From: DWH, Toolpusher (Deepwater Horizon)
Sent: Saturday, January 30, 2010 2:11 PM
To: DWH, AsstDriller (Deepwater Horizon)
Subject: MACONDO PART 2
Attachments: Macondo_Drilling_Sec06_22_Casing_Interval.pdf; Macondo_Drilling_Sec02_Subsurface.pdf; Macondo_Drilling_Sec03_PreSpud_Activities.pdf; Macondo_Drilling_Sec04_36_Casing_Interval.pdf; Macondo_Drilling_Sec05_28_Casing_Interval.pdf

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2 Subsurface Information

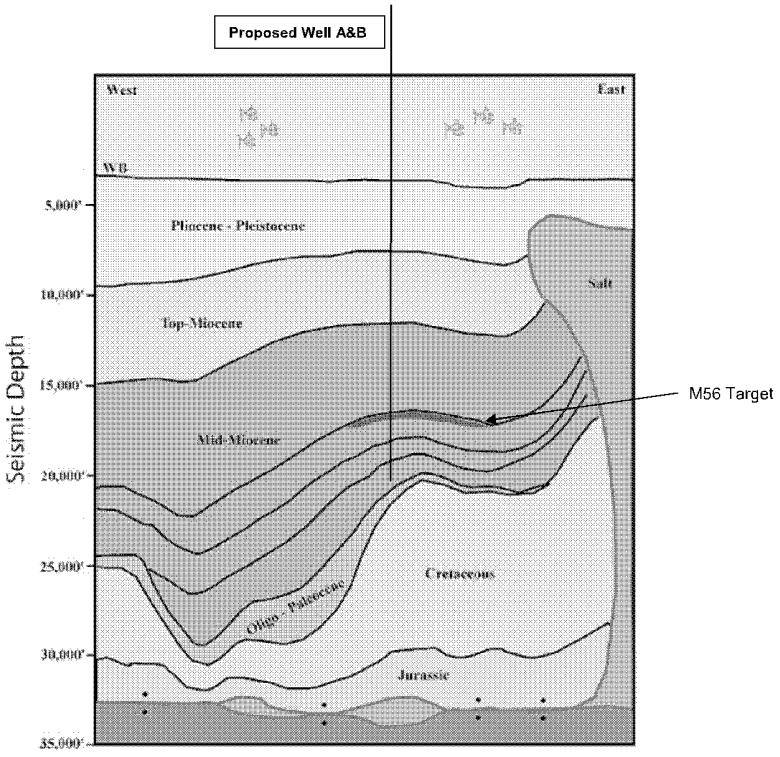
2.1 Prospect Summary

The Macondo project is proposed to test an extra salt amplitude prospect in northeastern Mississippi Canyon protraction area. The Macondo prospect is located in Block 252 where BP is Operator and currently has a WI=100%. (It is expected to have a partner prior to spud, or shortly thereafter)

The primary target is an amalgamated low relief channel-levee system of Middle Miocene age (M56). The channel system tracks from the NW to the SE both perpendicular to the strike and over an elongated Mesozoic ridge. The expected facies are low relief channel-levee deposits with adequate vertical and lateral connectivity. The trapping elements are a combination of dip and stratigraphic.

Two zones of interest have been identified along with the primary target. The first zone is a channel-levee complex at Rigel field, M87 in age and producing biogenic gas. Seismic evidence shows that the lateral extent of this channel does not reach the Macondo wellbore. The Macondo well will penetrate the M87 horizon updip of the Rigel field possibly encountering thin bedded reservoir charged with hydrocarbons.

The second zone of interest is the Miocene section below the M56 primary target. The current geologic model predicts the absence of any lower Miocene reservoirs with NW to SE trending channel complexes mapped west of the Macondo prospect. However, there is the chance of channel-levee overbank deposits thinning up and over the Macondo 4-way.



2.2 Formation Tops

List of Significant Markers Anticipated		
Name	**Subsea Depth**	**Top MD**
Reticulofenestra pseudoumbilicus; Globorotalia margaritae	7060	7060
Catinaster mexicanus	9100	9100
Catinaster coalitus	13145	13145
Discoaster kugleri; Globorotalia fohsi robusta	14153	14153
Cyclicargolithus floridanus	17481	17481
Globorotalia peripheroronda – M56	18400	18400
Sphenolithus heteromorphus	19120	19120
Discoaster petaliformis	19594	19594

2.3 Top Hole Formation Forecast

Prospect or Field Name:	Macondo			
Well Location Name:	Proposed MC 252 #1 Location (Surface location in MC 252)			
Well Type:	Exploration			
Surface Location Coordinates:	***Latitude***	***Longitude***	***Easting***	***Northing***
	28° 44' 17.277" N	88° 21' 57.340" W	X = 1,202,803.88 ft E	Y = 10,431,617.00 ft N
Geodetic Datum & Projection:	Geodetic Datum: NAD 1927; Spheroid: Clarke 1866; X and Y Coordinates in UTM Zone 16 (US feet)			
Protraction Area & Block No.:	Mississippi Canyon 252	**Block Calls:**	6,943 ft FNL	1,036 ft FEL

Author:	Craig A. Scherschel	**Date:**	08 June 2009	**Revision No.:**	0

Proposed Casing Program	Depth BML (ft)	Depth SS (ft)	Depth BDF (ft)	Subsea Error: ± (ft)	TWT BML (sec)	3D Seismic Line 17282 at the Proposed Surf. Loc. NW SE	"Units & (Horizons)	Seismic-Stratigraphic Interpretation and Principle Lithology	Shallow Gas	Shallow Water Flow	Hydrates	Comments
								Seawater				*Seafloor is relatively smooth with a gradient of ~3° (5.2%) to the southeast.*
36" csg	0	4,992	5,081	25	0	2.0 sec TWT		**Mudline / Seafloor**				
	250	5,242	5,331	32	0.094		1	*Hemipelagic clays with possible thin clay debris flows*	N	N	N/L	*36" csg to be jetted into upper Unit 2*
	280	5,272	5,361		0.105		(10)					
							36" Shoe 2	*Interbedded marine clays and thin clay-prone debris flows*	N	N	N/L	*Drill w/ Seawater*
	726	5,718	5,807	47	0.268		(15)	*Interbedded marine clays and possible marls*				
28-inch csg	844	5,836	5,925	50	0.310		(20)					
							3	*Interbedded marine clays and possible marls*	N	N	N/L	
	1,042	6,034	6,123	56	0.380		(30)					
	1,194	6,186	6,275		0.433		28" Shoe 4	*Clay turbidites and debris flows*	N	N	N/L	*28" csg shoe to be set within upper Unit 4*
	1,489	6,481	6,570	70	0.534		(34)	*Overbank/channel levee clays and possible silts and sands*		L		**Closest amplitude anomalies (possible shallow gas) are about 500 ft NW and 300 ft NE*
	1,620	6,612	6,701	74	0.578		(36)	*Clay turbidites and thin debris flows*			N	
	1,832	6,824	6,913	80	0.649		(38)	*Continuous sands and silts*		M		
22-inch csg	1,944	6,936	7,025	83	0.686		(40)					
							5	*Interbedded clay turbidites and thin clay-prone debris flows with possible sands*	N	L	N	*Drill w/ Seawater or 11.5+/- P&D mud if needed*
	2,533	7,525	7,614	101	0.876		(45)	*Massive clay-prone debris flow with possible silts*				
	2,832	7,824	7,913	110	0.970	3.0 sec TWT	(50)					
	2,919	7,911	8,000		0.997		22" Shoe	*Interbedded clay turbidites and debris flows*	N	N	N	
	3,202	8,194	8,283	121	1.084			*Sand-prone deposit*	L	M		
	3,367	8,359	8,448	126	1.134			*Interbedded clay turbidites and debris flows*	N	N	N	*22" and 18" csg shoes to be set within Unit 6.*
18-inch csg	3,761	8,753	8,842	138	1.252			*Sand-prone deposit*	M	M		
	3,958	8950	9,039	144	1.310		6	*Interbedded clay turbidites and debris flows*				*Drill w/ 9.0 – 10.6 ppg SOBM*
	4,372	9,364	9,453	156	1.430			*Sand-prone deposit*	M	M		
	4,618	9,610	9,699	164	1.500							
	4,819	9,811	9,900		1.557	1927 ft		*Interbedded clay turbidites and debris flows; thin silts and sands possible*	N	N	N	*Depth Limit of the Shallow Hazards Assessment.*
16-inch csg	5,328	10,320	10,409	185	1.698		(60)					

Depths below mudline converted from time with function derived from seismic velocities: (Y = 0.6883*(X)^2 + 2.8289*(X)) where Y = depth BML in feet and X = TWT BML in msec).

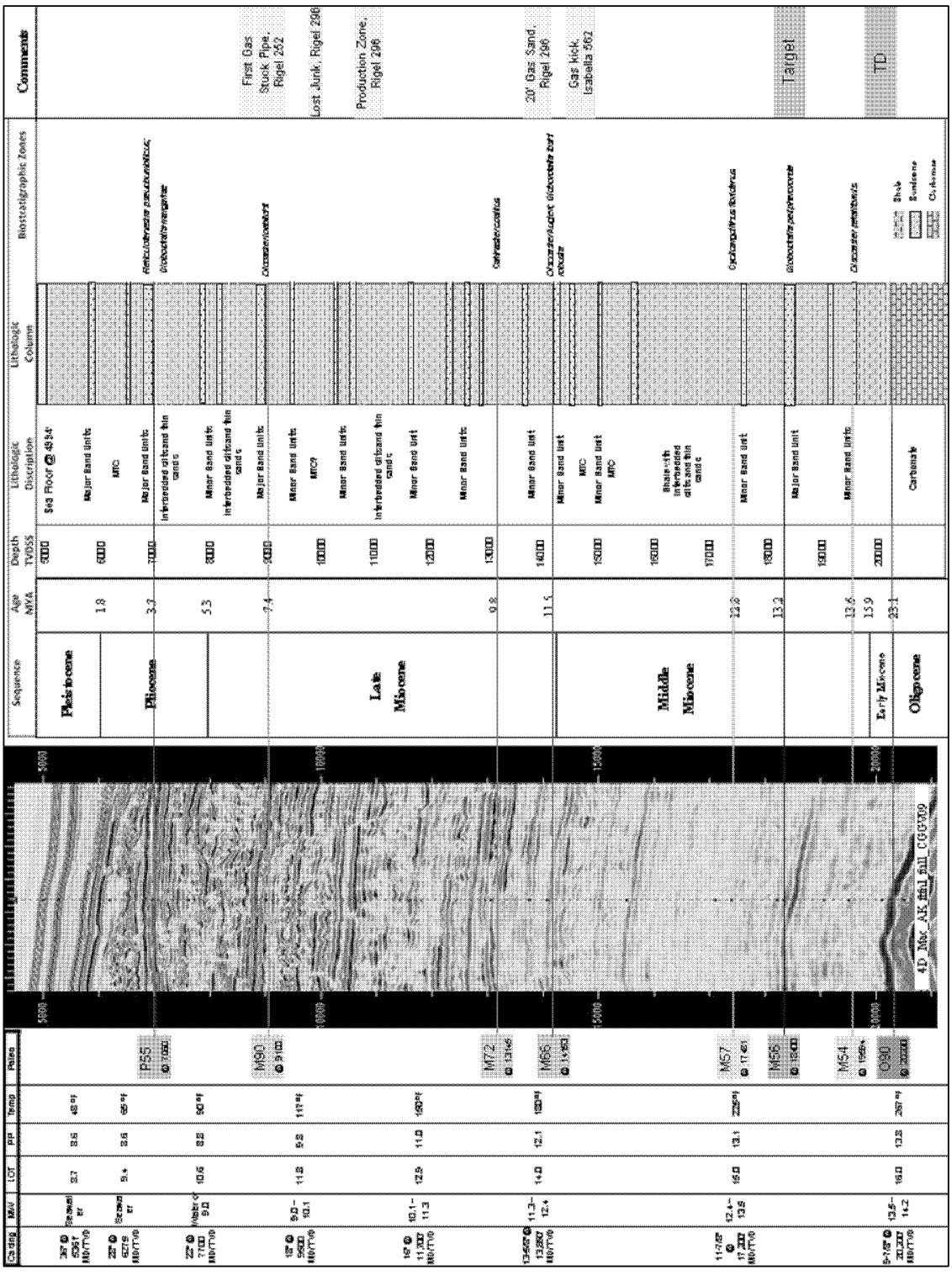
Risk Scale: Negligible | Low | Moderate | High

Abbreviations: BML = Below Mudline; SS = Subsea; BDF = Below Derrick Floor; TWT = Two-Way Travel Time

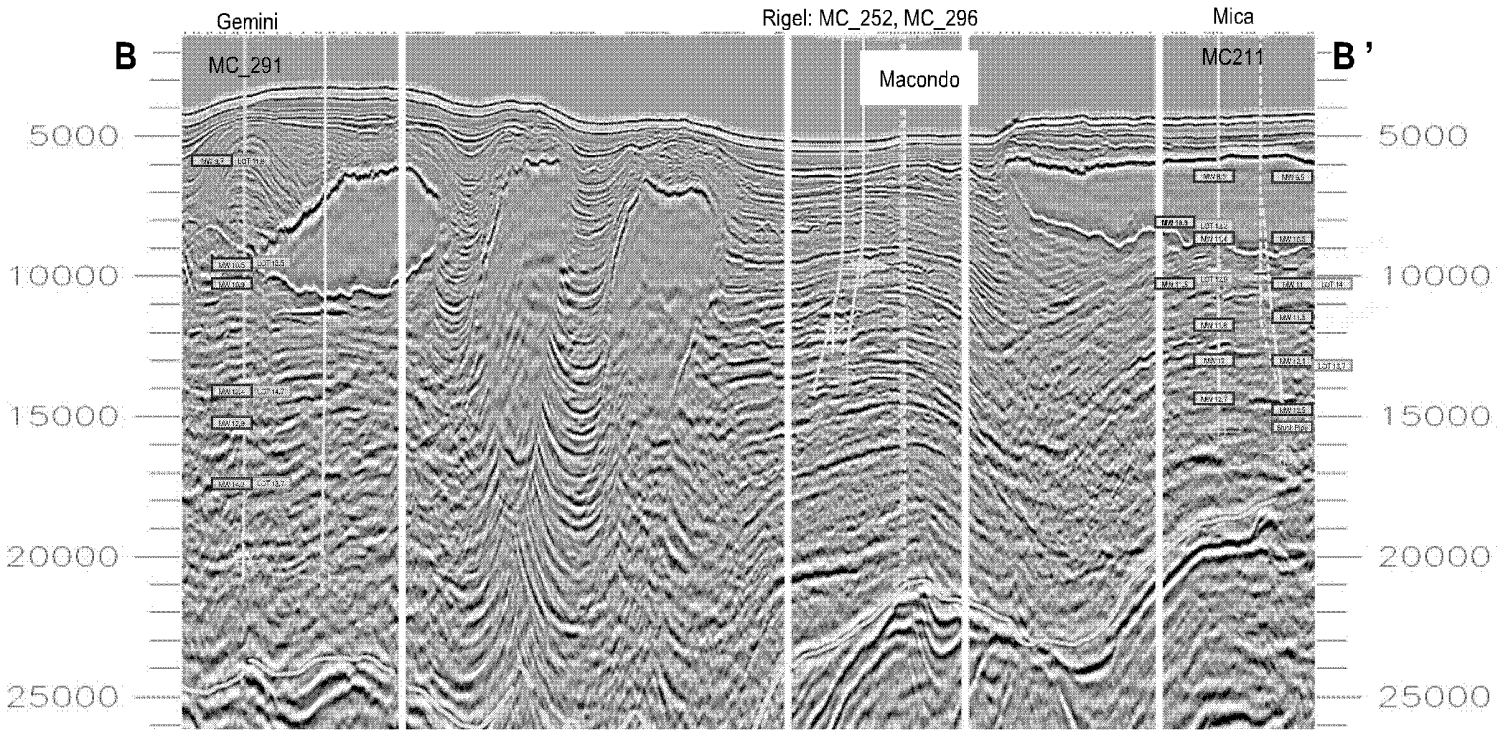
Plate 23

Air gap assumed to be 89 ft for the Marianas. Error: Estimated accuracy is ± 0.6% for seafloor, ± 3.0% depths BML (Subsea accuracy is the sum of these two).

