From: David Barnett
Sent: Thursday, June 10, 2010 12:42 PM
To: Mix, Kurt; 'Lasley, Barbara M'
Subject: Emailing: Intercept_Kill_BOD_07Jun10.docx
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BP EXPLORATION & PRODUCTION

MISSISSIPPI CANYON 252 #1 RELIEF WELL

INTERCEPT & KILL OPERATIONS PLAN

Revision 1.0 – 14 May 2010

1.0 Background & Objectives

This document discusses the strategy for drilling the intercept phase of the MC 252 relief well(s) which is targeted to kill and secure the MC 252 #1 blowout well. The "intercept phase" is defined as the hole section between the last casing shoe in the relief well (9 7/8" liner) and the intercept point. Preparations will be made so that all personnel are prepared and resources are in place to immediately implement the dynamic kill upon intercept.

Note: Preparations for immediate implementation of dynamic kill operations will be in place during the "Approach Phase" of the well – the 10 5/8" x 12 ½" hole section that ends with the relief well positioned very close to the target well. These preparations will be part of the contingency measures for early or unintentional intercept / communication with the blowout well.

The intercept section will be drilled with stringent directional control and proximity logs will be used as needed to ensure that the well remains aligned with the 7" casing. If no hydraulic communication has been established by the time the relief well has contacted the target well casing, it will be assumed that all flow is contained within the casing and a mill will be used to make a penetration.

The dynamic kill will be done using Synthetic Oil Based Mud (SBM). An attempt will be made to establish circulation up the blowout flow path at rates that are sufficient to raise the Bottom Hole Pressure (BHP) to static values (no flow from any permeable formations in the open hole) while staying below the fracture pressure. If this method is successful, it will provide a means to confirm that the well is static and it will allow measured and verifiable placement of an isolation cement plug.

The use of SBM is intended preserve the condition of the relief well hole in case further intervention is required – i.e., if after controlling the annular flow and isolating the annulus with cement, the well is still flowing inside the 9 7/8" x 7" casing, the 7" casing can be penetrated so that a dynamic kill can be implemented.

Initial fluid losses once the relief well is in communication will be the +/- 14.2 ppg mud that is being used to drill the 8-1/2" hole section. The blowout well will be dynamically controlled using this mud plus additional 14.2 ppg mud that will be available onboard the DDIII with contingency supply onboard two 30,000 bbl capacity Platform Supply Vessels (PSVs). The principle of the dynamic kill is to pump fluid with a density that is less than static EMW. The hydrostatic pressure of this fluid column is supplemented with friction pressure generated within the blowout well to create a BHP that is sufficient to stop all reservoir influx. Continued circulation of the dynamic kill fluid will remove all remaining hydrocarbons from the blowout well. This approach is required for deepwater kill situation since the mud weight required to establish static BHP from the seabed to the reservoir is typically much higher than what could be used to drill the well.

Once all reservoir fluids have been removed from the blowout well via the dynamic kill circulation, a column of heavier mud can be displaced into the blowout well to establish a hydrostatic column that will balance the reservoir without the need for friction pressure. A 16.4 ppg fluid column in the blowout well plus the hydrostatic pressure of 5,000' of seawater will be sufficient to establish a BHP of 14.2 ppg at the M57C sand.

A cement job will be implemented with the aim of placing 16.4 ppg cement into the open hole annulus both above and below the intercept point. Planned Top Of Cement (TOC) is between 9,000' and 11,000' MD in the blowout well.

This document includes:

- Results of dynamic kill modeling – blowout flow rates, kill requirements & associated pressures
    - Ole Rygg to do independent well flow / kill modeling using OLGA based simulator
- Fluid management plan for the kill operation
- Cementing Operations

2.0 Dynamic Kill Modeling

Modeling has been done to determine the estimated blowout flow assuming various flow paths. These estimated flow rates have been used to determine the necessary pump rates and fluid properties required to implement a dynamic kill of the MC 252 #1. The modeling was done by Add Energy using the OLGA Well Kill model which is a transient, multiphase dynamic kill model.

2.1 Blowout Flow & Kill Rates

Figure 1.0 shows modeled flow rates considering the following three scenarios:

A. **Flow inside 9 7/8" x 7" casing**

B. **Flow outside 9 7/8" x 7" casing**

C. **Flow up the inside & outside of the 9 7/8" x 7" casing**

The planning team has been advised that the investigation of the events associated with the incident clearly points to the higher likelihood of annular flow (Scenario B - up 9 7/8" x 7" annulus). However, the highest kill rate (scenario C) will be used for planning purposes.

