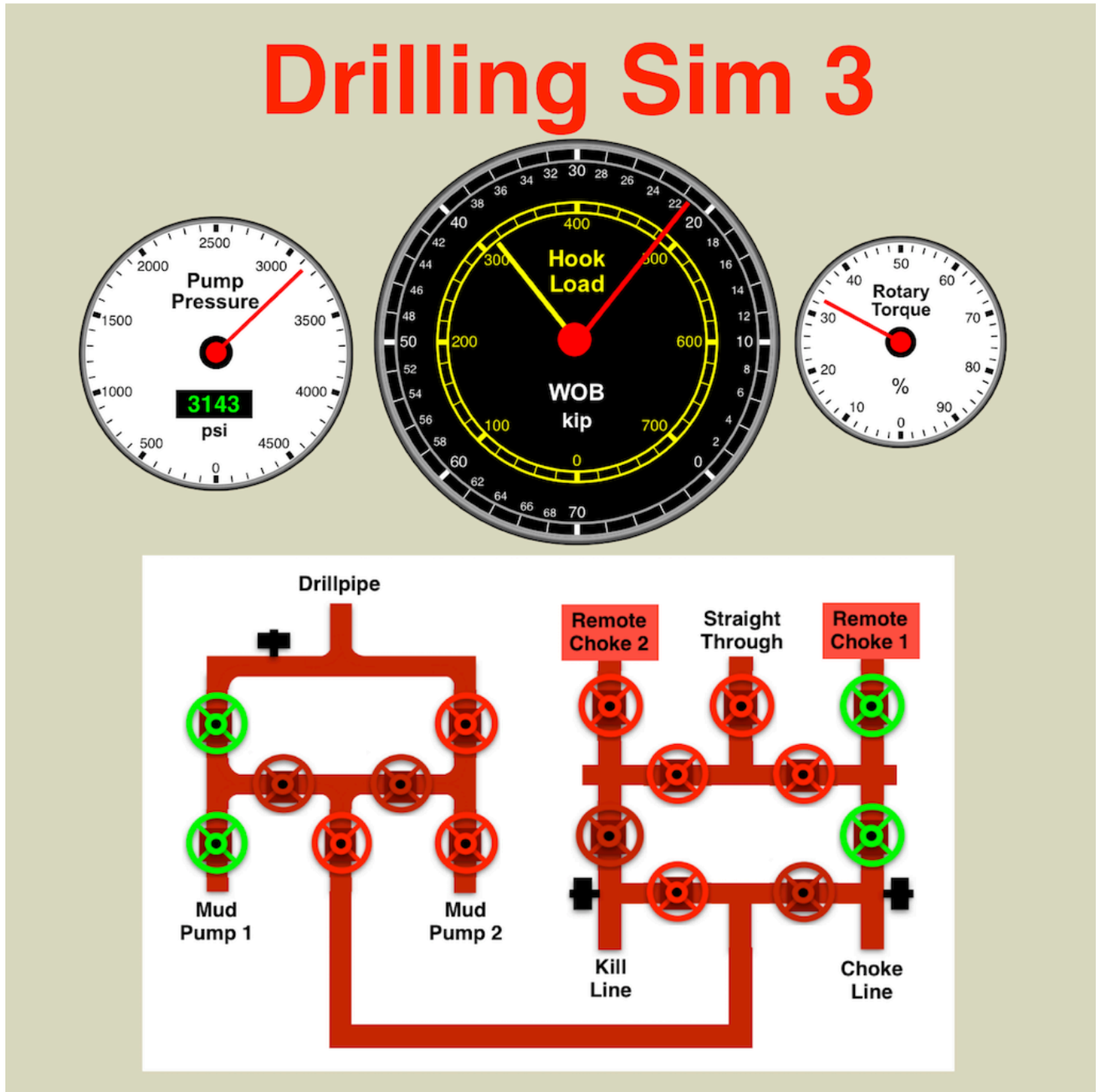
www.wellcontrol.com.br

Drilling Simulator 3

iPad Version 1.1



Available on the App Store

CHAPTER 2

Disclaimer

These tools and materials are provided 'as is' without warranties of any kind, express or implied.

Please verify the tools provided by this application by yourself before you use them. Ensure you understand the impact of using these tools.

Any use you choose to make of these tools & materials is undertaken by you entirely at you own risk.

Note:

This app was created with an educational proposal to help students and teachers of drilling engineering and has no intention of replace the professional softwares.

It is also an useful tool for other professionals in the oilfield, such as technicals and engineers.

Thanks

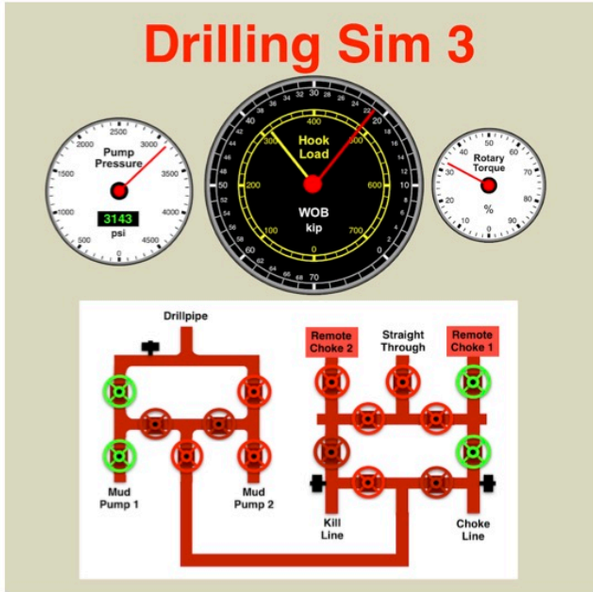
CHAPTER 3

Introduction

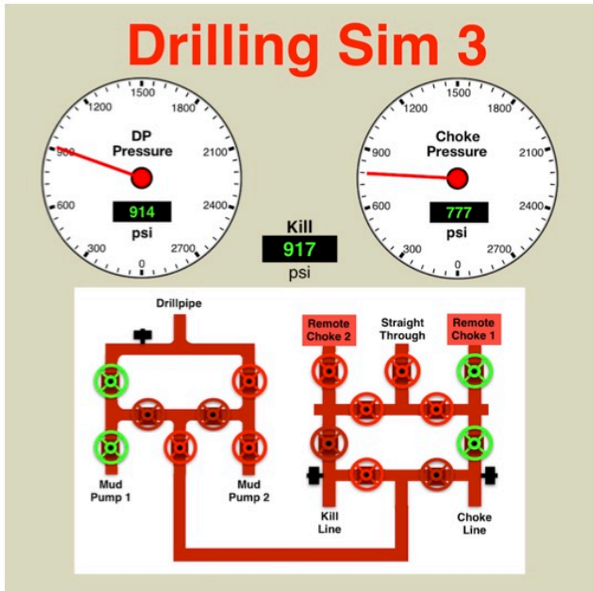
This is a basic drilling simulator that simulates drilling operations based in panels for **kick** detection, shut-in the well, stabilization of pressures and the choke operations during the well control operations using a hydraulic choke panel simulator.

This is a new project based on apps "Drilling Simulator 2" and "Well Control Simulator 2" available in our portfolio on the App Store.

iPad version icon:



iPhone version icon:



Features:

1. Driller Interface based on Pressure Gauge, Weight Indicator, Rotary Torque gauge and **Geolograph**.

2. Choke Interface based on Hydraulic **Choke** Panel.

3. Graph in full screen (with background color in black or white) for analysis.

4. Pre-recorded data form

5. Standpipe and choke manifolds, float valve, failures schedule and multiple kicks.

5. Three codes (admin, instructor, student) to view the gas into the borehole, the pressure at bottom, at shoe and at bop and to enable / disable the Lag Time (by adjusting the choke to change the kill pressure and drill pipe pressure, etc).

Attention: The Initial codes: "0000"

Note: If lose the admin code:

1. Export all data files to iCloud;

2. Delete the app on iPad

3. Re-install it from App Store.

4. Use the initial code: "0000"

5. 5. Import data files from iCloud

Other features also available:

A graphical very useful tool for training of roughnecks, derrickmen, drillers, toolpusher, drilling engineers and students in the well control procedures.

- Ability to drilling, kick detection, shut-in, stabilization of pressures;

- Interactive System: no pre-set methods;

- Ability to apply control methods: Driller's method, wait and weight, dynamic volumetric and static volumetric (lubricate and bleed);

- Hydraulics and Hydrostatics;

- Behavior of the kick;

- Applied with subsea stack or surface stack;

- Set well with until 4 sections: riser, casing, liner, open hole ;

- Directional and Horizontal Wells (Type I)

- Set Drillstring with drillpipe1, drillpipe2, heavy weight, drillcollar1, drillcollar2

- Standpipe Manifold and Choke Manifold

- Drill Pipe Float Valve (non-ported)

Others apps very useful of our portfolio for Well Control:

- Drilling Hydraulics
- Kick Tolerance
- Leak-Off Test Simulator
- Leak-Off Test Analyzer
- Well Control Methods
- Well Control Worksheets

These tools can complement (work with) this simulator by creating files which can be used in this application;

Notes:

This is a basic modeling that simulates drilling operations based in panels for drilling, kick detection, shut-in the well, stabilization of pressures and the choke operations during the well control operations using a hydraulic choke panel simulator.

This simulator is limited and is not applied to some complex situations.

Please, report us bugs and suggestions for improvements.

Thanks

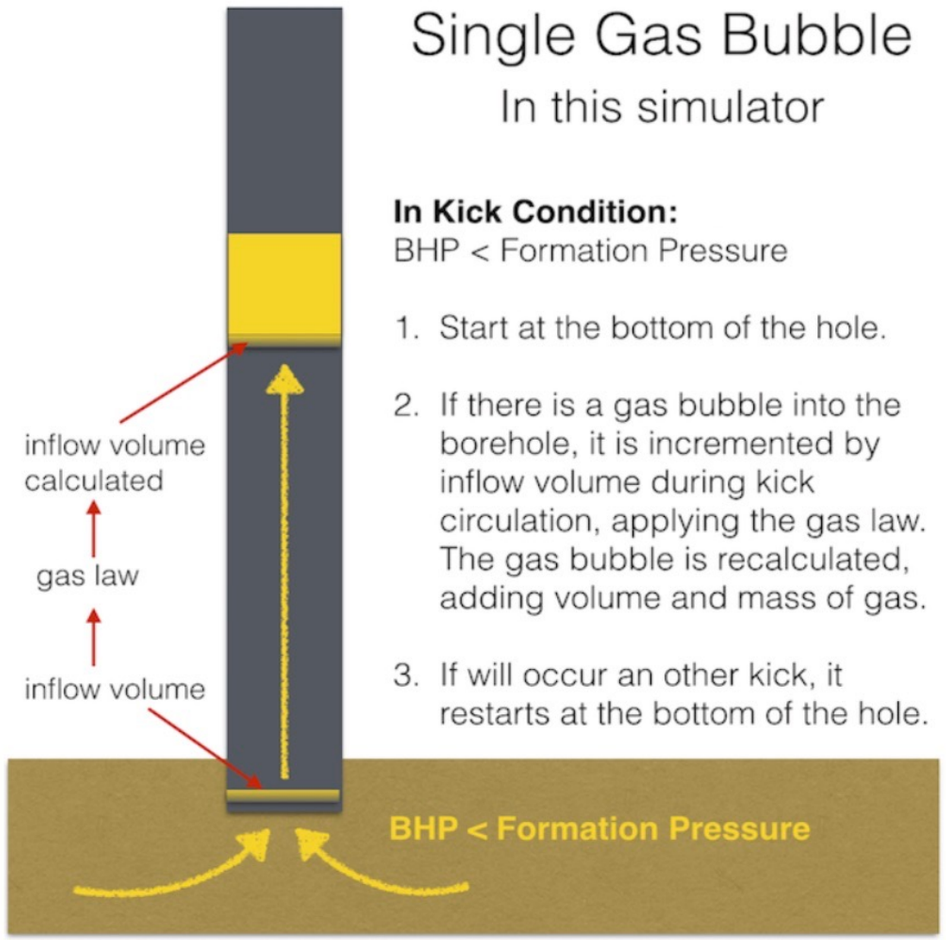
CHAPTER 4

Single Bubble Model

Kick Model in this simulator:

The model assumes that the kick starts as a single bubble at the bottom of the hole and migrates upward as a single bubble from the bottom to the surface.

In underbalanced condition (BHP<Form Pressure) during control, the single bubble volume is incremented with the inflow volume from formation to the well.



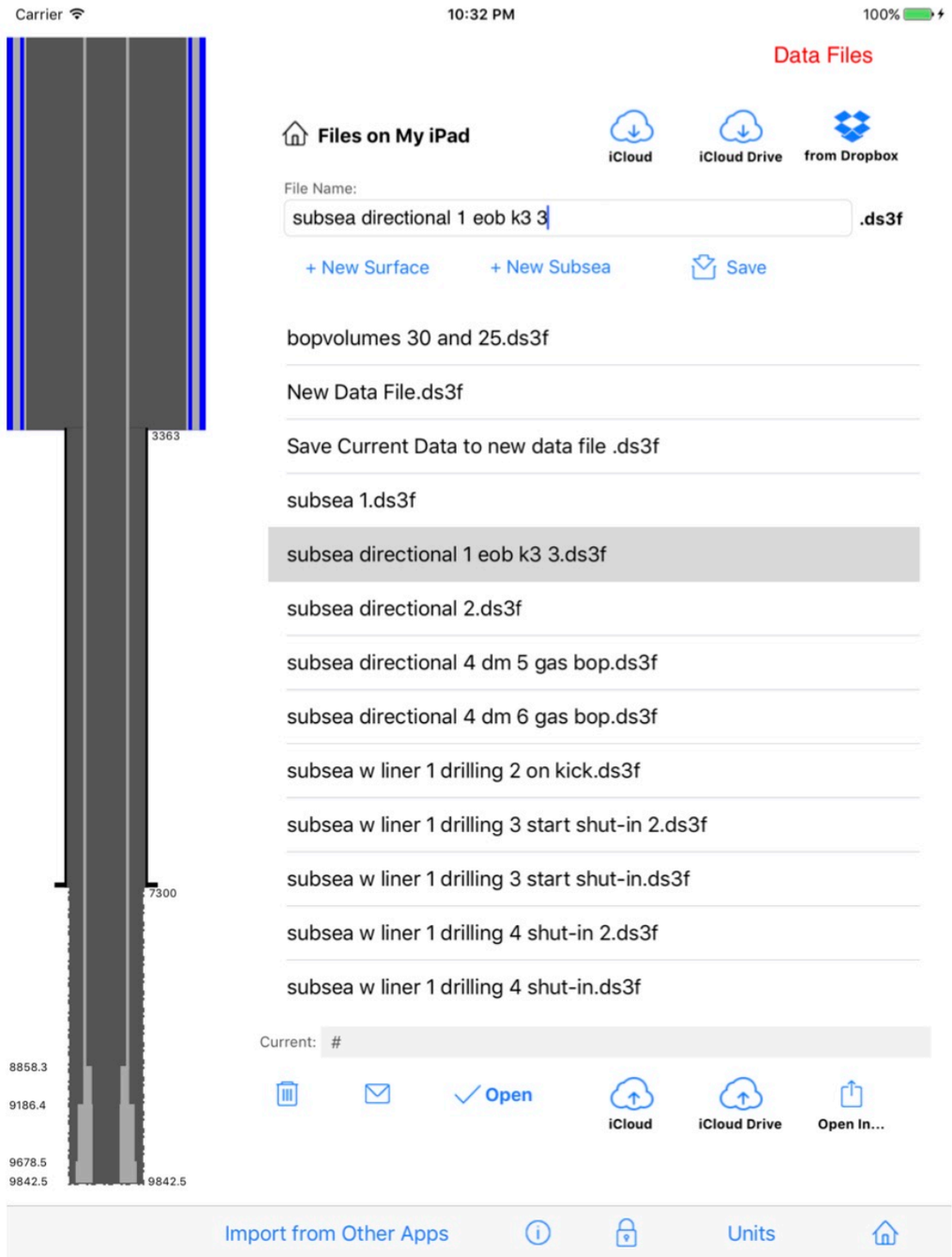
CHAPTER 5

Data Files

This app work with the extension (*.ds3f)

It's recommended first to create a data file to work with this app and to enable the "**Save**" button on views.
This app only opens data files locally in the Documents folder !

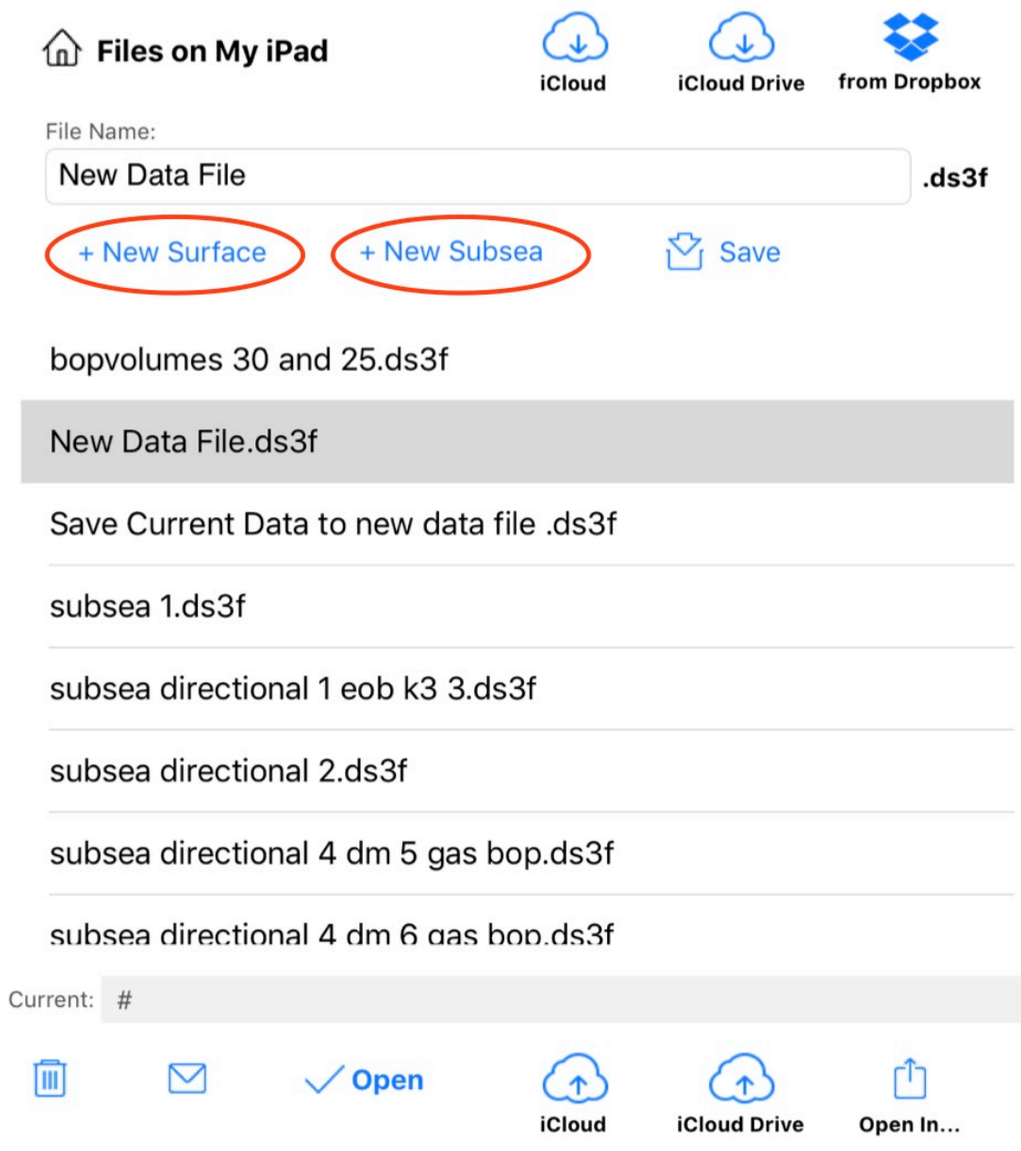
Use iCloud or others storage providers to import or export data files !



SECTION 1

Creating a New File

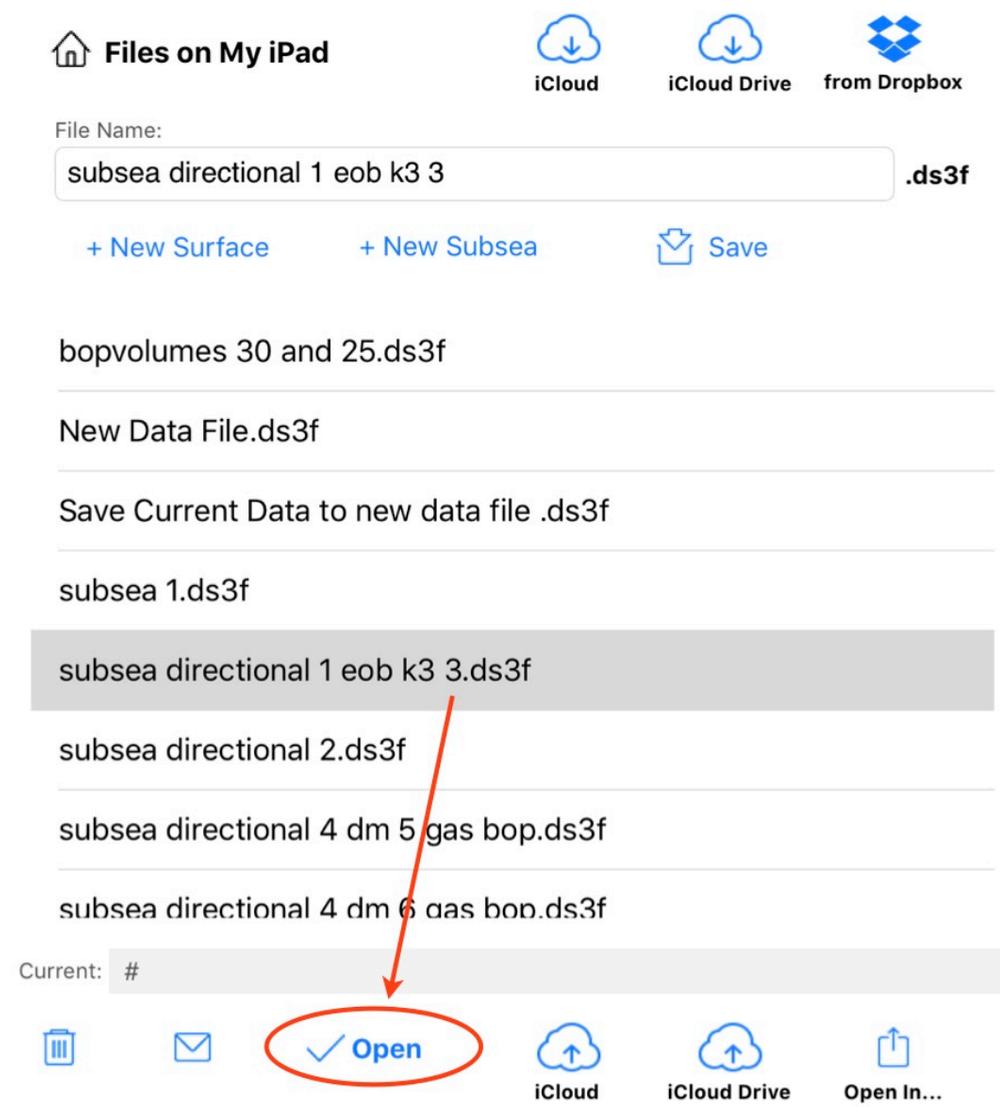
1. Input the file name in text box and tap on **[+ New Surface]** or **[+ New Subsea]** button.
2. The file will be created with default values.
3. The file will be saved on local document folder.



