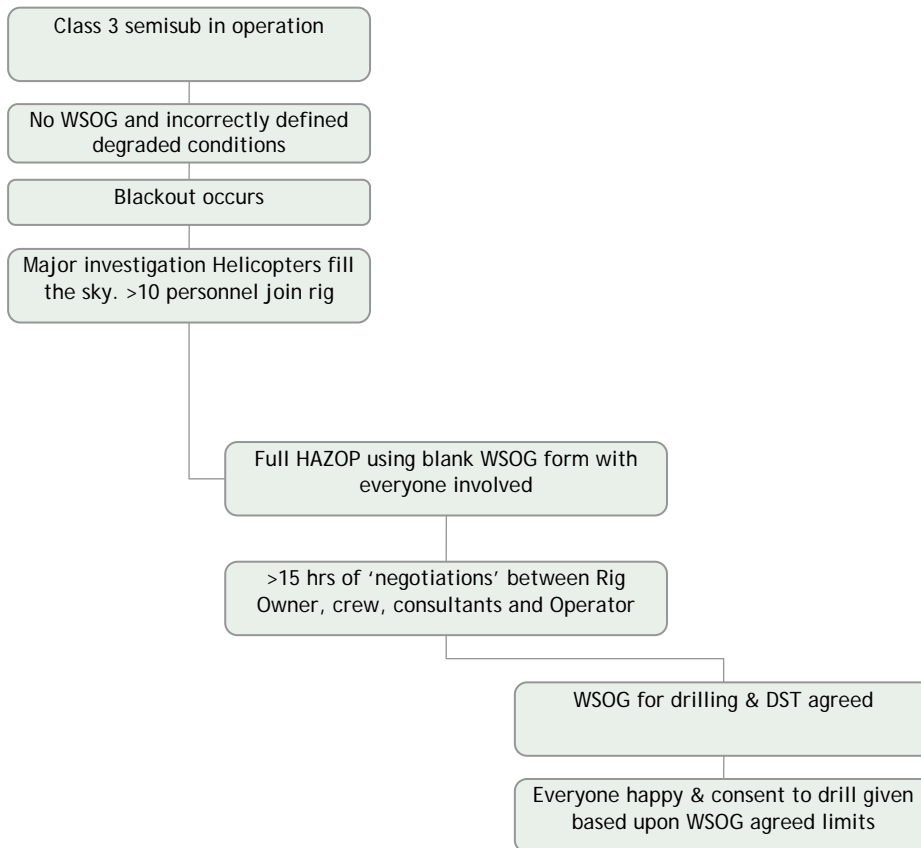
Condition		Green	Advisory	Yellow	Red
ANY DP INCIDENT	BLACK-OUT of ALL HV NETWORKS				Immediately
	DRIVE OFF incident or DRIFT OFF incident or FORCE OFF incident Unit offset deviation from start point Waterdepth: 380 metres			6,5 metres OR immediately when recognized by DPO	Immediately when confirmed that situation cannot be controlled or NOT > 11 metres
	DP position footprint	< 5 metres	> 5 metres	10 metres	15 metres
INTACT DP SYSTEM	DP heading footprint	< 2 deg	2-3 deg	If threat to position	If threat to position
	Power consumption each network (3-split configuration)	< 50%	Any PMS warnings.	>70% or loss of one power station + Consequence alarm	Situation specific
	Thrust consumption each online unit.	< 50%	Thruuster & PMS Warnings	Consequence alarm	Situation specific
	Position reference available	3 independent	Loss of a system or performance limitation	2 (situation specific)	If threat to position
	DP control system (including IAS- DP controllers)	2 + 1 backup	Any failure or loss of performance in any system	1 or loss of failure of backup controller	Loss of all system or unable to maintain position
	Wind sensors	3	2	1 or loss of backup wind sensor (stb, eft)	If threat to position
	Motion sensors (MRU)	3	2	1 or loss of backup MRU (No. 1)	If threat to position
	Heading sensors (Dyro)	3	2	2 or loss of backup gyro (No.1)	If threat to position
	DP-UPS	3	2	2 or loss of backup UPS (No.1)	If threat to position
	IAS System	No controllers or network alarms	Loss of one network or one of redundant controllers/servers	Loss of 2 of the redundant controllers/ server in any system	If threat to position
	Comms systems	3 system	1 system not operating	Situation specific	Situation specific
	Riser limitation UFJ	0-1,5 deg	2 deg	Situation specific	Situation specific
	Riser limitation LFJ	0-1,5 deg	2 deg	> 2 deg	4 deg
	Wind speed (10m/10s)	0-20 m/s	20 m/s	Situation specific	Situation specific
	Wind direction	Situation specific	Situation specific	Situation specific	Situation specific
	Sign. waveheight	0-4 m	5 m	Situation specific	Situation specific
	Riser twist	+/- 17 deg from BOP lendout	>17 deg advice BP Group	Situation specific	Situation specific
	Slip ring / Slip joint	Fully operable	Any failure or problem		
	Action required	Normal status	Advise Master, Driller, Toolpusher, BP Group Rep.	Issue alarm and follow procedures	Issue alarm and follow procedures
	Notify DIM immediately (Y/N)		Yes	Yes	Yes
	Notify BP Group immediately (Y/N)	Normal condition	Yes	Yes	Yes