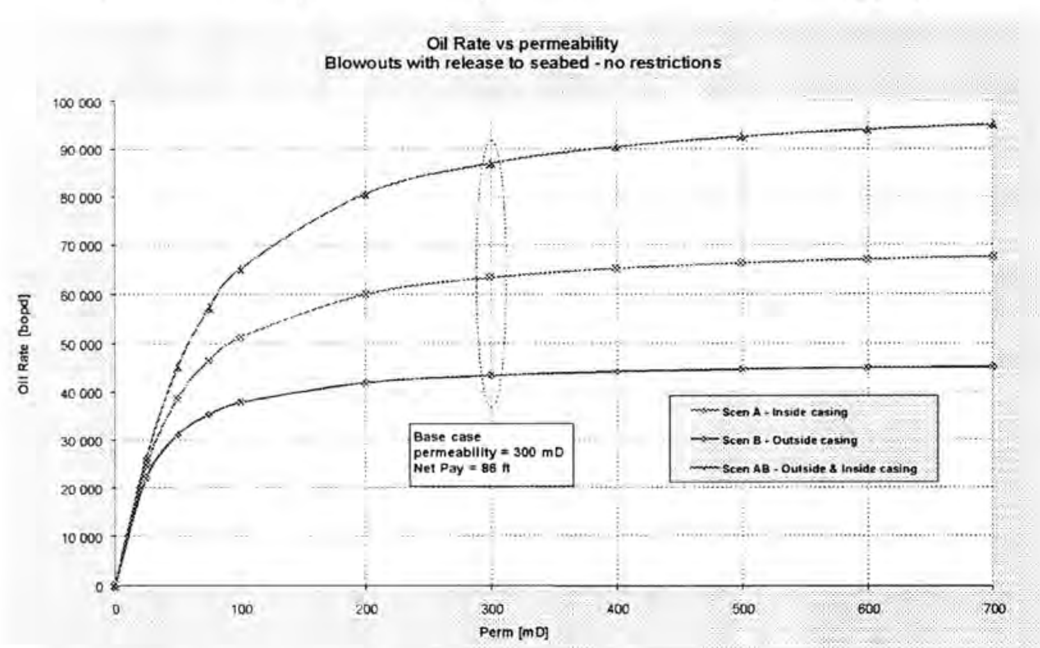


Figure 1.0 – Blowout Flow Rates to Seabed Vs Permeability – No Restrictions

Modeling indicates that the range of kill rates using 14.2 ppg SBM for the above scenarios is from 20.0 bpm of (scenario B) up to 50.0 bpm (scenario C). These are the maximum anticipated kill rates even if the reservoir deliverability is increased above the 300 mD values since the flow is limited by the well geometry and not the reservoir.

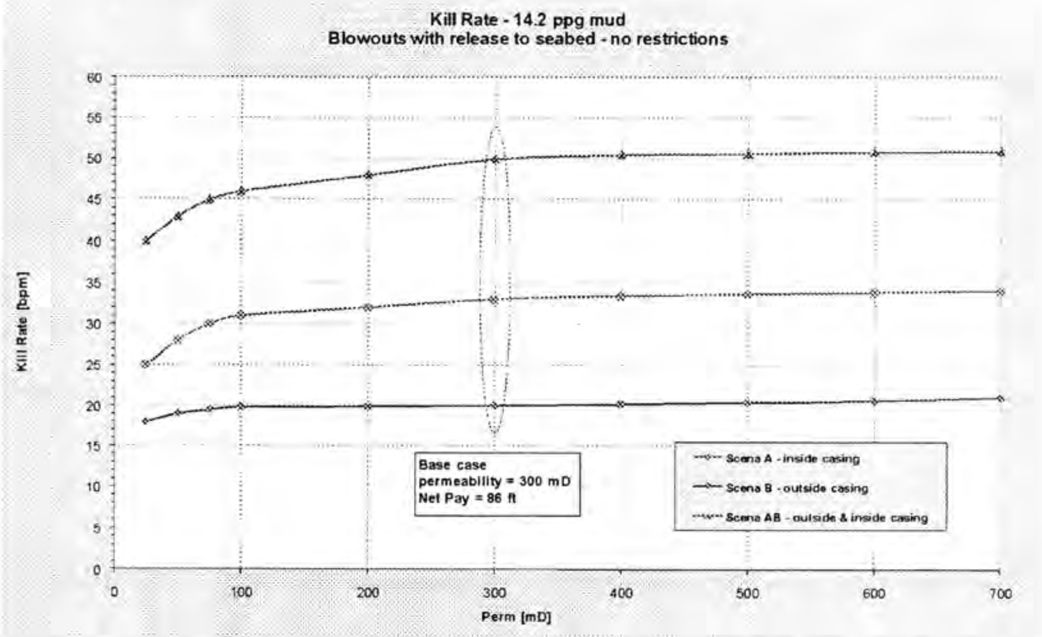


Figure 2.0 – Dynamic Kill Rates Vs Permeability Using 14.2 PPG Mud

For the well to remain static requires that the BHP be maintained above pore pressure but below fracture pressure. The best available information indicates that the maximum pore pressure in the 9 7/8" hole section of the blowout well is 14.15 ppg (17,797' TVD Geo Tap – confirmed by Halliburton) and the expected minimum fracture pressure is equivalent to a 14.5 ppg EMW. Records indicate that the drill pipe was pulled for logging with a 14.0 ppg (surface density measurement) mud in the hole and the well remained static during logging operations for almost six (6) days. Equivalent static density at that time would have been 14.2 ppg.

Since the blowout well is flowing to the mudline, an increase of the kill mud weight is required in order to compensate for the lack of mud hydrostatic back to sea level.

To establish a 14.2 ppg EMW at the bottom of the 9 7/8" section (18,274' TVDSS) requires a column of 16.40 ppg DMW mud from 13,282' TVD-BML up to the mudline in addition to the hydrostatic column of the 4,992' of seawater as shown in Figure 3.0.

Note: If the M57C (thin brine sand above the oil reservoir) is depleted it might be possible to establish sufficient BHP to balance the 12.6 ppg M56 oil sand using only the 14.2 ppg mud. However, it won't be possible to evaluate whether the well will remain static with only 14.2 ppg mud without displacing seawater to the mudline. The risks and rewards of making this assessment versus pumping 16.4 ppg mud regardless needs to be investigated.