SECTION 2

Open a Data File

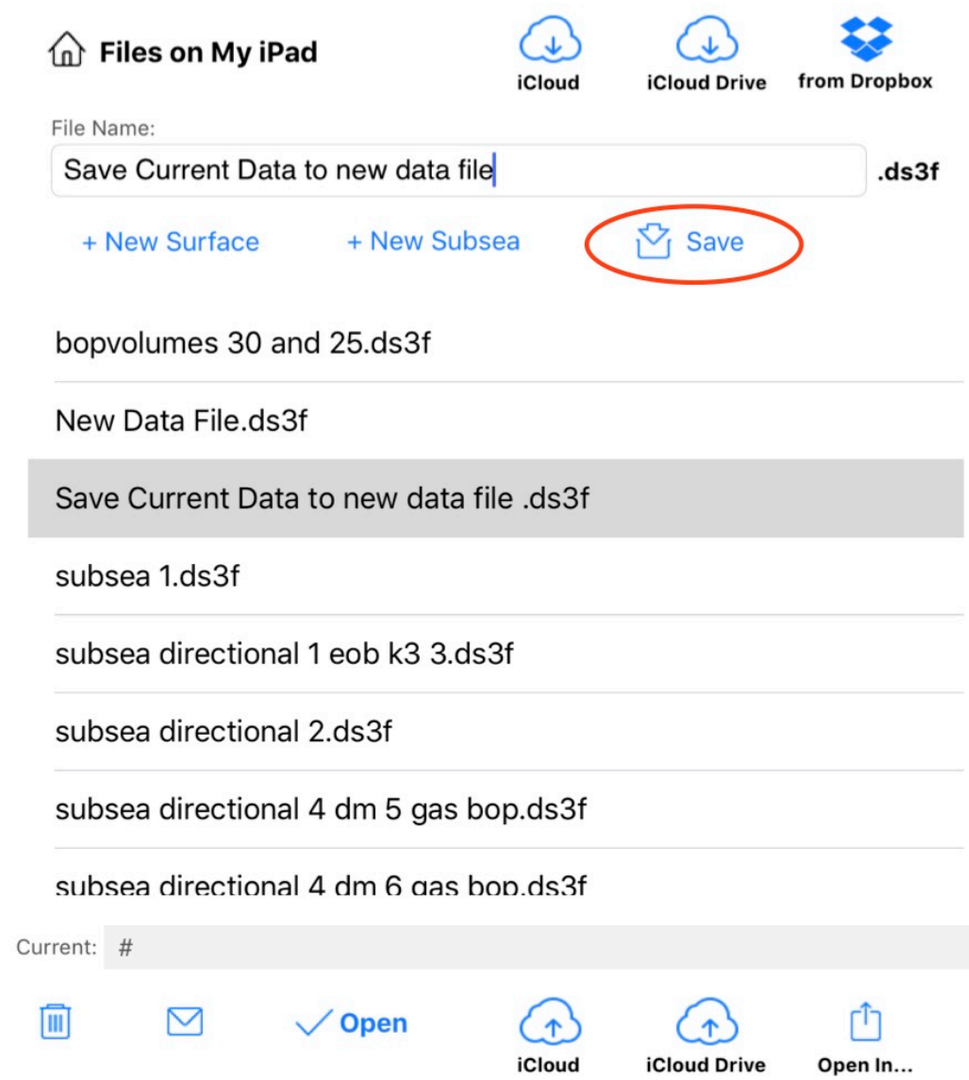
When TAP on “Open” button, the data that are on the Data File Highlighted are loaded in memory and can be saved with a new name (see Save As...)



SECTION 3

Save

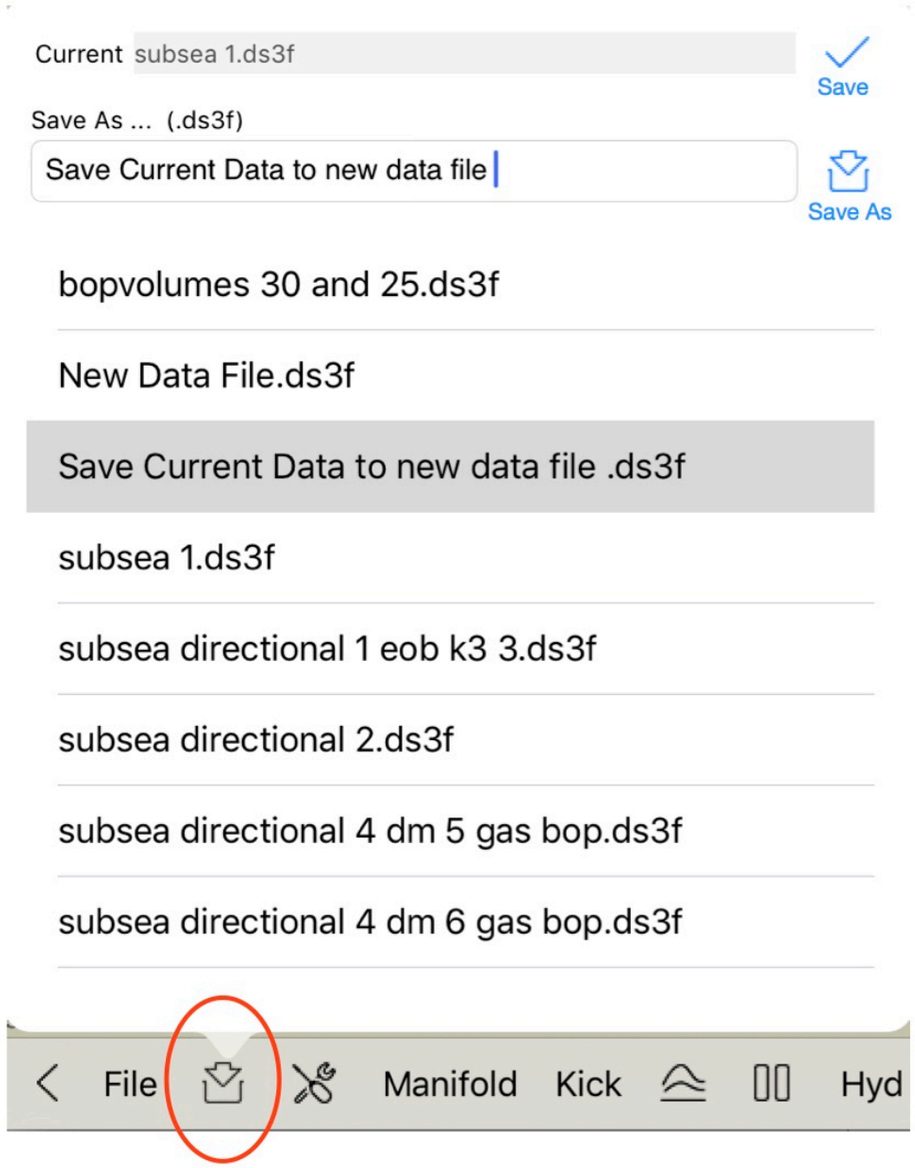
1. Input the File Name in the TextBox.
2. TAP on **Save** button. The data file is saved on local document folder.



On views (fast method, but to save only):

"Save" and **"Save As..."**

Use the button on toolbar:



Notes:

Save the exercise in several critical points to different data files:

Examples:

1. At the beginning of circulation
2. Gas near casing shoe
3. Gas after casing shoe
4. Gas near to bop (Subsea Stack)
5. Gas near to surface
6. All gas out
7. Kill Mud near to BHA
8. Kill Mud near to drill bit
9. Kill Mud near to casing shoe
10. Kill Mud near to bop

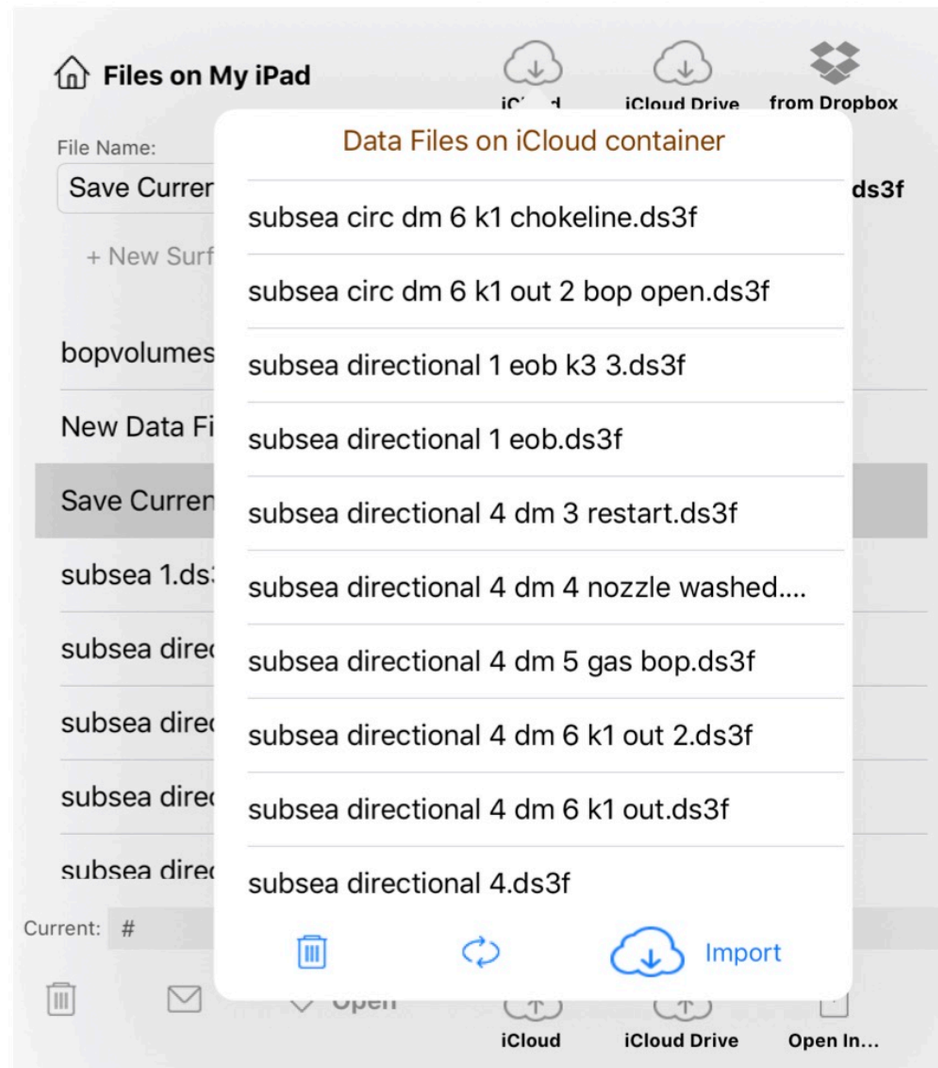
SECTION 4

Data File on iCloud

1. Check iCloud Settings
2. **iCloud Drive --> ON**

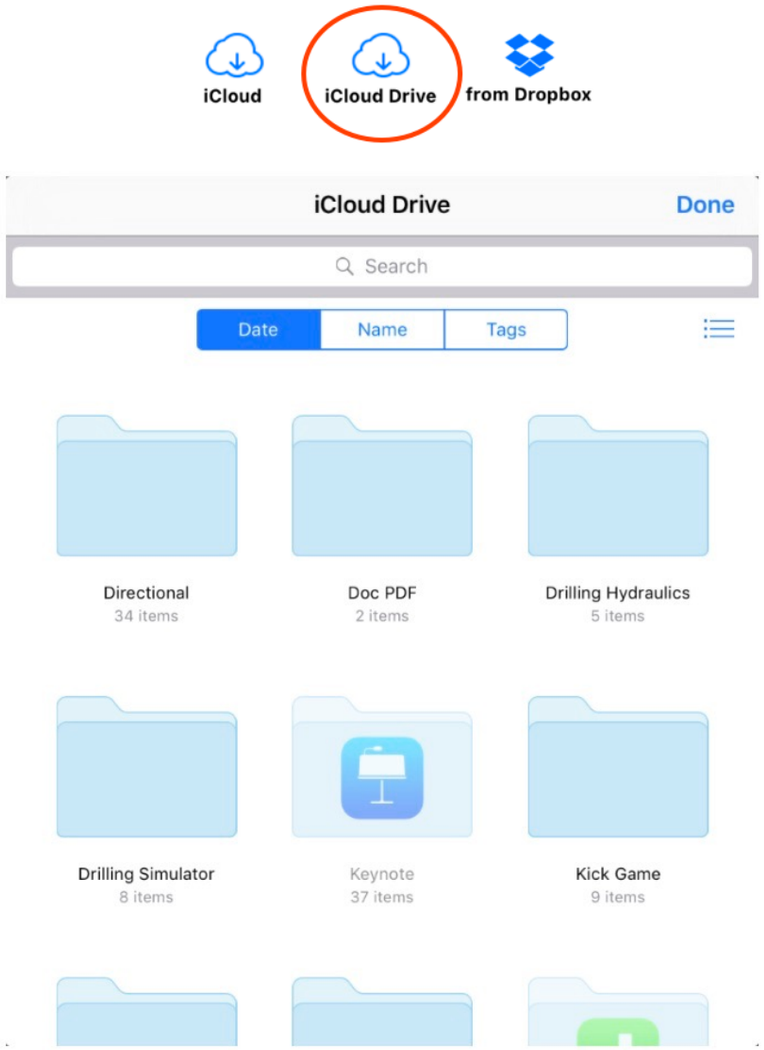
iCloud Container:

- Use this option to retrieve data files sent to iCloud from the same Apple Id on any device.

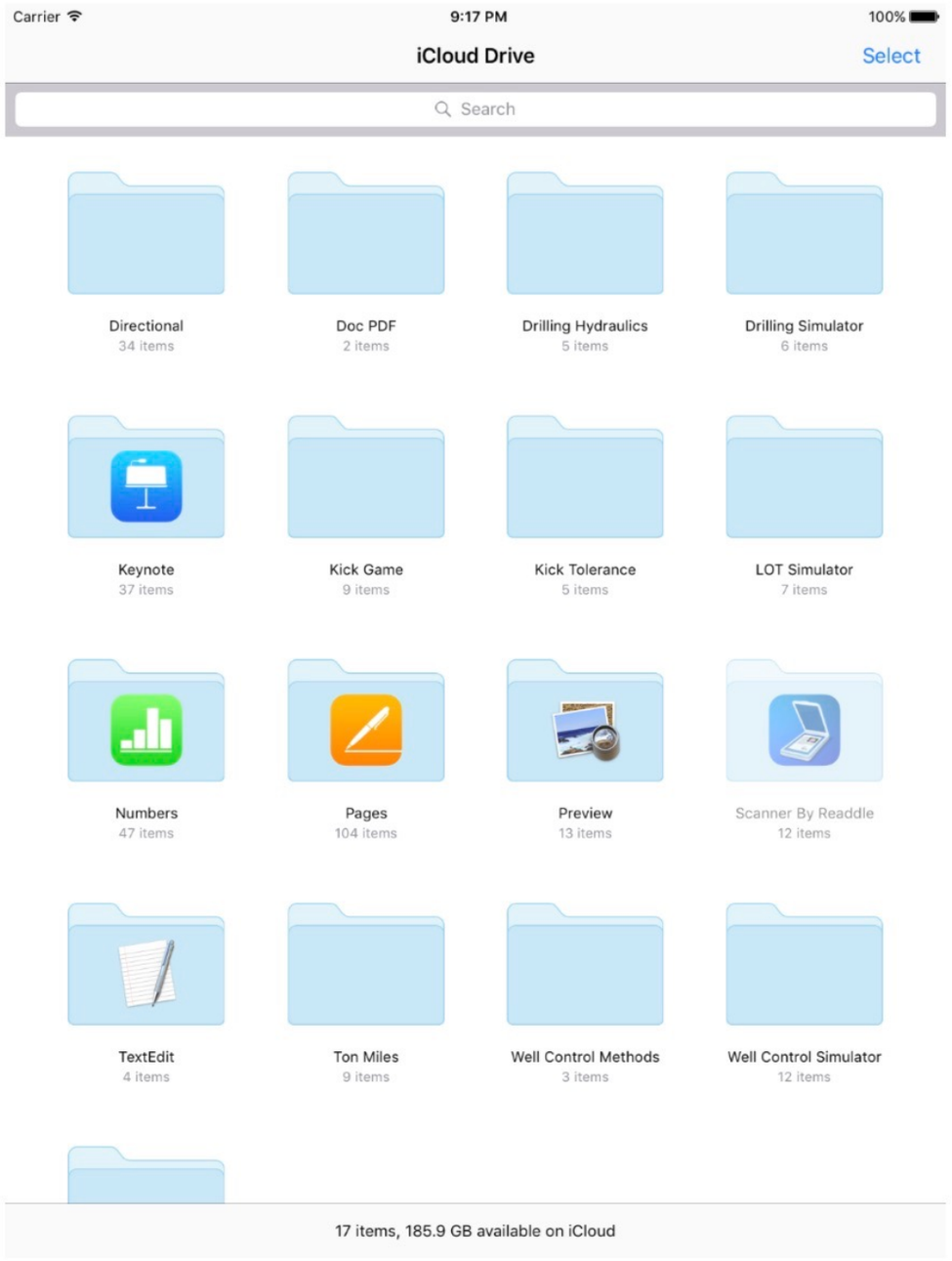


iCloud Drive:

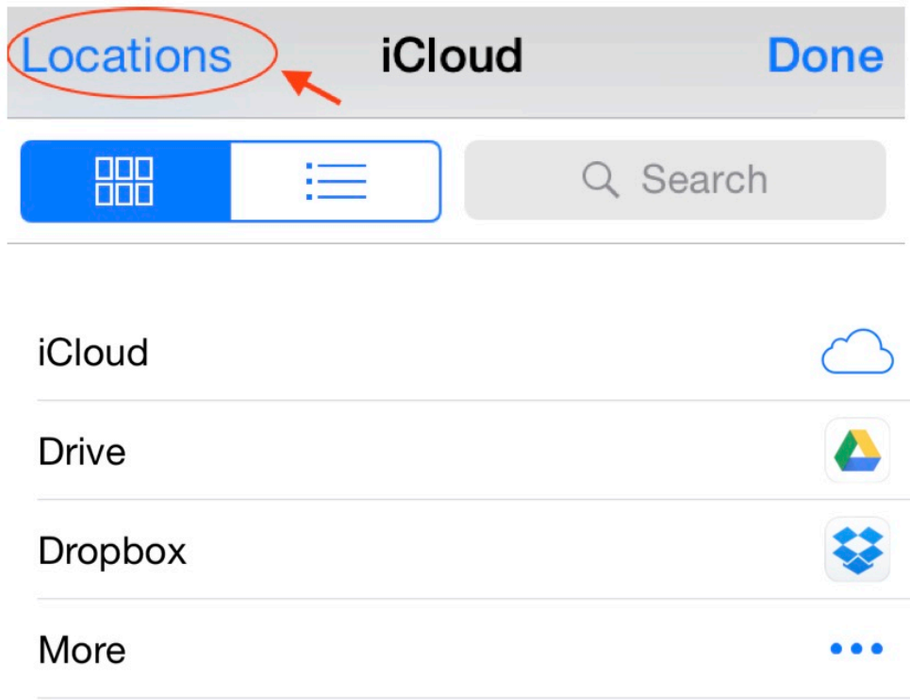
Use the this option to download/upload data files on iCloud Drive or other storage providers accessible via iCloud Drive interface.