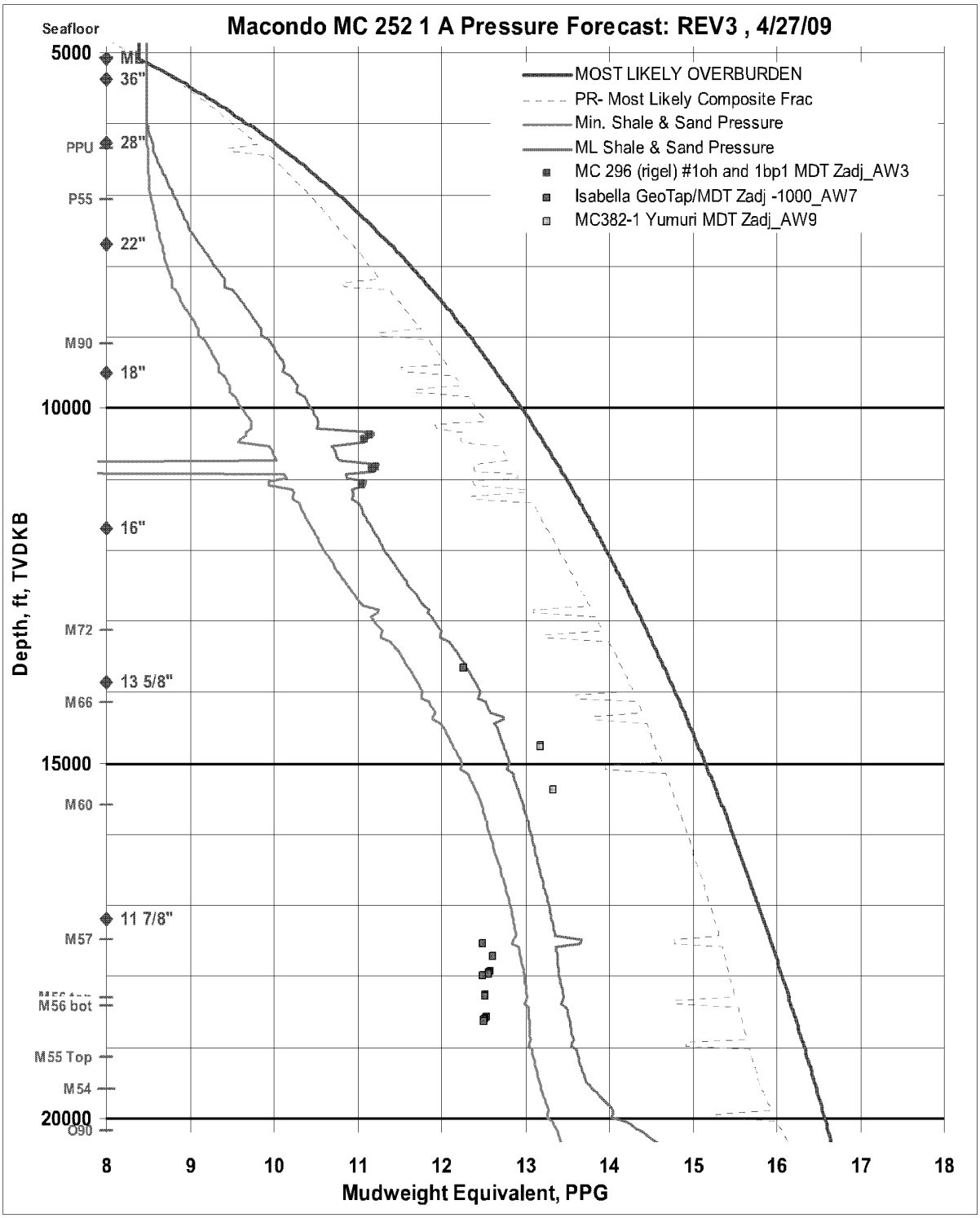
2.4 Stratigraphic Section



2.5 Seismic Cross Section



2.6 Pore Pressure Curve

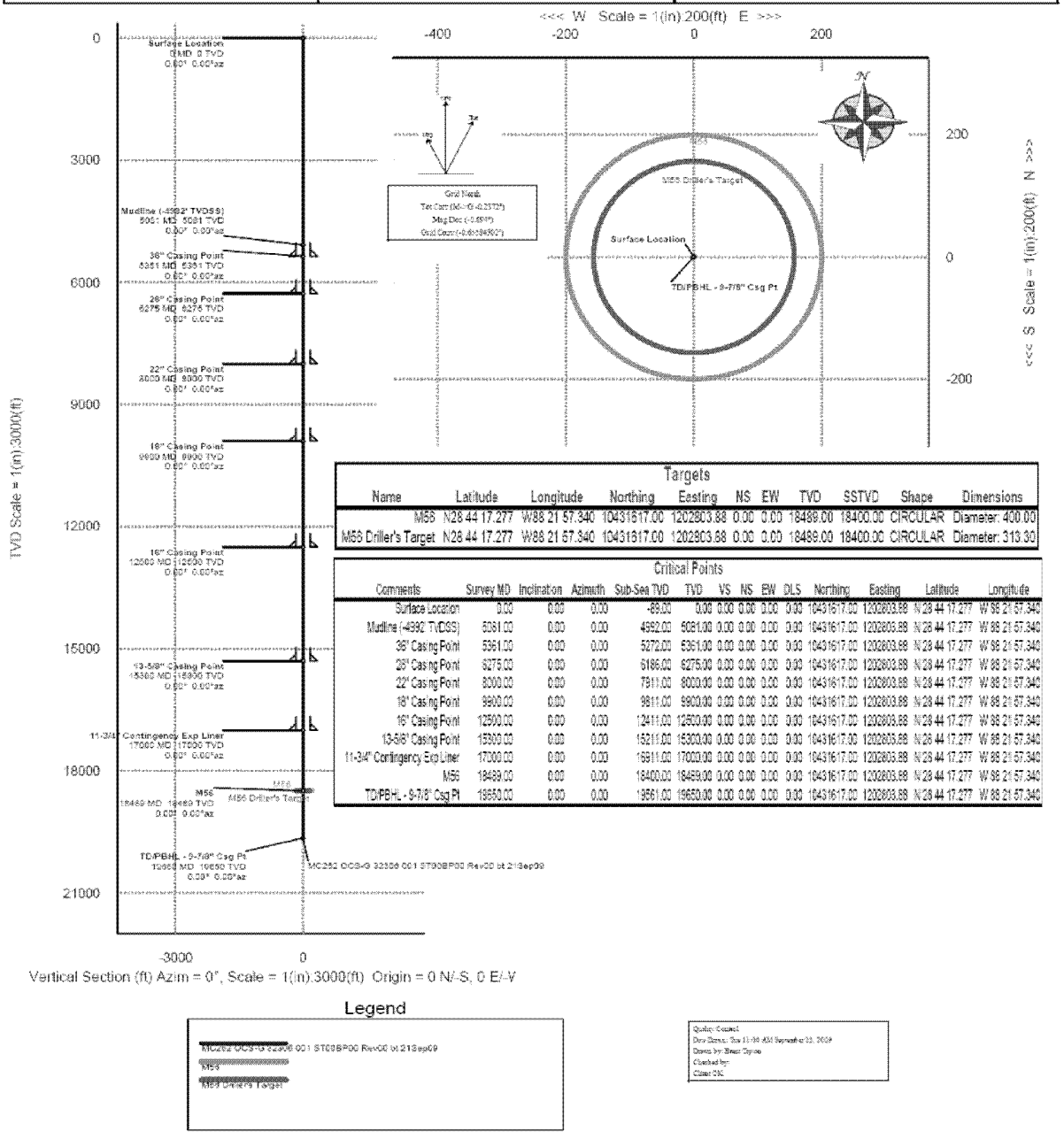


2.7 Directional Plan

BP

Schlumberger

OCS-G 32306 001 ST00BP00	Mississippi Canyon Block 252 (Macondo)	MC252 (Marianas RKB = 89.00 ft)



Targets

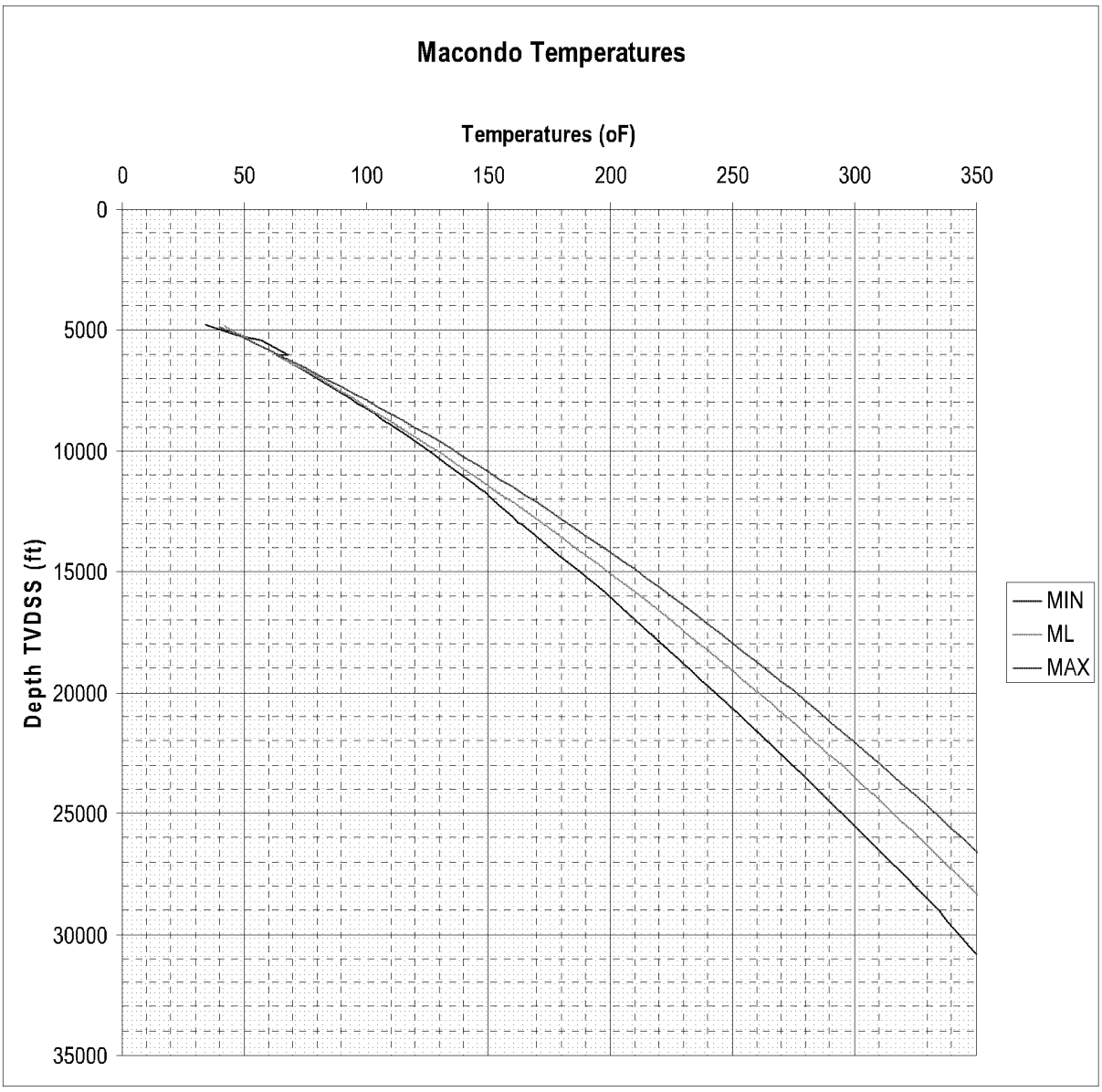
Name	Latitude	Longitude	Northing	Easting	NS	EW	TVD	SSTVD	Shape	Dimensions
MSS	N28 44 17.277	W88 21 57.340	10431617.00	1202803.68	0.00	0.00	18489.00	18400.00	CIRCULAR	Diameter: 400.00
MSS Driller's Target	N28 44 17.277	W88 21 57.340	10431617.00	1202803.68	0.00	0.00	18489.00	18400.00	CIRCULAR	Diameter: 313.90

Critical Points

Comments	Survey MD	Inclination	Azimuth	Sub-Sea TVD	TVD	VS	NS	EW	DLS	Northing	Easting	Latitude	Longitude
Surface Location	0.00	0.00	0.00	-89.00	0.00	0.00	0.00	0.00	0.00	10431617.00	1202803.68	N 28 44 17.277	W 88 21 57.340
Mudline (-4992' TVDSS)	5081.00	0.00	0.00	4992.00	5081.00	0.00	0.00	0.00	0.00	10431617.00	1202803.68	N 28 44 17.277	W 88 21 57.340
36" Casing Point	5361.00	0.00	0.00	5272.00	5361.00	0.00	0.00	0.00	0.00	10431617.00	1202803.68	N 28 44 17.277	W 88 21 57.340
26" Casing Point	6275.00	0.00	0.00	6186.00	6275.00	0.00	0.00	0.00	0.00	10431617.00	1202803.68	N 28 44 17.277	W 88 21 57.340
22" Casing Point	8000.00	0.00	0.00	7911.00	8000.00	0.00	0.00	0.00	0.00	10431617.00	1202803.68	N 28 44 17.277	W 88 21 57.340
18" Casing Point	9900.00	0.00	0.00	9811.00	9900.00	0.00	0.00	0.00	0.00	10431617.00	1202803.68	N 28 44 17.277	W 88 21 57.340
16" Casing Point	12500.00	0.00	0.00	12411.00	12500.00	0.00	0.00	0.00	0.00	10431617.00	1202803.68	N 28 44 17.277	W 88 21 57.340
13-5/8" Casing Point	15300.00	0.00	0.00	15211.00	15300.00	0.00	0.00	0.00	0.00	10431617.00	1202803.68	N 28 44 17.277	W 88 21 57.340
11-3/4" Contingency Exp Liner	17000.00	0.00	0.00	16911.00	17000.00	0.00	0.00	0.00	0.00	10431617.00	1202803.68	N 28 44 17.277	W 88 21 57.340
MSS	18489.00	0.00	0.00	18400.00	18489.00	0.00	0.00	0.00	0.00	10431617.00	1202803.68	N 28 44 17.277	W 88 21 57.340
TD/PBHL - 9-7/8" Csg Pt	19650.00	0.00	0.00	19561.00	19650.00	0.00	0.00	0.00	0.00	10431617.00	1202803.68	N 28 44 17.277	W 88 21 57.340

Legend

2.8 Estimated Temperature Plot



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3 Pre-Spud Activities

Surface Location			
Latitude:	28° 44' 17.277" N	Longitude:	88° 21' 57.340" W

3.1 Mobilization

- Ensure once rig is properly positioned on location by C&C Technologies that final positioning is validated by BP's internal resource, Bruce Carter (281-366-3788).
- Confirm that BP regulatory department (Scherie Douglas, 281-366-6843) has notified all proper authorities (i.e. MMS, Coast Guard, Naval Air Station-Air Operations, etc.) at least 48 hours prior to reaching new location.

3.2 Pre-Spud Meetings

A crew engagement meetings will be conducted prior to spud, at the rig site. The agenda will include safety status and goals, and presentation of the project plan.

Prior to drilling each hole section a review will be conducted with the well site leadership and office personnel to ensure all questions / concerns are addressed prior to undertaking the required work.

3.3 Rig Positioning

Rig positioning personnel and equipment should be on board at least 24 hours prior to spud. They should have current grid coordinates and should work closely with OIM to tie-in coordinates before final mooring positioning takes place on location.

Ensure well is spudded within 50' of proposed surface location. Fax final location report to Houston office and report final survey data on DIMS.

3.4 Action Items

- Load out and take on wellhead equipment, tubulars, and all handling equipment through the 22" casing section in Galveston, as space and deck load allows for the Marianas. Once jetted in, consider timing of 18" liner mobilization (should 22" get set early).
- Utilize proper derrick management to ensure sufficient drill pipe and BHA components are available to spud.

3.5 Equipment Load-Out and Preparation

1. All 36" wellhead will be ready to load out prior to leaving the shipyard in Galveston. Equipment will include Big Bore II Wellhead Housing with inclinometer support arms, and a complete set of Wellhead Running Tools.
2. Dril-Quip personnel and equipment should be on board in sufficient time to ensure all equipment is functional and ready to run. Required shear pins on all equipment should be checked and verified for proper number and shearing force. (For details, see *Dril-Quip Operations Manual.*)
3. Jetting BHA equipment should be on rig prior to leaving Galveston to allow make-up during transit.
4. Bulk materials including cement, cement additives, barite, gel, diesel, and fresh water should be on board prior to arriving at new location.
5. Both 2-degree bulls eye inclinometer and support arms for low pressure wellhead housing should be inspected for damage.
6. Measure and inspect all large OD casings as soon as possible after taking on rig. Clean casing connectors. Dril-Quip should inspect connections for damage and verify correct installation of lock ring. Apply grease lightly to box and pin surfaces and re-install pin protectors. Ensure extra O-rings are available and connectors have square shoulders so casing running tools will function properly. Make-up and stand-back all essential running tools.
7. Pick-up as much of jetting BHA as possible and stand-back in derrick. Pick-up and stand-back other running tools to extent possible.

Note:	**Due to successful jetting on the Isabela and a lack of jetting difficulties on offset wells, a CADA tool is planned.**

8. MU one stand of HWDP to top of running tool and stand-back in derrick.
9. Rabbit and drift all BHA components to maximum drift ID and verify there is no restriction to any ball or dart that may be dropped through each BHA. (For details, see BHA section.)
10. PU and MU cementing stand for 28" cementing job offline.

    – Ensure maximum amount of weighted gel mud possible is available in active and reserve systems and preparations are made for mud replacement, as required. Have enough 16 ppg on location to kill any shallow flow that may be encountered. If shallow flows or higher than anticipated pore pressure are encountered in 26" x 32-1/2" hole section, mud volumes will need to be re-evaluated.

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Interval Notes	
Item	**Comment**
Bit	26" mill tooth - Hughes CR-1
BHA	Motor, PWD, MWD, CADA, Smith 32-1/2" DTU, PBL
Special Equipment	Dril-Quip High Capacity Deep Dish Support Plate – pre installed on 36" (500K rating), Dril-Quip dual annular outlet sub with ball valves
Drillstring	6-5/8", 40#, S-135, FH Conn
Mud system	Seawater
Casing	36", jetted to ~253 ft BML
Inner string	See BHA
Cementing	n/a
Anticipated LOT/FIT	n/a

4 36" Casing Interval

4.1 Introduction

36" structural pipe will be jetted to ~253 ft BML, using the Modified Jet-cap method for jet-in (working pipe to maintain maximum ROP).

Target is for 10–12' of stick up above the ML, which will be confirmed with a mud stick and ROV during the jet-in.

Jetcap modeling indicates that the 22" casing is the critical factor driving the required depth of the 36" conductor. (See Attachment 1 – Jetcap modeling.) This modeling is consistent with recent wells that have run both 28" and 22" casing. After jetting is completed the CADA tool will be used to release from the wellhead and drill ahead to 28" TD.

The following table lists the nearby offset data.