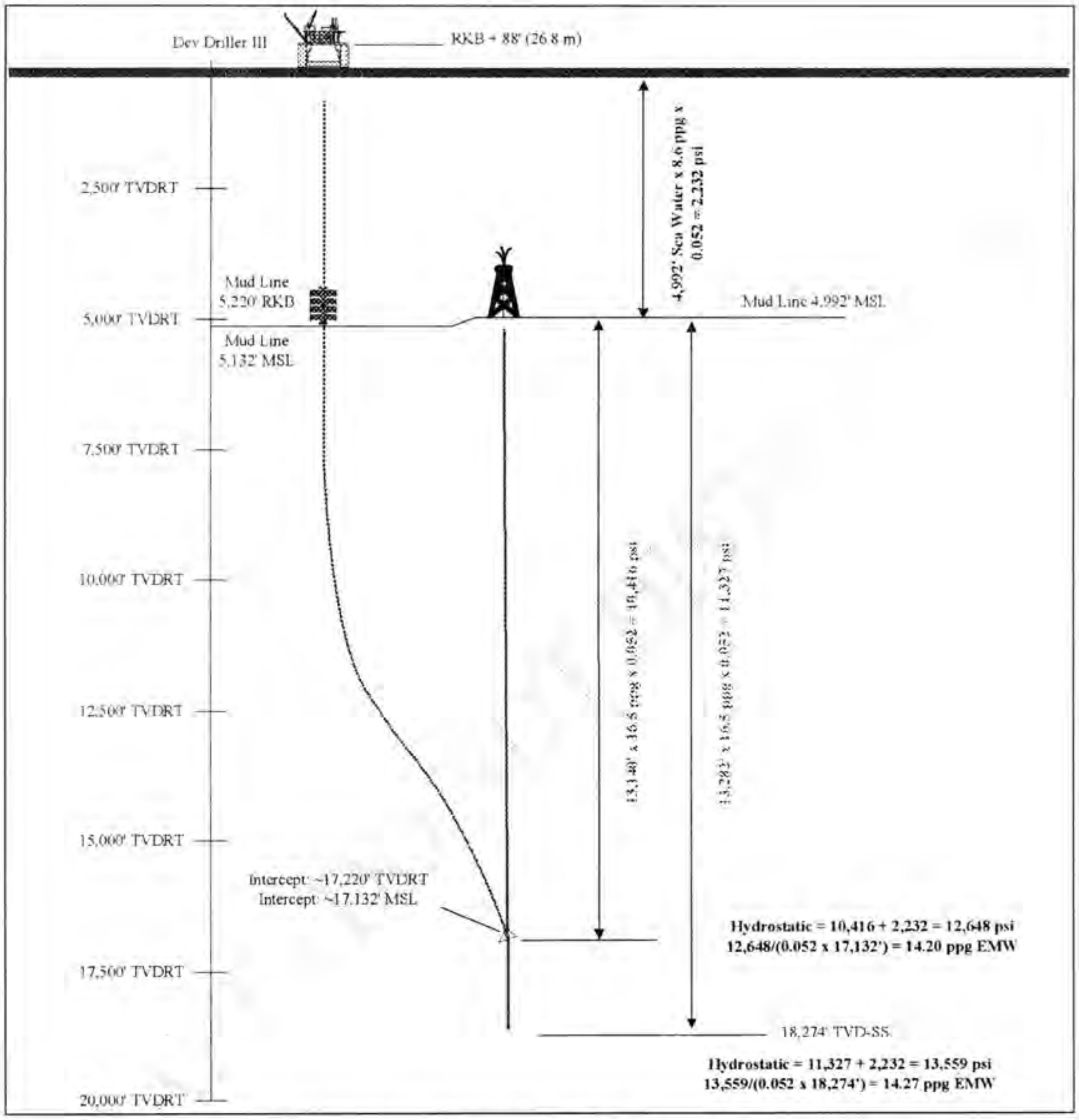


Figure 3.0 – Diagram of Relief Well & Blowout Well Fluid Levels

2.2 Pump Pressures

The maximum planned kill rate, 50.0 bbm, is for the dual flow path scenario (up annulus & up inside of casing). This is the peak rate that could be required in the initial stages of the dynamic kill. The rate will decrease in order to avoid exceeding the fracture pressure in the open hole section. BHP will be monitored by DPP observations during the kill and appropriate pump rate adjustments will be made.

The pressure required to implement a dynamic kill is primarily related to the friction pressure through the relief well annulus – this includes pressures through the surface lines and the choke & kill lines down to the BOP.

The highest predicted kill rate will be applied during the initial stages of the kill only. There will never be a time when mud is pumped through both wellbores at any rate that approaches the peak kill rate as this would cause excessive pressures resulting in fracturing and losses.

The maximum pressure required to move the kill mud through the relief well annulus (5" drill pipe below 9 7/8" liner top) at 50 bpm is approximately 4,300 psi using the following parameters (see Figure 4.0):

- Intercept depth (length of relief well annulus): 17,827' MD
- 4 ½" ID Choke / Kill Lines 0' to 5,000' MD
- 5 7/8" ID x 12.375" OD 5,000' to 13,362' MD
- 4,165' x 5" ID x 8.625" OD 13,362' to 17,527' MD
- 300' x 6 ¾" ID x 8 ½"OD: 17,527' to 17,827' MD
- MW 14.0 ppg
- PV 43
- YP 17

Wild Well Control

Calculated Values	
0.727 psi/ft	
n =	0.7792
K =	737
600 =	103
300 =	60

If Fann dial readings are unknown, Input PV & YP

Given PV =	43	
Given YP =	17	
Hole Size =	8.5	in

INPUT MUD PROPERTIES

MW =	14.00	ppg	1.68	g/cc
Kill Rate =	2100	gpm	50.0	bpm
600 =	103	lb/100 ft²	Input if known	
300 =	60	lb/100 ft²	Input if known	

Remarks	Top Depth ft	Bottom Depth ft	Length ft	OD in	ID in	Branch Factor	% Leak Off	GPM	Fluid Velocity ft/s	Reynold's Number	Fanning Friction Factor	Type Laminar Turbulent	Frictional Losses psi		% ress loss of total
Surface Equipment															
Surface Lines		300	300		4.500	2		1050	21.18	19056	0.0055874	Turbulent	90.7		2.1%
Choke/Kill Line		5000	5000		4.500	2		1050	21.18	19056	0.0055874	Turbulent	1511.4		34.9%
Equivalent Total Length			5300	1615.4 meters								Surface Losses	1602.1	psi	37.0%
Drill String															
Equivalent Total Length					meters							Drill String Losses		psi	
Annulus															
5" x 13 5/8"	5000	12957	7957	12.375	5.875	1		2100	7.23	5993	0.0077344	Turbulent	328.5		7.6%
7" x 13 5/8"	12957	13362	405	12.375	7.000	1		2100	8.24	6059	0.007709	Turbulent	26.2		0.6%
5" x 9 7/8"	13362	17325	3963	8.625	5.000	1		2100	17.37	11082	0.0064718	Turbulent	1416.2		32.7%
6 5/8" x 9 7/8"	17325	17527	202	8.625	6.625	1		2100	20.13	12559	0.0062509	Turbulent	331.4		7.6%
6 3/4" x 9 7/8"	17527	17727	200	8.625	6.750	1		2100	29.76	12794	0.0062101	Turbulent	389.7		9.0%
6 3/4" x 8 1/2"	17727	17827	100	8.500	6.750	1		2100	32.14	13322	0.0061595	Turbulent	240.9		5.6%
Equivalent Total Length			12827	3909.5 meters								Annulus Losses	2732.9	psi	63.0%