Table 13 WSOG Sample

Incidents

Incidents showing ‘good’ and ‘bad’ use of WSOG. The following trees represent 2 events which have occurred during deepwater DP drilling. They are used to highlight two separate occurrences where WSOG use were factors

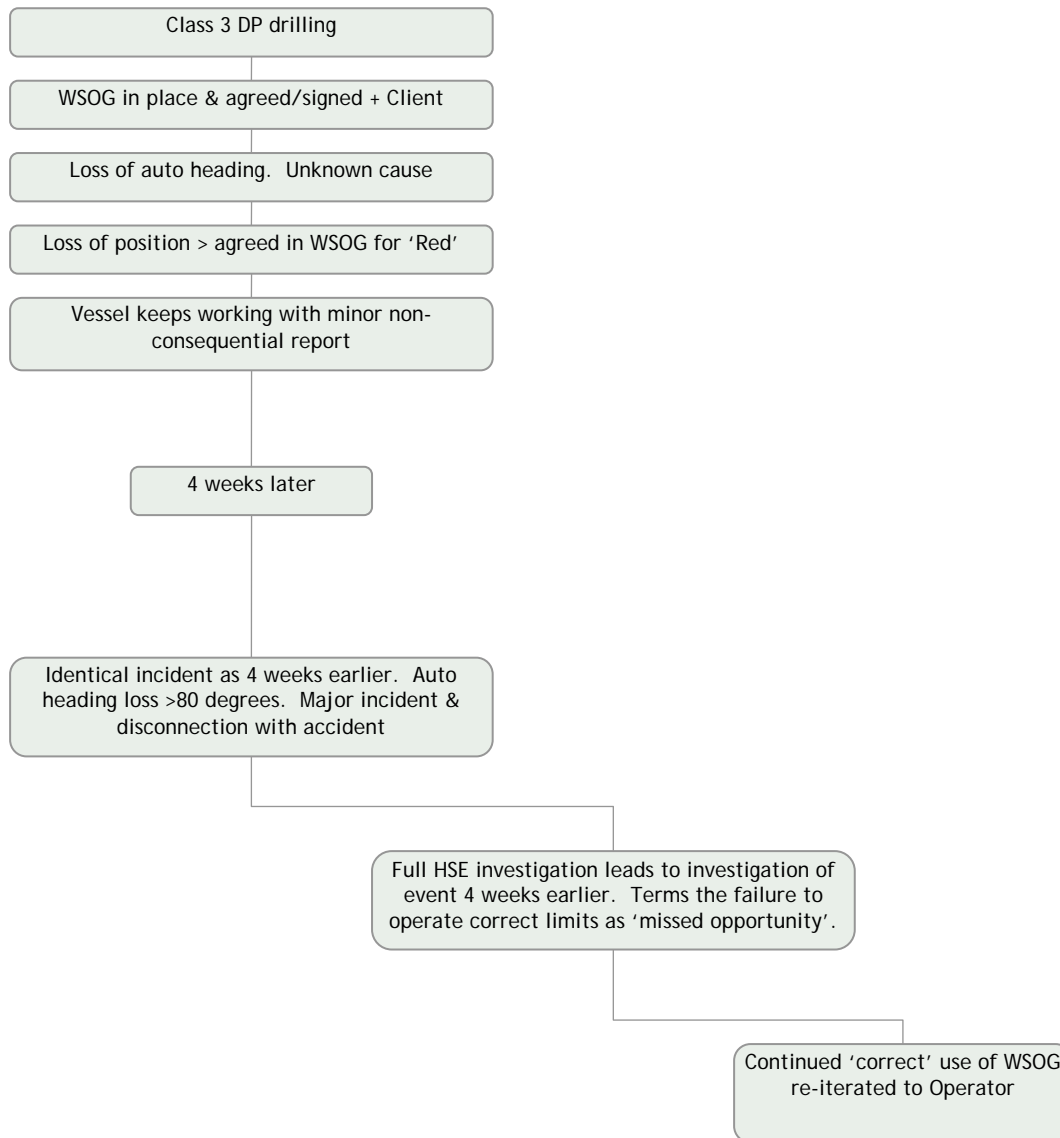
Incident 1



Discussion

This incident shows that the process itself was used as the HAZOP. All 84 boxes were discussed jointly between the Contractor, crew and Oil Company and a number of representatives. Everyone was happy that the exercise was valuable and the rig went back to work. It was interesting that some of the boxes within the WSOG took many hours of discussion to complete. How did the DP Operator cope ‘in operation’ when the debate took such a long time during a meeting. Question.