SL Block	Prospect	Operator	Distance	Date	Penetration
MC 252	Rigel	Dominion	2 mi	9/6/2003	257'
MC 382	Yumuri/Kama	Hess	10 mi	9/3/2001	283'
MC 561	Tortuga	Noble	21 mi	5/6/2008	276'
MC 519	Santa Cruz	Noble	20 mi	1/14/2009	283'
MC 562	Isabella	BP	22 mi	3/1/2006	265'

4.2 Objectives

- Jet 36" conductor to ~253 ft BML with 10–12' stick up above the ML.
- No washout / breaching around 36" conductor.
- Conductor installation at <0.75 degree of inclination.
- Release CADA tool and drill ahead to 28" TD

4.3 Concerns

Concern / Hazard	Mitigation of Concern / Hazard
Bigbore II System and Hole Angle	Close tolerances with this system make it critical that wellhead is as close to vertical as possible to minimize potential for casing, BOP, and riser wear as well is drilled. Also, this is a keeper well, with future SS Tree installation. A <0.75 degree goal has been set. Tight Tolerance: 28" Supplemental Adapter – 30.24 in.
36" Structural Casing Weight and Picking Up Wellhead Joint	Structural casing involves handling heavy loads. Rig crews should verify ratings of all lifting equipment and have a plan to lift long LPWHH extension joint.
Hard Formation During Jetting	Reciprocate, as needed, keeping weight on bit between available casing weight and casing weight + BHA weight. Soils may require aggressive reciprocation to get ~253 ft of penetration. In this case, more soak time may be observed to allow soils to build integrity.
Jetting to Correct Depth	Install a minimum of one bottom indicator rod to facilitate the final wellhead position on the mudline. Ensure that the rod is long enough to exceed anticipated mud cloud. Mark drill pipe where rod should be when conductor has reached TD. Use ROV instrumentation to ensure pipe is jetted to correct depth. Mud stick will be a backup to ROV.
Flow Shut-Off Valves	Use care when installing brackets, and then making up valves to housing in moonpool. ROV personnel should ensure they have complete access to valves subsea wellhead.
Plugging of Annulus Valves	Ensure ROV personnel have pump and hose to clean out flow valves, if needed.
Shallow Water Sands	Shallow waterflow potential is negligible in this hole section.

4.4 Pre-Operations Tasks

Conduct a pre-work Safety Meeting, hold a pre-tour review on the casing running operations, and review Conductor Operational Checklist (Table 4–1). (For detailed operational procedures, see the *Dril-Quip Service Manual*.)

Table 4–1: Conductor Operational Checklist

	Task
	Consider loop current proximity before starting open water work.
	Check for paint marks inside shoe jt (bit placement) / add as needed to help space-out verification.
	Mark bit with a line 6" from the bottom 360 degrees around (helps determine position of bit).
	Mark CADA the CADA tool once locked into position so ROV can visually monitor if the tool is starting to work free from the LPWH or un-jaying.
	Document depth measurement of 28" HOP in DIMS.
	Install bottom indicator rod to facilitate final wellhead positioning.
	Once at location and prior to spud, perform site clearance with ROV.
	Ensure ROV personnel have Annular Shut-off Valves on board and ready to go.
	Before installing Annular Shut-off Valves, install (2) two support arms with slope indicators.
	Install ROV-operated Annular Shut-off Valves and manually function.
	Ensure all valves close in same direction and handles are securely attached.
	Leave Annular Shut-off Valves in OPEN position for running.
	Ensure ROV personnel check annular shut-off valve orientation prior to launch.
	Ensure ROV personnel have hose and pump on board ROV to clean out the valves,
	Record weight while making up casing, inner string, and RIH, as well as just prior to tagging mudline. Compare actual values to calculated and adjust WOB measurements accordingly if deviations is greater than 10 kips. (spreadsheet provided)
	Compare Pipe Tally vs. ROV water depth measurements and record.
	Check and Record slope indicator readings.
	Circulate to verify string is not plugged.
	Take final location survey after dry-spud-in to confirm location prior to commencing jet-in.
	Mark drill pipe above rotary while jetting in for Surface/ML coordination of penetration.
	Plot all jetting parameters (WOB, Pump Pressure, Reciprocation Weight, ROP, etc.)
	Ensure ROV is equipped with • Transponder • Jet pump • High pressure wand • Hose • Dopler current meter • Ring gasket carriers/retriever and camera • pH meter (for next section cement job) • Glycol to periodically pump into connector (after riser is run)
	Ensure Dril-Quip anti-rotation key tool is on board.
	Ensure this checklist data is captured on the DIMS and IADC reports.

1. Prior to spud:
   - Have Dril-Quip personnel and equipment at location to ensure all equipment is functional and ready to use, including:
     a. 36" LP Housing
     b. 28" Housing
     c. 22" HP Housing (18" and 16" supplemental adapters)
     d. Slope indicators / Bracket
     e. 36" Cam Actuated Drill Ahead Tool (CADA)
     f. 28" Housing Running Tools
     g. Jetting BHA components
     h. 18-3/4" MRLD
     i. 36" / 28" / 18-3/4" Wellhead housing support plates
     j. 36" / 28" / 18-3/4" Drill pipe support plate
   - Backup equipment and may be held on boat (at location) if rig deck space is limited.
   - Have jetting equipment on rig (in Galveston). Ensure Dril-quip hand inspects all other components 24 hours in advance of running to ensure new components can be shipped offshore if a problem is found.
   - Have bulk materials, including cement, cement additives, barite, gel, diesel, and fresh water on board.
   - Paint the PBL sub white so the ROV can easily identify when TOH to wash the wellhead profile.
     a. Paint stabilizers white so driller can slow tripping speed as they go through the wellhead as well as the
     b. Tripping speed should also be slowed as bit and DTU go are brought through the wellhead.
     c. Use ROV on all oversized components to keep off the wellhead and prevent damage to the sealing surfaces.
   - Ensure **~14,000 bbls** of 16.3 ppg Super Saturated WBM are available.
     a. 4,000 bbls of WBM is required for the 28" x 32-1/2" (pad mud).
     b. 10,000 bbls of WBM required for the 26" hole sections.
     c. If mud is used as a contingency, additional WBM may need to be mobilized to ensure sufficient mud volumes. The volumes listed are prior to cut back. Shallow hazards risks in the riserless sections include water and gas flow.
2. Prior to jet in, ensure MOTF mixer is rigged up, tested, and operational.
3. Ensure backup items at rig include
   - Shoe joint
   - (1) 1.5" WT intermediate joint

Note:	**Leave other backup 36" joints at the dock in Fourchon.** **Pay extra attention to handling and inspection of 36" string as the primary backup string is configured differently and the entire string will need to be shipped out if one of the upper joints is damaged.**

4. Inspect both 2-degree bullseye inclinometers and support arms (for low pressure wellhead housing) for damage.
5. Measure and inspect all large OD casings, once at the rig.
   - Clean casing connectors.
   - Have Dril-Quip inspect connections for damage and verify correct installation of lock ring.
6. Apply grease lightly to box and pin surfaces and re-install pin protectors.
   - Ensure extra O-rings are available.
   - Ensure connectors have square shoulders so casing running tools will function properly.
   - Make-up and stand back all essential running tools.
7. Pick up as much of jetting BHA as possible and stand back in derrick.
   - The primary BHA will be pre-strapped prior to arriving at location, this will give plenty of extra time to call out extra cross-overs or pup jts if required.
   - Once the BHA arrives offshore, directional driller should strap the BHA and confirm all measurements. If can not get 6 in stick-out +/- 2" call for more pup jts / cross-overs to get the proper space-out.
8. PU and MU cementing stand.

Note:	**Conductor should have been painted to aid visibility while jetting. (This should have been done at Dril-Quip's shop.)**

9. Starting at shoe, paint white ROV reference stripes at 5' intervals along length of casing joints.
   - ROV will use these stripes to reference bit position.
   - Paint numbers above stripes to indicate length from shoe.
   - Paint white stripes, 6" and 12" inside bottom of 36" jet shoe.
   - On conductor, plan is to have 10–12' of stick-up from mud-line to wellhead.

4.5 36" Structural Casing 1 – Operations Procedure

1. Conduct a pre-job safety meeting, and hold a pre-tour review on casing running operations. (See Attachment 2 – Casing Diagram.)
2. Build and space out BHA:
   - Place bit cones approximately 6" (+/- 2") outside of shoe joint. Primary BHA will be strapped and configured before shipping (as noted above).

- Plan 36" wellhead housing to allow for 10–12' of stick-up above mud line.
- If unable to use previously laid out jetting BHA, adjust with extra supplied pup joints, if this can not be made to work; adjust the casing shoe length.
- Install split rotary bushing adapters in rotary prior to running 36" casing. Although, these adapters will have to be pulled out when running 36" casing, they may help in maintaining centralization of 36" casing during make-up.

Note:	**Check that "Landing Ring Bolts" are tight.** **Keep an impact wrench (with 3" and a 3-1/8" socket) available on drill floor for removal of landing pads and torque eyes (supplied by Dril-quip)**

Caution:	**When making up or breaking down the BHA, if lift subs are used monitor the connections between the DC and LS to ensure they do not back-out when rotating. The BHA could be dropped (reinforce this action in the JSA).**

3. Rig-up to run 36" structural casing.
   - Dope casing connectors with litho-plex grease or equivalent grease the rig has available (not pipe dope).
   - Remove box thread protectors before making up (potential for pressure build up once string enters the water)

Note:	**Joints are pre-equipped with pad eyes (box end) designed to fit into Dril-Quip's modified 36" LP housing landing split plate.** **Torque eyes (pin ends) have been pre-installed by Dril-Quip to eliminate need for bull tongs.**

4. Torque joints to 50,000 ft-lbs, except for wellhead connector joint, which should be torqued to 75,000 ft-lbs.
   - MU same by locking rotary and pulling required MU torque with tong MU line.
   - Install anti-rotation keys.

Caution:	**Calculated buoyed weight of 36" casing + jetting string is ~220,000 lbs.** **Dril-Quip high-capacity, deep-dish support plate is rated to 500k. Standard deep-dish support plate is rated to 200k.**

Table 4–2: Conductor String

Work Order	Connector	OD	Joint Type	QTY	Wall	Grade	Length (ft)	Thread Loss (ft)	Running Ftg	Usage	Approx Wt	Cum Length
00149566	HC-100D/MT	36	Dril-Quip LP Hsg	1	2.0"	X-65	44.83	0.78	**44.05'**	Primary	36.4 kips	44.05 ft
00149570	HC-100D/MT	36	INT	1	2.0"	X-65	42.22	0.78	**41.44'**	Primary	31.1 kips	85.49 ft
00149571	HC-100D/MT x D-90/MT	36	X-OVER	1	2.0"	X-65	40.14	0.634	**39.51'**	Primary	29.6 kips	125.00 ft
80-1H967	D-90/MT	36	INT	1	1.5"	X-56	41.90	0.634	**41.27'**	Primary	23.4 kips	166.26 ft
80-1H987	D-90/MT	36	INT	1	1.5"	X-56	41.90	0.634	**41.27'**	Primary	23.4 kips	207.53 ft
80-1H967	D-90/MT	36	INT	1	1.5"	X-56	41.90	0.634	**41.27'**	Primary	23.4 kips	248.79 ft
-	D-90/MT	36	SHOE	1	1.5"	X-56	15.10	0.000	**15.10'**	Primary	8.6 kips	263.89 ft
								Total	**263.89'**		**176.0 kips**	
80-1F435	HC 100D/MT-FR	36	Dril-Quip LP Hsg	1	1.5"	X-80	68.25	0.78	**67.47**	Backup	40.3 kips	67.47 ft
00126421	HC 100D/MT-FR; D-90/MT	36	X-OVER	1	1.5"	X-80	42.13	0.634	**41.496**	Backup	23.6 kips	108.97 ft
80-X5392	D-90/MT	36	INT	1	1.5"	X-56	41.9	0.634	**41.266**	Backup	23.4 kips	150.23 ft
80-1N725	D-90/MT	36	INT	1	1.5"	X-56	41.9	0.634	**41.266**	Backup	23.4 kips	191.50 ft
80-1C291	D-90/MT	36	INT	1	1.5"	X-56	42.6	0.634	**41.966**	Backup	23.4 kips	233.46 ft
00127172	D-90/MT	36	SHOE	1	1.5"	X-56	40.92	0.000	**40.920**	Backup	22.9 kips	274.38 ft

5. Confirm 28" adapter is in proper place inside of low pressure housing. The 28" adapter will be just below the 36" LPWH, between the two sets of annular shut off valves.
   - Dril-quip back-up running tool and deep swallow support plate will be made up to the joint when shipped out.
   - Remove pad-eyes/clamp-on ring.
   - Record casing weight prior to landing out.
   - Land 36" wellhead housing on deep swallow support plate.
   - RD lifting slings and RU for handling BHA equipment.
6. Land 36" WHH in rotary.
   - Back-out RT (this is the backup), load on skate.
   - Jump ROV in order to check space with enough time so rig is not waiting on it once inner string has been landed out.
7. Install false bowl and slips on 36" WHH.
   - RU and run jetting assembly inside structural casing. (See Attachment 3 – BHA Schematic.)
   - Space out provided to rig should place 26" drill bit cones ~6" (+/- 2") outside 36" shoe bevel.
8. Record weight of jetting assembly on daily drilling report. To improve ROV visibility, paint 26" bit white 6" up from the nose all the way around.
9. PU Dril-Quip 36" CADA tool and make up to last joint of jetting string.
   - Lower running tool until it lands out in the LPWH.

- Use ROV to ensure 26" drill bit is properly positioned in relation to 36" casing shoe. Adjust as necessary to put the bit cones ~6" (+/- 2") outside the 36".
- Make-up the top drive and pump through the inner string to ensure motor functions.
- Lock the running tool into the LPWH
- Paint vertical reference stripes on LPH, CADA, and drill pipe tool joint for ROV to confirm tools do not begin to work free.

10. PU 36" LP Wellhead Housing and lower below rotary table to the moonpool false rotary.
    - Install two support arms with slope indicators (173 ft/lbs).
    - Install eight (8) ROV-operated annulus shut-off valves.
    - Run on 6-5/8" 40 ppf FH drill pipe

Note	• **Ensure valves are functional at surface.** • **Run valves in OPEN position.** • **Prior to valve installation, ensure support arms are installed.** • **Have Oceaneering confirm proper installation of valves for ROV operations.** • **Have ROV personnel present when valves are installed on well head. Operators should manually operate valves to confirm direction of closure.** • **Install valves so valve stem is pointing upward, which puts valve handle so direction of closure occurs in horizontal plane only, allowing ROV operator to push valves closed without having to grab handle.** • **Ensure valves have a rigid stop to indicate closure. Another stop may also be installed to prevent attempts at actuating in wrong direction.** • **Ensure valve handles are attached in a secure manner and with a retaining device, such as a cotter pin. Double check all handles to ensure they are secured properly.** • **If ROV is unable to close valves, ensure plugs are available as a contingency.**

11. PU Assembly, remove false rotary and record on DIMS slope indicator readings and rig inclination.
    - Run 36" casing on 6-5/8" 40 ppf FH drill pipe to mudline, filling drill pipe, as necessary (positive float in drill string).
    - Use ROV to observe deployment operations.
    - Record weight every 10 stands and compare to calculated weight.
12. Before tagging sea floor, record weight of casing, jetting assembly, and running string on daily drilling report.

- Circulate to verify string is not plugged, and motor is still functioning, then check and record both slope indicator readings and rig inclination on DIMS again.
- Estimated ML depth is 5081 ft TVD-RKB (4992 ft WD + 89 ft DF to MSL).

13. Space out drill string so minimum number of connections are made during jetting:
    - No connections should be made in the first 60' or last 60' of jetting operations.
    - Mark drill pipe to assist in verifying that surface ROP corresponds to mud line penetration during jetting operations.
14. Tag mud line with pumps off.
    - Make final location survey.
    - Make final quality assurance check on well location (Fugro surveyors / BP Surveyor)
    - Lower joint 8-10' BML and adjust rig as necessary to ensure pipe is vertical
15. Begin jetting operations, bring pumps on at approximately 15'-20' BML per the directional driller's recommendations and attached pump schedule.
    - Continue to mark drill pipe at 5' intervals
    - Follow WOB schedule provided (Jetcap). Do not exceed the max WOB as this will put the running tool and drill string into compression and may cause the CADA tool to have issues releasing.
    - Pumps should be brought up approximately 100 gpm per 15' of penetration to max of 1300 gpm. (stop pumps immediately in the upper hole sections if problems arise)
    - While <100' BML reduce pumps during strokes, to the rate used for jetting at the depth BML:

      example: jetting at 90' bml (780 gpm), stroke up to 70' bml where the pump rate was 640 gpm, therefore pumps should be reduced during stroke to 640 gpm.
    - Monitor the CADA tool and ball outlets valves for returns.
    - Strokes should occur when at max weight for depth and ROP slows.
      a. We want to follow the Jetcap schedule provided, unless penetration rate drops and we aren't making footage, then we will increase stroke lengths / frequency to gain regain pipe movement (per the hodges method).
      b. Jetcap is only meant to break enough soil on the outside of the casing that skin friction is reduced just enough to keep the pipe moving efficiently.
      c. Hodges method is meant to keep soil on the outside of the 36" fluid, and build skin friction over the final 30'.
      d. The longer the stroke the more skin friction it will break down, the Hodges method maximizes stroke length, Jetcap minimizes. A modified version with strokes between 15 - 30' has been seen to work effectively.