Nozzles

Bit	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Nozzle Area (in²)	Nozzle Velocity (ft/s)	Cd	HHP	Jet Impact Force (lbs)	HSI
PDC	1000						766.9904	0.0	0.95	0.0	13.4	0.00
										Nozzle Losses	0.0 psi	0.0%

Maximum Pump Pressure	Maximum Rate	Maximum Horsepower	Total System Losses
4,335 PSI	50.0 BPM	5,311 HHP	4,335 100%

Figure 4.0 – Friction Through RW Annulus & Surface Lines

3.0 Fluid Management & Pump Capacities

The Development Driller III (DD 3) has an active mud system volume of approximately 10,000 bbls. This capacity will be divided equally between 14.0 ppg SBM and 16.4 ppg SBM. Additional mud volume will be provided by the HOS Strongline & HOS Centerline. Each of these vessels will be brought out with 10,000 bbls of 16.5 ppg SBm and 15,000 bbls of 14.0 ppg SBM. Some if the contingency mud will be used to top up the DD3 pits and a certain amount (+/- 5,000 bbls) of 14.0 ppg mud from the HOS Centerline will be placed on the BJ Blue Dolphin stimulation vessel. This should provide adequate capacity for the dynamic kill operation with sufficient contingencies for failed kill attempts and severe mud losses.

Fluid losses to the open hole are likely during the kill operation. It is recommended that background LCM (15 ppb Calcium Carbonate) be in the active mud system while drilling this section. A minimum of two x 100 bbl LCM pills with heavier concentration (60 to 80 ppb) of CalCarb and possibly additional LCM material be pre-mixed and ready to pump as part of the kill preparations.

Primary Kill Plant

- Rig Pumps – 4 x 14-P-220 (2,200 HP) Rated 7,500 psi (5,000 psi with 6" liners)

- Rig Pits (see above)

Secondary Kill Plant

- Stimulation Vessel (list specs when vessel is identified)
- 16.4 ppg SSBM

Contingency Kill Plant

- Stimulation Vessel (list specs when vessel is identified)
- 19.0 ppg WBM

Table 2.0 – Stimulation Vessels & Capabilities

Company	Boat	BP Boat Class	DP-2	Coflex Hoses Sizes (inches)	Completion Brine Vol (bbls)	Mud Vol (bbls)	Boat Basic Pump Horsepower (hhp)	Can Vessel Handle Mud below Deck (Y/N)	What Rate can the Mud be delivered to the Pumps (bbl/min)
B J Services	Blue Ray	A	Yes	4 & 3	10,000	8600 @ 19 ppg	12,500	Yes	+50
	Blue Dolphin	A	Yes	4, 4 & 3	12,000	9600 @ 19 ppg	23,000	Yes	+50
Baker	HR Hughes	B	Yes	4 & 3	6,600		12,500		
	RC Baker	B	No	4 & 3	4,000		9,200		
	Blue Tarpon	A	Yes						
Halliburton	Stim Star II	A	Yes	4 & 3	5,400		17,500	Yes	+50
	Stim Star III	B	Yes	4 & 3	9,000	5,324 @ 19 ppg	21,500	Yes	+50
Schlumberger	Deepstim II	A	Yes	4 (45 BPM)	6,600		21,450		
	Deepstim III	A	No	3 (25 BPM)	4,140		12,850		

The proposed pit segregation is (Joel Furgeson to confirm pit layout):

	Slop Pit #1 CAP: 200 BBL		Slug Pit #1 CAP: 200 BBL		Slug Pit #2 CAP: 200 BBL		Slug Pit #3 CAP: 200 BBL		Slop Pit #2 CAP: 200 BBL
PRODUCT		PRODUCT	Slug	PRODUCT	Pop off valve pit	PRODUCT	Barite Plug	PRODUCT	Cement Spacer Pit
Planned Volume		Planned Volum	100 bbls	Planned Volum	Do Not Use	Planned Volum	As Directed	Planned Volum	
Lower Agitator	86	Lower Agitator	86	Lower Agitator	86	Lower Agitator	86	Lower Agitator	86
Upper Agitator	141	Upper Agitator	141	Upper Agitator	141	Upper Agitator	141	Upper Agitator	141
Overflow	203	Overflow	203	Overflow	203	Overflow	203	Overflow	203
Max OP. Level	185	Max OP. Level	185	Max OP. Level	185	Max OP. Level	185	Max OP. Level	185

	MUD PIT # 1 CAP: 950 BBL	MUD PIT # 2 CAP: 906 BBL	MUD PIT # 3 CAP: 566 BBL	MUD PIT # 4 566 BBL		BRINE PIT # 5 CAP: 583 BBL	BRINE PIT# 6 CAP: 583 BBL	BRINE PIT # 7 CAP: 933 BBL	BRINE PIT # 8 CAP: 689 BBL	
PRODUCT	Drilling Mud	Drilling Mud	LCM/ProMix	LCM	Product	Kill Mud	Kill Mud	Kill Mud	Kill Mud	
Planned Volume	800	730	450	450	Planned Volume	450	450	750	700	2350
Lower Agitator	353	340	213	213	Lower Agitator	318	318	349	328	
Upper Agitator	594	589	355	355	Upper Agitator	384	384	583	548	
Overflow	906	824	536	514	Overflow	530	530	848	808	
Max OP. Level	768	719	448	448	Max OP. Level	457	457	727	703	
	MUD PIT # 9 CAP: 903 BBL	MUD PIT # 10 CAP: 883 BBL	MUD PIT # 11 CAP: 539 BBL	MUD PIT # 12 CAP: 548 BBL	⟷	BRINE PIT # 13 CAP: 539 BBL	BRINE PIT#14 CAP: 566 BBL	BRINE PIT # 15 CAP: 863 BBL	BRINE PIT # 16 CAP: 503 BBL	
PRODUCT	Drilling Mud	Drilling Mud	Drilling Mud	Drilling Mud	Product	Kill Mud	Kill Mud	Kill Mud	Kill Mud	
Planned Volume	750	700	450	450	Planned Volume	400	400	700	650	2150
Lower Agitator	332	332	292	285	Lower Agitator	283	301	331	302	
Upper Agitator	563	540	338	344	Upper Agitator	338	338	540	508	
Overflow	853	815	509	571	Overflow	509	497	785	747	
Max OP. Level	722	684	428	435	Max OP. Level	433	422	675	648	
										4500