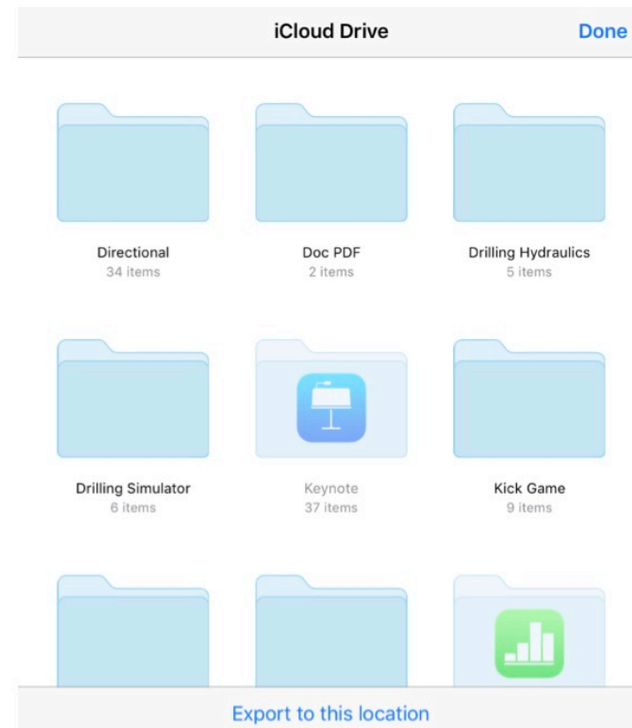
Using the **iCloud Drive** app (available on iOS 9)

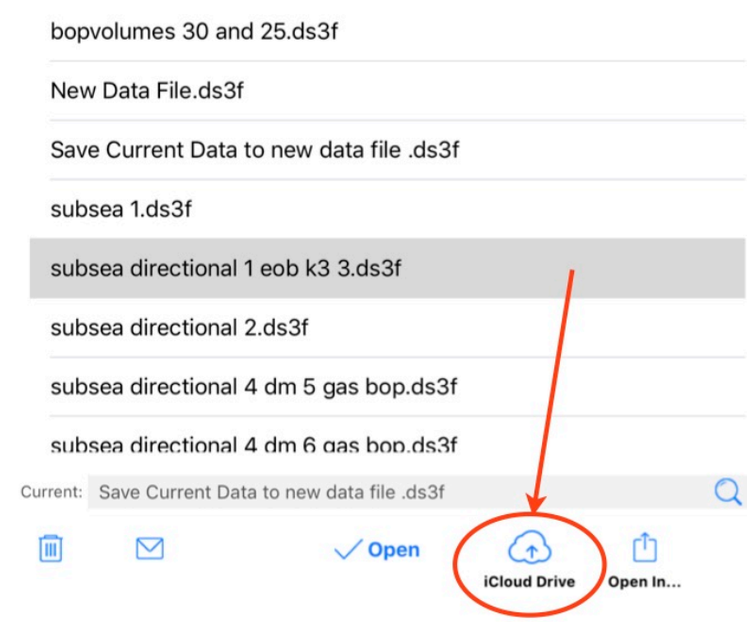


Accessing other Storage Providers via iCloud Drive interface:



Exporting data files to iCloud Drive

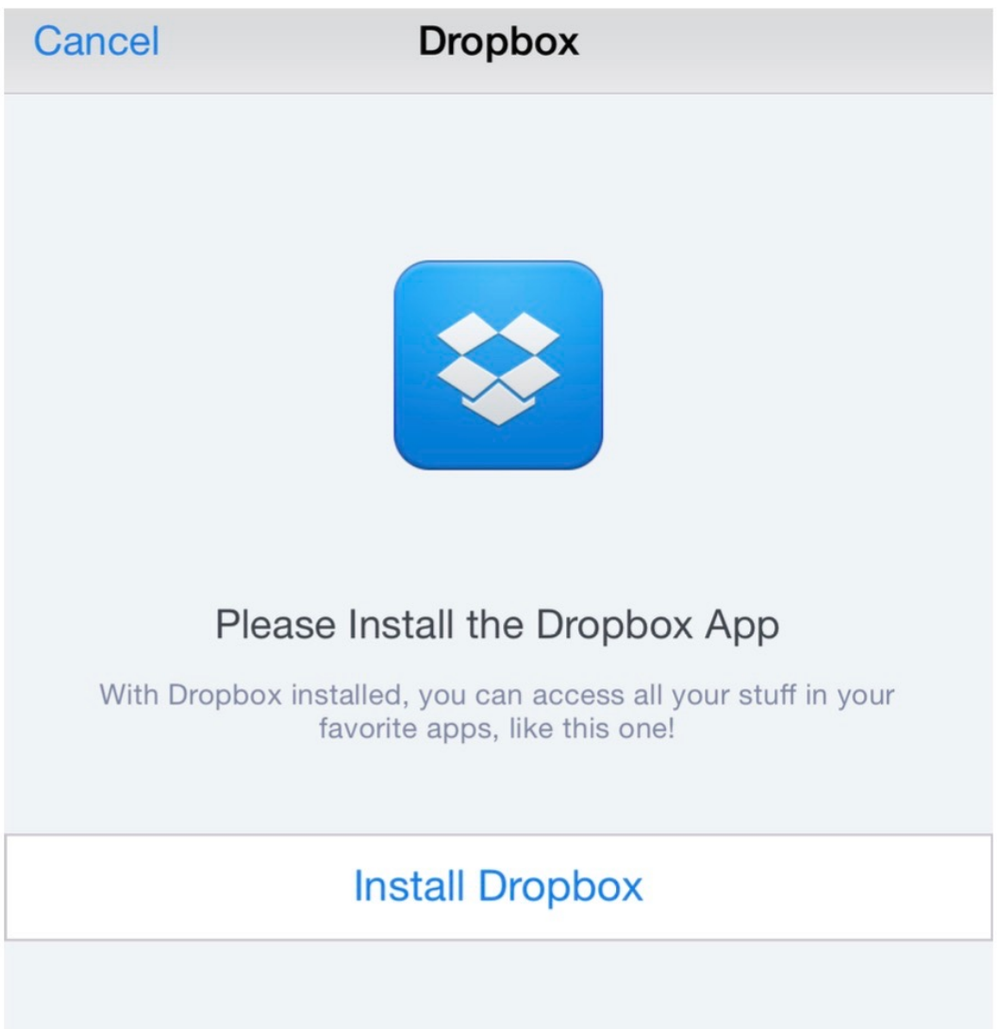




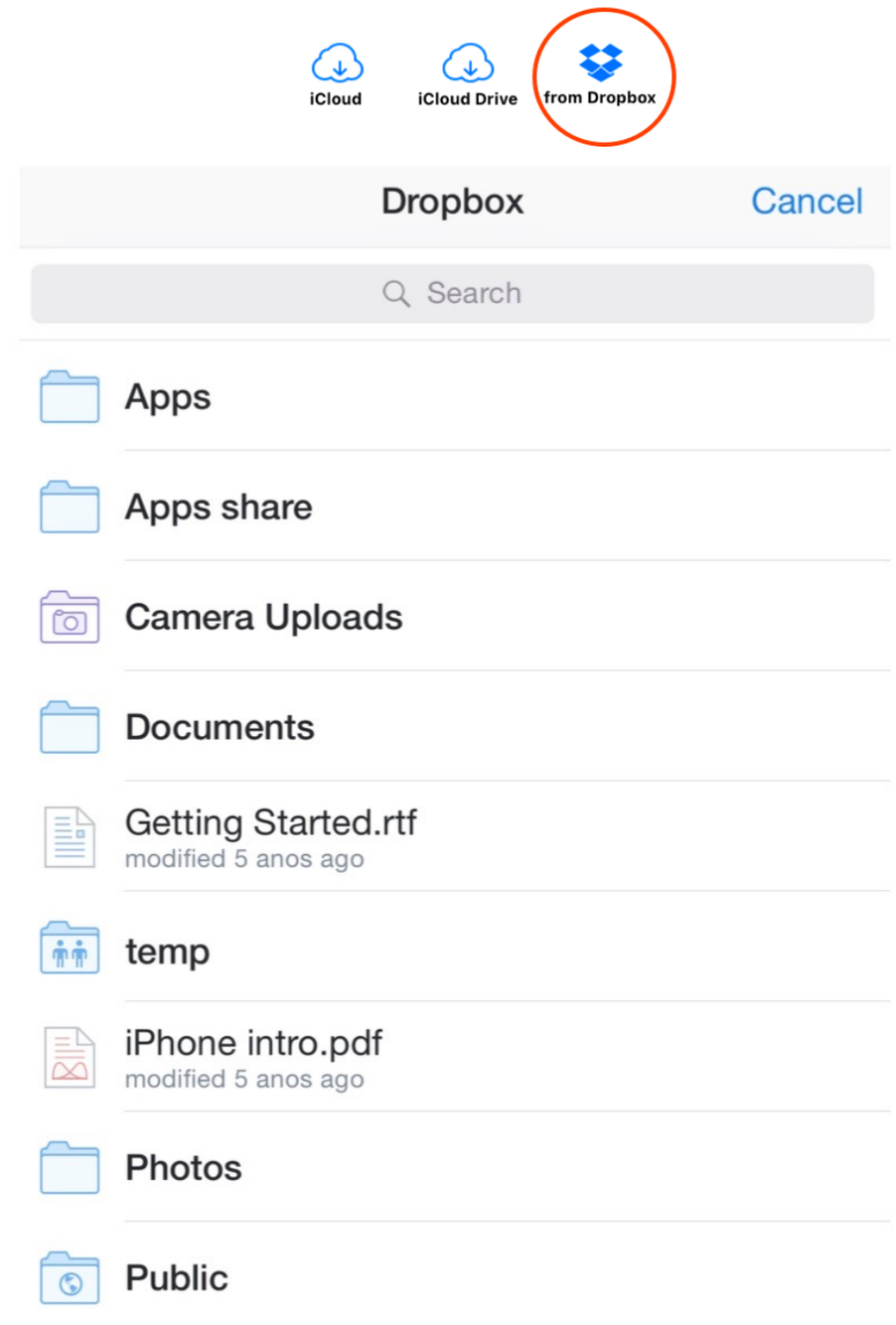
SECTION 5

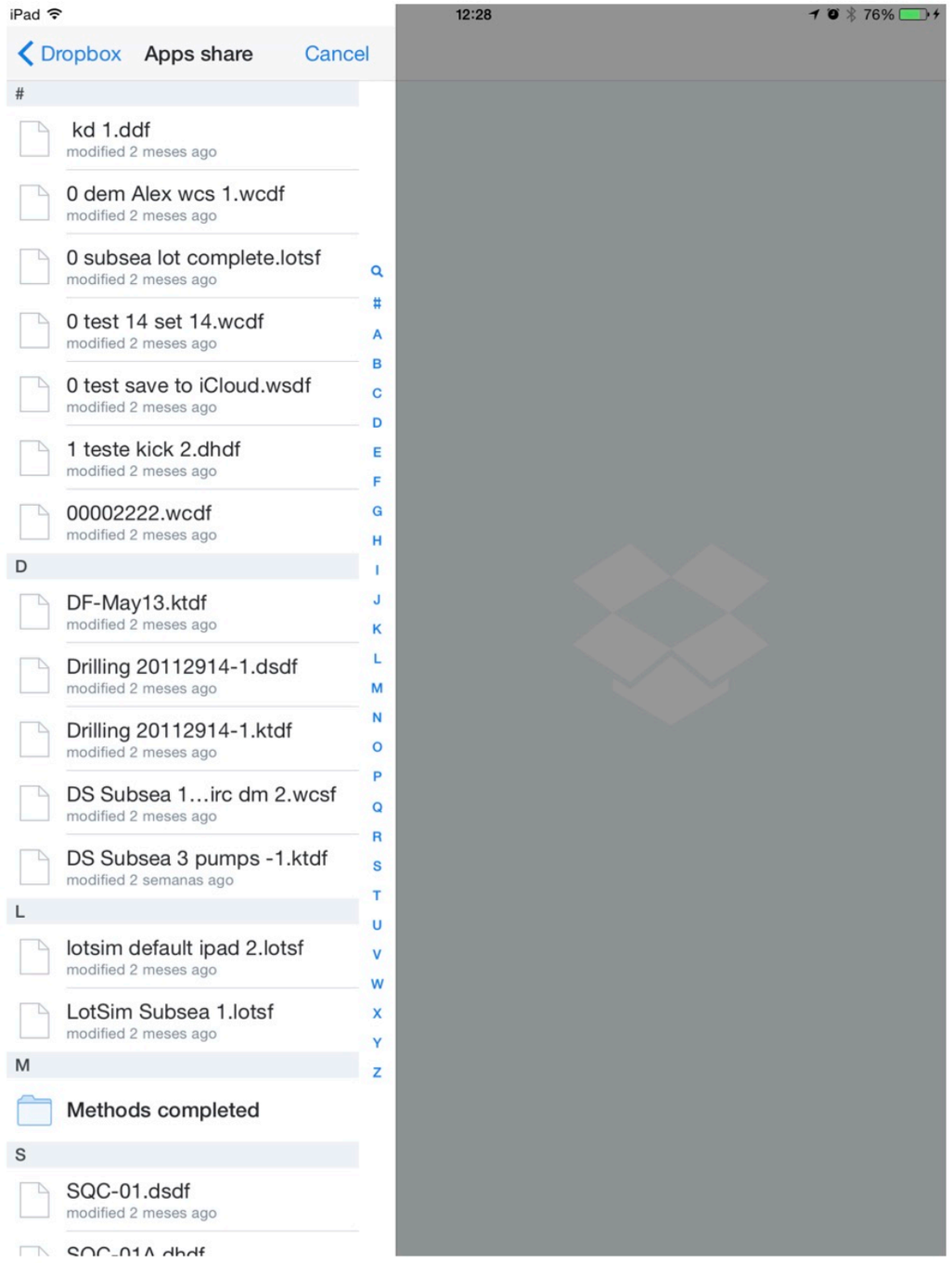
Data Files on Dropbox

1. Install the Dropbox app on your device
2. **Do a login in the Dropbox app**



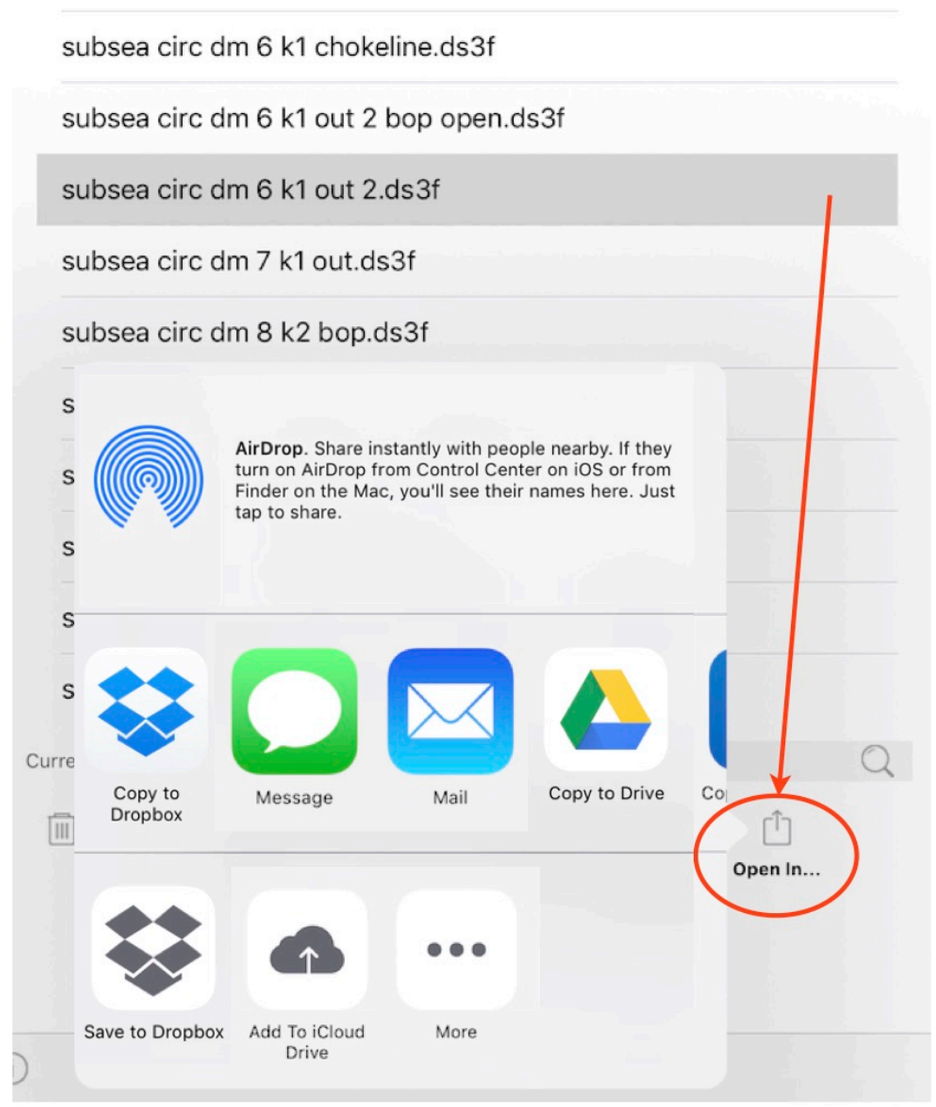
Importing from Dropbox





Upload to Dropbox:

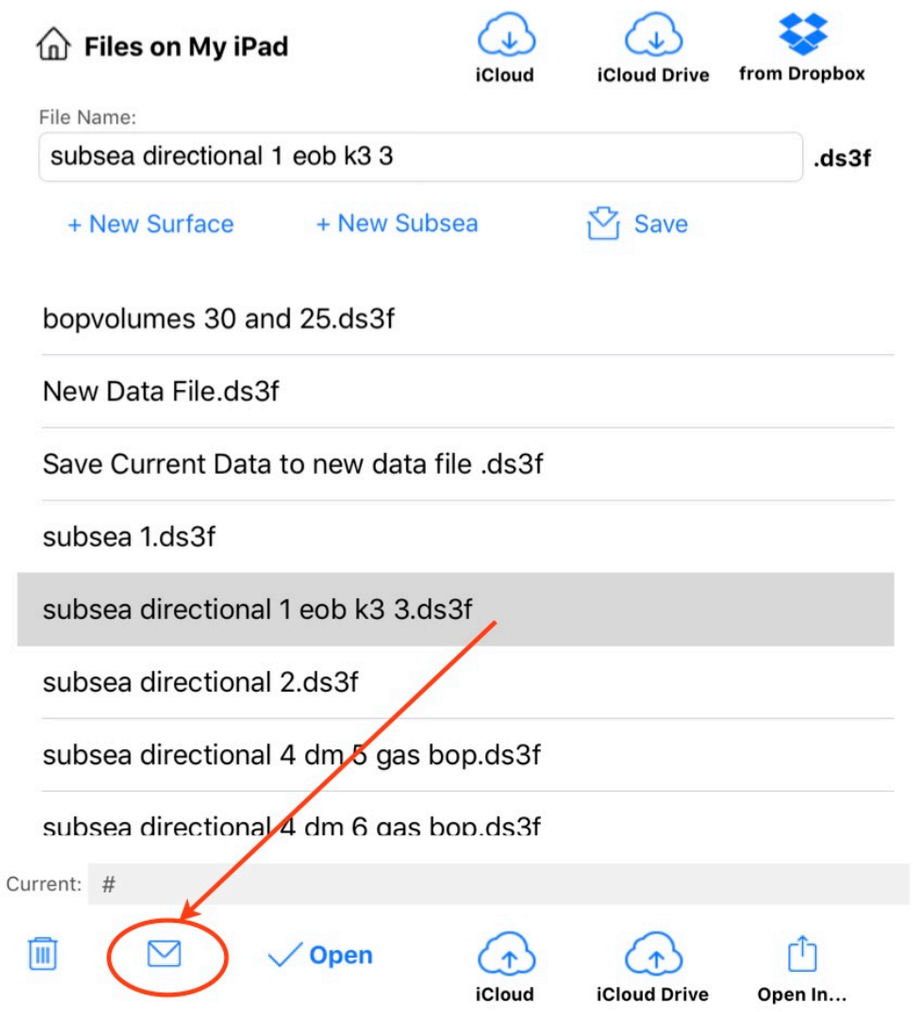
To submit a data file to Dropbox provider, use the **Open In...** button and open it in the Dropbox app:



SECTION 6

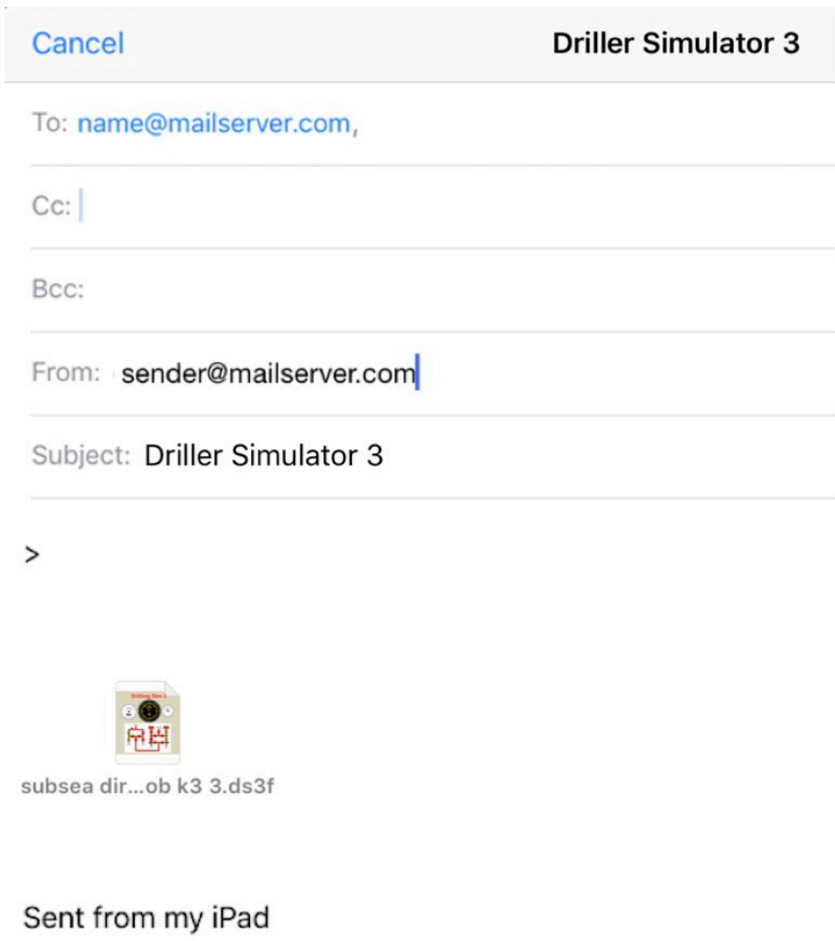
Send a data file by Email

1. Select the data file.
2. TAP on button.



1. Input the mail address to send:
2. Edit the subject.

Note: Configure an account mail on **Mail app**



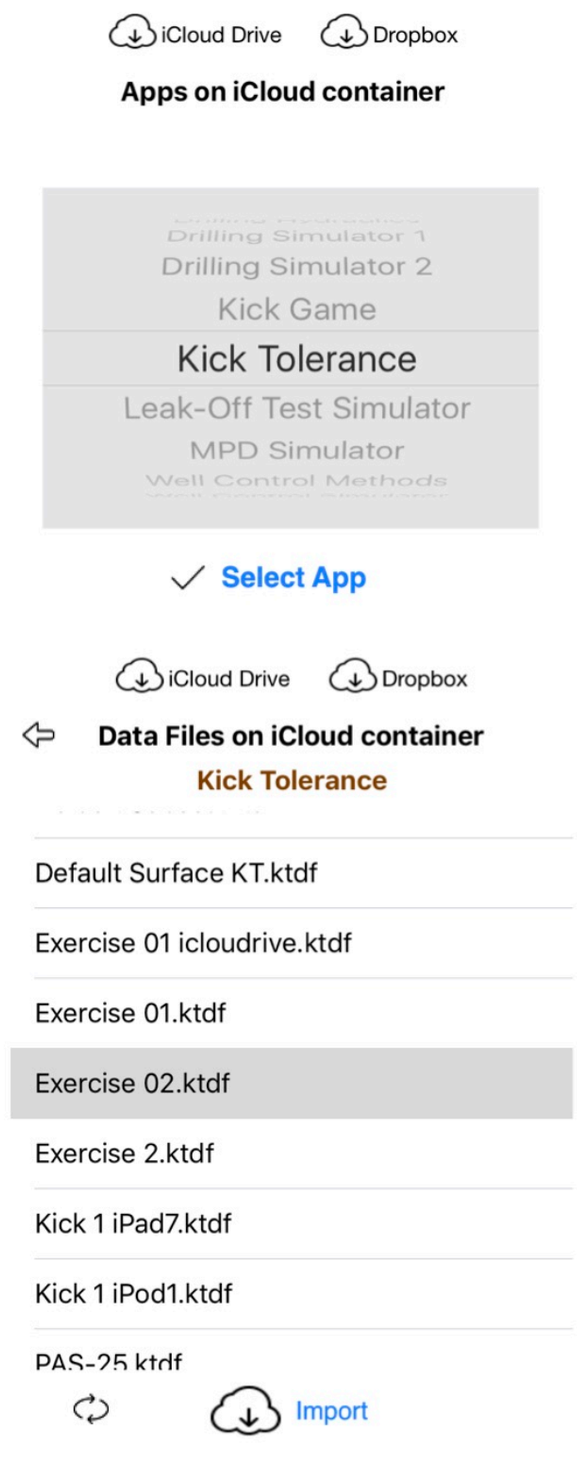
SECTION 7

Importing from other apps

COMPATIBLES APPS ON OUR PORTOLIO:

1. Drilling Simulator 1
2. Drilling Simulator 2
3. Drilling Simulator 3
4. Drilling Hydraulics
5. Kick Tolerance
6. Leak-Off Test Simulator
7. MPD Simulator
8. Well Control Methods
9. Well Control Simulator
10. Well Control Worksheets

Tap on "**Import from Other Apps**" button on toolbar:



CHAPTER 6

Unit Systems

Select units per Unit System:
METRIC, SI or OILFIELD

or per parameter.