Incident 2



Source: UK HSE & AAIB

Discussion

This incident shows that, even when the correct process has been followed, there can be no substitute for effective training and experience aboard the unit. The major error made in the incident detailed above was the failure to follow the process detailed in the agreed WSOG.

Incident investigation

During investigating any LOP (loss of position) event or blackout even with no LOP, most investigators would immediately ask for the limits in place & the operating mode leading up to the event.

Additional Uses of WSOG

The WSOG alert and reporting regime have been, and are in use on well intervention units Regalia, Seawell and Island Frontier, working for Statoil in the North Sea.

The DP Floatel industry in the Norwegian Sector has developed FOGS (Floatel Operating Guidelines) along the same principles as WSOG.

In addition Statoil are currently working on updated requirements for moored units due to the large number of incidents with dropped chains and dragged anchors. The group is proposing WSOG principles to be implemented on moored units as an efficient early warning and HAZOP tool. The non-DP moored unit sector in the US may well find advantages in this approach.

Conclusions

1. WSOG has proved that it has an important role to play in the establishment of safe working practices for offshore drilling units. There are a great number of lessons to be captured from its use.
2. Effective operating limits must be agreed between the contractor and operator at 'pre-spud' in order to avoid confusion caused by contractual arrangements offshore.
3. WSOG allows for all manner of 'change'.
4. In US GOM, some operators view Advisories as 'crucial' therefore fundamentally supporting the use of WSOG.
5. WSOG clearly works equally well with drillships and semisubs.
6. Has had a degree of take-up in other non drilling DP sectors such as floatel market.
7. The concept of lessons learnt and continual improvement is allowed using this procedure which must be embraced & continued.
8. Having drilling personnel 'trained' in one process has great appeal to Oil Majors. It means that experience can build between rigs/ships of different contractors.
9. Contractors must accept that Operators have a vested interest in operational risk issues. (Procedures, reporting). This will always increase because station keeping incidents will continue.
10. The use of Advisory to handle changes in the units operating status from Non-DP changes is ideal. I.e. Pseudo Oil Based Mud / riser displacement timings. Non-shearable exposure timings.
11. History has shown that by having a mature WSOG system aboard, this will satisfy Oil Operators & regulators verification processes.
12. WSOG eliminates negative reporting if followed correctly. Ref. Incident No. 2
13. Limit setting HAZOP should take place prior to each well. (Even if everything is the same)
14. There must be consensus following the WSOG limit setting exercise & 'sign-off'.
15. The limit setting exercise should involve, as far as possible, personnel who have working knowledge of the rigs operating criteria. The supply of experienced & competent crew is central here and further re-enforces worries in the industry.
16. Incorrect figures placed in WSOG can make the DP drilling less safe. There have been incidents caused by incorrect figures.
17. Is ideal tool for HAZOP and has been successfully used in other 'non drilling' DP scenarios
18. Norway is advancing the WSOG concept for use in moored operations as a early warning HAZOP process.
19. There has been a large 'take-up' of this simple form since 1999 which should indicate that the process works.

Real-time feedback Survey

The paper presentation concludes with an open questionnaire to all participants in the hall (audience). The authors, with the help of the MTS committee, would like to conduct a poll of the audience with the following 4 questions:-

1. How many people (in DW drilling) know about WSOG in limit setting regimes? (count)
2. How many people use them on their rigs/ships as policy? (count)
3. How many people present believe that WSOG (in its present form) works well for their operation? (count)
4. How many people wish to change the present method of limit settings for something else? (count)

The authors propose noting the response figures in order to allow the MTS DP committee to use the data in further debate on the limit setting issue.

POST CONFERENCE ANALYSIS

The questionnaire took place and the following represents the findings. We estimated a total of about 75 personnel were present for the survey.

1. How many people (in DW drilling) know about WSOG in limit setting regimes?
ANSWER =19
2. How many people use them on their rigs/ships as policy? (count) **ANSWER =13**
3. How many people present believe that WSOG (in its present form) works well for their operation? (count) **ANSWER =14**
4. How many people wish to change the present method of limit settings for something else? (count) **ANSWER = NIL**

Therefore, 68% of personnel involved in DW drilling have WSOG as Policy. 74% approve of the WSOG as it works well. 0% wish to change the limit setting regime in place.

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26th October 2006
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