- Try not to reciprocate over the final 30', and attempt to land out with max available WOB (according to Jetcap ~147 kips (80%), if special attention is paid to ensure string does not go into compression up to 90% of the weight can be used or ~183 kips).
- With 10-20' to go, calibrate remaining footage and drill pipe measurement, so can land out without the mud stick if the ROV losses visibility
- Shut down pumps at TD; do not pump more than necessary.
- Monitor marks on CADA tool and LPWH with ROV to ensure tool is not working itself free.
- Don't lock top drive brake while jetting.

Note:	**Use Hodges method to jet. (Use JetCap only as reference.)** **Keep string moving, working as required to maintain an effective ROP.**

16. Use ROV to monitor for washout around outside of structural casing.
17. Plot all jetting information, including weight on bit after reciprocations and send into Houston office.

Note:	**Reciprocation is required once maximum pump pressure and WOB is reached.** **Decide where to begin reciprocation on actual conditions at rig site, using expertise of directional driller. (See Attachment 4 – 36" Conductor Casing Jetting String.)**

18. Monitor slope indicator to ensure LP WHH inclination is < 0.75 degree of level. If LP WHH inclination is > 0.75 degree, consider pulling 36" casing and re-jetting to attempt to reduce inclination.

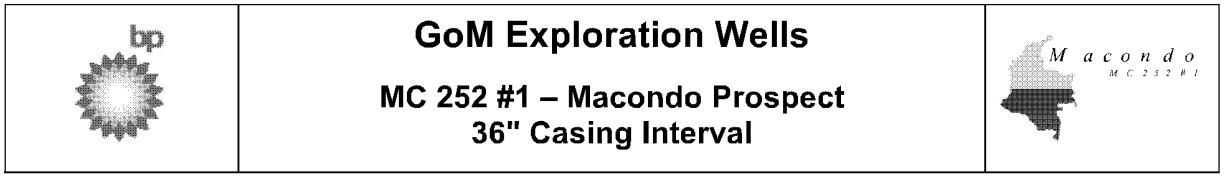
Note:	**If inclination starts climbing, stroke pipe up and reposition rig to counter angle. Multiple reciprocations alone will NOT improve angle.** **Ensure details of any rig displacement are recorded on morning report.**

19. Stop jetting when LP WHH is in position, ~10–12' stick up:
    - If conditions allow use ROV visually confirm casing is at the proper depth
    - If visibility is limited, use the ROV to help landing the wellhead out with the correct stick-up.
    - As mentioned earlier, 10-20' before landing out the drill pipe depth should be calibrated and should be used as a tool to land out with the correct stick-up too.
20. Once 36" casing is in position, stop circulation. Allow minimum soak time of 2 hrs, increase to 4 hrs if issues were encountered while jetting.

21. Monitor soils around 36" casing and low pressure housing for seafloor deformation indicators. Discuss with management, and consider pulling and re-jetting if angle at wellhead is >0.75 degree.
22. Record on Morning Drilling and IADC reports:
    - Actual water depth and RKB-ML depth
    - Date and time on location
    - Date and time of spud
    - Final well location coordinates
    - Depth from ML to top of low pressure wellhead housing
    - Depth where reciprocation started
    - Inclination with pipe hanging free in water column
    - Inclination at final jetted depth
    - Structural pipe penetration depth
    - Depth of 28" adapter
    - Position of bit relative to 36" casing shoe
    - Temperature at seafloor
    - Bulk and liquid volumes of consumables
23. Prepare to release from the wellhead and drill ahead
24. Rotate the drill pipe approximately 5 turns per the Dril-Quip hand/procedure (unlocks the tool from the housing)
25. Release the drill ahead tool; maintain 3 kips weight down on the CADA tool. Apply right hand torque of approximately 23,000 ft-lbs (book on says 13,000 ft-lbs, but shear pins have been upgraded).
26. Center stem will drop and should be detected, once this has occurred begin drilling the 26" x 32-1/2" hole.

Attachments

No.	Title
1	JetCap Modeling
2	Jetting Flow Profile
3	36" Casing Diagram
4	36" Conductor Casing Jetting String
5	36" Jetting String - MOP



Attachment 1:
JetCap Modeling

Determination of Weight on Bit Profile during jetting

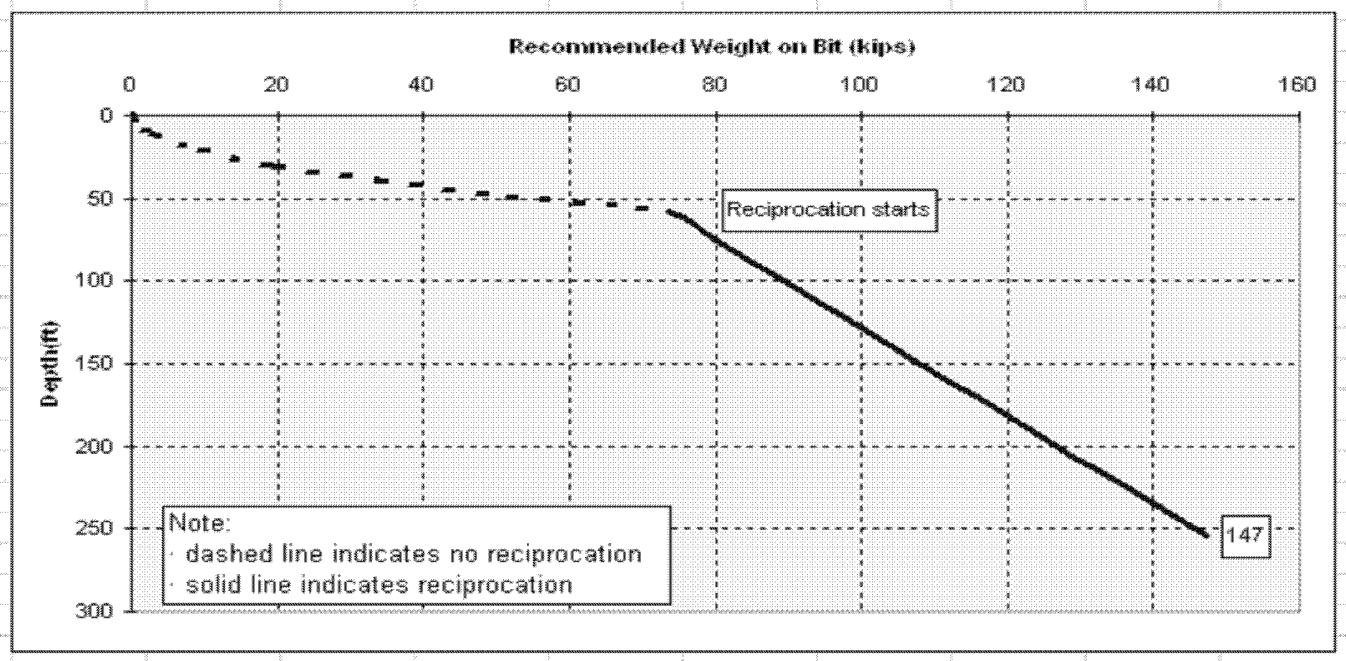
VERSION 2.0 - Oct. 1999

Well name: Macondo

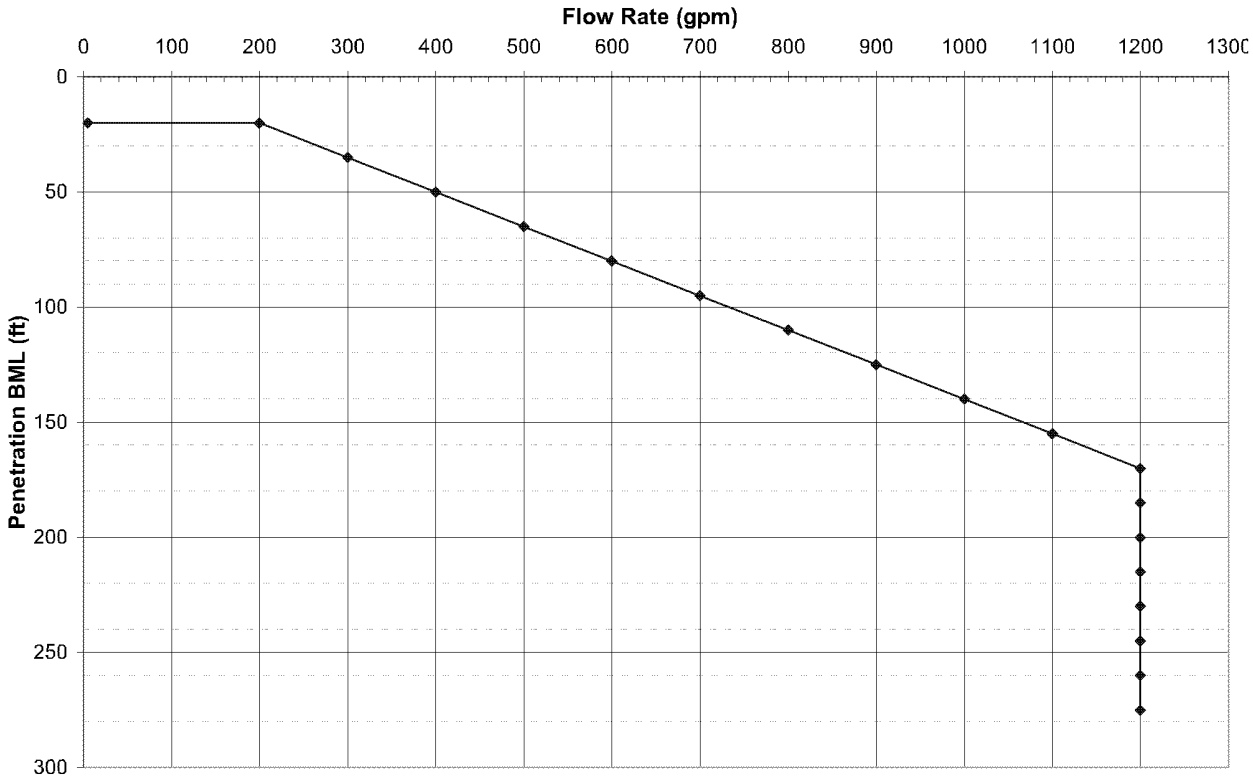
Selected conductor length (ft): 254

Available weight on bit during jetting (kips):	184
Utilization ratio:	0.8
Usable weight on bit during jetting (kips):	147
Anticipated depth at which to start reciprocation (ft):	58

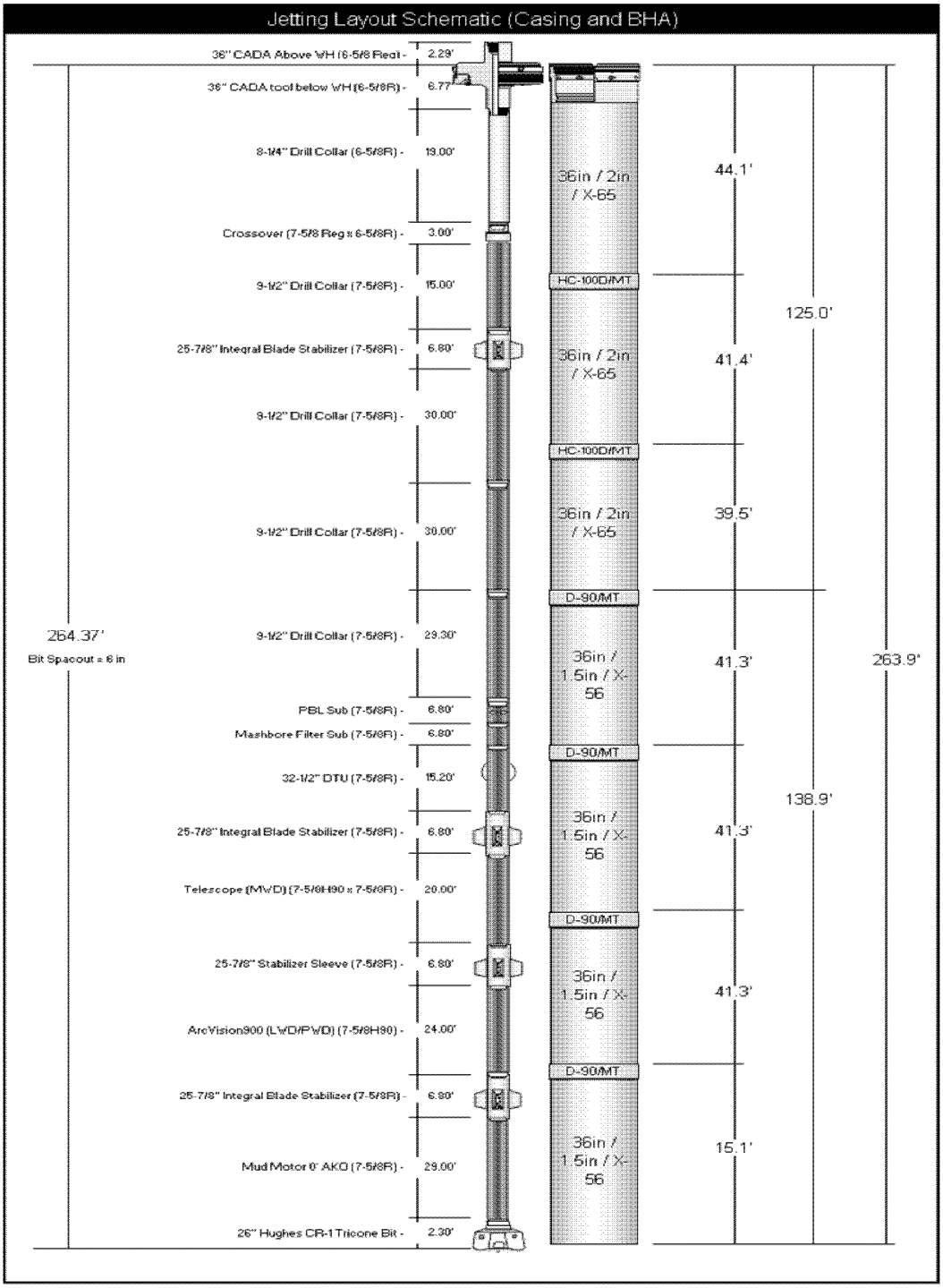
Depth (ft)	Recommended WOB (kips)
0	0
10	3
19	9
29	20
39	34
48	52
58	74
72	79
86	84
100	89
114	95
128	100
142	105
156	110
170	116
184	121
198	126
212	131
226	137
240	142
254	147



Attachment 2:
Jetting Flow Profile



Attachment 3:
36" Casing Diagram



Attachment 4:
36" Conductor Casing Jetting String

Jetting Assembly Weight Schedule

			Calculated			Cumulative Weight			
Component	Length	Cumulative Length	Weight			Air Weight		Bouyed Weight	Actual Weight
	ft	ft	lb/ft	lbs	kips	lbs	kips	kips	kips
Shoe Jt	44.1	44.1	826.7	36416.7	36.4	36416.7	36.4	31.7	
Intermediate Jt	41.4	85.5	751.2	31129.7	31.1	67546.4	67.5	58.8	
Intermediate Jt	39.5	125.0	749.6	29614.7	29.6	97161.0	97.2	84.5	
Intermediate Jt	41.3	166.3	567.6	23423.8	23.4	120584.9	120.6	104.9	
Intermediate Jt	41.3	207.5	567.6	23423.8	23.4	144008.7	144.0	125.3	
Intermediate Jt	41.3	248.8	567.6	23423.8	23.4	167432.5	167.4	145.7	
Housing Jt	15.1	222.6	567.4	8567.7	8.6	176000.1	176.0	153.1	
Bit	2.3	2.3	565.2	1300.0	1.3	177300.1	177.3	154.3	
Motor	29.0	31.3	208.0	6032.0	6.0	183332.1	183.3	159.5	
25-7/8" Stabilizer	6.8	38.1	240.0	1632.0	1.6	184964.1	185.0	160.9	
Arc900	20.0	58.1	200.0	4000.0	4.0	188964.1	189.0	164.4	
25-7/8" Stabilizer	6.8	64.9	240.0	1632.0	1.6	190596.1	190.6	165.8	
Telescope	24.0	88.9	189.0	4536.0	4.5	195132.1	195.1	169.8	
25-7/8" Stabilizer	6.8	95.7	240.0	1632.0	1.6	196764.1	196.8	171.2	
32-1/2" DTU	15.2	110.9	250.0	3800.0	3.8	200564.1	200.6	174.5	
Filter Sub	6.8	117.7	230.0	1564.0	1.6	202128.1	202.1	175.9	
PBL	6.8	124.5	260.0	1768.0	1.8	203896.1	203.9	177.4	
9-1/2" Drill Collar	29.3	153.8	224.0	6563.2	6.6	210459.3	210.5	183.1	
9-1/2" Drill Collar	30.0	183.8	224.0	6720.0	6.7	217179.3	217.2	188.9	
9-1/2" Drill Collar	30.0	213.8	224.0	6720.0	6.7	223899.3	223.9	194.8	
25-7/8" Stabilizer	6.8	220.6	240.0	1632.0	1.6	225531.3	225.5	196.2	
9-1/2" Drill Collar	15.0	235.6	224.0	3360.0	3.4	228891.3	228.9	199.1	
Crossover	3.0	238.6	224.0	672.0	0.7	229563.3	229.6	199.7	
8" Collar	19.0	257.6	167.0	3173.0	3.2	232736.3	232.7	202.5	
Running Tool	6.8	264.4	327.7	2218.3	2.2	234954.7	235.0	204.4	
Running Tool	2.3	266.7	328.7	752.7	0.8	235707.3	235.7	205.1	
Crossover	4.8	271.5	182.81	879.3	0.9	236586.6	236.6	205.8	
6-5/8" HWDP	900.0	1171.5	57	51300.0	51.3	287886.6	287.9	250.5	
6-5/8 - 40 ppf DP	600.0	1771.5	48.5	29100.0	29.1	316986.6	317.0	275.8	
6-5/8 - 40 ppf DP	600.0	2371.5	48.5	29100.0	29.1	346086.6	346.1	301.1	
6-5/8 - 40 ppf DP	600.0	2971.5	48.5	29100.0	29.1	375186.6	375.2	326.4	
6-5/8 - 40 ppf DP	600.0	3571.5	48.5	29100.0	29.1	404286.6	404.3	351.7	
6-5/8 - 40 ppf DP	600.0	4171.5	48.5	29100.0	29.1	433386.6	433.4	377.0	
6-5/8 - 40 ppf DP	600.0	4771.5	48.5	29100.0	29.1	462486.6	462.5	402.4	
6-5/8 - 40 ppf DP	286.0	5057.5	48.5	13871.0	13.9	476357.6	476.4	414.4	

Attachment 5:
36" Jetting String - MOP

Landing String Design - Margin of Overpull

This worksheet calculates *Margin of Overpull (MOP)* for pipe configurations with up to 5 different sizes of drill pipe and 3 different sizes of drill collars plus hevi-wate dp. It can also incorporate a safety factor.