Note about Gravity value used in the hydrostatic calculations:

Hydrostatic Pressure (Pa)
= Gravity (m/s2) x Density (kg/m3) x Height (m)

This app uses the value **Gravity = 9.80665 m/s2**

—> Hydrostatic Pressure (Pa)
= 9.80665 x Density (kg/m3) x Height (m)

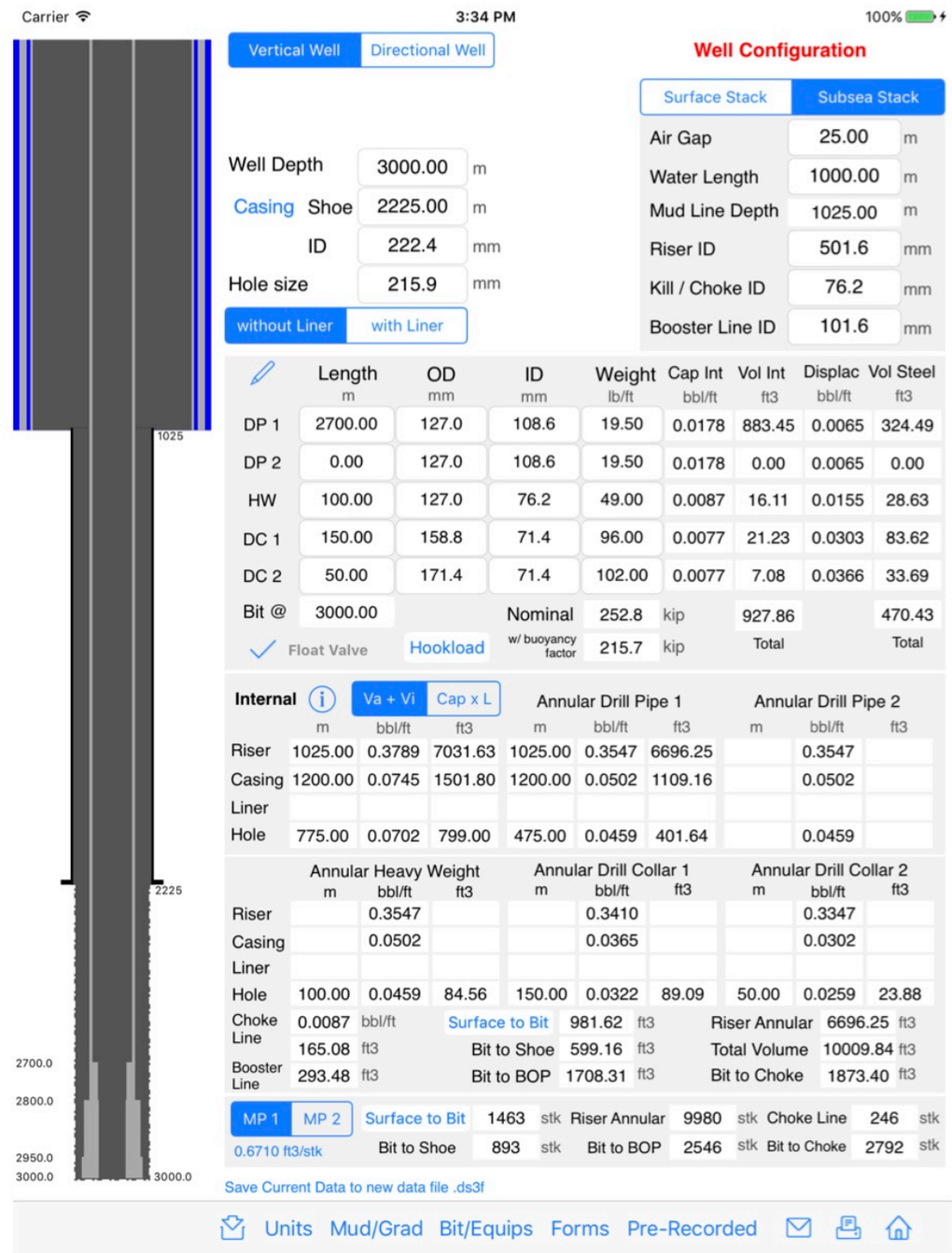
—> Hydrostatic Pressure (psi)
= 0.051948 x Density (ppg) x Height (ft)

	METRIC	SI	OILFIELD	Others
Pressure	bar	kPa	psi	atm
Density	kg/l	kg/m3	ppg	lb/ft3
Gradient	bar/m	kPa/m	psi/ft	psi/m
Length	m	m	ft	ft
Diameter	mm	mm	inch	cm
Area	mm2	mm2	sq. in	cm2
Volume	liter	m3	bbl	ft3
Capacity	liter/m	m3/m	bbl/ft	bbl/m
Flow Rate	l/min	m3/min	gpm	ft3/min
Power	kw	kw	hp	hp
Force	kgf	daN	lbf	N
Jet Velocity	m/s	m/s	ft/s	ft/s
Temp Grad	C/100m	C/100m	F/100ft	F/100ft
Plastic Visc	mPa.s	mPa.s	cP	cP
Yield Point	kg/m2	N/m2	lb/100ft2	Pa
Hookload	ton	ton	kip	kip
Pipe Weight	kg/m	kg/m	lb/ft	lb/ft
Mass/Weight	kg	kg	lb	lb
Bop Volume	liter	liter	gal	gal

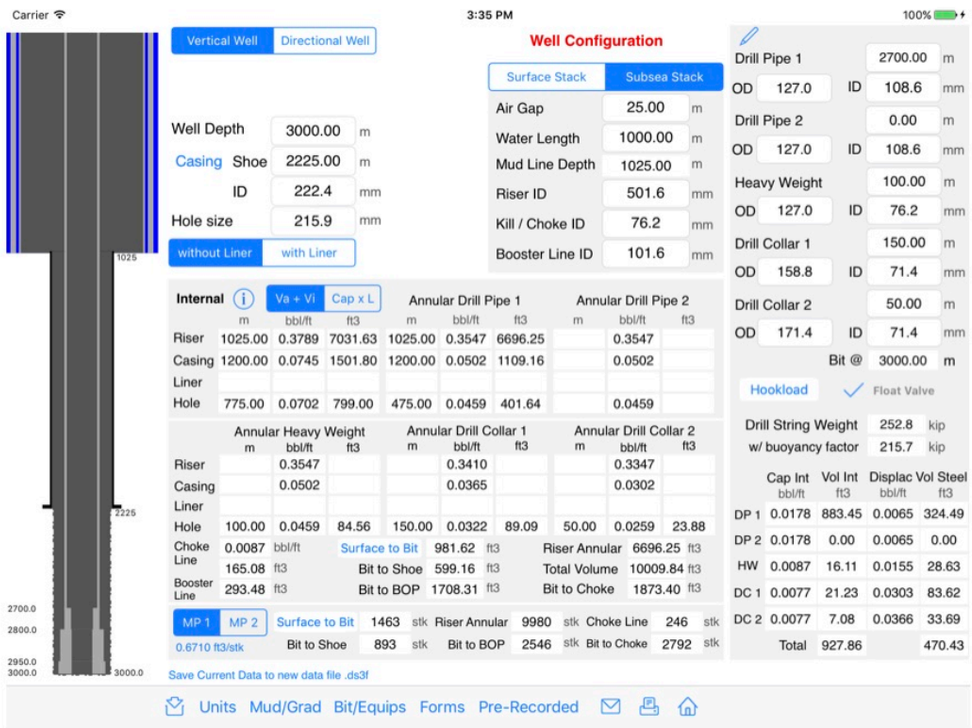
CHAPTER 7

Well Configuration

On Main View, tap on button on tool-bar to edit the Well



iPad on horizontal position:



Casing

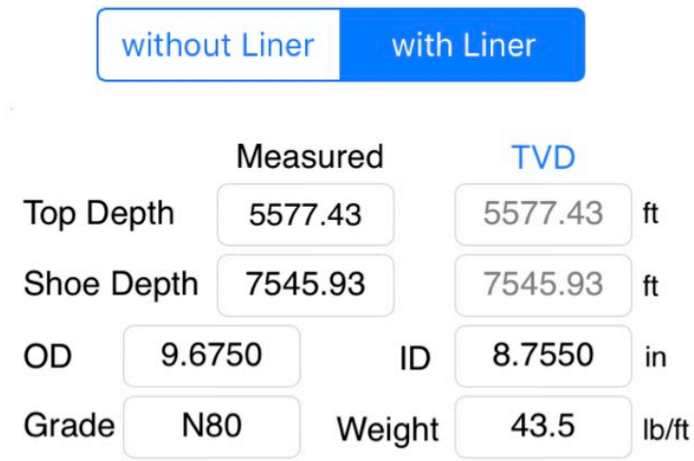
Weight	43.5	lb/ft	Grade	N80	
Size	244	mm	ID	222	mm
Burst	6330	psi	DF	1.25	80.0 %
Burst/DF	5064	psi		1.1 - 1.4	70 - 90

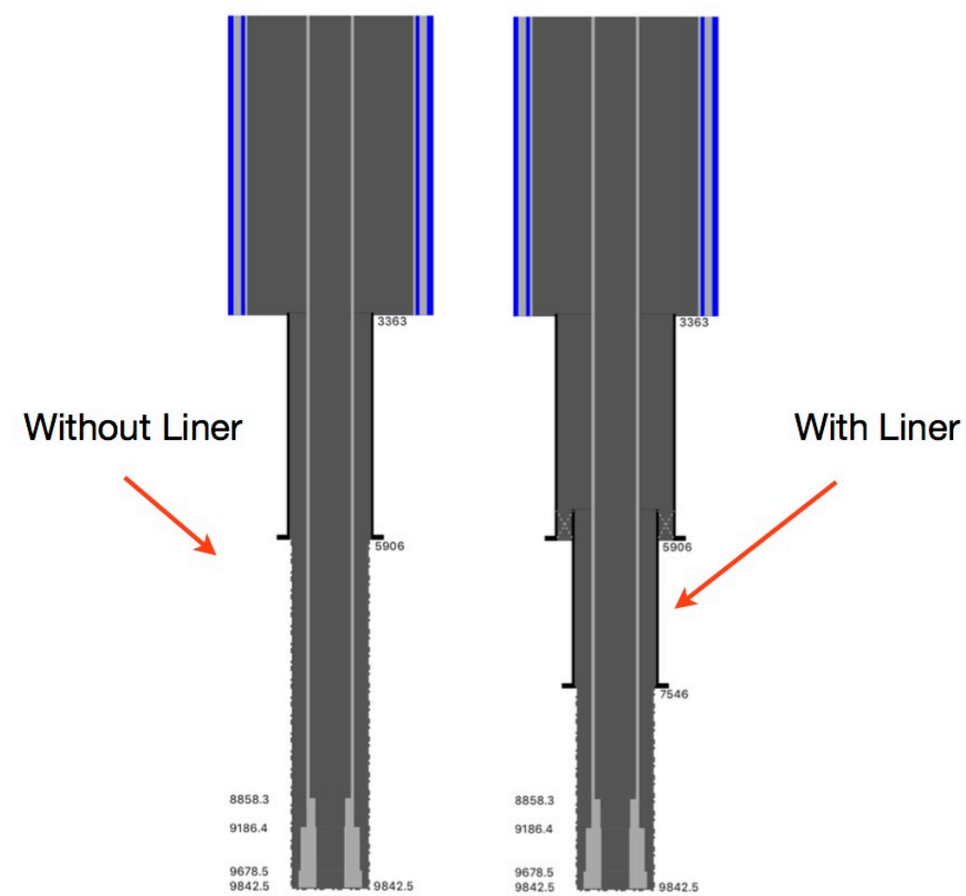
Burst -> Burst Pressure

DF -> Design Factor (values 1.1 to 1.4)

Also named “SF - Safety Factor” (values 70% - 90%)

Well with Liner





Vertical Well

Vertical Well | Directional Well

Well Depth	9842.52	ft
Casing Shoe	5905.51	ft
ID	8.7550	in
Hole size	8.5000	in

without Liner | with Liner

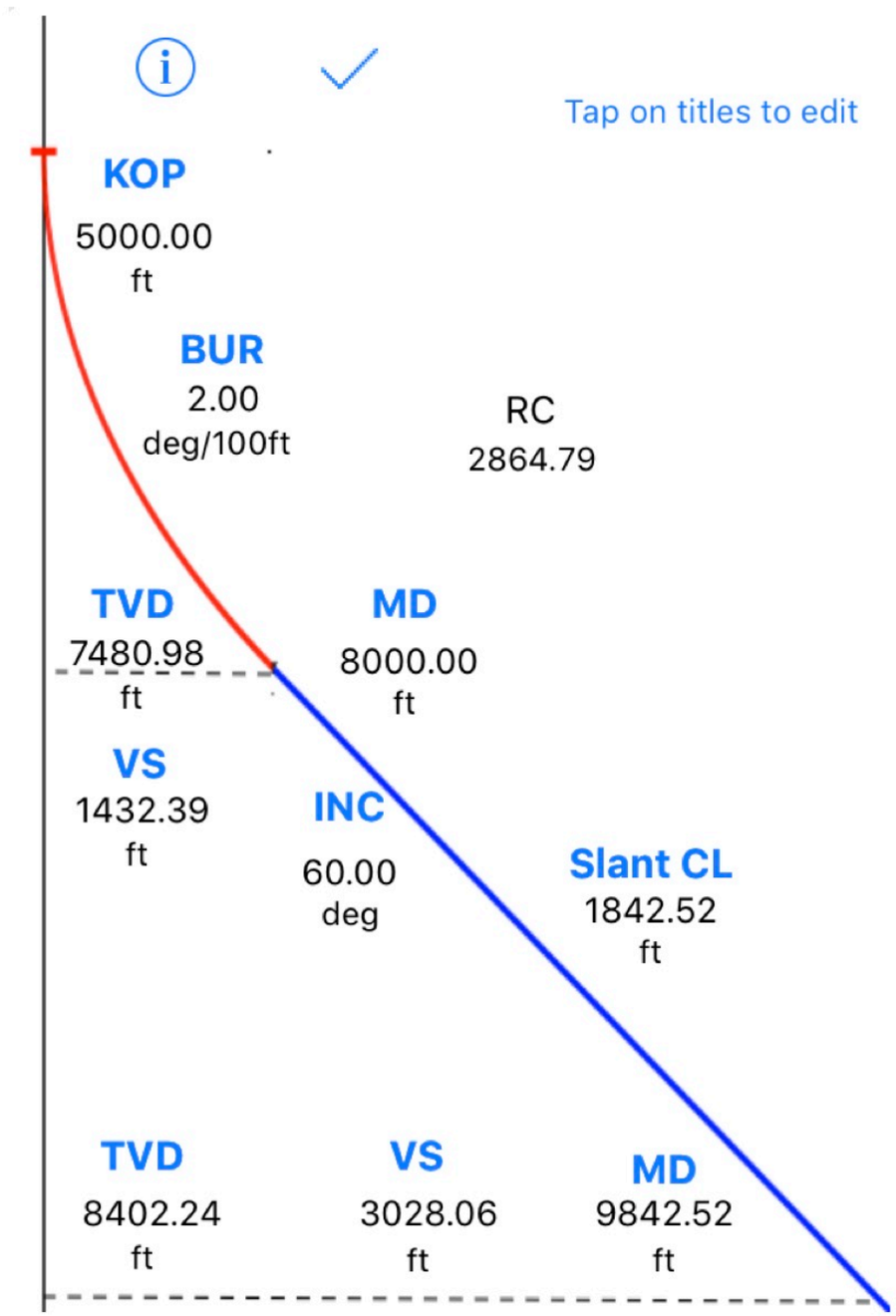
Directional Well

Vertical Well | Directional Well | Builder

			TVD
Kick-Off Point	5000.00	ft	
End Of Build Up	8000.00	ft	7480.98
Well Depth	9842.52	ft	8402.24
Casing Shoe	7000.00	ft	6841.45
ID	8.7550	in	
Hole size	8.5000	in	

without Liner | with Liner

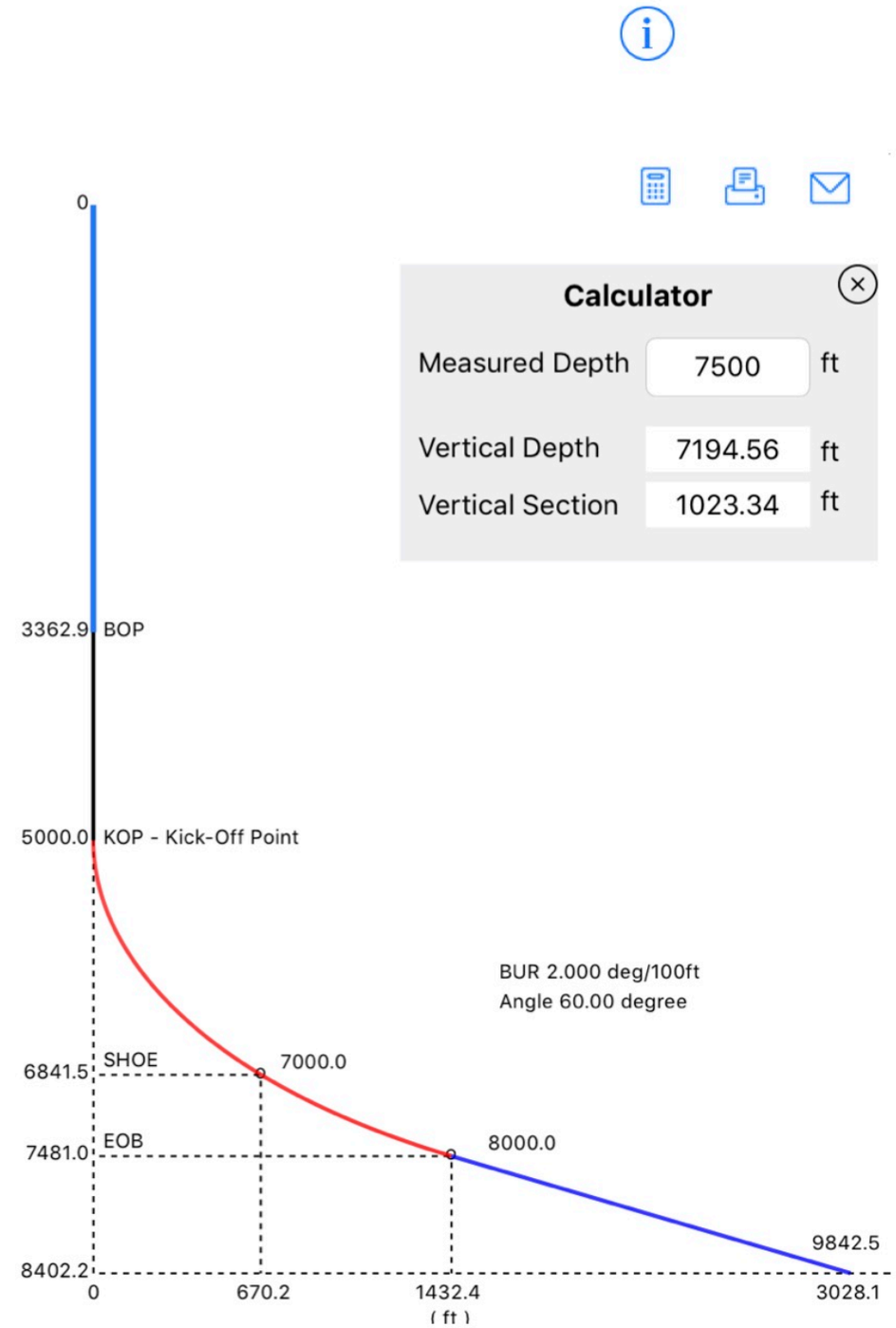
Directional Well Type I Builder



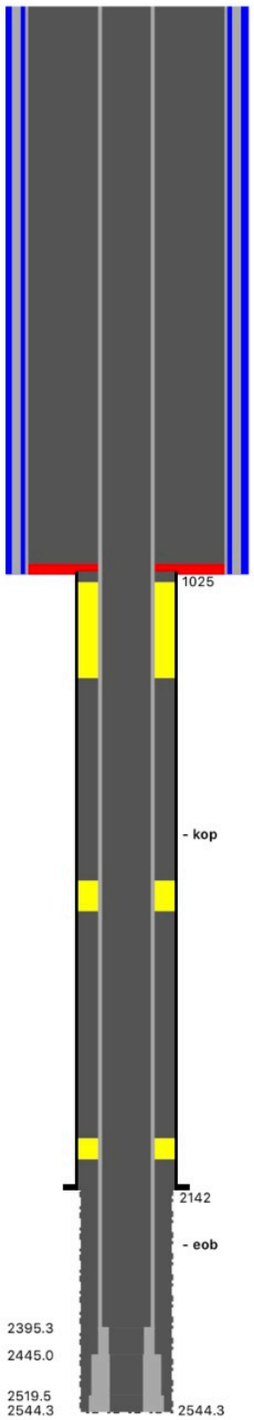
Edit parameters from top to down

Directional Terms

KOP	- Kick Off Point
BUR	- Build Up Rate
DOR	- Drop Off Rate
DLS	- Dog leg Severity
RC	- Radius of Curvature
INC	- Inclination, Drift
TVD	- True Vertical Depth
MD	- Measured Depth
VS	- Vertical Section
CL	- Course Length = MD2 - MD1
N/S	- North / South coordinate
E/W	- East / West coordinate
TR	- Turn Rate
HD	- Horizontal Displacement
CD	- Closure Distance (= HD)
AZI	- Azimuth



Carrier 11:52 PM 100%



Vertical Well | Directional Well | Builder

Well Configuration

			TVD
Kick-Off Point	1500.00	m	
End Of Build Up	2400.00	m	2244.29
Well Depth	3004.21	m	2544.29
Casing Shoe	2225.00	m	2142.02
ID	8.7550	in	
Hole size	8.5000	in	

without Liner | with Liner

Surface Stack | Subsea Stack

Air Gap	25.00	m
Water Length	1000.00	m
Mud Line Depth	1025.00	m
Riser ID	19.7500	in
Kill / Choke ID	3.0000	in
Booster Line ID	4.0000	in

	Length m	OD in	ID in	Weight lb/ft	Cap Int bbl/ft	Vol Int bbl	Displac bbl/ft	Vol Steel bbl
DP 1	2704.21	5.0000	4.2760	19.50	0.0178	157.59	0.0065	57.88
DP 2	0.00	5.0000	4.2760	19.50	0.0178	0.00	0.0065	0.00
HW	100.00	5.0000	3.0000	49.00	0.0087	2.87	0.0155	5.10
DC 1	150.00	6.2500	2.8125	96.00	0.0077	3.78	0.0303	14.89
DC 2	50.00	6.7500	2.8125	102.00	0.0077	1.26	0.0366	6.00