	RESERVE # 1 AFT/PORT PONTOON CAP: 2,589 BBL	RESERVE # 3 AFT/PORT PONTOON CAP: 2,589 BBL		BRINE RESERVE TANK AFT/PORT PONTOON CAP: 4,840 BBL	BASE OIL TANK AFT/STBD PONTOON CAP: 4,840 BBL
PRODUCT	Kill Mud	Kill Mud			
Planned Volume	2,300	2,300	4,600		
Lower Agitator	1207	1207			
Upper Agitator	1500	1500			
Overflow	NA	NA			
Max OP. Level	2300	2300			

6,160 Drilling
5,100 Killing

	RESERVE # 2 STBD/PORT PONTOON CAP: 2,589 BBL	RESERVE # 4 STBD/PORT PONTOON CAP: 2,589 BBL
PRODUCT	Drilling Mud	Riser Displacement
Planned Volume	2,300	0
Lower Agitator	1207	1207
Upper Agitator	1500	1500
Overflow	NA	NA
Max OP. Level	2300	2300

Transfer Rates	
Pontoon-Pit (12.3 ppg max 2 date)	17.0 bpm
Pontoon-Brine Tank	??
Pit - Pit	40.0 bpm
Boat - Pit (1 MV - 16.3 ppg)	15.0 bpm
Boat - Pit (2 MVs - 16.3 ppg)	23.0 bpm
Boat - Brine Tank (??)	??

What about HOS boats?

Figure 1.0 – DD III Pit Segregation Plan

4.0 Operations Summary

The relief well 9 7/8" casing will be set ~ 50' TVD (verify against directional plans & wellbore stability – get final advice from Steve Wilson) above the 9 7/8" shoe of the blowout well with approximately 5' of separation between the two wells at the relief well casing point. Precise placement of the 9 7/8" casing point is essential – if possible, the entire hole section will be drilled using RSS. However, it's possible that bent motor assemblies may provide better directional control under certain conditions – if necessary, run bent housing motors to assure precise placement of the casing point and alignment with the target well.

The 9 7/8" casing needs to be set as close to bottom as possible. This will require a separate trip to open the 10 5/8" hole to 12 ¼". Note: If bent housing motors are used for the bottom portion of the 10 5/8" hole section, a separate hole opening trip will be required anyway. The plan is to drill out 9 7/8" shoe & clean rat hole – perform cement integrity test to 15.0 ppg EMW before drilling any new hole. It is imperative to establish that a competent cement sheath exists prior to communicating with the blowout well. After drilling 10' of new hole, an FIT will be performed to 15.0 ppg EMW.

Since it is unclear if the blowout flow path is up the annulus or through the 7" x 9 7/8" casing string it is possible that the relief well could establish hydraulic communication with the blowout before contacting and penetrating the 7" casing. This requires the highest level of preparedness while drilling the 8 ½" hole section since the dynamic kill could start at any time.

One of the primary safeguards associated with the relief well is to prevent getting the BHA stuck when the intercept is made and the dynamic kill is implemented. The best way to reduce the chances of getting the BHA stuck is to raise it above the 9 7/8" casing shoe while the kill operations are underway. It is preferable to maintain a configuration that allows pulling the BHA to the shoe without stopping to break out a stand of drill pipe (this also ensures that we can continue pumping down the drill pipe throughout the kill). The ability to raise the BHA to the casing shoe is a function of open hole length and position of the top drive in the derrick when the intercept is made Note: Tool joint hang off positioning, EDS consideration and shut in details will be covered in the Operational Procedures. When the intercept depth is known these parameters can be planned with adequate detail. However, in this situation where communication with the blowout could happen at any point below the casing shoe, the ability to plan these parameters is reduced. The only real options are to minimize the open hole section length and keep the top drive as close to the rig floor as possible by drilling with single joints. Since it is likely that short sections will be drilled in the 8 ½" section followed by Vector Magnetics proximity logs, drilling with singles should not present added difficulty.

The initial kill procedure will involve keeping the relief well annulus full with the rig pumps while the pumps are configured for kill operations. One of the four rig pumps should be connected to the riser boost line. The boost line pump and the drilling mud pump can both be used to keep the hole full while the drill string is raised into kill position.

The first 1,150 bbls (volume of the relief well annulus) of fluid entering the blowout well will be the mud in use at the time of intercept – estimated to be 14.0 ppg SSBM but mud weight should be maintained as low as possible based on drilling indicators. This should completely displace the blowout well annulus prior to entry of the first barrel of kill fluid.

As soon as the BHA is in position and the pumps are lined up, pumping will commence for well kill. This will involve closing an annular (upper/lower TBD) and pumping down both choke and kill lines. BHP will be monitored by observing the Drill Pipe Pressure (DPP) and adjustments will be made to the annulus pump rates to keep BHP between maximum pore pressure and minimum fracture pressure in the open hole. In this situation, there is very little margin between PP (14.2 ppg) and FG (14.5 ppg); therefore, losses are anticipated.

For the most likely scenario of annular flow with backpressure/restriction the BOP, modeling indicates that a maximum rate of approximately 16.0 bpm of 16.4 ppg SSBM may be required during the initial stages of the kill operations. This rate will reduce as kill mud is circulated up the blowout well and BHP increases.

A minimum of three (3) complete displacements of the blowout well should be done with the BHP between the parameters mentioned above. It is anticipated that this will require at least 3,500 bbls of 16.4 ppg SSBM.

The cementing pump will be used throughout the kill procedure to establish and monitor bottom hole pressure. This will be done by pumping down the drill pipe at a slow, steady rate (i.e., 1 1/2 bpm) while kill pumping is underway down the annulus.