Well: Macondo **Description:** 36" JETTING STRING

Drill Pipe Data

Bottommost Section ← → Uppermost Section

Casing		Inner String		Pipe #1		Pipe #2		Pipe #3
36	OD		OD	6.625	OD		OD	
33	ID		ID	5.375	ID		ID	
552.69	Nominal Wt		Nominal Wt	40.05	Nominal Wt		Nominal Wt	
658	Adjusted Wt		Adjusted Wt	47.8	Adjusted Wt		Adjusted Wt	
56,000	Yield strength, psi		Yield strength, psi	135,000	Yield strength, psi		Yield strength, psi	
100	% rem wall		% rem wall	90	% rem wall		% rem wall	

Tensile strengths from the pipe drill pipe data entered above

9,104,336	Tensile Strength		Tensile Strength	1,416,478	Tensile Strength		Tensile Strength	

BHA Data

9.500	⇐ DC #1 OD	8.000	⇐ DC #2 OD		⇐ DC #3 OD	6.625	⇐ HWDP OD	Tensile Str.
3	⇐ DC #1 ID	2.6	⇐ DC #2 ID		⇐ DC #3 ID	4.499	⇐ HWDP ID	1,021,600
245	⇐ DC #1 Length	20	⇐ DC #2 Length		⇐ DC #3 Length	900	⇐ HWDP Length	HWDP Air Wt.
☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	68,787

217	Wt/ft DC #1	153	Wt/ft DC #2		Wt/ft DC #3	Buoyancy Factor	0.8679
53,282	Wt. DC #1	3,064	Wt. DC #2		Wt. DC #3	Air Wt of BHA / WH	135,333
			WH / RT	10,200		Buoyed weight of BHA	117,450
Depth of Interest ⇒ ⇒ ⇒ ⇒			5,335	Safety Factor	80 %	Total length of BHA	1,165'
Anticipated Mud weight			8.65	Block Wt	145,000	**Total depth**	5,335

		Buoyed Wt	Section MOP		
				Pipe needed on last sec.	0'
Enter Casing Length ⇒	264	150,757		Weak point in string	691,947
Enter Inner String ⇒				Total weight of string	441,235
Enter Length DP #1 ⇒	4,171	173,028	691,947 #	Total weight BLK & string	586,235
Enter Length DP #2 ⇒				Total weight Indicator Reading	
Enter Length DP #3 ⇒				With over pull	1,278,182

36" pipe weight adjusted for entire string (2" and 1.5" casing will be used).
All pipe shall be inspected to 90% of rem wall.
Modeled as being all collars (9-1/2" and 8")
Adjusted drill pipe weight based off 95% RBW (nominal is 46.7 ppg) - worst case
WH / RT includes wellhead, 28" supplemental adapter and running tool

Table of Contents

Interval Notes	
Item	**Comment**
Bit	26" mill tooth – Hughes CR1
BHA	Motor, MWD, PWD, DTU (32-1/2"), PBL, CADA
Special Equipment	Dril-Quip High Capacity hanger support plate (630k rating), 28" Casing Hanger Running Tool (1000k), ATC Dart Catcher Sub & Down-Jet Sub
Drillstring	6-5/8" 40 ppf S-135 FH
Mud system	Seawater
Casing	28", 218 ppf, X-52, 0.812" wall, S60MT connections
ROV	Annular shut off valves need T-Handle plugs for back-up if valves fails to close
Landing String	6-5/8" 40 ppf S-135 FH
Inner string	5-1/2" 24 ppf S-135 HT-55
Cementing	Nitrogen Foamed Cement
Anticipated LOT/FIT	Riserless section – no LOT or FIT
Mud volume on location	4000 bbl 16.3 Super Saturated WBM

5 28" Casing Interval

5.1 Introduction

The short 26" x 32-1/2" hole interval is planned to be drilled using the same jetting BHA, and drill ahead tool. The casing point is designed to protect the structural integrity of the 36" conductor string and establish a competent base before any shallow water formation in the subsequent 22" casing interval is encountered. According to Jet-Cap models, the 36" casing string is not capable of holding the 22" casing on its own without extended set-up time greater than 12 days. However, assuming the 28" supports 15% of the 22" load, as well as itself, reduces the required set-up time to 2.5 days. The design is based off this assumption.

The onsite BP Wellsite leaders will need to adjust the actual TD based on casing tally, required rat hole, and lithology.

5.2 Objectives

- Drill 26" x 32-1/2" hole to allow 28" casing to be placed at the desired depth. The goal is to provide additional structural support to the 36" conductor, mitigate any shallow hazards, and gain sufficient fracture strength to drill the 22" casing Interval.

5.3 Concerns

Concern / Hazard	Mitigation of Concern / Hazard
SGF and SWF Risks	Negligible SWF or shallow gas flow in this interval.
Gumbo/Hydrates	Use seawater to drill this section, if gumbo is encountered consider control drilling.
Wellhead Subsidence	Monitor wellhead (with ROV) for any subsidence while setting weight on hanger. Notify Houston team if any subsidence is witnessed. Plan to hold onto the casing string after pumping the cement job if subsidence is witnesses, until the cement have been given adequate time to set-up.
Adequate Cement Job	Pump foam cement to minimize shallow flow contamination. Have a foam specialist to QA/QC process.
Inclination / DLS	Keeping inclination <3 degrees and dog leg severity (DLS) <0.5 degrees / 100' is goal. With a motor assembly in hole, consider controlling ROP and back-reaming, as necessary, to maintain these criteria.
Connector Tight Clearance	Pass 28" S60D/MT connectors, with a 29.91" OD, through the LP wellhead with a **minimum** ID of 30.24". Slowly run 28" casing to ensure 28" connectors pass through 36" FR HC100D/MT connector without damage.
Offset Well Problems	No major issues encountered in this section on offset wells.

5.4 Conductor 2 Drilling Operations Procedure

1. Release CADA tool from the 36" LPWH, un-jay and drill 26" hole until the 26" bit is at least 120' below the 36" shoe.
   - Control drill until stabilizers and DTU are out of the casing. Rotate the drill string at 30 – 50 rpm.

Caution:	**To prevent washout, avoid excess circulation just outside 36" shoe.** **Must have a clean profile to correctly land 28" positive stop hanger in supplemental adapter.** **To avoid potential adapter damage from bit, wash area across 28" landing shoulder with PBL sub.**

2. Once the DTU is outside the 36" casing, increase string rpm to 80-150 with seawater, maximizing flow rate at ~ 1200+ gpm (700 – 1468 gpm).
   - Begin fast drilling between 200-450 ft/hr.
   - Use ROV to monitor wellhead for any subsidence or flow on connections.

Note:	**"Fast Drill" Methodology** **Maximize ROP between 200-450 ft/hr, loading the wellbore with cuttings to maintain an equivalent circulating density above seawater. Sweeps, in most cases, are not necessary as the goal is to load the wellbore with cuttings.** **Closely monitor downhole conditions for packing off and flow on connections. Quick connections are required to make this successful.** **Surveys will be pumped up in this section after making connections, NO stopping to circulate for surveys.**

3. Drill to planned interval TVD point 6275' ft MD/TVD (1194 ft BML), minimizing rathole requirements (min = distance of bit to top of DTU +20 ft).
   - Use ROV to monitor returns while drilling. Check for indications of lost circulation or water/gas influx.
   - No sweeps necessary as fast drill should be utilized
   - Utilize PWD tool to monitor and manage ECD to minimize chance for shallow water flow.
   - Observe well for flow at each connection, but not for longer than connection make-up time.
   - If a moderate flow is encountered, onsite wellsite supervisor, drilling engineer, and shallow hazard specialist will evaluate its magnitude. A decision will be made to continue drilling or to kill well until additional weighted drilling mud can be sourced to facilitate pump and dump (if required).

- There will be approximately 4000 bbls of ~16.3 ppg water-based mud on location, which equates to 9000 bbls at 12.0 ppg.
- Keep minimum of 2 volumes of kill weight mud on rig at all times:
    - 1000 bbls of 16.3 ppg SS base mud

Note:	**This interval will utilize MWD for survey requirements. If a failure occurs while drilling, discuss options with Wells team (See MMS regulation 250.461.)**

4. Wellsite leaders will ensure these parameters / guidelines are monitored and communicated to necessary personnel:

Parameter	Guideline
ROP	Control drill while DTU and stabilizers are inside casing. Once out ROP drill between 200-450 fph. Hole cleaning should not be a problem for this riserless interval. Keep ECD below 9.5 ppg.
WOB	5-65 kips (limited by bit and *wellbore Inclination*)
RPM	Rotate drill string at 80-150 RPM. As recommended by Schlumberger DD (30-50 RPM while DTU is inside the casing)
Torque	Monitor difference between on and off bottom torque. Do not exceed make-up torque of weakest connection in hole.
ECD / PWD	Abrupt changes in ECD (generally an increase) may indicate SWF / SGF. Gradual increases may indicate annulus is loading up with cuttings. Monitor PWD closely throughout hole section.
Pump Rates	Consult with Smith Reamer rep to get proper flow rate in casing to prevent under-reamer arm from opening up in 36" casing. Even though casing ID is greater than OD of reamer, rotating with reamer open could damage casing. Planned flowrate once DTU is outside casing, should be 1,200 - 1,500 gpm. Rate adjustments can be made based on actual ROPs and mud volumes.
Hole Deviation	Keep wellbore inclination at 3 degrees, or less, to minimize potential for casing wear and to prevent problems running 18" casing in tight clearances.
Section TD	Adjust hole section TD and space out casing to position shoe at 6200 ft TVD (~20'-40' above 32-1/2" hole TD). **Prior to drilling more than 100' TVD deeper than the permitted hole section TD, MMS approval is required.**

5. At interval TD (**~6275' MD/TVD**);
    - ~40-50' of rat hole above the pilot hole (room for 1 joint tally error)

- Pump a 200 bbl high density / viscosity sweep w/ black dye
- Pump **12.0 ppg** water based pad mud (1.5 to 2.0 times the gauge hole volume) of pad mud to stabilize well.
- Ensure mud going in has an API fluid loss below 20cc
- Spot a pill of ±16.3 ppg water based mud in the rathole prior to POOH

6. Short trip to 36" casing shoe.
   - Monitor flow for a minimum of 10 minutes.
   - Evaluate drag while POOH and make a wiper trip, only if necessary.
   - If flow is observed, increase pad mud density, then discuss adjustments with Houston team.
7. If hole conditions permit, POOH.
8. Wash 28" landing shoulder with the PBL sub. A clean profile is imperative for correctly landing 28" hanger in the supplemental adapter.
9. POOH and prepare to run 28" casing.

Note: See section 4 - 36" Casing Interval for BHA schematic

Figure 1: 28" Casing OH Section: Drill String – MOP

Drill String Design - Margin of Overpull

This worksheet calculates *Margin of Overpull (MOP)* for pipe configurations with up to 5 different sizes of drill pipe and 3 different sizes of drill collars plus hevi-wate dp. It can also incorporate a safety factor.

Well: Macondo **Description:** 28" LINER OH SECTION

Drill Pipe Data

Bottommost Section ← → Uppermost Section

Pipe #1		Pipe #2		Pipe #3		Pipe #4		Pipe #5
5.5	OD	6.625	OD		OD		OD	
4.67	ID	5.375	ID		ID		ID	
22.51	Nominal Wt	40.05	Nominal Wt		Nominal Wt		Nominal Wt	
28.6	Adjusted Wt	47.8	Adjusted Wt		Adjusted Wt		Adjusted Wt	
135,000	Yield strength, psi	135,000	Yield strength, psi		Yield strength, psi		Yield strength, psi	
90	% rem wall	90	% rem wall		% rem wall		% rem wall	

Tensile strengths from the pipe drill pipe data entered above

798,925	Tensile Strength	1,416,478	Tensile Strength		Tensile Strength		Tensile Strength	

BHA Data

11.000	⇐ DC #1 OD	9.500	⇐ DC #2 OD	8.000	⇐ DC #3 OD	6.625	⇐ HWDP OD	Tensile Str.
3	⇐ DC #1 ID	3	⇐ DC #2 ID	2.8	⇐ DC #3 ID	4.499	⇐ HWDP ID	1,021,600
20	⇐ DC #1 Length	275	⇐ DC #2 Length	90	⇐ DC #3 Length	750	⇐ HWDP Length	HWDP Air Wt.
☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	57,323
300	Wt/ft DC #1	217	Wt/ft DC #2	150	Wt/ft DC #3	Buoyancy Factor		0.8679
5,996	Wt. DC #1	59,806	Wt. DC #2	13,529	Wt. DC #3	Air wt of BHA / WH		136,653
						Buoyed weight of BHA		118,595
Depth of Interest ⇒ ⇒ ⇒ ⇒			6,275	Safety Factor	80 %	Total length of BHA		1,135'
Anticipated Mud weight			8.65	Block Wt.	145,000	**Total depth**		6,275

		Buoyed Wt	Section MOP		
				Pipe needed on last sec.	0'
Enter Length DP #1 ⇒	0	0	520,545 #	Weak point in string	520,545
Enter Length DP #2 ⇒	5,140	213,226	801,361 #	Total weight of string	331,821
Enter Length DP #3 ⇒	0			Total weight BLK & string	476,821
Enter Length DP #4 ⇒	0			Total weight Indicator Reading	
Enter Length DP #5 ⇒	0			With over pull	997,366

NOTE: The air weight of spiraled hevi-wate drill pipe is calculated as 96% of non-spiraled HWDP.
All pipe shall be inspected to 90% of rem wall.

Figure 2: BHA Operating Ranges

	WOB (klbs)		RPM (rev/min)		Torque (kft-lbs)		Flow Rate (gpm)		Nominal OD (in)	ID (in)	Max LCM
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX			
26 "Bit	35	85	----	----	----	----	----	----	26	----	100 lbm/bbl
32.5" DTU w/ Non Ported Float	----	33	80	150	----	----	700	1468	22	----	limited by bit
26" PD 1200	----	65	----	220 (>160 affects perf)	----	48	800	1500	25.52	3.20	50 lbm/bbl nut plug
Arc 9	----	82	----	----	----	35	----	1950	9	3	No Limit
Telescope 950 HF	----	103	----	----	----	35	400	1600	10	6	50 lbm/bbl nut plug

5.5 28" Casing and Cementing Operations

Lesson Learned:	Context: 28" Hanger Running Tool Lesson: Handling of the 28" hanger running tool has been problematic in the past. Installing a 20' pup to the running tool made handling easier. Check with the rig to get their preference.

5.5.1 Casing and Cement Preparation

- Ensure cement, additives, and fresh and seawater samples are sent to lab for final testing.
- Do not move the rig away from the wellhead to run casing, there is no other infrastructure in the area.
- Prepare 28" casing tally.
- Prepare to set 28" shoe ~20' above 32-1/2" hole TD.
- 28" connectors will be delivered pre-doped with Citgo Lithoplex CM grease.
- Prior to shipment, verify casing has been drifted. Visually inspect to ensure there is no debris in pipe once at the rig.
- Surge / Swab calculation will be run by Baroid prior to running casing to determine maximum running speed without breaking down formation.
- Paint shoe joint white and paint a vertical stripe across connectors to be able to verify connectors have not backed out.
- Paint top of first stand on the inner string for ROV identification when POOH, so cement stinger does not score the wellhead profiles.
- Rabbit the 6⅝ 40 ppf and 5½-in. 34 ppf while RIH with the 28 in. casing to 2-5/8".
- Primary 28" Casing Hanger Running Tool w/ crossovers to a stand of drill pipe and lay out on the skate (per Dril-Quip procedures).
    - Primary tool should come out with cross-overs pre-installed. Use bucking machine to make up single on top offline prior to laying out on the skate.
    - 6-5/8R (pin) x 6-5/8 FH (box) on top
    - 5-1/2" HT-55 (pin) x 4-1/2" IF (box) on bottom
    - Back-up RT will be pre-installed in housing (no cross-overs), a solid body handling joint will be made-up on top.
- Inspect all components for damage.
- Make sure anti-rotation keys are shipped.
- Ensure ROV operators caliper the pH meter.