Bit @ 3004.21 | Nominal 253.1 kip | 165.50 | 83.87

Float Valve | Hookload | w/ buoyancy factor 216.0 kip | Total | Total

Internal | Va + Vi | Cap x L

	Annular Drill Pipe 1 m	bbl/ft	bbl	Annular Drill Pipe 2 m	bbl/ft	bbl
Riser	1025.00	0.3789	1252.39	1025.00	0.3547	1192.65
Casing	1200.00	0.0745	267.48	1200.00	0.0502	197.55
Liner						
Hole	779.21	0.0702	143.19	479.21	0.0459	72.17

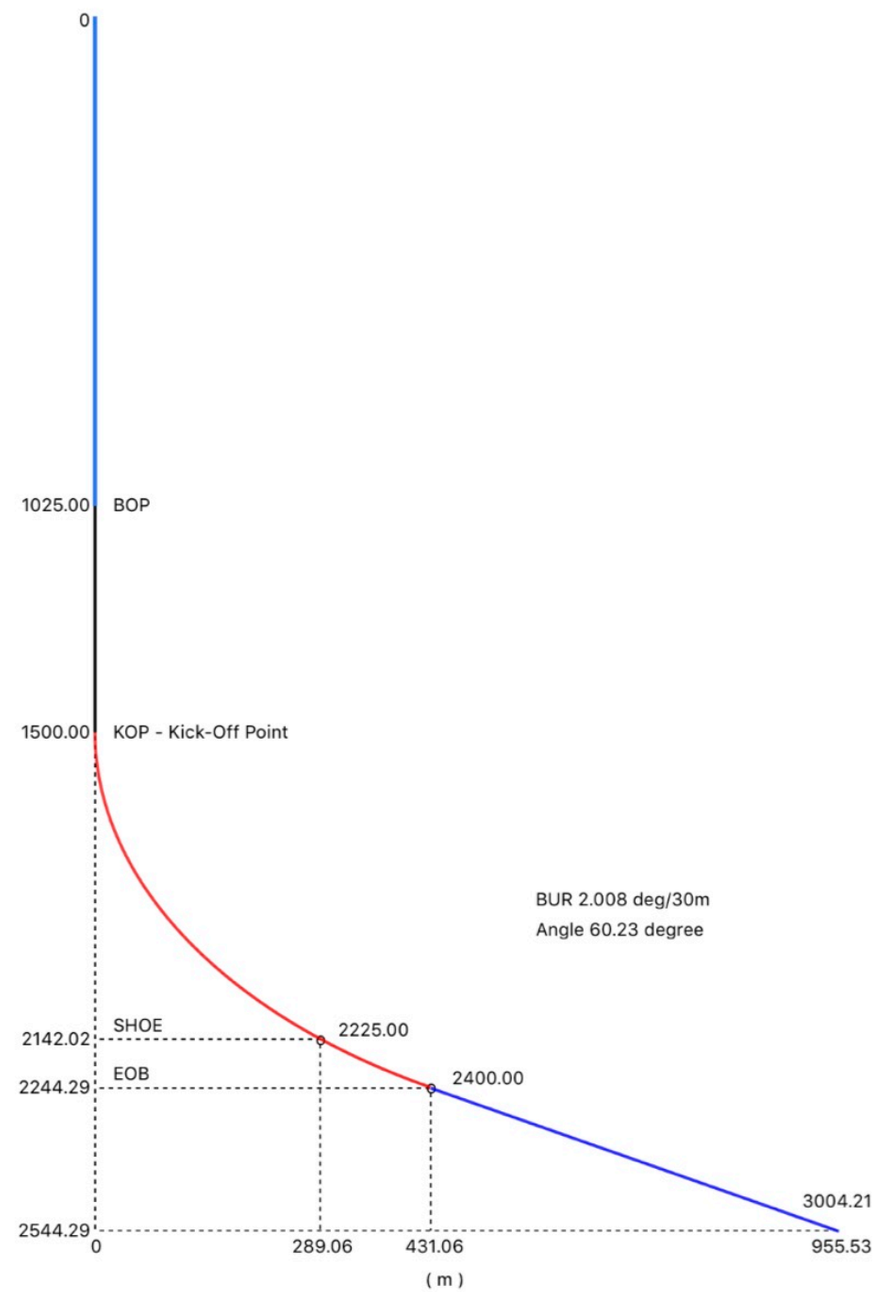
	Annular Heavy Weight m	bbl/ft	bbl	Annular Drill Collar 1 m	bbl/ft	bbl	Annular Drill Collar 2 m	bbl/ft	bbl
Riser		0.3547			0.3410			0.3347	
Casing		0.0502			0.0365			0.0302	
Liner									
Hole	100.00	0.0459	15.06	150.00	0.0322	15.87	50.00	0.0259	4.25

Choke Line	0.0087	bbl/ft	Surface to Bit	175.08	bbl	Riser Annular	1192.65	bbl
	29.40	bbl	Bit to Shoe	107.35	bbl	Total Volume	1783.70	bbl
Booster Line	52.27	bbl	Bit to BOP	304.90	bbl	Bit to Choke	334.30	bbl

MP 1 | MP 2 — 0.1195 bbl/stk

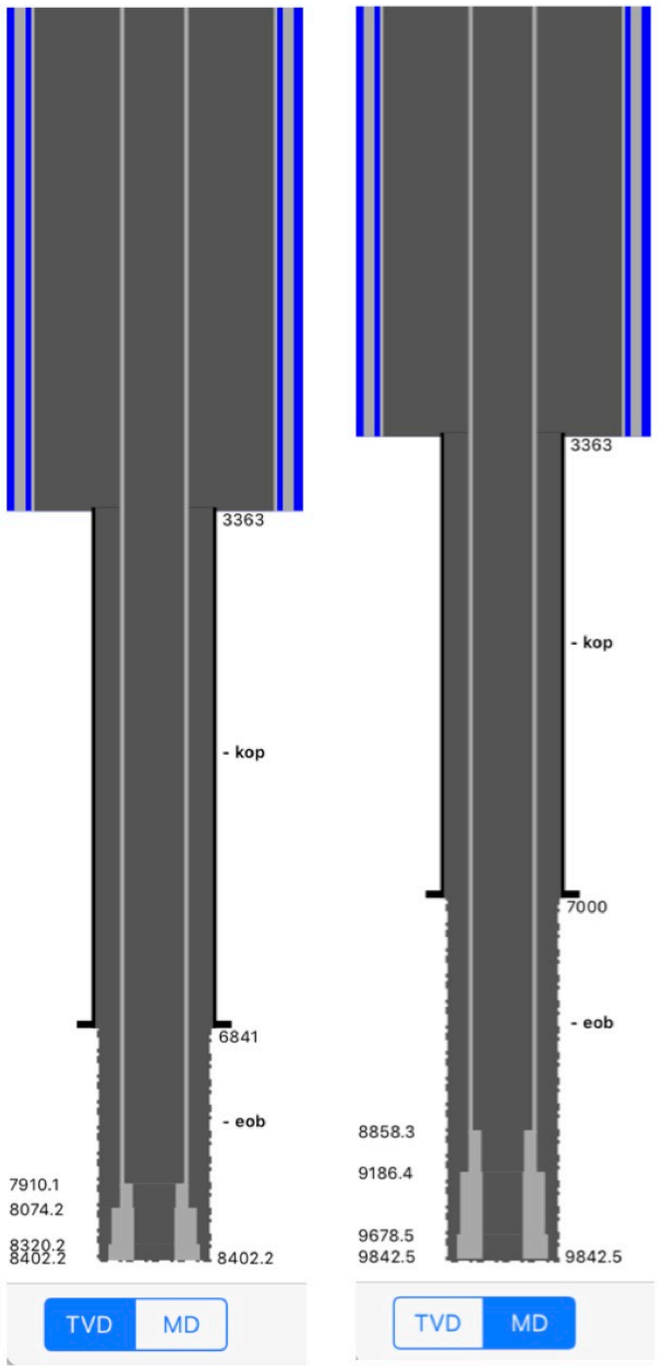
Surface to Bit	1465	stk	Riser Annular	9980	stk	Choke Line	246	stk
Bit to Shoe	898	stk	Bit to BOP	2551	stk	Bit to Choke	2797	stk

subsea directional 1 eob k3 3.ds3f

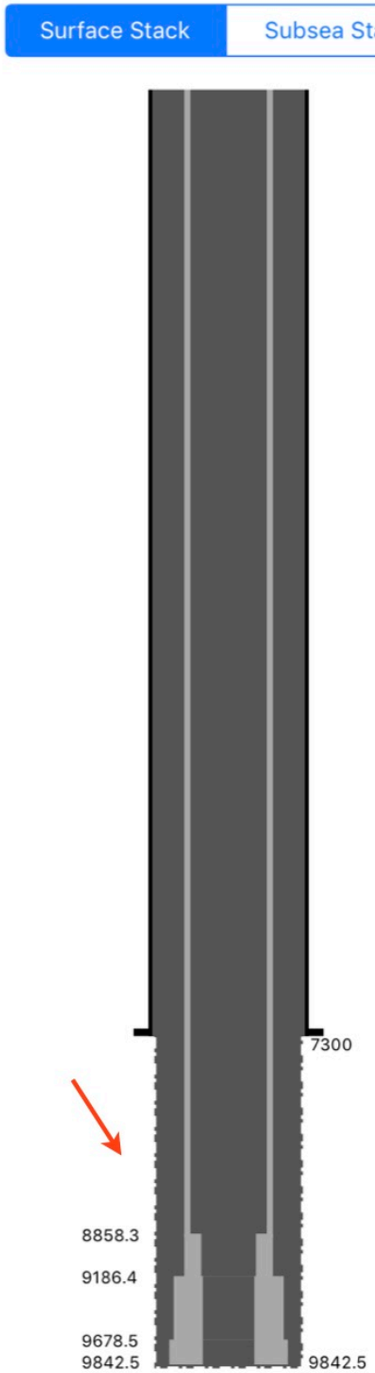


TVD | MD — Units Mud/Grad Bit/Equips Forms Pre-Recorded

Directional Well: TVD x MD projection

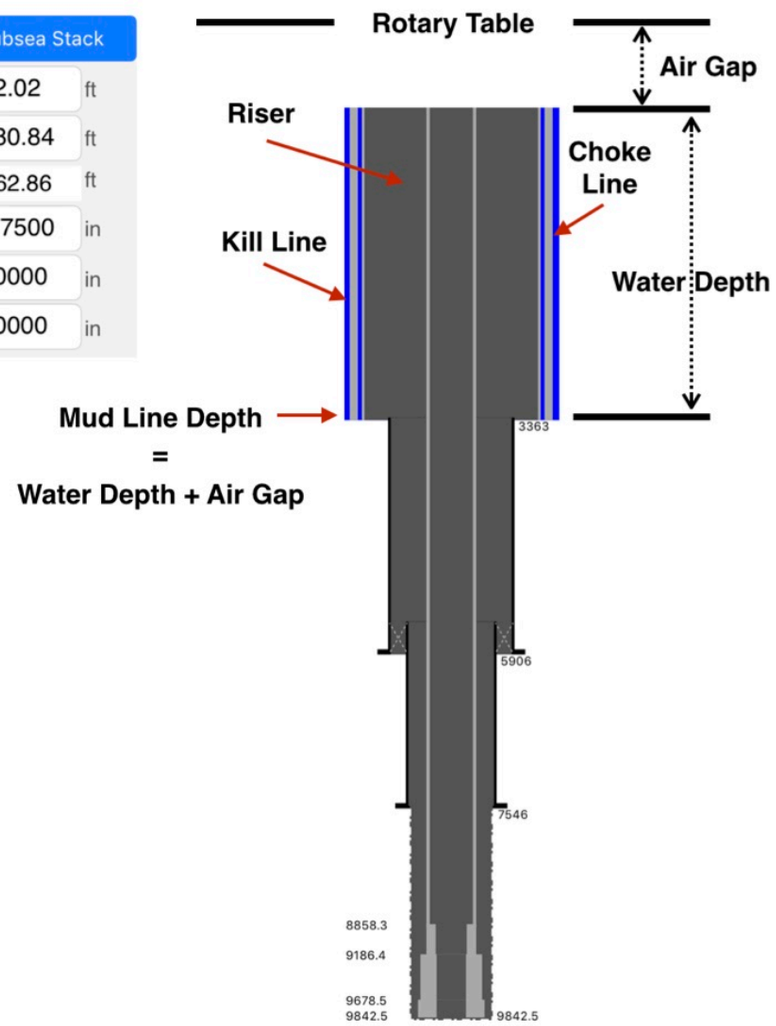


Surface Stack (Land Rigs, Jack-Up Rigs, etc)



Subsea Stack (Semi-Submersible Platform, Drill Ship, etc)

Surface Stack	Subsea Stack	
Air Gap	82.02	ft
Water Length	3280.84	ft
Mud Line Depth	3362.86	ft
Riser ID	19.7500	in
Kill / Choke ID	3.0000	in
Booster Line ID	4.0000	in



Drill String

Edit Drill string labels:

	Section Name	Short
1:	Drill Pipe 1	DP 1
2:	Drill Pipe 2	DP 2
3:	Heavy Weight	HW
4:	Drill Collar 1	DC 1
5:	Drill Collar 2	DC 2

Edit Drill String Sections (iPad on portrait position):

	Length ft	OD in	ID in	Weight lb/ft	Cap Int bbl/ft	Vol Int bbl	Displac bbl/ft	Vol Steel bbl
DP 1	8858.27	5.0000	4.2760	19.50	0.0178	157.35	0.0065	57.79
DP 2	0.00	5.0000	4.2760	19.50	0.0178	0.00	0.0065	0.00
HW	328.08	5.0000	3.0000	49.00	0.0087	2.87	0.0155	5.10
DC 1	492.13	6.2500	2.8125	96.00	0.0077	3.78	0.0303	14.89
DC 2	164.04	6.7500	2.8125	102.00	0.0077	1.26	0.0366	6.00
Bit @	9842.52		Nominal	252.8	kip	165.26		83.78
Float Valve		Hookload	w/ buoyancy factor	215.7	kip	Total		Total

Traveling Assembly Weight		120	kip
Drill String Nominal Weight		252.8	kip
x Buoyancy Factor	0.8534	215.7	kip
Hook Load		335.7	kip

Edit Drill String Sections (iPad on landscape position):

Drill Pipe 1			8858.27	ft
OD	5.0000	ID	4.2760	in
Drill Pipe 2			0.00	ft
OD	5.0000	ID	4.2760	in
Heavy Weight			328.08	ft
OD	5.0000	ID	3.0000	in
Drill Collar 1			492.13	ft
OD	6.2500	ID	2.8125	in
Drill Collar 2			164.04	ft
OD	6.7500	ID	2.8125	in
		Bit @	9842.52	ft

Hookload ✓ Float Valve

Drill String Weight	252.8	kip
w/ buoyancy factor	215.7	kip

	Cap Int bbl/ft	Vol Int bbl	Displac bbl/ft	Vol Steel bbl
DP 1	0.0178	157.35	0.0065	57.79
DP 2	0.0178	0.00	0.0065	0.00
HW	0.0087	2.87	0.0155	5.10
DC 1	0.0077	3.78	0.0303	14.89
DC 2	0.0077	1.26	0.0366	6.00
Total		165.26		83.78

Float Valve

Drill String Float Valve (non-ported)

Float Valves are run to prevent Drilling Fluids from back owing up the Drill String to the surface. It is basically a one way or Downhole Check Valve.
Float Valves may be used for additional Well Control and also to protect high cost tools such as Rotary Steerables, MWD/LWD, etc from Drilling Fluid, Cuttings and Metal Debris owing up the Drill String whilst running in the hole.
They are essential tools on MPD and UBD operations.

Ported type:

Pressure-Monitoring Float Valve has a special port running through of the Float Valve. This Valve is used when monitoring the bit head for gas pressure and allowing differential pressure measuring when required.

Capacities and Volumes

Internal (i) Va + Vi | Cap x L

	Annular Drill Pipe 1 ft	bbl/ft	bbl	Annular Drill Pipe 2 ft	bbl/ft	bbl
Riser	3362.86	0.3789	1252.39	3362.86	0.3547	1192.65
Casing	3937.01	0.0745	267.48	3937.01	0.0502	197.55
Liner						
Hole	2542.65	0.0702	142.31	1558.40	0.0459	71.53

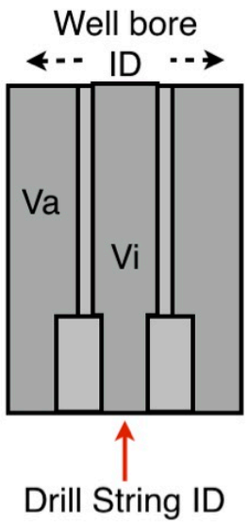
	Annular Heavy Weight ft	bbl/ft	bbl	Annular Drill Collar 1 ft	bbl/ft	bbl	Annular Drill Collar 2 ft	bbl/ft	bbl
Riser		0.3547			0.3410			0.3347	
Casing		0.0502			0.0365			0.0302	
Liner									
Hole	328.08	0.0459	15.06	492.13	0.0322	15.87	164.04	0.0259	4.25

Choke Line	0.0087	bbl/ft	Surface to Bit	174.83	bbl	Riser Annular	1192.65	bbl
	29.40	bbl	Bit to Shoe	106.71	bbl	Total Volume	1782.82	bbl
Booster Line	52.27	bbl	Bit to BOP	304.26	bbl	Bit to Choke	333.67	bbl

MP 1 | MP 2

Surface to Bit	1463	stk	Riser Annular	9980	stk	Choke Line	246	stk
0.1195 bbl/stk	Bit to Shoe	893	stk	Bit to BOP	2546	stk	Bit to Choke	2792	stk

Internal Volume (just volume of fluid)
Calculated without the steel volume (drill string)

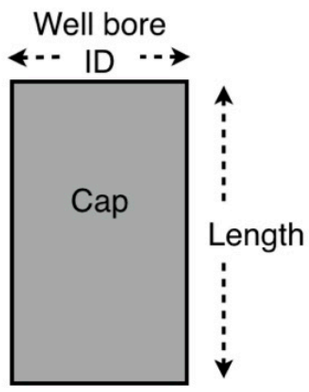


Internal	Va + Vi	Cap x L
ft	bbl/ft	bbl
Riser 3362.86	0.3789	1250.08
Casing 2214.57	0.1497	316.54
Liner 1968.50	0.0745	133.74
Hole 2296.59	0.0702	126.64

Vol = Va + Vi

Total Internal Volume
(volume of fluid + volume of steel)

Internal	Va + Vi	Cap x L
ft	bbl/ft	bbl
Riser 3362.86	0.3789	1274.33
Casing 2214.57	0.1497	331.60
Liner 1968.50	0.0745	146.58
Hole 2296.59	0.0702	161.20



Vol = Cap x Length

Strokes Calculations

Surface To Bit	Volume bbl	Strokes stk
Surface Lines	9.57	80
Drill String	184.09	1540
	193.67	1621

Strokes with Mud Pump #1

MP 1	MP 2	Surface to Bit	1621	stk	Riser Annular	9836	stk	Choke Line	246	stk
0.1195 bbl/stk		Bit to Shoe	798	stk	Bit to BOP	3911	stk	Bit to Choke	4157	stk

Strokes with Mud Pump #2

MP 1	MP 2	Surface to Bit	1276	stk	Riser Annular	7744	stk	Choke Line	194	stk
0.1518 bbl/stk		Bit to Shoe	629	stk	Bit to BOP	3079	stk	Bit to Choke	3273	stk

Mud (Drilling Fluid)

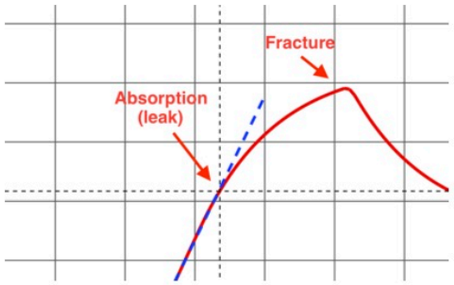
This app works just with parameters used in the hydraulics calculations:

-> Mud Weight, Plastic Viscosity, Yield Point and Initial Gel

Mud Weight	9.60	ppg	MW Gradient	0.4987	psi/ft
Plastic Viscosity	15.0	cP	@ 300 rpm	25	Direct Reading Viscometer:
Yield Point	10.0	lb/100ft2	@ 600 rpm	40	- YP in lb/100ft2 - PV in cP
Initial Gel	5.0	lb/100ft2			
Sea Water Density	8.50	ppg	Rheological Model	Power / Bingham	

Fracture and Absorption Gradients

The Absorption Gradient is the Leak Gradient detected on the LOT (Leak-Off Test)



On Mud & Gradients view:

Formation Data @ Shoe Depth					
	Absorption Gradient	14.30	ppg	0.7429	psi/ft
	Fracture Gradient	14.80	ppg	0.7688	psi/ft
	Porosity	35.0	%	Permeability 100	mD

Equipments

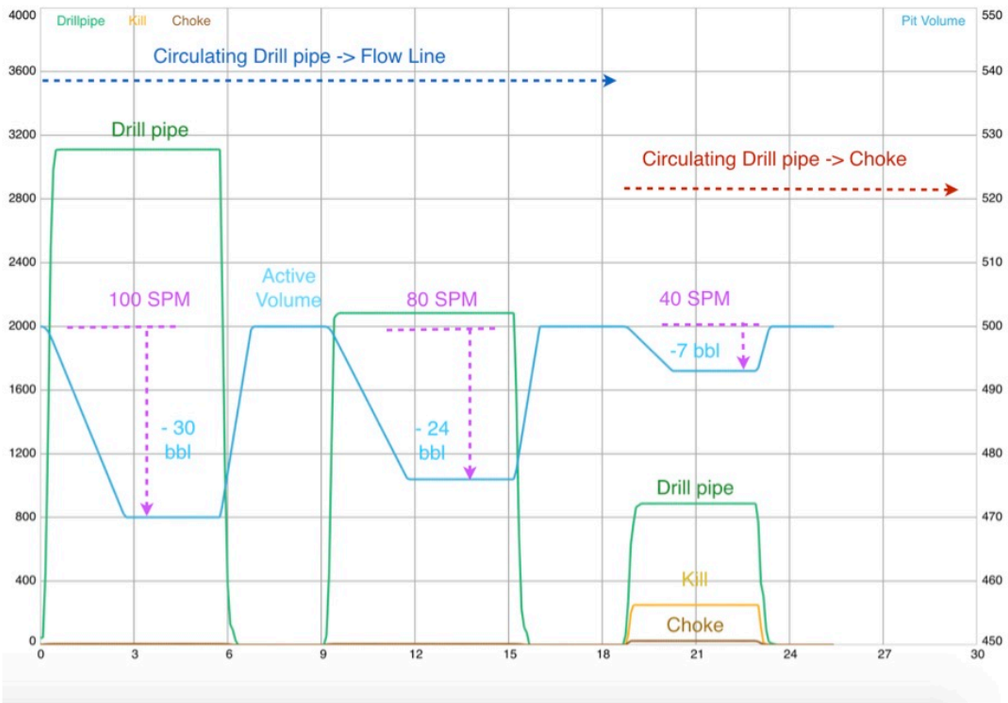
Chokes 1 & 2 Diameter, Max	1.5000		in
Chokes 1 & 2 Coefficient	65.0		%
BOP Test Pressure	5000		psi
Vol to Close	25	to Open 30	gal
Active Pit Capacity	700.00		bbl
Active Pit Volume	500.00		bbl
Surface Circulation Volume:			
Circ. by flowline @ 100 spm	30.00		bbl
Circ. by choke @ 40 spm	7.00		bbl

About the Surface Circulation Volume (SCV):

Surface Circulation Volume = Volume of the flow line, pipes, etc when circulating at the surface.