Once the well has been displaced with kill mud and indications are that the well is dead, it is anticipated that the drill pipe will stand full of 14.0 ppg SBM. The annulus will continue to u-tube with kill mud exiting the blowout well at the wellhead. In order to establish hydrostatic balance the Kill Line (KL) will be isolated and the Choke Line (CL) will be displaced with base oil until surface pressure = 500 psi (should require approximately 48 bbls). Shut down and monitor CL pressure while observing blowout well at seabed with ROV. If additional kill pumping is required it will be done via the KL only.

After establishing that the blowout well is static, the base oil will be removed from the CL by closing the VBRs to isolate the well from the C/K lines, opening the KL and circulating the base oil (u-tube) out of the CL. Once the base oil has been removed, both CL & KL will be displaced with 16.4 ppg SSBM. The CL & KL will have to be isolated from the wellbore with failsafe valves prior to opening the VBRs.

The situation at this point will be as follows:

- Relief well annulus full of 16.4 ppg mud
- Relief well C & K lines full of 16.4 ppg mud and isolated with failsafe valves
- Relief well annular closed
- Relief well riser full of 14.0 ppg mud
- Relief well drill pipe full of ~ 400 bbls of 14.0 ppg mud
- Blowout well full of 16.4 ppg mud to seabed

The 400 bbls of 14.0 ppg mud in the DP will cause an 830 psi reduction in hydrostatic pressure if pumped into the blowout well. A method needs to be developed to remove this volume of mud without causing the blowout well to become underbalanced. A few options include:

- Displace seawater down CL to 384 bbls below BOP – surface pressure should be approximately 1,200 psi at this point. The seawater in the DP x casing annulus will provide adequate imbalance to allow the 14.0 ppg mud in the DP to be circulated into the annulus – surface pressure will be bled off per pumping schedule while the 14.0 ppg mud is displaced into the annulus via the PBL sub.
- Pump down DP with 16.4 ppg mud displacing 14.0 ppg mud into blowout well. Simultaneously pump down annulus to mix heavier mud with the 14.0 ppg mud and minimize the overall hydrostatic reduction. The 14.0 ppg mud will need to be displaced completely out of the blowout well back to the seabed to ensure that the blowout well is static prior to starting cementing operations.
- Displace DP during kill operations and unload 14.0 ppg mud completely from blowout well – this makes it impossible to monitor BHP during kill operations. Unless a mud saver valve is installed in the DP, the DP will never stabilize unless it is displaced with lighter fluid. This requires displacement of the DP and the CL in order to balance the hydrostatic columns between the relief well and the blowout well.
- Displace down DP with 16.4 ppg mud while base oil is in the CL – this will provide a means to monitor and maintain BHP above SBHP of the blowout well by varying the pump rate during the displacement. Once the DP has been displaced, cementing operations should commence.

Cementing will be done through the DP using the PBL sub. Once the 14.0 ppg mud has been removed from the DP and it has been determined that the blowout well is static the PBL sub will be opened (if not open already during DP mud removal) and cementing will commence.

Estimated slurry volume to cover from 18,100' TVD (top of sand) to 9,000' TVD is 550 bbls. Due to uncertainties with flow paths and other unknowns it is recommended to pump 50% excess volume for a total of 825 bbls of cement.

Slurry density should be 16.4 ppg to avoid under-balancing the blowout well during placement. Pump times, lead / tail transition times and other properties TBD.

5.0 Preparations Prior to drilling out the 9-7/8" Shoe

5.1 General

- Review SIMOP plan with pertinent personnel.
- Station ROVs to monitor flow from the Macondo #1.
- Test all communications onboard rig and between rig & marine vessels.
- All personnel to be clear about assignments, duties and positions during kill operations. All personnel shall be at their assigned stations and prepared to implement dynamic kill.

5.2 Mud Systems & Pumping

- All high & low-pressure pump equipment will be tested and ready.
- One mud pump lined up on top drive, one pump on the riser boost line & other two pumps lined up on the annulus (choke & kill lines)
- Ensure that all mud and cement storage facilities (rig pits, bulk tanks & marine vessels) are at adequate levels. Mud transfer rates from auxiliary vessels should be pre-determined. What is out minimum acceptable rate?
- Kill mud will be in the active pits conditioned and ready for kill as per pre-determined fluid management plan. Mud engineer to record the exact fluid levels in all pits. Mud Engineer to check and record all mud properties.
- Ensure all equipment is onboard rig for kill & plugging operations so that vessels do not have to come alongside during kill (except those possibly required to transfer mud).