- Ensure any pup joints or crossovers required are either rented or provided by the rig and inspected. Give material certifications to rig and engineer. (These certifications will be used to verify proper load carrying capabilities.)
- Ensure any pup joints or crossovers in landing and inner strings do not have internal square shoulders or bore-backs, which have proven to hang-up drill pipe darts. Ensure internal tapers are at least 45 degrees.
- Visually inspect each joint of 28" casing before it's picked up from the skate to ensure there isn't a gap between the casing and horseshoe elevators.
- If cement stand can be racked in derrick in a secure area, pick up ATC Top Drive Surface Cement equipment (maximum hookload of 2.2MM at 5,000 psi), and stand back in derrick, as follows (Adjust stand height as needed):
  - 1 jt 6-5/8" DP
  - 15' DP pup joint
  - Full Open Safety valve
  - ATC Top Drive Cement Head,
    with ATC 2.50" OD no-go dart pre-loaded
  - ATC Positive Launch Indicator Sub (PL1)
  - Full Open Safety valve
    (Function test valve to verify valve alignment versus bore of valve is centered. For example, make sure bore is centered in valve body and there is a "dart" bushing on top of valve assembly.)
  - 5' DP pup joint
  - 1 jt 6-5/8" DP (drifted with a 2-5/8" drift)

5.5.2 *Casing Procedure*

1. Rig-up and run 28" casing, adjusting tally based on actual depth:

Item	Ftg	Size	Wall	ppf	Grade	Connection
Float Shoe Jt (w/cent)	~45'	28"	0.75"	218	X-52	Dril-Quip S60/MT Box
Centralized Jts (2)	~120"	28"	0.75"	218	X-52	Dril-Quip S60/MT Pin x Box
Non-centralized Jts	~xxx'	28"	0.75"	218	X-52	Dril-Quip S60/MT Pin x Box
Hanger Joint	~45'	28"	0.75"	218	X-52	Dril-Quip S60/MT Pin
ATC Dart Catcher Sub & Down-Jet Sub	~6'	N/A	N/A	N/A	N/A	HT-55
Inner String	~x,xxx'	5-1/2"	0.415"	24	S-135	HT-55
Cross-over	~5'	5-1/2"	0.415"	24	S-135	5-1/2" HT-55 x 4-1/2" IF
28" running tool	~3.6'					4-1/2" IF x 6-5/8" R
Cross-over	~5'	6-5/8"	0.625"	40	S-135	6-5/8" R x 6-5/8" FH
6-5/8" Landing String	~'x,xxx'	6-5/8"	0.625"	40	S-135	FH

Casing OD: 28.00"

Casing ID: 26.50"

Casing drift: 26.25"

Casing collar OD: 29.88"

Centralizers: 3 Weatherford Bow Springs with stop collars

Note:	Recommended make-up torque is 45,000 ft-lbs. Dril-Quip to use feeler gauge to check for proper makeup. Spray paint white vertical line with stencil across all connections at the same orientation (positioned for ROV inspection if required)

2. After first two joints are run.
   - Check for seawater returns to ensure floats are clear.
   - Fill casing with seawater every joint while running.
   - Make-up Dril-Quip multi-thread connectors with 5/8 turn to right.
   - Thread-lock bottom four joints.
   - Remove thread protectors on box end before lifting to the rig floor.

Note:	**Dril-Quip high capacity hanger support plate has a 630 Klbs rating. Estimated buoyed weight of 28" casing, plus 5-1/2" inner string, is 254 Klbs.**

3. Install 1 Weatherford BOW spring centralizer on shoe joint, and on next 3 joints run in hole. Centralizers to be mounted over stop rings mid-joint.
   - Stop rings will need to be installed on location.
   - Confirm centralizers and stops are per program and will pass through the 28" hanger profile (min ID = 30.24")
4. Continue running 28" casing, filling each joint with seawater.
5. PU and set Casing Hanger joint in rotary.
6. RU false rotary. Run ATC down-jet cementing sub with dart catcher and inner string inside 28" casing. Ensure top connection of lower most inner string stand is painted white. Space out to make final position of stinger/cement diverter ~150' above 28" float shoe.
7. Make-up 28" running tool onto 28" casing hanger (per Dril-Quip procedures.)
8. Align anti-rotation lugs on running tool with slots in hanger.
   - Land out and rotate running tool to left (approximately three turns) until a positive torque buildup occurs.
9. RIH with casing on 6-5/8" FH S-135 40 ppf drill pipe, filling DP every 10 stands to avoid collapse.
   - Just after entering wellhead housing, displace seawater in landing, inner string and 28" casing below stinger with 12.0 ppg pad mud.
   - Continue to fill drill string with 12.0 ppg pad mud until landed.
10. When last stand of drill pipe has been picked up, make-up ATC Cement Head on landing string.
11. Make-up top drive.
    - Record up and down weight prior to landing.
    - Wash down to last 10' of 28" Casing with 12.0 ppg pad mud.
    - Ensure 4" ball valves below 28" supplemental adapter are open and free of debris while circulating.
12. Slack-off and land 28" casing.
    - Confirm hanger is located properly in hanger profile.
    - Confirm lock ring is engaged by pulling 50,000 lbs tension over "landing string + inner string weight". Monitor with ROV for movement.
    - Slack off to neutral landing string weight.
13. Circulate one drill pipe, casing (below inner string) and annular volume of 12.0 ppg pad mud prior to cementing.

5.5.3 *Cementing 28" Casing*

For detailed cementing procedures, a cement program will be provided to the rig prior to pumping the job. Ensure at minimum Ops and planning engineers have signed off on procedure.

1. Rig-up and test cement lines to required pressure.
2. Pump spacer (with black dye to caliper the hole and adjust cement volumes based on data) and cement (per vendor cementing procedure and APD).
3. Drop 2.50" ATC drill pipe dart (~1,200 psi when dart leaves PLI sub).

Caution:	**Ensure cement volume pumped exceeds approved APD volumes.** **If channeling occurs, cement returns may appear earlier than anticipated. In this situation, ensure switch from lead to tail slurry does not occur until pumped lead slurry volume is equal to, or greater than, calculated gauge hole volume.**

Note:	**Give special attention to the Full Open Safety valve below cement head (ensuring it is fully open), to prevent hanging-up DP dart during displacement. A "dart" bushing on top of valve assembly will help transition dart cleanly.**

4. Switch to rig pumps and displace through Top Drive so higher pump rate (25-30 bpm) can be achieved.
   - Displace cement with seawater.
   - Monitor returns with ROV pH meter. Clean out flow valves with high pressure hose immediately after displacing cement.
   - ~10 bbls prior to dart landing in dart catcher, slow pump rates to 5 bpm.
   - When dart lands in sub, increase pressure to 1,800 psi above final circulating pressure to shift sleeve (dart stays in sleeve).
   - Continue displacing to leave ~100' of cement in shoe track (50' = ~34 bbls).
   - Displace at maximum rate possible.
   - Check if floats are holding.
5. If floats do not hold, pump flowback volume and hold for an appropriate set time based on cement slurry.
6. Use ROV to close bottom set of 4" annular valves. Have T-handle plugs as backup.
7. If cement returns were observed, there may be cement around inner string in wellhead. Therefore, once cement is in place, immediately POOH with inner string.
8. If desired CMC can be utilized at the WSL discretion. Adjust to support only weight of landing string and cement stinger.
9. Rotate landing string approximately 5 turns to right to release running tool.

10. Pull two stands, pump soft *nerf*-type wiper ball and CBU with seawater.
11. RD cementing manifold and pull inner string to above 28" hanger.
    - When painted ROV strip is seen by the ROV slow pulling speed to prevent damage to wellhead profiles. Use ROV to center inner string as required.
    - POOH and prepare to drill 26" hole.

Attachments

No.	Title
1	28" (5-1/2" in. Inner Str) Landing String – MOP
2	28" Casing Diagram
4	Allamon Tool Pressure Sequence

Attachment 1:
28" (5-1/2 in. Inner Str) Landing String – MOP

Landing String Design - Margin of Overpull

This worksheet calculates *Margin of Overpull (MOP)* for pipe configurations with up to 5 different sizes of drill pipe and 3 different sizes of drill collars plus hevi-wate dp. It can also incorporate a safety factor.

Well: Macondo **Description:** 28" LINER LANDING STRING

Drill Pipe Data							
Bottommost Section →							Uppermost Section
Casing		Inner String		Pipe #1		Pipe #2	Pipe #3
28	OD	5.5	OD	6.625	OD		OD
26.5	ID	4.67	ID	5.375	ID		ID
218.27	Nominal Wt	22.51	Nominal Wt	40.05	Nominal Wt		Nominal Wt
218.27	Adjusted Wt	28.6	Adjusted Wt	47.8	Adjusted Wt		Adjusted Wt
52,000	Yield strength, psi	135,000	Yield strength, psi	135,000	Yield strength, psi		Yield strength, psi
100	% rem wall	90	% rem wall	90	% rem wall		% rem wall
Tensile strengths from the pipe drill pipe data entered above							
3,338,728	Tensile Strength	798,925	Tensile Strength	1,416,478	Tensile Strength		Tensile Strength

BHA Data

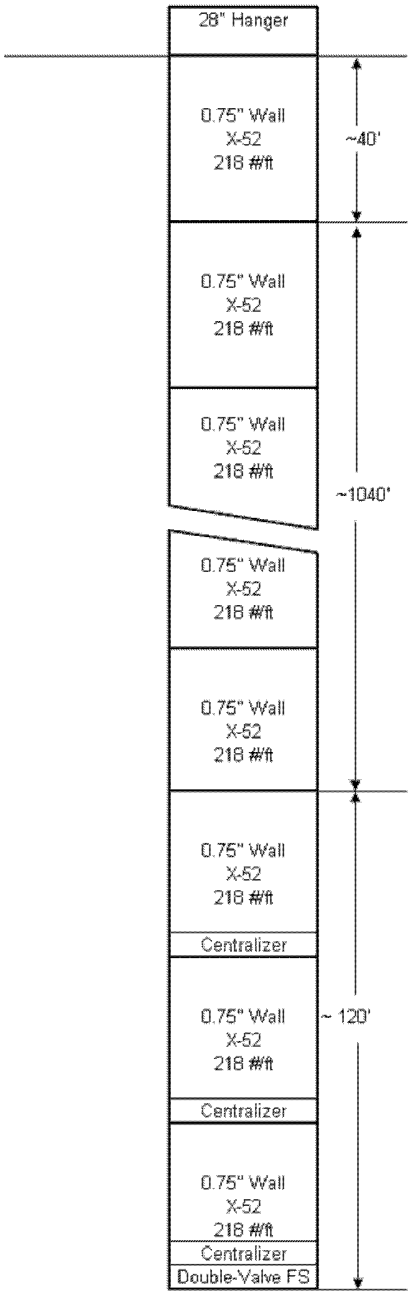
	⇐ DC #1 OD		⇐ DC #2 OD		⇐ DC #3 OD	6.625	⇐ HWDP OD
	⇐ DC #1 ID		⇐ DC #2 ID		⇐ DC #3 ID		⇐ HWDP ID
	⇐ DC #1 Length		⇐ DC #2 Length		⇐ DC #3 Length		⇐ HWDP Length
☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)

	Wt/ft DC #1	Wt/ft DC #2		Wt/ft DC #3	Buoyancy Factor 0.8679
	Wt. DC #1	Wt. DC #2		Wt. DC #3	Air weight of BHA 4,000
		WH / RT	4,000		Buoyed weight of BHA 3,471
Depth of Interest ⇒ ⇒ ⇒ ⇒		6,275	Safety Factor	80 %	Total length of BHA 0'
Anticipated Mud weight		8.65	Block Wt.	145,000	**Total depth 6,275**

		Buoyed Wt	Section MOP	
Enter Casing Length ⇒	1,204	228,071		Pipe needed on last sec. 0'
Enter Inner String ⇒	1,054	26,161		Weak point in string 665,116
Enter Length DP #1 ⇒	5,071	210,363	665,116 #	Total weight of string 468,067
Enter Length DP #2 ⇒	0			Total weight BLK & string 613,067
Enter Length DP #3 ⇒	0			Total weight Indicator Reading With over pull. 1,278,182

All pipe shall be inspected to 90% of rem wall.
WH / RT includes wellhead and running tool

Attachment 2:
28" Casing Diagram



Note: 28" hanger will land out at ~ 5075' and shoe is planned for 6275'

NOTE: Float shoe is a Weatherford model 313 DS double valve upjet shoe

NOTE: Centralizers are Weatherford bowspring centralizers with stop rings.

Attachment 3:
Allamon Tool Pressure Sequence
28" ATC Dart Catcher with Down Jet Sub

No	Operation	Min Pressure	Max Pressure
1	Realease ATC 2.5" no go OD dart with the cement unit w/ pressure increase through PLI	1200	
2	Land dart in dart catcher	1800	

Table of Contents

Interval Notes	
Item	**Comment**
Bit	26" CR-1 mill tooth
BHA	RSS, MWD, PWD, PBL
Special Equipment	High capacity MRLD (1400k rating), 18" and 16" Supplemental Adapters, Standard capacity deep dish support plate (800k rating), ATC Dart Catcher Sub & Down-Jet Sub
Drillstring	5-1/2" 24.7 ppf S-135 HT-55 x 6-5/8" 40 ppf S-135 FH
Mud system	Drilling fluid – Seawater w/ 14,000 bbls of mud at 16.3 ppg – o Pad Mud 2,500 bbls 16.3 ppg cutback - 12 ppg o P&D Mud 5,000 bbls 16.3 ppg cutback - 11.5 ppg o P&D Mud 2,500 bbls 16.3 ppg cutback - 11.5 ppg (short trip if required)
Casing	22", 277 ppf, X-80, 1.25" wall, H-80MT x 22", 224 ppf, X-80, 1.00" wall, S-90MT
Landing String	6-5/8" 40 ppf S-135 FH
Inner string	5-1/2" 24.7 ppf S-135 HT-55
Cementing	Nitrogen Foamed Cement
Anticipated Fracture Gradient at start of 22"' interval	11.1 ppg

6 22" Surface Casing Interval

6.1 Introduction

26" hole interval will be drilled to a total depth of 8,000 ft MD / TVD (~2,919ft BML). The onsite BP Wellsite Leaders will adjust the actual TD based on casing tally, lithology, and required rathole not to exceed 100' past the permitted depth.

The primary objective for this interval is to isolate any shallow hazard intervals and provide a shoe with adequate fracture strength to reach the planned 18" casing setting depth.

Summary of Shallow Hazards specifies negligible risk of shallow gas from ML to section TD at 8,000 ft BML. There is low-moderate risk of shallow water flow at 1,489 ft to 2,533 ft BML. The lithology in this interval is described as clay, silts, and sands.

The 26" hole section is planned to be drilled riserless, using seawater. The fast drill method should be applied throughout the section or until water base mud drilling is started. If 500' before the interval TD, the PWD readings are not equal to or greater than 9.2 ppg, seawater as the drilling fluid should be switched over to water based mud. If PWD readings meet these requirements continue drilling with seawater. At any time if flow is seen and verified, the wellbore should be displaced from seawater to 11.5 ppg (~9.4 ppg equivalent) WBM, and the remainder of the hole drilled using the pump and dump method. With any indication of flow, increase the MW accordingly. Enough water based mud has been supplied to drill 500' (1200 gpm / 70 fph). Anticipated frac gradient at the 28" shoe is 9.8 ppg. Attempt to set the 22" casing shoe in competent shales.

6.2 Objectives

- Drill 26" section with minimum downtime.
- Land and pre-load (2.0MM lbs) high / low pressure housing per procedure to obtain a competent well foundation.
- Obtain a competent cement job, with returns to the mud line per the MMS regulations and isolate shallow hazard zones, while providing a competent shoe of 11.1 ppg.

6.3 Concerns

Concern / Hazard	Mitigation of Concern / Hazard
Shallow Water / Gas Potential	Ensure crew readiness to immediately spot pad / kill mud, if required. Mud may be used to kill any unexpected flows, if encountered. If pad / kill mud fails to kill unexpected flows, alternate action (higher KWM) may be required. A foam cement job is planned in this section to prevent flows / channeling after cementing. Immediately close annulus shut off ball valves after cementing.
Offset Well Problems	Numerous offsets experienced slight flows while drilling this section. Some of the flows were bad enough to require pumping kill mud and drilling the remainder of the section with waterbase mud. Other offset wells that experienced flow during connections, choose not to pump kill weight mud and were able to successfully TD this section without any major flows being encountered.
Hole Cleaning	Set pump rates based off desired ECD readings vs. ROP taking into account the estimated fracture gradient. "Fast Drill" methodology should be used to maximized ROP, limiting ECD to a max of 9.6 ppg. Hi-Vis sweeps with low water loss may aid in sealing off sand faces and forming a thin/ tough filter cake. Once WBM is drilling is initiated, sweeps to be pumped at discretion of rig team. Short trips should be made only if necessary to evaluate hole condition and minimize potential for stuck pipe.
Cementing	Utilize foam cement to cement 22" to mudline. (If shallow flows requires higher mud weight than planned, keep required hydrostatic pressure on zone, get cement as high as possible, and shut valves to hold pressure on it.)
Plugging of Annulus Valves	Ensure ROV personnel have pump and hose to clean out flow valves, if needed.
Wellhead Subsidence	Monitor wellhead with the ROV for any signs of subsidence while setting weight on the hanger. If subsidence occurs begins to occur use drillstring to support weight while cement is pumped and sets up. Deactivate the motion compensator due to weight limitations. If wellhead starts to subside with the compensator activated driller may not be able to reach fast enough to prevent it from dropping to far.
Gumbo Attacks	If gumbo is encountered, control drill not to exceed 150 fph to avoid overloading the wellbore, pump at the maximum rate to clean the hole and make short trips as necessary to prevent casing from getting stuck.

6.4 Surface Drilling Operations Procedure

1. Review and conduct response drills for encountering potential shallow hazards with drill crews. Assure personnel assignments are clear to immediately adjust pump and dump mud weight, as required.
2. Premix mud volumes required for gel sweeps and ensure sufficient 16.3 ppg mud is available for well control. Have Vortex / HiSide mixer available onsite for immediate use.
3. Make up 26" bit and BHA, paint the PBL sub white, and RIH

Caution	**When making up or breaking down the BHA, if lift subs are used monitor the connections between the DC and LS to ensure they do not back-out when rotating. The BHA could be dropped (reinforce this action in the TSTP).**

4. Drill shoe track and clean out as required.
5. Drill 26" hole to planned casing point of 8,000 ft MD/TVD-RKB (2,919 ft BML).
   - Utilize "Fast Drill" methodology, limiting ECD to 9.6 ppg (maximum) and adhering to hole inclination/DLS guidelines. The predicted flow rate for this interval is from 1100-1400 gpm.
   - ROP and RPM should be limited until all stabilizers are out of the casing.