When occur a kick on the drilling, the driller stops the mud pump and the "Surface Circulation Volume" return to tank.

The calculation of the real volume of the kick = Static Vol. after shut-in the well - Dynamic Volume on drilling - Surface Circulation Volume.



Circulating Drillpipe -> Flow Line

SPM = 0
Static Volume = 500 bbl
SCV = 0 bbl

SPM = 100
Dynamic Volume = 470 bbl
SCV = 30 bbl

SPM = 80
Dynamic Volume = 476 bbl
SCV = 24 bbl

SPM = 40 (mud pump stopped)
Active Volume = 100 bbl
SCV = 0 bbl

Circulating Drillpipe -> Choke

SPM = 0
Static Volume = 500 bbl
SCV = 0 bbl

SPM = 40
Dynamic Volume = 493 bbl
SCV = 7 bbl

Bit Nozzles

BIT NOZZLES

Coefficient	0.9500	
Total Flow Area	0.3313	sq.in

Nozzles | TFA Fixed

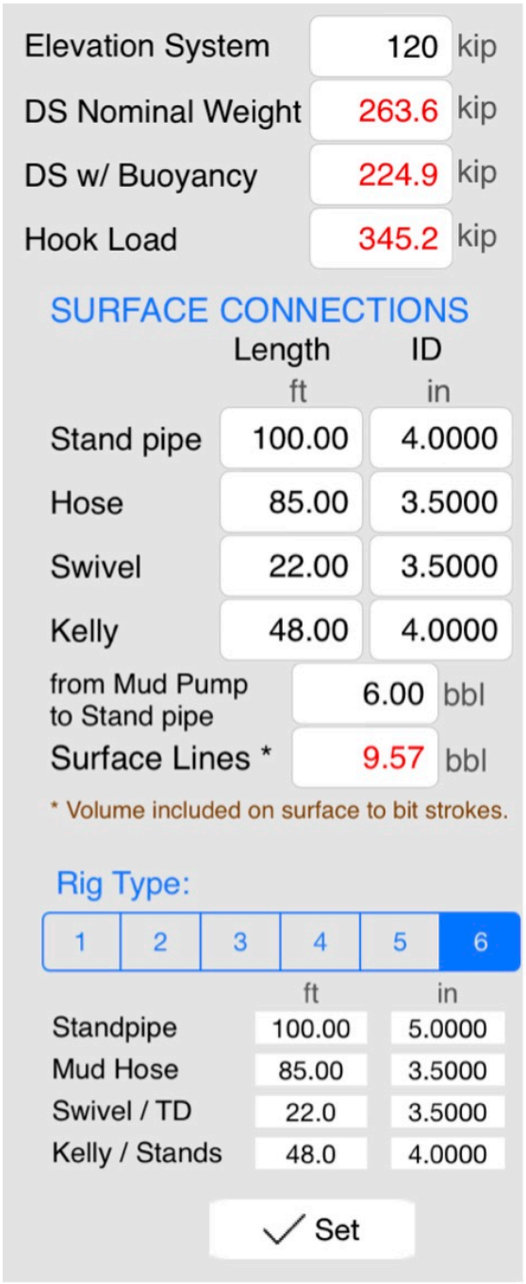
Qty.	Size (1/32) in	mm
1	12	9.5250
1	12	9.5250
1	12	9.5250
0	0	0.0000

Mud Pumps:

MUD PUMPS	#1	#2 / 3*	
Liner Diameter	6.5000	6.5000	in
Max Pressure	4200.0	4200.0	psi
Stroke Length	12.0000	12.0000	in
Rod Diameter	2.0000	2.0000	in
Power	1300.0	1300.0	hp
Efficiency	97.0	97.0	%
Pump Type	Triplex / Duplex	Triplex / Duplex	
Maximum Speed	120	120	spm
True Pump Output	0.1195	0.1195	bbl/stk
	5.0192	5.0192	gal/stk

* Mud Pump #3 used to Booster Line of the riser (Subsea only).

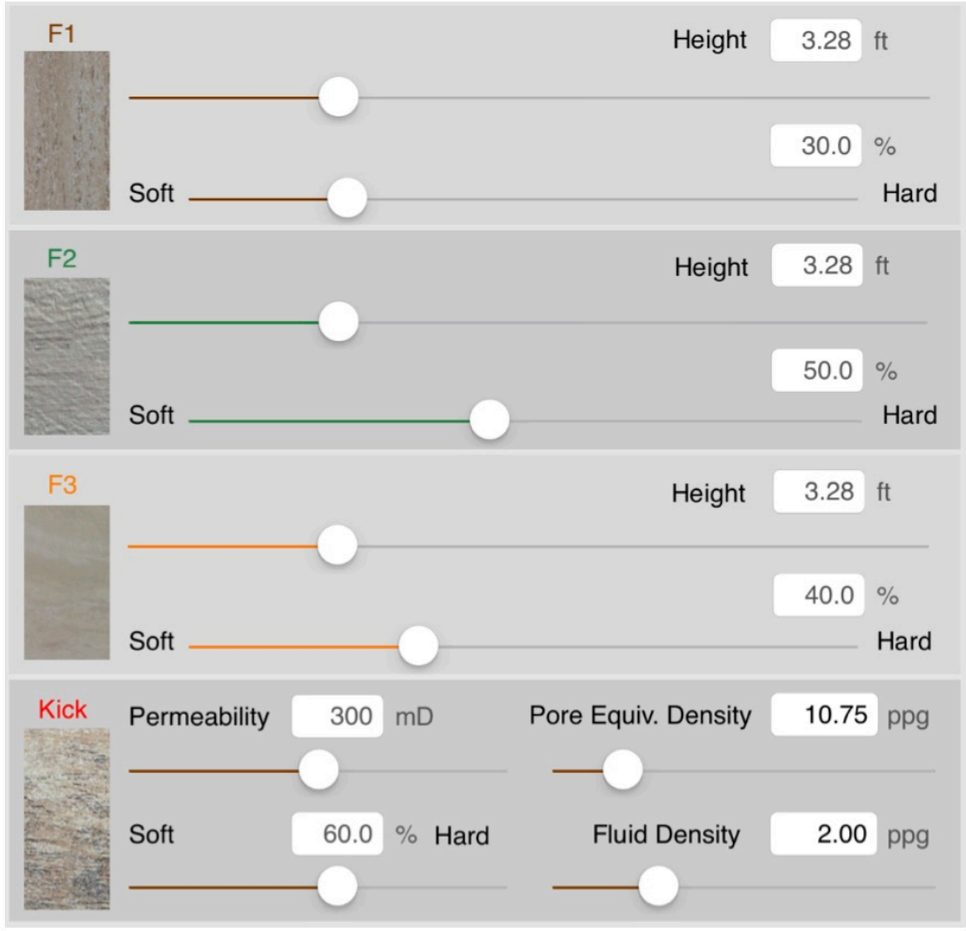
Surface Connections

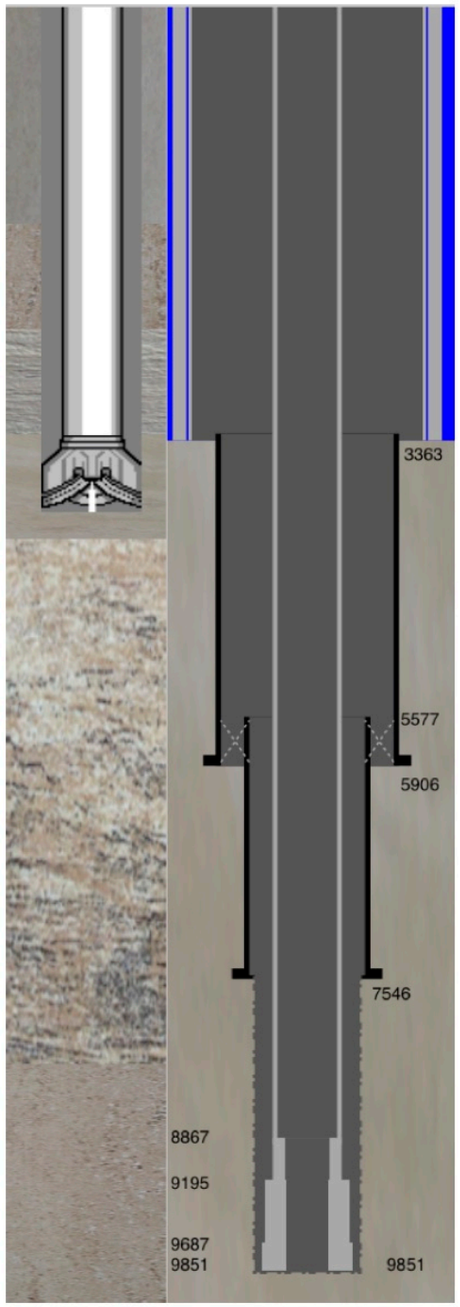


Formations to Drill

Set the height and difficulty to drill (soft to hard 100%) for formations #1, #2 and #3 The last (#4) is a kick formation. Set the parameters:

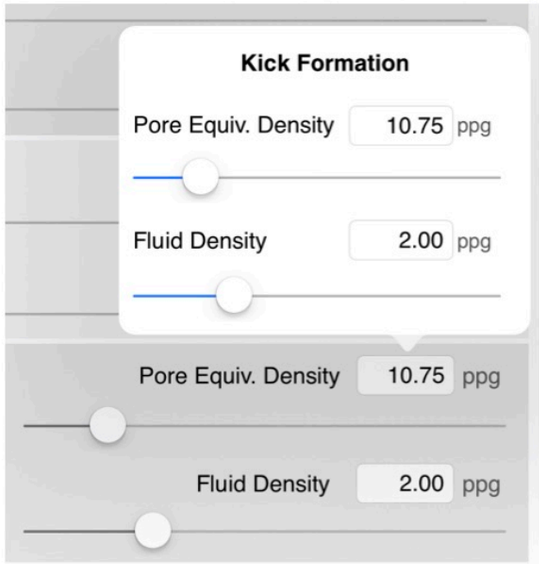
permeability, difficulty to drill (soft to hard 100%), Pore Equivalent density and the fluid density



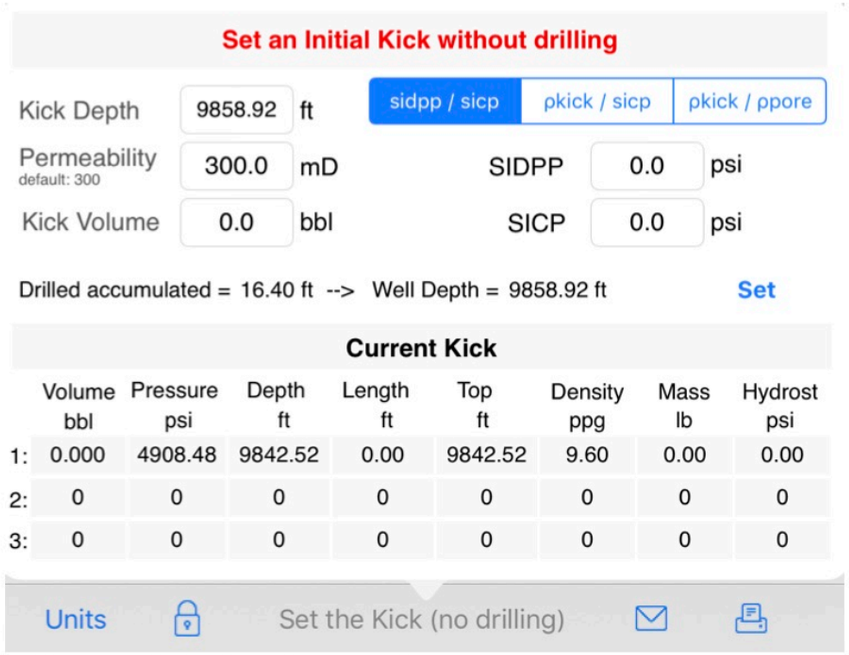


Kick Settings

Set the Pore Equivalent Density and Fluid Density

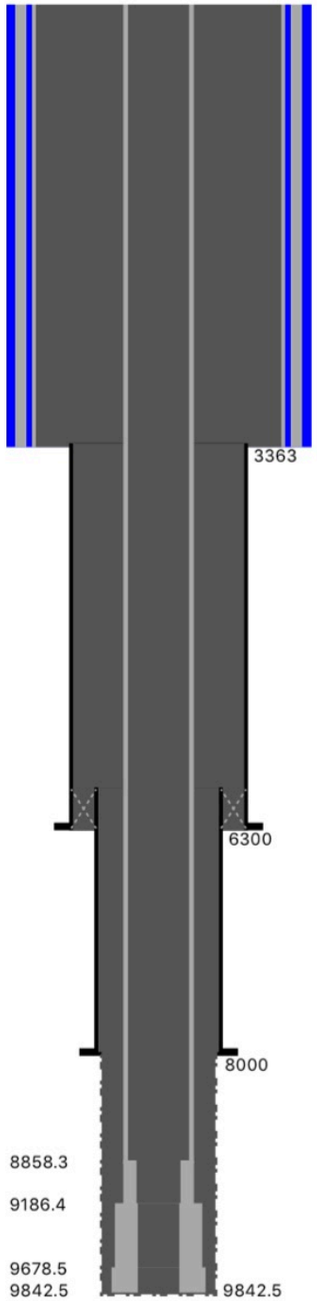


or Set the Kick Data in this view:



Carrier 9:23 PM 100%

Mud & Gradients



Mud Weight	9.60	ppg	MW Gradient	0.4987	psi/ft
Plastic Viscosity	15.0	cP	@ 300 rpm	25	Direct Reading Viscometer:
Yield Point	10.0	lb/100ft2	@ 600 rpm	40	- YP in lb/100ft2 - PV in cP
Initial Gel	5.0	lb/100ft2			
Sea Water Density	8.50	ppg	Rheological Model	Power / Bingham	

Formation Data @ Shoe Depth

Absorption Gradient	14.30	ppg	0.7429	psi/ft
Fracture Gradient	14.80	ppg	0.7688	psi/ft
Porosity	35.0	%	Permeability 100	mD

Temperature Gradient

1.400 F/100ft

Temperature at Surface

28.0	°C	82.4	°F
301.1	K	542.0	°R

Temperature at Mud Line

4.0	°C	39.2	°F
277.1	K	498.9	°R

Buoyancy Factor	0.8534					
Shoe Depth Hydrostatic	3989.6	psi	@ Shoe TVD	8000.00	ft	
Absorption Pressure	5942.9	psi	Max @ surface	1953.2	psi	
Fracture Pressure	6150.7	psi	Max @ surface	2161.0	psi	
Bottom Hole Hydrostatic	4908.5	psi	@ Well TVD	9842.52	ft	
Bottom Hole Temperature	54.4 °C	129.9 °F	327.5 K	589.6 °R		

New Data File.ds3f

Units

Carrier 9:23 PM 100%

Chokes 1 & 2 Diameter, Max	1.5000	in
Chokes 1 & 2 Coefficient	65.0	%
BOP Test Pressure	5000	psi
Vol to Close 25.0 to Open	30.0	gal
Active Pit Capacity	700.00	bbl
Active Pit Volume	500.00	bbl
Surface Circulation Volume:		
Circ. by flowline @ 100 spm	30.00	bbl
Circ. by choke @ 40 spm	7.00	bbl
BIT NOZZLES Coefficient	0.9500	
Total Flow Area	0.3313	sq.in
Volume to Close BOP	45	gal

Nozzles | TFA Fixed

Qty.	Size (1/32) in	mm
1	12	9.5250
1	12	9.5250
1	12	9.5250
0	0	0.0000

Equipments

MUD PUMPS	#1	#2 / 3*	
Liner Diameter	6.5000	6.5000	in
Max Pressure	4200.0	4200.0	psi
Stroke Length	12.0000	12.0000	in
Rod Diameter	2.0000	2.0000	in
Power	1300.0	1300.0	hp
Efficiency	97.0	97.0	%
Pump Type	Triplex / Duplex	Triplex / Duplex	
Maximum Speed	120	120	spm
True Pump Output	0.1195	0.1195	bbl/stk
	5.0192	5.0192	gal/stk

* Mud Pump #3 used to Booster Line of the riser (Subsea only).

Traveling Assembly	120	kip
DS Nominal Weight	253.3	kip
DS w/ Buoyancy	216.2	kip
Hook Load	336.4	kip

SURFACE CONNECTIONS

	Length ft	ID in
Stand pipe	100.00	4.0000
Hose	85.00	3.5000
Swivel	22.00	3.5000
Kelly	48.00	4.0000
from Mud Pump to Stand pipe	6.00	bbl
Surface Lines *	9.57	bbl

* Volume included on surface to bit strokes.

Rig Type: 1 | 2 | 3 | 4 | 5 | 6

	ft	in
Standpipe	100.00	5.0000
Mud Hose	85.00	3.5000
Swivel / TD	22.0	3.5000
Kelly / Stands	48.0	4.0000

Set

New Data File.ds3f

Units

Chapter 8

Pre-Recorded Data

Drilling Simulator 3 — PRE-RECORDED - SURFACE STACK

WELL: | RIG: | DATE: 9 de jun de 2016 | BY:

WELL, FLUID, LOT AND EQUIPMENTS					True Vertical Depth (TVD)		3937.01	ft
					Measured Depth (MD)		3937.01	ft
					Shoe Vertical Depth (TVD,shoe)		2296.59	ft
Active Surface Volume			200.00	bbl	Shoe Measured Detph (MD,shoe)		2296.59	ft
Mud Weight (ρm)	9.60	ppg	0.4987	psi/ft	BOP Test Pressure		5000	psi
Fracture Gradient (ρf)	16.50	ppg	0.8571	psi/ft	Casing Burst Pressure	6330 x 0.80	5064	psi
MAXIMUM STATIC PRESSURES	Maximum Allowable At Surface Pressure, MAASP = 0.0519 x (ρf - ρm) x TVD,sap						823	psi
	Maximum Casing Pressure: IPR = Casing Burst Pressure x DF (DF = 1/Design Factor)						7912	psi
	Maximum BOP Pressure = BOP Test Pressure						5000	psi
	Maximum Equipment Pressure: Smaller of (Maximum Casing or Maximum BOP)						5000	psi

LENGTH, CAPACITY AND VOLUMES

Drill String	ID (in)	OD (in)	Cv,i (bbl/ft)	L (ft)	Vi (bbl)	Annular	Cv,a (bbl/ft)	L (ft)	Va (bbl)
Drillpipe, DP1	4.2760	5.0000	0.0178	2985.56	53.03	Open Hole - DC2	0.0259	164.04	4.25
Drillpipe, DP2	4.2760	5.0000	0.0178			Open Hole - DC1	0.0322	459.32	14.81
Heavy Weight, HW	3.0000	5.0000	0.0087	328.08	2.87	Open Hole - HW	0.0459	328.08	15.06
Drill Collar, DC1	2.8125	6.2500	0.0077	459.32	3.53	Open Hole - DP2	0.0459		
Drill Collar, DC2	2.8125	6.7500	0.0077	164.04	1.26	Open Hole - DP1	0.0459	688.98	31.63
Total Drill String				**3937.01**	**60.69**	**Total Open Hole**		**1640.42**	**65.75**
WellBore	**ID (in)**	**OD (in)**	**Cv,i (bbl/ft)**	**L (ft)**	**Vi (bbl)**	Liner - DP2			
Open Hole	8.5000		0.0702	1640.42	115.14	Liner - DP1			
Liner						Casing - DP2	0.0502		
Casing	8.7550	9.6250	0.0745	2296.59	171.01	Casing - DP1	0.0502	2296.59	115.24

Cv,i = ID^2 / 1029.4147 Vi = Cv,i x L Cv,a = (BoreD^2 - OD^2) / 1029.4147 Va = Cv,a x L

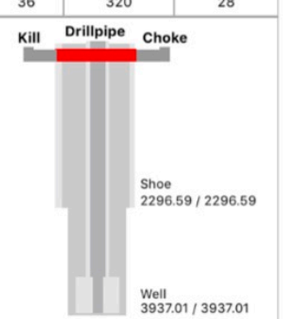
MUD PUMPS δmp = δ x ε SPM = Flow / (42.00 x δmp)

Nº	δ (bbl/stk)	ε (%)	δmp (bbl/stk)	100.0 gpm	150.0 gpm
PUMP 1	0.1027	97.0	0.0996	24	36
PUMP 2	0.1027	97.0	0.0996	24	36

SLOW CIRCULATION RATE pressure in (psi)

Flow (gpm)	SPM	Pump Pressure	Casing Friction
100.0	24	175	24
150.0	36	320	28

VOLUMES AND STROKES	Vol (bbl)	Stk, MP1	Stk, MP2
Surface Connections	6.00	60	60
Internal Drill String	60.69	609	609
Surface to Bit (Surface Connections + Drill String)	66.69	670	670
Bit to Shoe	65.75	660	660
Bit to BOP	180.98	1817	1817
Bit to Surface	180.98	1817	1817
Drill String + Annular	241.68	2427	2427
Total Active Fluid System Volume	447.68		



Carrier 9:24 PM 100%

Drilling Simulator 3 — PRE-RECORDED - SUBSEA STACK

WELL: | RIG: | DATE: Nov 24, 2016 | BY:

WELL, FLUID, LOT AND EQUIPMENTS	Sea Water Length (Lsw)			3280.84	ft	True Vertical Depth (TVD)	9842.52	ft
	Sea Water Density (ρsw)			8.50	ppg	Measured Depth (MD)	9842.52	ft
	Mud Line Depth (Dml)			3362.86	ft	Shoe Vertical Depth (TVD,shoe)	8000.00	ft
	Mud Weight (ρm)	9.60	ppg	0.4987	psi/ft	Shoe Measured Detph (MD,shoe)	8000.00	ft
	Fracture Gradient	14.80	ppg	0.7688	psi/ft	BOP Test Pressure (Pt,BOP)	5000	psi
	Active Surface Volume			500.0	bbl	Casing Burst Pressure 6330 x 0.80	5064	psi
MAXIMUM STATIC PRESSURES	Maximum Allowable At Surface Pressure, MAASP = 0.0519 x (ρf - ρm) x TVD,sap						2161	psi
	Maximum Casing Pressure: (Burst Pressure x DF) - 0.0519 x (ρm x Dml – 8.50 x Lsw)						4836	psi
	Maximum BOP Pressure = (Pt,BOP) - 0.0519 x (ρm x Dml – 8.50 x Lsw)						4772	psi
* DF = 1 / Design Factor	Maximum Subsea Equipment Pressure: Smaller of (Max Casing or Max BOP)						4772	psi