Updated 3/15/10 Hull # Vessel Type	Edison Chou 171 AHTS	Joe Griffin 262 OSV	C-Fighter 240 OSV	C-Freedom 238 OSV	C-Legacy 221 OSV	Kobe Chou 223 OSV
Length	276'	280'	280'	280'	280'	280'
Beam	60'	60'	60'	60'	60'	60'
Depth	27'	24'	24'	24'	24'	24'
Draft @ LL	23'	19.24'	19.24'	19.24'	19.6'	19.6'
BHP - Main Engines	16,000	7,200	7,200	7,200	7,200	7,200
DWT @ LL	4,065 LT	4870 LT	4870 LT	4870 LT	5,004 LT	4,870 LT
Clear Deck Area	141' x 50'	201' x 50'	203' x 50'	203' x 50'	203' x 50'	203' x 50'
Deck Cargo Capacity	1350 LT	2700 LT	2700 LT	2700 LT	2700 LT	2700 LT
Deck Capacity p/sqft	540 lbs	1200 lbs	1200 lbs	1200 lbs	1200 lbs	1200 lbs
Fuel Capacity	368,930 gal	379,615 gal	378,248 gal	378,248 gal	295,937 gal	294,316 gal
Discharge Manifold	4"	6"	6"	6"	6"	6"
Water Capacity	386,876 gal	341,500	279,248	279,248	279,567 gal	270,584 gal
Bulk Capacity	9,850 cu. Ft.	12,000 cu. Ft	12,000 cu. Ft	12,000 cu. Ft	11,440 cu. Ft.	11,440 cu. Ft.
L/M Rated Capacity	5,482 bbl. *	13,460 bbl	15,414 bbl.	15,414 bbl.	15,646 bbl.	15,646 bbl.
L/M Avg Max Capacity		12,380 bbl	14,200 bbls	14,200 bbls	14,450 bbls	14,450 bbls
# & Type of Tanks	4 + 4 / RD	8 / SQ	8 / SQ	8 / SQ	8 / SQ	8 / SQ
Split System Configuration	4 - C/L - 2608 4 - aft - 2820	4 - fwd - 6482 4 - aft - 6978	4 - fwd - 7324 4 - aft - 8090	4 - fwd - 7324 4 - aft - 8090	4 - fwd - 7322 4 - aft - 8324	4 - fwd - 7322 4 - aft - 8324
Pump Size - HP	1 x 125/1 x 200	2 x 300	2 x 300	2 x 300	2 x 300	2 x 300
Circulation Method	Agitate	Circulate	Circulate	Circulate	Circulate	Circulate
Circulation System	Flygt - 15hp 11,680 gpm	4 x 50hp 1,050 gpm	4 x 50hp 1,050 gpm	4 x 50hp 1,050 gpm	4 x 50hp 1,050 gpm	4 x 50hp 1,050 gpm
Methanol Capacity	n/a	n/a	n/a	n/a	1,836 bbl.	n/a
DP Class	DP-2	DP-2	DP-2	DP-2	DP-2	DP-2
Ref. Systems	CNAV 2050	CNAV 2050	CNAV 2050	CNAV 2050	CNAV 2050	CNAV 2050
	Mini-Max	CNAV 1000	CNAV 1000	CNAV 1000	Mini-Max	CNAV 1000
	Fanbeam	Radiscan	Cyscan	Cyscan	Cyscan	Cyscan
		Cyscan				
Fire Monitor	n/a	n/a	n/a	n/a	n/a	n/a
Bunks	41	29	29	29	28	29
A-Frame Capable	Yes	No	No	No	No	No
Certified Ship Crane	2 x 5 Ton	No	No	No	No	No
Liquid Level Readers**	F,W,LM	F,W,LM	F,W,LM	F,W,LM	F,W,LM,M	F,W,LM

* Includes chain lockers

**Liquid Level Readers : F = Fuel, W = Water, LM = Liquid Mud, M = Methanol, C = Chemicals

Updated 3/15/10	Dante	C-Pacer	C-Pioneer	C-Hero	C-Captain	C-Express
Hull #	227	210	209	217	152	184
Vessel Type	OSV	OSV	OSV	OSV	OSV	OSV
Length	280'	260'	260'	260'	260' S	240'
Beam	60'	56'	56'	56'	56'	56'
Depth	24'	21'	21'	21'	18.9'	21'
Draft @ LL	19.2'	18'	18'	18'	15.24'	18'
BHP - Main Engines	7,200	5,400	5,400	5,400	3,420	3,420
DWT @ LL	4696 LT	3,450 LT	3,450 LT	3,450 LT	2,846 LT	3,000 LT
Clear Deck Area	203' x 50'	185' x 46'	185' x 46'	185' x 46'	185' x 46'	165' x 46'
Deck Cargo Capacity	2700 LT	1825 LT	1825 LT	1825 LT	1900 LT	1750 LT
Deck Capacity p/sqft	1200 lbs	540 lbs	540 lbs	1200 lbs	540 lbs	540 lbs
Fuel Capacity	369,208 gal	235,435 gal	235,435 gal.	261,521 gal	205,292 gal.	202,935 gal
Discharge Manifold	6"	6"	6"	6"	4"	4"
Water Capacity	246,549 gal	365,165 gal.	285,830 gal.	176,136 gal	376,750 gal.	260,215 gal.
Bulk Capacity	11,440 cu. Ft.	10,175 cu. Ft.	10,175 cu. Ft.	10,500 cu. Ft.	9,600 cu. Ft.	8,000 cu. Ft.
L/M Rated Capacity	15,414 bbl.	7,274 bbl.	7,274 bbl.	10,500 bbl.	8,127 bbl.	6,058 bbl.
L/M Avg Max Capacity	14,250 bbl.	6,600 bbls	6,600 bbls	9,700 bbls	7,550 bbls	5,500 bbls
# & Type of Tanks	8 / SQ	12 / RD	12 / RD	8 / SQ	8 / SQ	10 / RD
Split System Configuration	4 - fwd - 7324 4 - aft - 8090	6 - fwd - 3637 6 - aft - 3637	6 - fwd - 3637 6 - aft - 3637	4 - fwd - 5432 4 - aft - 5068	4 - fwd - 5447 4 - aft - 2680	6 - fwd - 3648 4 - aft - 2680
Pump Size - HP	2 x 300	2 x 300	2 x 300	2 x 300	2 x 200	2 x 200
Circulation Method	Circulate	Agitate	Agitate	Circulate	Circulate	Agitate
Circulation System	4 x 50hp 1,050 gpm	Flygt - 15hp 11,680 gpm	Flygt - 15hp 11,680 gpm	4 x 50hp 1,050 gpm	FWD - 1 x 50hp 1,050 gpm AFT - 1 x 60hp 220 gpm	Flygt - 15hp 11,680 gpm
Methanol Capacity	n/a	n/a	n/a	n/a	2,100 bbl	n/a
DP Class	DP-2	DP-2	DP-2	DP-2	DP-2	DP-2
Ref. Systems	CNAV 2000	CNAV 1000	CNAV 2050	CNAV 2050	CNAV 2050	CNAV 2050
	Mini-Max	Mini-Max	Mini-Max	Mini-Max	Mini-Max	CNAV 1000
	Cyscan	Fanbeam	Fanbeam	Fanbeam	Fanbeam	Fanbeam
Fire Monitor	n/a	n/a	n/a	n/a	n/a	n/a
Bunks	29	29	29	26	31	27
A-Frame Capable	No	No	No	No	No	No
Certified Ship Crane	No	No	No	No	No	No
Liquid Level Readers**	F,W,LM	F,W,LM	F,W,LM	F,W,LM	F,W,LM,M	F,W,LM