Note:	**"Fast Drill" Methodology** **Maximize ROP between 200-450 ft/hr, loading the wellbore with cuttings to maintain an equivalent circulating density above seawater. Sweeps, in most cases, are not necessary as the goal is to load the wellbore with cuttings.** **Closely monitor downhole conditions for packing off and flow on connections. Quick connections are required to make this successful.** **Surveys will be pumped up in this section after making connections, NO stopping to circulate for surveys.**
Note:	**Fracture gradient at 28" shoe is anticipated to be about 9.8 ppge.** **Keep two hole volumes of KWM on rig at all times.**

   - Actual drill depth can be adjusted up to 100' (per MMS regulations) to fit casing tally with appropriate rathole.
   - Use ROV to monitor returns for lost circulation or water/gas influx while drilling.
   - Observe well for flow at each connection. Monitor for indications of flow using ROV, PWD variations, and pump pressure changes.
   - MWD should be programmed for continuously reporting of inclination to minimize doglegs. Do not wait for surveys on a connection. If no survey is achieved after <280' (2 stands), take a normal survey. Maximum hole angle at interval TD should be less than 3.0 degrees.

- If shallow flow is encountered pump and dump should be initiated. Kill mud weight may be adjusted based on hole conditions, but will most likely be 11.5 ppg

The following table lists key drilling parameters for this section.

Parameter	Guideline
ROP	Maximize ROP while staying within directional and ECD constraints.
WOB	5-65 kips (limited by Rotary Steerable)
RPM	Rotate drill string to optimize penetration rate, vibrations, and wellbore incl. (120-180 RPM) RSS RPM range is 0 - 220 RPM (speeds over 160 can affect tool performance)
ECD / PWD	Limit ECD to 9.6 ppg (max) ECD on bottom > ECD at 28" shoe. Abrupt changes in ECD (generally an increase) may be evidence in SWF / SGF. Gradual increases may indicate annulus is loading up with cuttings. Monitor PWD closely through section.
Pump Rates	1000-1300 gpm. Rate adjustments can be made based on actual ROPs and mud volumes. RSS flow rate range is 800-1500 gpm. MWD flow rate range is 400-1600 gpm.
Hole Deviation	< 3 degrees
Section TD	Designed to maximize LOT in order to push 18" to the required depth. **Prior to drilling more than 100' TVD deeper than the permitted hole section TD, MMS approval is required.**

6. At 7500' TVD:
   - Prior to reaching this depth, attempt to use flow rates and penetration rate to increase cutting load in the wellbore to sustain at least a 9.2 ppg PWD reading, as described in the Fast Drill procedure. Do not reduce flow rate past a point where hole cleaning is not occurring.
   - Once at 7500' TVD, if the PWD is equal to or greater than 9.2 ppg continue drilling ahead. Continue to monitor for shallow flows.
   - If PWD reading is less than 9.2 ppg switch from seawater to 11.5 ppg waterbase mud and drill to TD. Continue monitoring ECD's and adjust ROP as required.
7. At interval TD, pump a sweep (with black dye) followed by at least 1-1/2 hole volume of 12.0 ppg mud.
   - ~40-50' rat hole (room for 1 joint tally error)

Note:	**Ensure final pad mud has been conditioned properly to lower API fluid loss and the yield strengths have been adjusted to give best properties for cementing.**

8. POOH to 28" shoe to evaluate hole conditions.
   - Monitor well for minimum of 10 minutes with ROV.
   - Evaluate drag while pulling out of hole.

- Make a wiper trip, only if necessary.
- If hole conditions warrant, RIH and repeat Steps 5 and 6.

9. Continue to POOH to 36" Wellhead Housing.

- Drop ball for the PBL sub
- Pull PBL sub above the 36" wellhead
- Pressure up to open the PBL sub and confirm flow with the ROV.
- TIH and wash profiles until clean
- Finish pulling out of hole and lay down BHA.

Figure 1: 22" Casing OH Section: Drill String – MOP

Drill String Design - Margin of Overpull

This worksheet calculates *Margin of Overpull (MOP)* for pipe configurations with up to 5 different sizes of drill pipe and 3 different sizes of drill collars plus hevi-wate dp. It can also incorporate a safety factor.

Well: Macondo **Description:** 22" CASING OH SECTION

Drill Pipe Data

Bottommost Section ← Uppermost Section

Pipe #1		Pipe #2		Pipe #3		Pipe #4		Pipe #5
5.5	OD	6.625	OD		OD		OD	
4.67	ID	5.375	ID		ID		ID	
22.51	Nominal Wt	40.05	Nominal Wt		Nominal Wt		Nominal Wt	
28.6	Adjusted Wt	47.8	Adjusted Wt		Adjusted Wt		Adjusted Wt	
135,000	Yield strength, psi	135,000	Yield strength, psi		Yield strength, psi		Yield strength, psi	
90	% rem wall	90	% rem wall		% rem wall		% rem wall	

Tensile strengths from the pipe drill pipe data entered above

798,925	Tensile Strength	1,416,478	Tensile Strength		Tensile Strength		Tensile Strength	

BHA Data

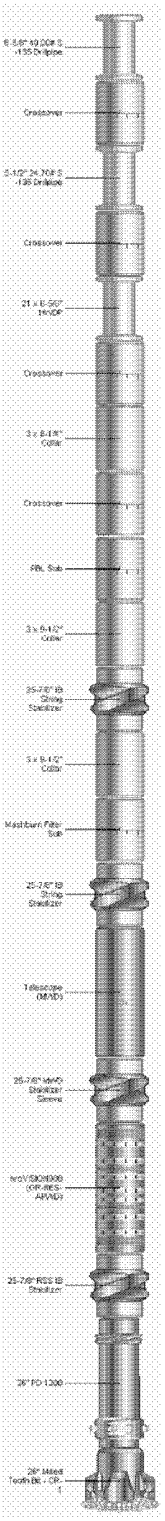
9.500	⇐ DC #1 OD	8.000	⇐ DC #2 OD		⇐ DC #3 OD	6.625	⇐ HWDP OD	Tensile Str.
3	⇐ DC #1 ID	2.81	⇐ DC #2 ID		⇐ DC #3 ID	4.499	⇐ HWDP ID	1,021,600
310	⇐ DC #1 Length	90	⇐ DC #2 Length		⇐ DC #3 Length	920	⇐ HWDP Length	HWDP Air Wt.
☑ Spiraled	⇐ Spiraled (√)	☑ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	☑ Spiraled	⇐ Spiraled (√)	67,503

209	Wt/ft DC #1	144	Wt/ft DC #2		Wt/ft DC #3	Buoyancy Factor	0.8679
64,721	Wt. DC #1	12,975	Wt. DC #2		Wt. DC #3	Air weight of BHA	145,199
						Buoyed weight of BHA	126,012
Depth of Interest ⇒ ⇒ ⇒ ⇒			8,000	Safety Factor	80 %	Total length of BHA	1,320'
Anticipated Mud weight			8.65	Block Wt.	145,000	**Total depth**	**8,000**

		Buoyed Wt	Section MOP		
Enter Length DP #1 ⇒	2,180	54,109	**459,019 #**	Pipe needed on last sec.	**0'**
Enter Length DP #2 ⇒	4,500	186,676	**766,385 #**	Weak point in string	**459,019**
Enter Length DP #3 ⇒	0			Total weight of string	**366,797**
Enter Length DP #4 ⇒	0			Total weight BLK & string	**511,797**
Enter Length DP #5 ⇒	0			Total weight Indicator Reading With over pull	**970,817**

NOTE: The air weight of spiraled hevi-wate drill pipe is calculated as 96% of non-spiraled HWDP.
Assumes worst case bouyed in seawater (not pump and dump mud)
All pipe shall be inspected to 90% of rem wall.

Figure 2: BHA Schematic



Schlumberger

BHA02: 26" PowerDrive Assembly

Field Name	Mississippi Canyon 252			Hole Size (in)	26.000			Depth In (ft)		6275 ft	
Well Name	OCS-G 32306 001 ST00BP00			BHA Name	BHA02: 26" PD			Depth Out (ft)		8000 ft	
	Description	Vendor	Serial #	OD/ID (in)	Max OD (in)	Connection (Bottom/Top) (in)	Gender (Bot/Top)	Joint Count	Length (ft)	Cum Length (ft)	Cum Weight (klbm)
1	26" Milled Tooth Bit - CR-1	Hughes Christensen		15.600	26.000	0		1	2.16	2.16	1.3
				3.750		7 5/8 REG	Pin				
2	26" PD 1200	Schlumberger		11.000	26.000	7 5/8 REG	Box	1	16.54	18.70	10.5
				3.200		7 5/8 REG	Pin				
3	25-7/8" RSS IB Stabilizer	Schlumberger		9.500	25.875	7 5/8 REG	Box	1	5.98	24.68	11.9
				2.813		7 5/8 H90	Pin				
4	arcVISION900 (GR-RES-APWD)	Schlumberger		9.500	10.000	7 5/8 H90	Box	1	19.32	44.00	15.8
				4.250		7 5/8 H90	Pin				
5	25-7/8" MWD Stabilizer Sleeve	Schlumberger		9.625	25.875	7 5/8 H90	Box	1	6.8	50.80	17.2
				2.875		7 5/8 REG	Pin				
6	Telescope (MWD)	Schlumberger		9.500	9.680	7 5/8 H90	Box	1	28.29	79.09	22.2
				6.250		7 5/8 REG	Pin				
7	25-7/8" IB String Stabilizer	Stabil-Drill		9.625	25.875	7 5/8 REG	Box	1	6.8	85.89	23.6
				2.875		7 5/8 REG	Pin				
8	Mashburn Filter Sub	Mashburn		9.500	9.500	7 5/8 REG	Box	1	7.65	93.54	25.1
				4.063		7 5/8 REG	Pin				
9	3 x 9-1/2" Collar (3 joints)	Rig		9.500	9.500	7 5/8 REG	Box	3	93.01	186.55	45.8
				2.625		7 5/8 REG	Pin				
10	25-7/8" IB String Stabilizer	Stabil-Drill		9.500	25.875	7 5/8 REG	Box	1	8.38	194.93	47.6
				2.813		7 5/8 REG	Pin				
11	3 x 9-1/2" Collar (3 joints)	Rig		9.500	9.500	7 5/8 REG	Box	3	91.35	286.28	68.0
				2.625		7 5/8 REG	Pin				
12	PBL Sub	Downhole Devices		9.500	9.500	7 5/8 REG	Box	1	2.74	289.02	68.6
				2.875		7 5/8 REG	Pin				
13	Crossover	Stabil-Drill		9.500	9.500	7 5/8 REG	Box	1	2.74	291.76	69.2
				2.875		6 5/8 REG	Pin				
14	3 x 8-1/4" Collar (3 joints)	Rig		8.250	8.250	6 5/8 REG	Box	3	92.99	384.75	84.3
				2.625		6 5/8 REG	Pin				
15	Crossover	Allis Chalmers		8.625	9.500	6 5/8 REG	Box	1	4.37	389.12	85.1
				3.500		6 5/8 FH	Pin				
16	21 x 6-5/8" HWDP (22 joints)	Allis Chalmers		6.625	8.500	6 5/8 FH	Box	22	655.97	1,045.09	134.3
				4.500		6 5/8 FH	Pin				
17	Crossover	Allis Chalmers		8.250	8.250	6 5/8 FH	Box	1	2.8	1,047.89	134.7
				4.000		5 1/2 HT55	Pin				
18	5-1/2" 24.70# S-135 Drillpipe (63 joints)	Rig		5.500	7.125	5 1/2 HT55	Box	63	1953	3,000.89	185.7
				4.670		5 1/2 HT55	Pin				
19	Crossover	Allis Chalmers		8.250	8.250	5 1/2 HT55	Box	1	2.8	3,003.69	186.1
				4.000		6 5/8 FH	Pin				
20	6-5/8" 40.00# S-135 Drillpipe (111 joints)	Allis Chalmers		6.625	8.500	6 5/8 FH	Box	111	5000	8,003.69	421.5
				5.375		6 5/8 FH	Pin				

Total Length	8,003.69
Total Weight in Air (klbm)	421.5
Total Buoyant Weight (klbm)	373.4
Buoyant Weight Below Jar (klbm)	373.4
Weight in Air Below Jar (klbm)	421.5

BHA Comments

Drill 26" hole vertically to 22" casing point at 8000'.

Stabilizer Summary

Blade Length (ft)	Blade Mid-Pt to Bit (ft)
2.000	22.09
2.000	47.3
2.000	82.39
2.000	190.55

Bend Summary

Bend Angle (deg)	Bend to Bit (ft)

Sensor

Type	Distance to Bit (ft)
RES	31.600
GR	31.850
Survey	56.110

BHA Nozzle Summary

Bit Nozzle		Reamer Nozzle	
Count	1/32 in	Count	1/32 in
3	20.000		
	Center Jet		
1	22.000		
		TFA (in2)	0.000
Flow	1300 gpm		
MWD	700-1400gpm	PD Flow Restrictor	
		Reor By Pass Nozzle (1/32 in)	
TFA (in2)	1.052		

Mud Properties

Mud Weight (lbm/gal)	8.6	YP (lbf/100ft2)	
Funnel Viscosity (s)		PV (cP)	

Date	23Sep2009
Designed By	NAMBTipton
Approved By	

Figure 3: BHA Operating Ranges

	WOB (klbs)		RPM (rev/min)		Torque (kft-lbs)		Flow Rate (gpm)		Nominal OD (in)	ID (in)	Max LCM
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX			
26" Bit	35	85	----	----	----	----	----	----	26	----	100 lbm/bbl
26" PD 1200	----	65	----	220 (>160 affects perf)	----	48	800	1500	25.52	3.2	50 lbm/bbl nut plug
Arc 9	----	86	----	----	----	35	---	1950	9	4.25	No Limit
Telescope 950 HF	----	107	----	----	----	35	400	1600	9.5	6.25	50 lbm/bbl nut plug

6.5 22" Casing and Cementing Operations

6.5.1 Casing and Cement Preparation

- Ensure cement, additives, and fresh and seawater samples are sent to lab for final testing.
- 22" connectors will be delivered pre-doped with Citgo Lithoplex CM grease.
- Prior to shipment, verify casing has been drifted. Visually inspect to ensure there is no debris in pipe.
- Ensure anti-rotation keys, installation, and removal tools have been shipped. Anti-rotation keys have been reduced in size and are specially marked with red paint.
- Ensure 18-3/4" wellhead housing deep dish support plate is properly made up to wellhead housing prior to making up and landing out in the rotary table.
- Confirm bottom of shoe joint is painted white.
- Rabbit inner / landing string to 2-5/8" in. before running 22" casing.
  - 22" landing string: 6-5/8" 40 ppf S-135 DP (~5070 ft)
  - 22" inner string: 5-1/2" 24 ppf S-135 (~150 above shoe ft) w/ dart catcher.
- Have DQ hand should ensure 22" x 18" and 22" x 16" supplemental adapters have been welded with proper orientation – NOT upside down.
- Minimum ID of 28" casing string is 26.313 in (casing drift).
- Baroid will calculate swab / surge pressures for various running speeds. Select an acceptable running speed to ensure formation breakdown pressure is not exceeded. (BP real time operating center will also calculate surge and swab).
- Mechanical Rigid Lockdown / 18-3/4" Wellhead Running tool
  - Standard running tool and thick walled handling sub should be sent to the rig made up to the 18-3/4" housing, if not make up prior to picking up.
  - Inspect all components for damage.
  - Ensure Nominal Bore Protector has **NOT** inadvertently been installed in high-pressure wellhead.
  - Ensure Dril-Quip has made up crossovers to the primary tool:
    - Below 5-1/2" HT-55 (pin) x 4-1/2" IF (box) pup joint
- Make-up Allamon cementing manifold and place on riser skate.
  - 6-5/8" DP single
  - 15' DP pup joint (for handling)
  - Full Open Safety valve

- ATC Top Drive Single Plug Cement Head,
  w/ ATC Drill pipe 2.50" OD no-go dart (pre-loaded with same)
- ATC Positive Launch Indicator Sub (PL1)
- Full Open Safety valve
  (Function test valve to verify ball alignment versus bore of valve body. For example, make sure bore is centered in valve body and there is a "dart bushing" on top of valve assembly.)
- 5 ft DP pup joint (for space out on rig floor)
- 1 jt 6-5/8" DP (drifted with a 2-5/8" drift)

6.5.2 Casing Procedure

1. Rig-up and run 22" casing string based on the information in the following table.

Item	Ftg	Size	Wall	ppf	Grade	Connection
Shoe Jt with DV shoe	~45'	22"	1.0"	224	X-80	S-90/MT
Centralized Jts (~3 jts)	~126'	22"	1.0"	224	X-80	S-90/MT
Non-centralized Jts (~6 jts)	~252'	22"	1.0"	224	X-80	S-90/MT
Adapter Jt (with 18" SA ~400' above shoe)	~45'	22"	1.0"	224	X-80	S-90/MT
Non-centralized Jts (~56 jts)	~x,xxx'	22"	1.0"	224	X-80	S-90/MT
Adapter Jt (with 16" SA in middle)	~46'	22"	1.25"	224	X-80	H-90D/MT x S-90/MT
Thick Wall Jt (3 jts)	~126'	22"	1.25"	277	X-80	H-90D/MT
Hanger Joint	~40'	22"	1.25"	277	X-80	H-90D/MT
18-3/4" HPWHH	~7'	Welded to hanger joint				H-90D/MT
ATC Dart Catcher Sub & Down-Jet Sub	~6'	N/A	N/A	N/A	N/A	HT-55
Inner String	~x,xxx'	5-1/2"	0.415"	24	S-135	HT-55
Cross-over	~5'	5-1/2"	0.415	24	S-135	5-1/2" HT-55 x 4-1/2" IF
18-3/4" HC MRLD	~13.8'	N/A	N/A	N/A	N/A	4-1/2" IF x 6-5/8 FH
Landing String	~x,xxx'	6-5/8"	0.625"	40	S-135	FH