LENGTH, CAPACITY AND VOLUMES Cv,i = ID^2 / 1029.4147 Vi(bbl)=Cv,i x L Cv,a = (BoreD^2 - OD^2) / 1029.4147 Va (bbl)=Cv,a x L

Drill String	ID (in)	OD (in)	Cv,i (bbl/ft)	L (ft)	Vi (bbl)	Annular	Cv,a (bbl/ft)	L (ft)	Va (bbl)
Drillpipe, DP1	4.2760	5.0000	0.0178	8858.27	157.3	Open Hole - DC2	0.0259	164.04	4.3
Drillpipe, DP2						Open Hole - DC1	0.0322	492.13	15.9
Heavy Weight, HW	3.0000	5.0000	0.0087	328.08	2.9	Open Hole - HW	0.0459	328.08	15.1
Drill Collar, DC1	2.8125	6.2500	0.0077	492.13	3.8	Open Hole - DP2			
Drill Collar, DC2	2.8125	6.7500	0.0077	164.04	1.3	Open Hole - DP1	0.0459	858.27	39.4
Total Drill String				**9842.52**	**165.3**	**Total Open Hole**		**1842.52**	**74.6**
Open Hole	8.5000		0.0702	1842.52	129.3	Liner - DP2			
Liner	8.7550	9.6750	0.0745	2000.00	148.9	Liner - DP1	0.0502	2000.00	100.4
Casing	12.5150	9.6250	0.1522	2637.14	401.3	Casing - DP2			
Riser	19.7500		0.3789	3362.86	1274.3	Casing - DP1	0.1279	2637.14	337.2
Kill / Choke Line	3.0000		0.0087	3362.86	29.4	Riser - DP2			
Booster Line	4.0000		0.0155	3362.86	52.3	Riser - DP1	0.3547	3362.86	1192.7

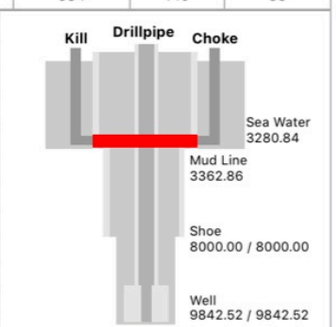
MUD PUMPS δmp = δ x ε SPM = Flow / (42.00 x δmp)

Nº	δ (bbl/stk)	ε (%)	δmp (bbl/stk)	100.0 gpm	150.0 gpm
PUMP 1	0.1232	97.0	0.1195	20	30
PUMP 2	0.1232	97.0	0.1195	20	30

SLOW CIRCULATION RATE pressure in (psi)

Flow (gpm)	SPM	Pump Pressure	Ch Line Loss	Casing Friction
100.0	20	213	72	29
150.0	30	384	140	33

VOLUMES AND STROKES	Vol (bbl)	Stk, MP1	Stk, MP2
Surface Connections (Lines)	9.6	80	80
Internal Drill String	165.3	1383	1383
Surface to Bit (Surface Connections + Drill String)	174.8	1463	1463
Bit to Shoe	74.6	624	624
Bit to BOP	512.1	4286	4286
Choke Line	29.4	246	246
Bit to Choke	541.6	4532	4532
Booster Line	52.3	437	437
Riser Annular	1192.7	9980	9980
Surface+Drill String+Annular+CL+KL+Booster L+Riser Ann	1990.7	16658	16658
Total Active Fluid System Volume	2500.3		



New Data File.ds3f Units Control Methods

Carrier 9:24 PM 100%

PRE-RECORDED - SUBSEA STACK

Drilling Simulator 3

WELL: RIG: DATE: Nov 24, 2016 BY:

WELL, FLUID, LOT AND EQUIPMENTS	Sea Water Length (Lsw)			3280.84	ft	True Vertical Depth (TVD)	9842.52	ft
	Sea Water Density (ρsw)			8.50	ppg	Measured Depth (MD)	9842.52	ft
	Mud Line Depth (Dml)			3362.86	ft	Shoe Vertical Depth (TVD,shoe)	8000.00	ft
	Mud Weight (ρm)	9.60	ppg	0.4987	psi/ft	Shoe Measured Detph (MD,shoe)	8000.00	ft
	Fracture Gradient	14.80	ppg	0.7688	psi/ft	BOP Test Pressure (Pt,BOP)	5000	psi
	Active Surface Volume			500.0	bbl	Casing Burst Pressure 6330 x 0.80	5064	psi

MAXIMUM STATIC PRESSURES	Maximum Allowable At Surface Pressure, MAASP = 0.0519 x (ρf - ρm) x TVD,sap	2161	psi
	Maximum Casing Pressure: (Burst Pressure x DF) - 0.0519 x (ρm x Dml – 8.50 x Lsw)	4836	psi
	Maximum BOP Pressure = (Pt,BOP) - 0.0519 x (ρm x Dml – 8.50 x Lsw)	4772	psi
* DF = 1 / Design Factor	Maximum Subsea Equipment Pressure: Smaller of (Max Casing or Max BOP)	4772	psi

LENGTH, CAPACITY AND VOLUMES Cv,i = ID^2 / 1029.4147 Vi(bbl)=Cv,i x L Cv,a = (BoreD^2 - OD^2) / 1029.4147 Va (bbl)=Cv,a x L

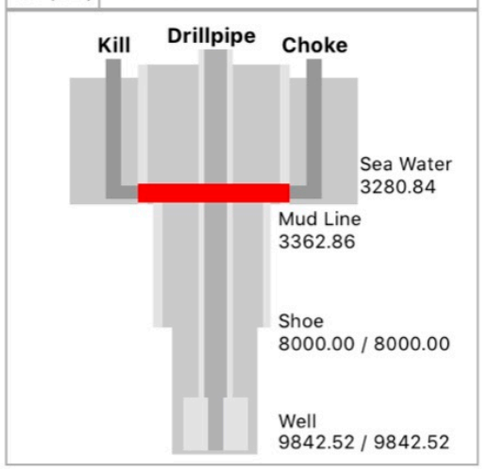
Drill String	ID (in)	OD (in)	Cv,i (bbl/ft)	L (ft)	Vi (bbl)	Annular	Cv,a (bbl/ft)	L (ft)	Va (bbl)
Drillpipe, DP1	4.2760	5.0000	0.0178	8858.27	157.3	Open Hole - DC2	0.0259	164.04	4.3
Drillpipe, DP2						Open Hole - DC1	0.0322	492.13	15.9
Heavy Weight, HW	3.0000	5.0000	0.0087	328.08	2.9	Open Hole - HW	0.0459	328.08	15.1
Drill Collar, DC1	2.8125	6.2500	0.0077	492.13	3.8	Open Hole - DP2			
Drill Collar, DC2	2.8125	6.7500	0.0077	164.04	1.3	Open Hole - DP1	0.0459	858.27	39.4
Total Drill String				**9842.52**	**165.3**	**Total Open Hole**		**1842.52**	**74.6**
Open Hole	8.5000		0.0702	1842.52	129.3	Liner - DP2			
Liner	8.7550	9.6750	0.0745	2000.00	148.9	Liner - DP1	0.0502	2000.00	100.4
Casing	12.5150	9.6250	0.1522	2637.14	401.3	Casing - DP2			
Riser	19.7500		0.3789	3362.86	1274.3	Casing - DP1	0.1279	2637.14	337.2
Kill / Choke Line	3.0000		0.0087	3362.86	29.4	Riser - DP2			
Booster Line	4.0000		0.0155	3362.86	52.3	Riser - DP1	0.3547	3362.86	1192.7

MUD PUMPS δmp = δ x ε SPM = Flow / (42.00 x δmp) **SLOW CIRCULATION RATE** pressure in (psi)

Nº	δ (bbl/stk)	ε (%)	δmp (bbl/stk)	100.0 gpm	150.0 gpm	Flow (gpm)	SPM	Pump Pressure	Ch Line Loss	Casing Friction
PUMP 1	0.1232	97.0	0.1195	20	30	100.0	20	213	72	29
PUMP 2	0.1232	97.0	0.1195	20	30	150.0	30	384	140	33

VOLUMES AND STROKES Stk = Vol / δmp

Surface Connections (Lines)					
Vol (bbl)	9.6	Stk,P1	80	Stk,P2	80
Internal Drill String					
Vol (bbl)	165.3	Stk,P1	1383	Stk,P2	1383
Surface to Bit					
Vol (bbl)	174.8	Stk,P1	1463	Stk,P2	1463
Bit to Shoe					
Vol (bbl)	74.6	Stk,P1	624	Stk,P2	624
Bit to BOP					
Vol (bbl)	512.1	Stk,P1	4286	Stk,P2	4286
Bit to Choke					
Vol (bbl)	541.6	Stk,P1	4532	Stk,P2	4532
Well Circulation					
Vol (bbl)	706.8	Stk,P1	5914	Stk,P2	5914
Riser Annular					
Vol (bbl)	1192.7	Stk,P1	9980	Stk,P2	9980
Total Active Fluid System Volume					
Vol (bbl)	2500.3				



New Data File.ds3f Units Control Methods

SECTION 1

Pre-Recorded Data (Directional Wells) On iPad Pro

Carrier 11:52 PM 100%

Drilling Simulator 3

PRE-RECORDED - SUBSEA STACK

WELL: RIG: DATE: 9 de jun de 2016 BY:

WELL, FLUID, LOT AND EQUIPMENTS	Sea Water Length (Lsw)			1000.00	m	True Vertical Depth (TVD)	2544.29	m
	Sea Water Density (psw)			8.50	ppg	Measured Depth (MD)	3004.21	m
	Mud Line Depth (Dml)			1025.00	m	Shoe Vertical Depth (TVD,shoe)	2142.02	m
	Mud Weight (pm)	9.60	ppg	0.4987	psi/ft	Shoe Measured Detph (MD,shoe)	2225.00	m
	Fracture Gradient	14.80	ppg	0.7688	psi/ft	BOP Test Pressure (Pt,BOP)	5000	psi
	Active Surface Volume			500.0	bbl	Casing Burst Pressure 6330 x 0.80	5064	psi

MAXIMUM STATIC PRESSURES		
	Maximum Allowable At Surface Pressure, MAASP = 0.1704 x (pf - pm) x TVD,sap	1898 psi
	Maximum Casing Pressure: (Burst Pressure x DF) - 0.1704 x (pm x Dml – 8.50 x Lsw)	4836 psi
	Maximum BOP Pressure = (Pt,BOP) - 0.1704 x (pm x Dml – 8.50 x Lsw)	4772 psi
* DF = 1 / Design Factor	Maximum Subsea Equipment Pressure: Smaller of (Max Casing or Max BOP)	4772 psi

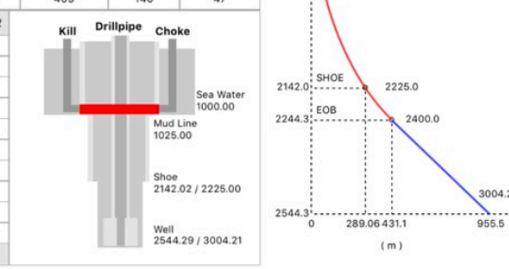
LENGTH, CAPACITY AND VOLUMES Cv,i = ID^2 / 1029.4147 Vi(bbl)=Cv,i x L Cv,a = (BoreD^2 - OD^2) / 1029.4147 Va (bbl)=Cv,a x L

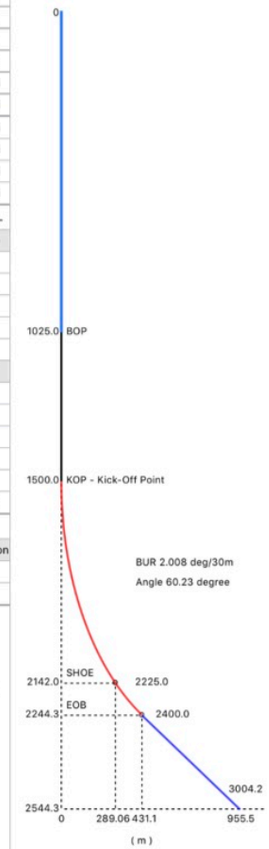
Drill String	ID (in)	OD (in)	Cv,i (bbl/ft)	L (m)	Vi (bbl)	Annular	Cv,a (bbl/ft)	L (m)	Va (bbl)
Drillpipe, DP1	4.2760	5.0000	0.0178	2704.21	157.6	Open Hole - DC2	0.0259	50.00	4.3
Drillpipe, DP2						Open Hole - DC1	0.0322	150.00	15.9
Heavy Weight, HW	3.0000	5.0000	0.0087	100.00	2.9	Open Hole - HW	0.0459	100.00	15.1
Drill Collar, DC1	2.8125	6.2500	0.0077	150.00	3.8	Open Hole - DP2			
Drill Collar, DC2	2.8125	6.7500	0.0077	50.00	1.3	Open Hole - DP1	0.0459	479.21	72.2
Total Drill String				**3004.21**	**165.5**	**Total Open Hole**		**779.21**	**107.3**
Open Hole	8.5000		0.0702	779.21	179.4	Liner - DP2			
Liner						Liner - DP1			
Casing	8.7550	9.6250	0.0745	1200.00	293.2	Casing - DP2			
Riser	19.7500		0.3789	1025.00	1274.3	Casing - DP1	0.0502	1200.00	197.5
Kill / Choke Line	3.0000		0.0087	1025.00	29.4	Riser - DP2			
Booster Line	4.0000		0.0155	1025.00	52.3	Riser - DP1	0.3547	1025.00	1192.7

MUD PUMPS δmp = δ x ε SPM = Flow / (42.00 x δmp) SLOW CIRCULATION RATE pressure in (psi)

Nº	δ (bbl/stk)	ε (%)	δmp (bbl/stk)	100.0 gpm	150.0 gpm	Flow (gpm)	SPM	Pump Pressure	Ch Line Loss	Casing Friction
PUMP 1	0.1232	97.0	0.1195	20	30	100.0	20	234	72	41
PUMP 2	0.1232	97.0	0.1195	20	30	150.0	30	409	140	47

VOLUMES AND STROKES	Vol (bbl)	Stk, MP1	Stk, MP2
Surface Connections (Lines)	9.6	80	80
Internal Drill String	165.5	1385	1385
Surface to Bit (Surface Connections + Drill String)	175.1	1465	1465
Bit to Shoe	107.3	898	898
Bit to BOP	304.9	2551	2551
Choke Line	29.4	246	246
Bit to Choke	334.3	2797	2797
Booster Line	52.3	437	437
Riser Annular	1192.7	9980	9980
Surface+Drill String+Annular+CL+KL+Booster L+Riser Ann	1783.7	14926	14926
Total Active Fluid System Volume	2293.3		





subsea directional 1 eob k3 3.ds3f Units Control Methods

Carrier 11:52 PM 100%

Drilling Simulator 3

PRE-RECORDED - SUBSEA STACK

WELL: RIG: DATE: 9 de jun de 2016 BY:

WELL, FLUID, LOT AND EQUIPMENTS	Sea Water Length (Lsw)			1000.00	m	True Vertical Depth (TVD)	2544.29	m
	Sea Water Density (ρsw)			8.50	ppg	Measured Depth (MD)	3004.21	m
	Mud Line Depth (Dml)			1025.00	m	Shoe Vertical Depth (TVD,shoe)	2142.02	m
	Mud Weight (ρm)	9.60	ppg	0.4987	psi/ft	Shoe Measured Detph (MD,shoe)	2225.00	m
	Fracture Gradient	14.80	ppg	0.7688	psi/ft	BOP Test Pressure (Pt,BOP)	5000	psi
	Active Surface Volume			500.0	bbl	Casing Burst Pressure 6330 x 0.80	5064	psi

MAXIMUM STATIC PRESSURES		
	Maximum Allowable At Surface Pressure, MAASP = 0.1704 x (ρf - ρm) x TVD,sap	1898 psi
	Maximum Casing Pressure: (Burst Pressure x DF) - 0.1704 x (ρm x Dml – 8.50 x Lsw)	4836 psi
	Maximum BOP Pressure = (Pt,BOP) - 0.1704 x (ρm x Dml – 8.50 x Lsw)	4772 psi
* DF = 1 / Design Factor	Maximum Subsea Equipment Pressure: Smaller of (Max Casing or Max BOP)	4772 psi

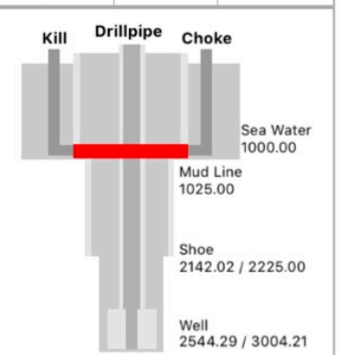
LENGTH, CAPACITY AND VOLUMES Cv,i = ID^2 / 1029.4147 Vi(bbl)=Cv,i x L Cv,a = (BoreD^2 - OD^2) / 1029.4147 Va (bbl)=Cv,a x L

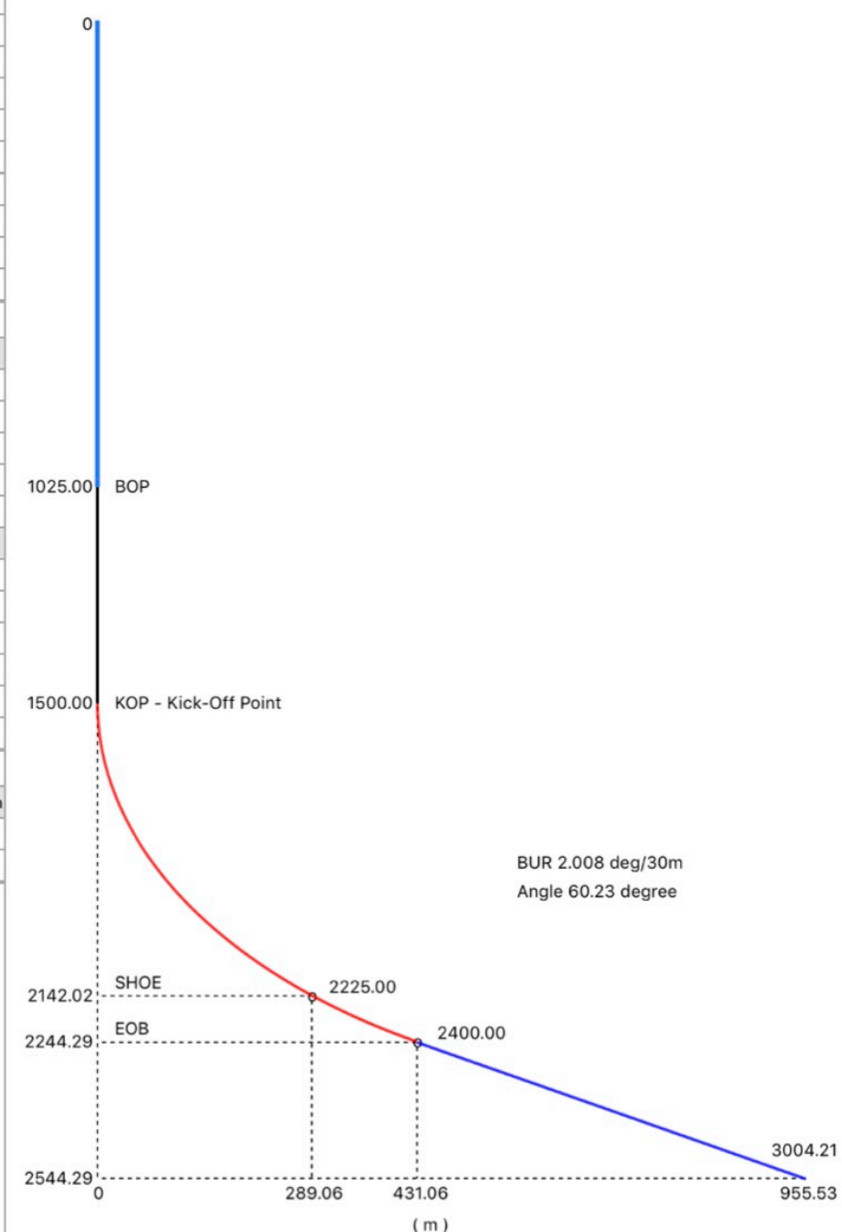
Drill String	ID (in)	OD (in)	Cv,i (bbl/ft)	L (m)	Vi (bbl)	Annular	Cv,a (bbl/ft)	L (m)	Va (bbl)
Drillpipe, DP1	4.2760	5.0000	0.0178	2704.21	157.6	Open Hole - DC2	0.0259	50.00	4.3
Drillpipe, DP2						Open Hole - DC1	0.0322	150.00	15.9
Heavy Weight, HW	3.0000	5.0000	0.0087	100.00	2.9	Open Hole - HW	0.0459	100.00	15.1
Drill Collar, DC1	2.8125	6.2500	0.0077	150.00	3.8	Open Hole - DP2			
Drill Collar, DC2	2.8125	6.7500	0.0077	50.00	1.3	Open Hole - DP1	0.0459	479.21	72.2
Total Drill String				**3004.21**	**165.5**	**Total Open Hole**		**779.21**	**107.3**
Open Hole	8.5000		0.0702	779.21	179.4	Liner - DP2			
Liner						Liner - DP1			
Casing	8.7550	9.6250	0.0745	1200.00	293.2	Casing - DP2			
Riser	19.7500		0.3789	1025.00	1274.3	Casing - DP1	0.0502	1200.00	197.5
Kill / Choke Line	3.0000		0.0087	1025.00	29.4	Riser - DP2			
Booster Line	4.0000		0.0155	1025.00	52.3	Riser - DP1	0.3547	1025.00	1192.7

MUD PUMPS δmp = δ x ε SPM = Flow / (42.00 x δmp) **SLOW CIRCULATION RATE** pressure in (psi)

Nº	δ (bbl/stk)	ε (%)	δmp (bbl/stk)	100.0 gpm	150.0 gpm	Flow (gpm)	SPM	Pump Pressure	Ch Line Loss	Casing Friction
PUMP 1	0.1232	97.0	0.1195	20	30	100.0	20	234	72	41
PUMP 2	0.1232	97.0	0.1195	20	30	150.0	30	409	140	47

VOLUMES AND STROKES	Vol (bbl)	Stk, MP1	Stk, MP2
Surface Connections (Lines)	9.6	80	80
Internal Drill String	165.5	1385	1385
Surface to Bit (Surface Connections + Drill String)	175.1	1465	1465
Bit to Shoe	107.3	898	898
Bit to BOP	304.9	2551	2551
Choke Line	29.4	246	246
Bit to Choke	334.3	2797	2797
Booster Line	52.3	437	437
Riser Annular	1192.7	9980	9980
Surface+Drill String+Annular+CL+KL+Booster L+Riser Ann	1783.7	14926	14926
Total Active Fluid System Volume	2293.3		





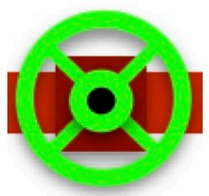
subsea directional 1 eob k3 3.ds3f Units Control Methods

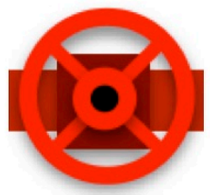
CHAPTER 9

Circulating System

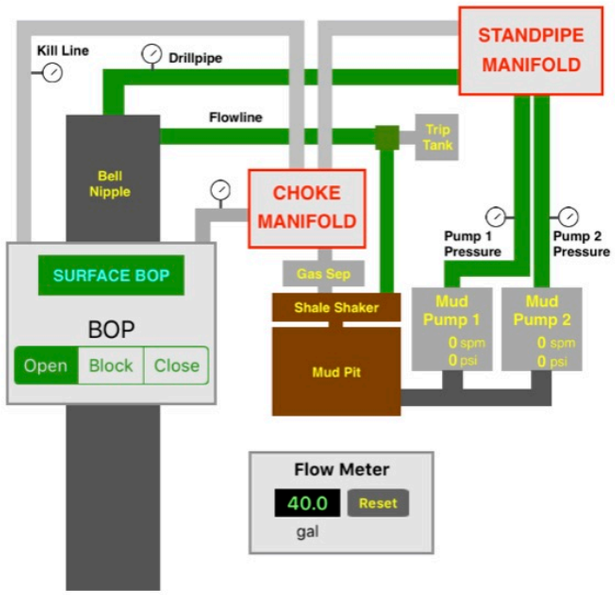
The system is different for wells with surface stack or subsea stack.