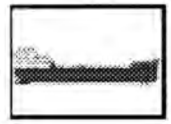
**Liquid Level Readers : F = Fuel, W = Water, LM = Liquid Mud, M = Methanol, C = Chemicals

Updated 3/15/10	C-Commander	C-Enforcer	C-Carrier	Amy Chouest	C-Courageous
Hull #	162	199	175	141	165
Vessel Type	OSV	OSV	OSV	OSV	OSV
Length	240'	240'	240'	234'	220'
Beam	56'	56'	56'	52'	56'
Depth	18.9'	21'	18.9'	21.9'	18.9'
Draft @ LL	16'	18'	15.6'	18'	15.6'
BHP - Main Engines	3,420	3,420	3,420	3,200	3,200
DWT @ LL	2,670 LT	3,250 LT	2,650 LT	2,984 LT	2,664 LT
Clear Deck Area	165' x 46'	165' x 46'	165' x 46'	160' x 44'	165' x 46'
Deck Cargo Capacity	1750 LT	1750 LT	1525 LT	1590 LT	1500 LT
Deck Capacity p/sqft	540 lbs	540 lbs	540 lbs	540 lbs	540 lbs
Fuel Capacity	167,931 gal	309,270 gal	257,131 gal	227,862 gal.	302,511
Discharge Manifold	4"	4"	4"	4"	4"
Water Capacity	432,607 gal	236,185 gal.	317,848 gal	257,008 gal.	362,968
Bulk Capacity	6,320 cu. Ft.	8,000 cu. Ft.	9480 cu. Ft.	11,250 cu. Ft.	9,480 cu. Ft.
L/M Rated Capacity	6,592 bbl.	6,063 bbl.	n/a	4,407 bbl.	6,660 bbl.
L/M Avg Max Capacity	6,200 bbls	5,500 bbls	n/a	4,000 bbl.	6,100 bbls
# & Type of Tanks	4 / SQ	10 / RD	n/a	6 / SQ	4 / SQ
Split System Configuration	2 - fwd - 3296 2 - aft - 3296	4 - fwd - 2432 4 - mid - 2432 2 - aft - 1194	n/a	4 - fwd - 2350 2 - aft - 2057	2 - fwd - 3396 2 - aft - 3264
Pump Size - HP	1 x 125/1 x 200	3 x 200	n/a	1 x 100/1 x 5 rotary	1 x 125/1 x 200
Circulation Method	Circulate	Agitate	n/a	Circulate	Circulate
Circulation System	FWD - 1 x 125hp 1,600 gpm AFT - 1 x 200hp 2,800 gpm	Flygt - 15hp 11,680 gpm	N/A	FWD - 1 x 60hp 220 gpm AFT - 1 x 100hp 500 gpm	FWD - 1 x 125hp 1,600 gpm AFT - 1 x 200hp
Methanol Capacity	n/a	n/a	1251 bbl		n/a
DP Class	DP-2	DP-2	DP-2	DP-2	DP-2
Ref. Systems	CNAV 2050	CNAV 2050	CNAV 2050	CNAV 2050	CNAV 1000
	Mini-Max	CNAV 1000	CNAV 1000	Mini-Max	Mini-Max
	Fanbeam	Fanbeam	Fanbeam	Fanbeam	Fanbeam
Fire Monitor	n/a	2 x 8000 GPM	n/a	n/a	n/a
Bunks	31	29	27	27	31
Corrosion Inhibitor			(2) 404 / 161 bbl		
Asphaltine Inhibitor			(2) 161 / 151 bbl		
Parafin Inhibitor			(2) 263 / 151 bbl		
Scal Squeeze			217 bbl		
Scale Inhibitor			101 bbl		
Calcium Nitrate			288 bbl		
LDHI			607 bbl		
A-Frame Capable	No	No	No	No	No
Certified Ship Crane	No	No	No	No	No
Liquid Level Readers**	F,W,LM	F,W,LM	F,W,LM,M,C	F,W,LM	F,W,LM

**Liquid Level Readers : F = Fuel, W = Water, LM = Liquid Mud, M = Methanol, C = Chemicals

HOS CENTERLINE

370MFSV Multi Purpose Service Vessel



Length:	[illegible]	Beam:	[illegible]	Draft Max:	[illegible]
Tonnage/Gross:	[illegible]	Net:	[illegible]	Draft Min:	[illegible]
IMO:	[illegible]	O.N.:	[illegible]	Flag:	[illegible]
Certifications:	[illegible]				
Classifications:	[illegible]				

Cruise Speed:	[illegible]	Max Speed:	[illegible]	[illegible]
On DP:	[illegible]	On Standby:		[illegible]

Main Engines:	[illegible]	Total Rating:	[illegible]
Primary Generators:	[illegible]	Total Rating:	[illegible]
Main Propulsion:	[illegible]	Total Horsepower:	[illegible]
Aft Bow Thruster:	[illegible]	Total Horsepower:	[illegible]
Fwd Bow Thruster:	[illegible]	Total Horsepower:	[illegible]
Stern Thruster:	[illegible]	Total Horsepower:	[illegible]
		Power Generation:	480V, 60 Hz/3-Phase

Deadweight:	[illegible]	Deck Area:	[illegible] (13,920ft²)
			[illegible] (3,293ft²)
Deck Cargo:	[illegible]	Deck Load Rating:	[illegible]
Brine:	[illegible]	Discharge Rate:	[illegible]
Cargo Oil (D/O):	[illegible]	Discharge Rate:	[illegible]
Liquid Mud:	[illegible]	Discharge Rate:	[illegible]
Potable Water:	[illegible]		
Rig Fuel (ULL):	[illegible]	Discharge Rate:	[illegible]
Rig Water:	[illegible]	Discharge Rate:	[illegible]
Freezer Area:	[illegible]	Cooler Area:	[illegible]

[illegible]

[illegible]

Roll Damping:	[illegible]	Watermaker Cap.:	[illegible]
Stores Crane:	[illegible]	Max Lift @ Max Radius:	[illegible]
		Max Lift @ Min Radius:	[illegible]
ROV:	Suitable for 2 x Perry XLS-150 HP		

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WWC008-001081