Centralizer details: 4 Weatherford bow spring

Min Casing ID: 19.5 in (22" x 1.25")

Min Casing drift: 19.313 in (22" x 1.25")

Casing collar OD: 23" (H-90D/MT) / 24" (S-90/MT)

Note:	**Dril-Quip deep-dish support plate P/N 2-402558-02 has a 1400 Klbs rating. Estimated buoyed weight of 22" casing (seawater), plus 5-1/2 in. inner string is ~650 Klbs.**

	Ensure supplemental adapters are in correct locations. These items are similar and should be clearly marked before being shipped. Verify this equipment on location. Document setting depths of both 18" and 16" supplemental adapters and centralizers on IADC and Daily Drilling Reports.
	The 16" supplemental adapter will be set near the wellhead with 1.25" WT casing between the adapter and wellhead. The back-up equipment is set-up differently than the primary 16" SA, and if required ensure differences are understood in order to run correctly.
Note:	**Final make-up torque for 22" X-80 S-90 / H-90 casing connections is 75,000 ft-lbs. Use casing power tongs.**

2. After first two joints are run:
   - Check for seawater returns to ensure floats are clear.
   - Continue running 22" casing filling with seawater every joint.
   - Thread-lock bottom 4 joints
   - After stabbing casing connections, mark vertical scribe line on pin and box.
   - After connection make-up, ensure pin rotation of ~5/8 of a turn, and inspect connection for proper make-up in 4 quadrants.
   - Install special anti-rotation keys (with red markings) after each connection is made-up.
   - Ensure 18" and 16" supplemental adapters are properly placed in the string (18" towards the bottom and 16" at the top)
3. Land last casing joint before wellhead in rotary, and pick up WH joint.
   - Using standard running tool pre-installed in the 18-3/4" wellhead (heavy duty lift sub on top, and deep-dish support plate pre-installed to housing).
   - MU wellhead extension to 22" casing.
   - Install anti-rotation key in this connection.
   - Lower wellhead and land in rotary.
   - Remove and LD standard running tool.
4. RU slotted plate with bowl and slips.
   - Run 5-1/2", 24 ppf inner string, complete with Allamon dart catcher and down-jet sub. Space out to make final position of inner string ~150' above 22" shoe
   - Ensure any pup joints or crossovers required in landing and inner strings are rented and inspected. Give material certifications to rig. (These certifications will be used to verify proper load carrying capabilities.)
   - Ensure any pup joints or crossovers in landing and inner strings do not have internal square shoulders or bore-backs, which have proven to hang-up drill pipe darts. Ensure internal tapers are at least 45 degrees.

5. PU MRLD x 18-3/4" Wellhead Running Tool. MU 5-1/2" inner string to wellhead running tool.
6. Install MRLD x 18-3/4" WHRT into 18-3/4" wellhead.
   - Make sure four (4) spring loaded pins are in tool.
   - Engage four (4) holes in top face of 18-3/4" wellhead to prevent rotation of running tool outer body. (For detailed operating procedures, see *Dril-Quip Service Manual*.)

Note:	**Total buoyed weight of 22" casing, plus inner string, is under 650 kips in seawater (from casing analysis).** **Use a high capacity MRLD tool rated for 1400 kips.**

7. Rotate tool stem five (5) turns to left.
   - Observe indicator rod for positive indication of running tool lockdown.
   - Open ball valve on 18-3/4" wellhead running tool.
   - Ensure double-check valve assembly is properly installed.

Note:	**If possible, install cable or other manipulating device to allow ROV to close ball valve once below water line. This should eliminate need for placing personnel in riding belt. If this is not an option, then lower a man in a riding belt to close the valve and manage risk utilizing TOI's SMS.**

8. Run casing on 6-5/8 in., 40 ppf S-135 landing string that has been inspected to at least 95% remaining body wall.
   - Lower casing to position the wellhead just above water level.
   - Circulate slowly through float equipment with seawater.
   - Observe flow from ball valve.
   - Ensure casing is full. When casing is full, lower casing to allow ROV to close ball valve.

Note:	**It is essential that the ball valve in Step 7 be closed to prevent cement from flowing up inside 22" casing. If casing has been run in moonpool, re-confirm that valves are closed.** **Wellsite leader may elect to pre-load the wellhead prior to cement job.**

9. Continue to run casing, filling DP with seawater every 10 stands.
   - Once casing shoe is stabbed into wellhead, circulate slowly through float equipment, displacing drill pipe and 22" casing below stinger with 12 ppg pad mud.

- Observe mud flow from casing with ROV.

10. After string has been displaced to 12.0 ppg continue to run casing, filling DP with 12.0 ppg mud every 10 stands.
    - Monitor casing running operation and avoid putting casing or drill pipe above wellhead into compression.
    - On last joint before landing wellhead, record pick-up, slack-off, and neutral weights.
    - Have ROV rigged-up to clean four 4" annulus shut-off valves.
11. Make-up ATC Cement head on landing string and begin pumping 12.0 ppg pad mud to flush hanger of any debris.
12. Land 18-3/4" wellhead in 36" wellhead housing.
    - Set down a minimum of 50,000 lbs to land wellhead.
    - Apply 50,000-100,000 lbs of overpull per the Dril-quip hand, being careful not to exceed overpull rating. (Do not exceed 175 klbs.)
13. Slack off 50,000 lbs of overpull and apply 20,000 - 30,000 lbs of running string weight on MRLD tool (Hold 15-30 minutes at WSL discrepancy). Have ROV monitor 36" housing for subsidence, driller should be on alert to quickly pick-up if casing starts to subside.

Note:	**If subsidence occurs, support wellhead until the cement job has been pumped and sets up.**

Note:	**Record in DIMS and on IADC report:** • **RKB to top of wellhead** • **Top of 18" and 16" adapter** • **Bottom of 22" shoe**

6.5.3 *Cementing 22" Casing*

For detailed cementing procedures, a cement program will be provided to the rig prior to pumping the job.

Test Pressures and Volumes are provided only as a reference, **review APD** for final values.

1. Rig-up and test cement lines to required pressure. Circulate a minimum of 1-1/2 annular volumes (12.0 ppg) through upper set of annular valves with casing landed.
2. Pump spacer (with black dye to caliper the hole, adjust cement volumes based on data) and cement (minimum volume 3300 cu ft per APD)
   a. A detailed cementing procedure will be supplied prior to pumping the job.
   b. Ensure at a minimum senior operations engineer and planning engineer have reviewed and approved procedure.
3. Drop 2.50" ATC drill pipe dart (1200 psi when dart leaves PLI sub).

Caution:	**Ensure cement volume pumped exceeds approved APD volumes.** **If channeling occurs, cement returns may appear earlier than anticipated. In this situation, ensure switch from lead to tail slurry does not occur until pumped lead slurry volume is equal to, or greater than, calculated gauge hole volume.**

4. Displace cement with seawater at maximum rate possible (25-30 bpm).
   - ~10 bbls prior to dart landing in ATC Plug Catcher Sub, slow displacement rate to 5 bpm.
   - When dart lands in sub, increase pressure to 1800 psi above circulating pressure to shift sleeve.
   - Finish displacement, leaving ~100' of cement in shoe track.
   - Check if floats are holding. Don't let more than 15 bbls flow back.
5. If floats do not hold, pump flowback volume and hold for an appropriate set time based on cement slurry.
6. Use ROV to close bottom set of six 4" annular valves. Have T-handle plugs as backup.
7. Pre-load 18-3/4" wellhead using MRLD (2.0MM lbs).
   - Place 5,000 to 10,000 lbs on MRLD.
   - Apply 4-6K ft-lbs of left hand torque to shear threaded shear pins in telescoping joint.
   - Apply an over–pull on MRLD of 160 Kips. (An over-pull of 120 kips will result in 1.5MM lbs preload and an overpull of 160 kips will result in 2.00MM lb preload.)

- Use ROV to observe this operation. (For detailed operating instructions, see *Dril-Quip Service Manual.*) Ensure ROV umbilical doesn't get tangled around the DP.
- Test lockdown (per Dril-Quip procedure).
- Monitor the wellhead for subsidence and ensure everything looks safe to release.

8. Release MRLD (per Dril-Quip procedures) and POOH.

6.5.4 Riser and BOP Operations

1. Prepare to run BOP stack and marine riser. Prior to running BOP stack, stump test single ram type BOP's to 10,000 psi on and annular type BOP's to 5000 psi on 5-1/2" and 6-5/8" drill pipe **with seawater per APD.**
2. Run BOP and marine riser.

Notes:	**Prior to running BOP, all gauges, transducers, and flow meters should be calibrated.** **Incremental tests of riser connections should be done at these minimum running intervals, or per rig contractor policy (whichever is most stringent):** **1. After termination joint has been picked up (first joint of riser).** **2. Two intermediate tests.** **3. Prior to picking up telescopic joint.** **Pressure test choke and kill lines to the highest pressure for this well per the APD while running (6500 psi). Test rigid conduit and boost line to rig specific guidelines.** **Test BOP to highest APD pressure for this well.**

3. Land and latch BOP. Take 50k overpull to verify latch. Tension up marine riser. RD BOP running equipment. All subsea tests will be completed only on 5-1/2" DP.
4. Test blind shear rams and 22" casing to 250 psi for 5 minutes and 3400 psi for 30 minutes **with seawater per APD**. Plot volume versus pressure to be used in reference for 22" shoe test. Prepare to test BOP stack and surface equipment.
5. Trip-in with BOP test tool and test BOPs. (A bore protector is not in place.) Test wellhead connector to 250 psi (low) and 10000 psi (high) **with seawater per APD**.

Note:	**Connector test to 10000 psi = highest BOP test pressures (per APD).** **Ensure 5-1/2" DP is rated for 10000 psi test pressure.**

6. Test annulars to 250 psi (low) and 5000 psi (high) with seawater. Test remaining equipment (per approved APD requirements).

Notes:	**Test BOPE to highest pressures for any subsequent hole sections that may be drilled within the next 14 days.**

7. POOH and lay down test tool.
   - Clean all working pits and fill with SOBM.
   - Anticipated drill out mud weight is 10.0 ppg.

Attachments

No.	Title
1	22" (5-1/2 in. Inner Str) Landing String – MOP
2	22" Casing Diagram
3	Allamon Tool Pressure Sequence

Attachment 1:
22" (5-1/2 in. Inner Str) Landing String – MOP

Yellow cells = input data, Green cells = calculated results

Landing String Design - Margin of Overpull

This worksheet calculates *Margin of Overpull (MOP)* for pipe configurations with up to 5 different sizes of drill pipe and 3 different sizes of drill collars plus hevi-wate dp. It can also incorporate a safety factor.

Well: Macondo **Description:** 22" CASING LANDING STRING

Drill Pipe Data

Bottommost Section Casing		Inner String		Pipe #1		Pipe #2	Uppermost Section Pipe #3
22	OD	5.5	OD	6.625	OD		OD
20	ID	4.67	ID	5.375	ID		ID
224	Nominal Wt	22.51	Nominal Wt	40.05	Nominal Wt		Nominal Wt
224	Adjusted Wt	28.6	Adjusted Wt	48.5	Adjusted Wt		Adjusted Wt
80,000	Yield strength, psi	135,000	Yield strength, psi	135,000	Yield strength, psi		Yield strength, psi
100	% rem wall	90	% rem wall	90	% rem wall		% rem wall
	Tensile strengths from the pipe drill pipe data entered above						
5,277,876	Tensile Strength	798,925	Tensile Strength	1,416,478	Tensile Strength		Tensile Strength

BHA Data

	⇐ DC #1 OD		⇐ DC #2 OD		⇐ DC #3 OD	6.625	⇐ HWDP OD	Tensile Str.
	⇐ DC #1 ID		⇐ DC #2 ID		⇐ DC #3 ID	4.499	⇐ HWDP ID	1,021,600
	⇐ DC #1 Length		⇐ DC #2 Length		⇐ DC #3 Length	0	⇐ HWDP Length	HWDP Air Wt.
☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	☐ Spiraled	⇐ Spiraled (√)	

	Wt/ft DC #1		Wt/ft DC #2		Wt/ft DC #3	Buoyancy Factor	0.8167
	Wt. DC #1		Wt. DC #2		Wt. DC #3	Weight Wellhead Equip	20,000
			WH / RT	20,000		Bouyed Wt WH Equip	16,334
Depth of Interest ⇒⇒⇒⇒			8,000	Safety Factor	80 %	Total length of BHA	0'
Anticipated Mud weight			12.00	Block Wt.	145,000	**Total depth**	**8,000**

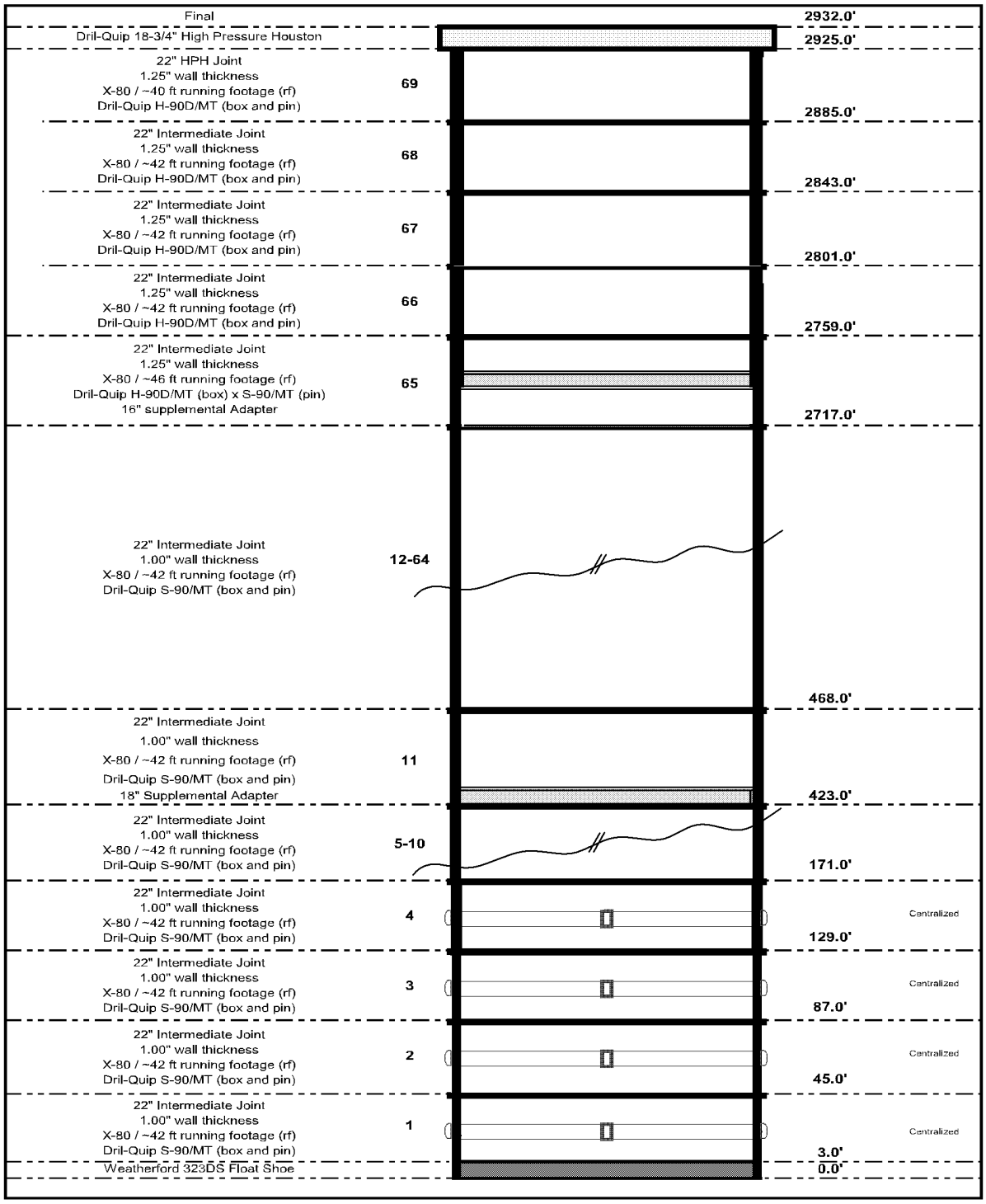
		Buoyed Wt	Section MOP		
Enter Casing Length ⇒	2,929	535,822		Pipe needed on last sec.	0'
Enter Inner String ⇒	2,800	65,400		Weak point in string	314,769
Enter Length DP #1 ⇒	5,071	200,858	314,769 #	Total weight of string	818,413
Enter Length DP #2 ⇒	0			Total weight BLK & string	963,413
Enter Length DP #3 ⇒	0			Total weight Indicator Reading With over pull.	1,278,182

WH / RT includes running tool (7500 lbs), wellhead (8100 lbs) and supplental adaptars (4000 lbs)

Assumes 12 ppg pad mud in hole & casing (actual - seawater inside casing will reduce string wt)

All pipe shall be inspected to 90% of rem wall.

Attachment 2:
22" Casing Diagram



Attachment 3:
Allamon Tool Pressure Sequence

No	Operation	Min Pressure	Max Pressure
1	Realease ATC 2.5" no go OD dart with the cement unit w/ pressure increase through PLI	1200	
2	Land dart in dart catcher	1800	