1. For rigs with surface stack (land rigs, jack-up rigs, etc) only two mud pumps.
2. For subsea stack (semi-submersible, drill-ship, etc) are 3 mud pumps, with the mud pump #3 only for booster line.
3. This system allows circulation for Drill String or for Kill line only.
4. The return can be by flow line or by choke.
5. Use Standpipe manifold and Choke Manifold to set the path of the circulation.
6. Valves: GREEN -> OPEN and RED -> CLOSED

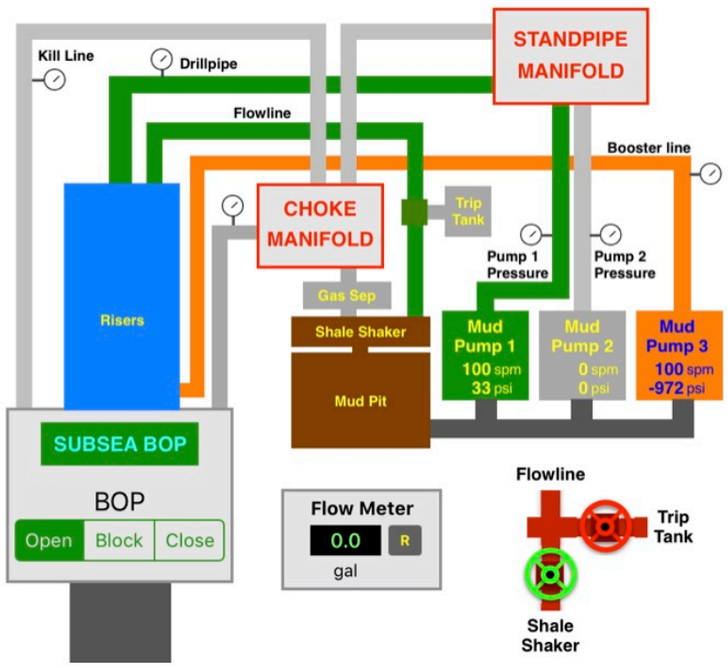




Surface Stack

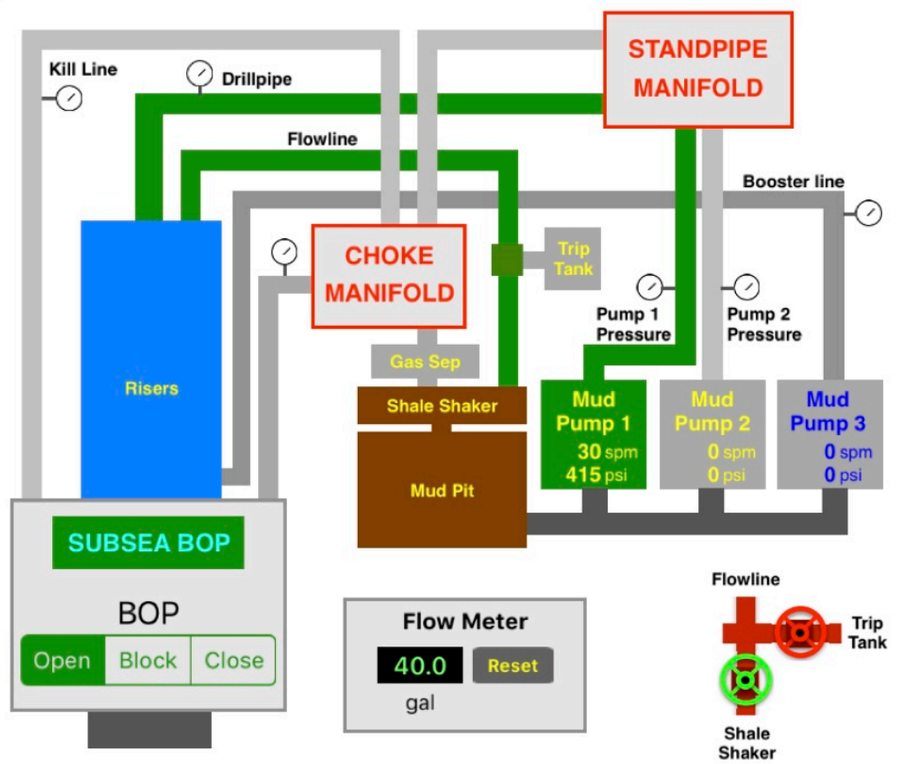


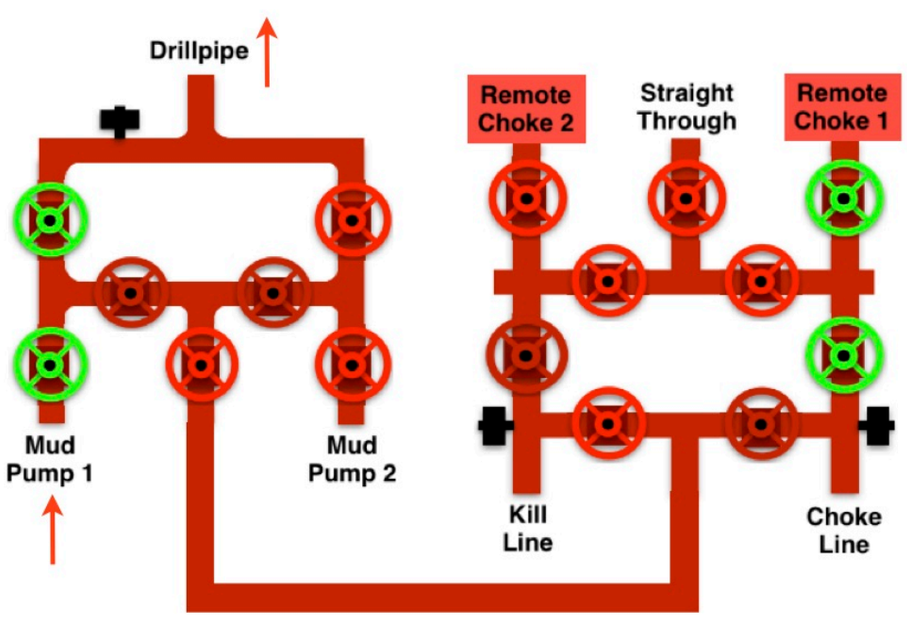
Subsea Stack



Drill String with return by Riser/Flow Line

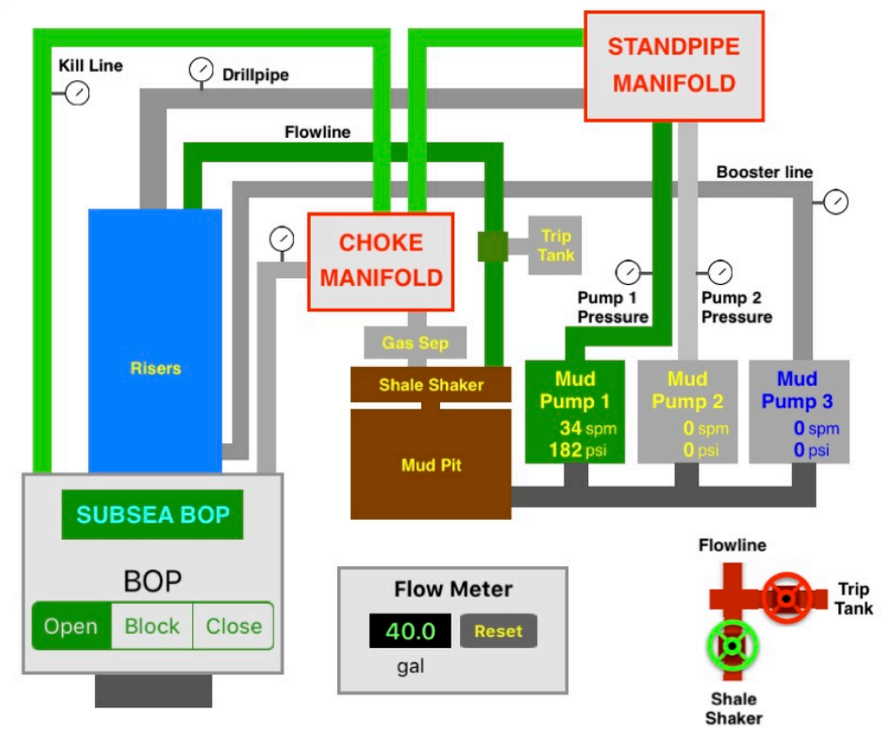
Record the DP Pressure at Slow Circulating Rate.

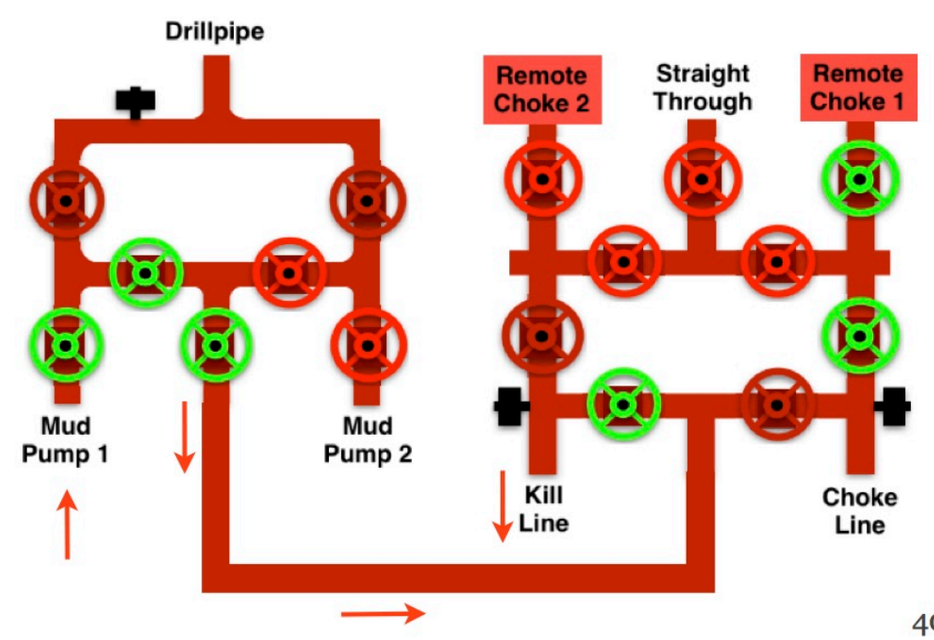




Kill Line with return by Riser/Flow Line

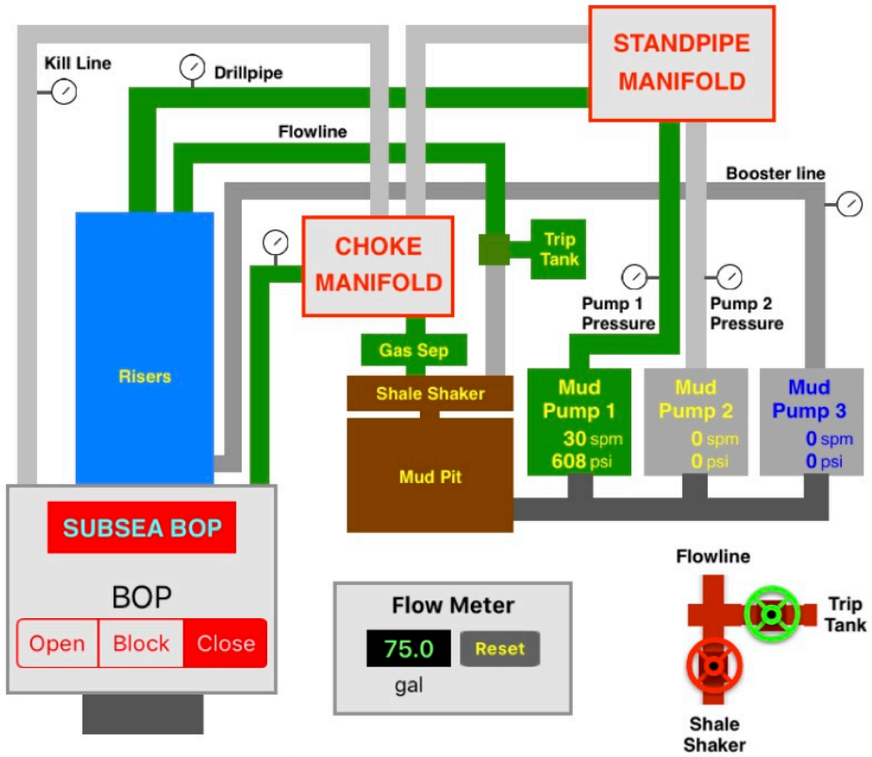
Used to record the Kill/Choke Line Friction Losses at Slow Circulating Rate on Kill Pressure Gauge:

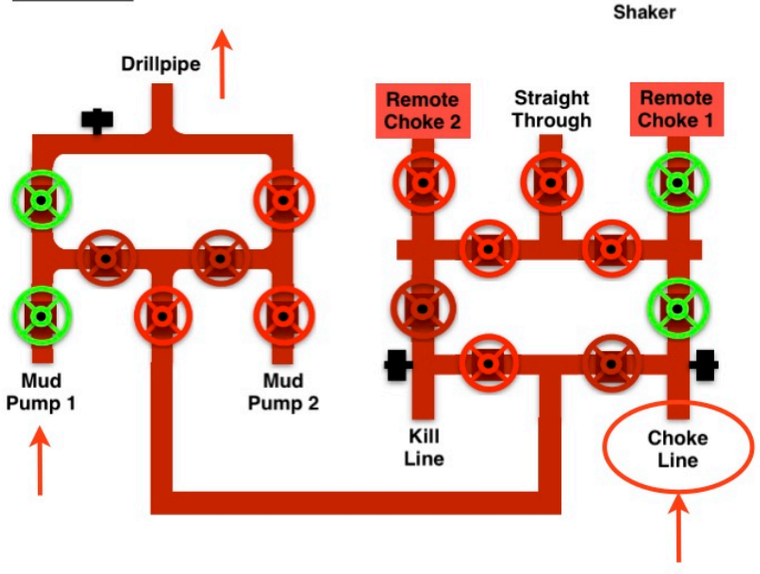




Drill String with return by Choke

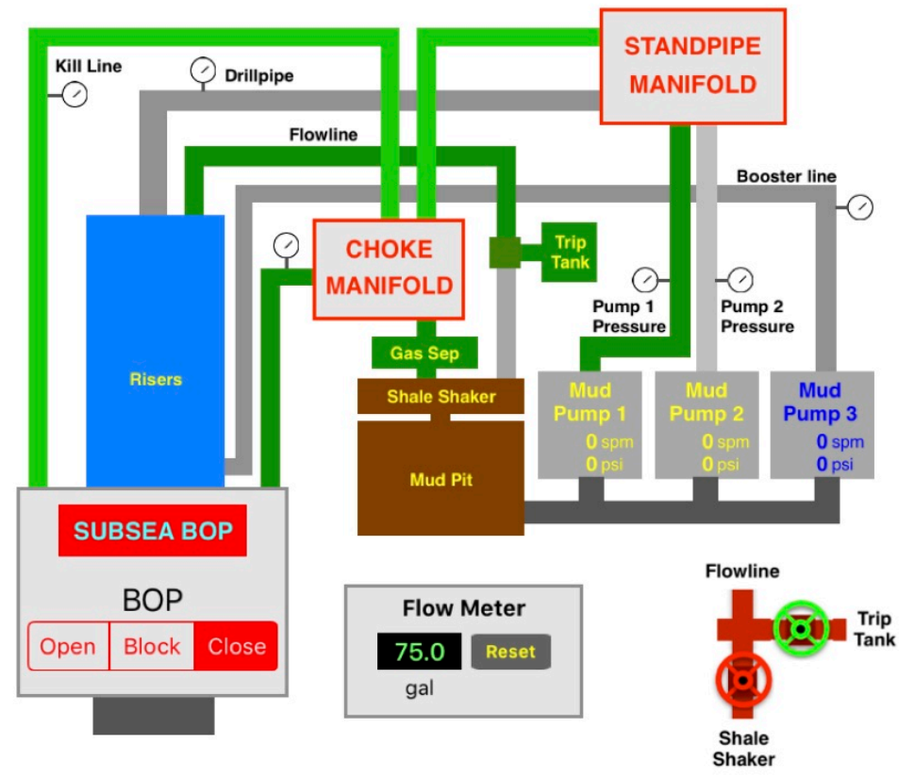
Used normally to Well Control applying the circulation methods: Driller's Method and Weight and Wait method

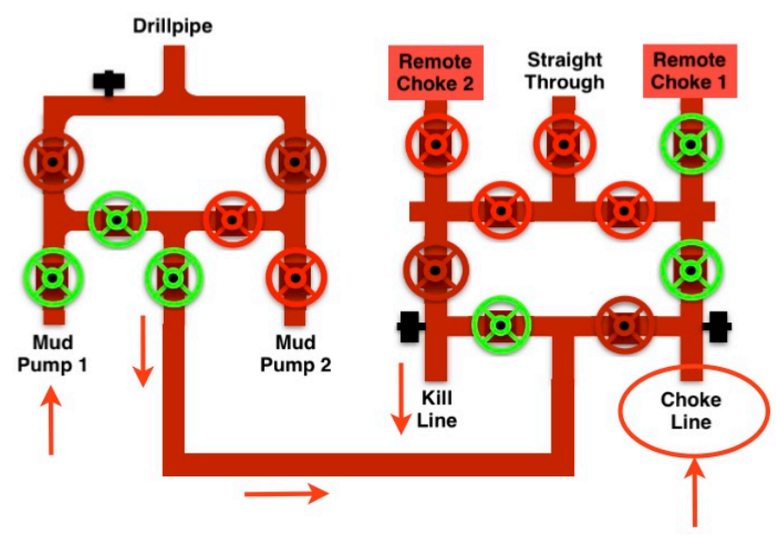




Kill Line with return by Choke

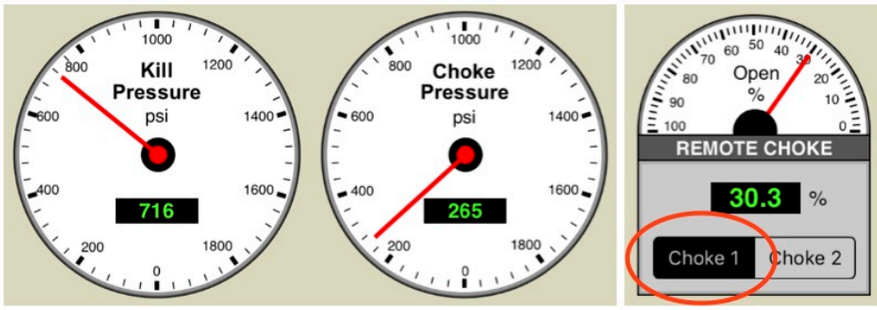
Used to Well Control applying the Dynamic Volumetric Method



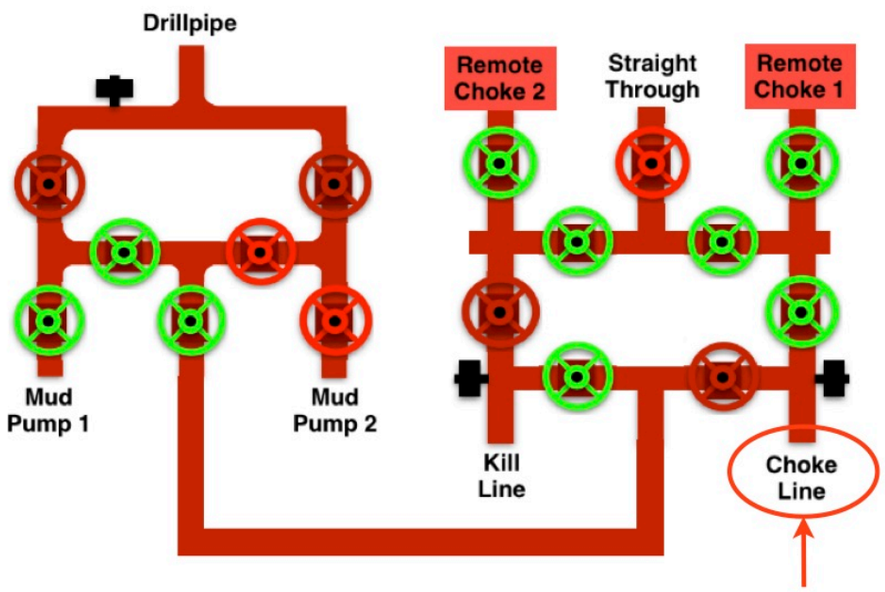


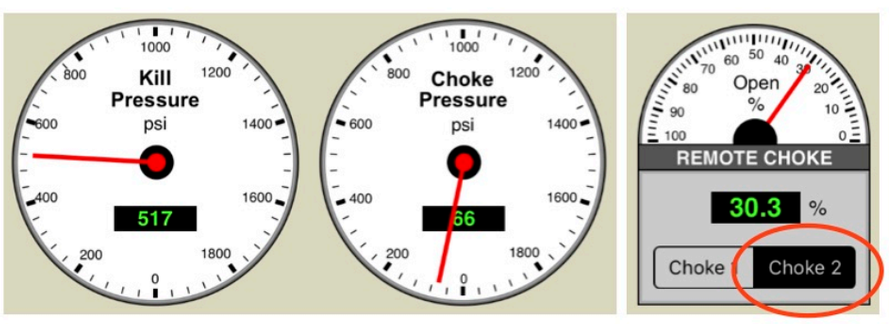
Returning by Chokes

Using choke #1 only:

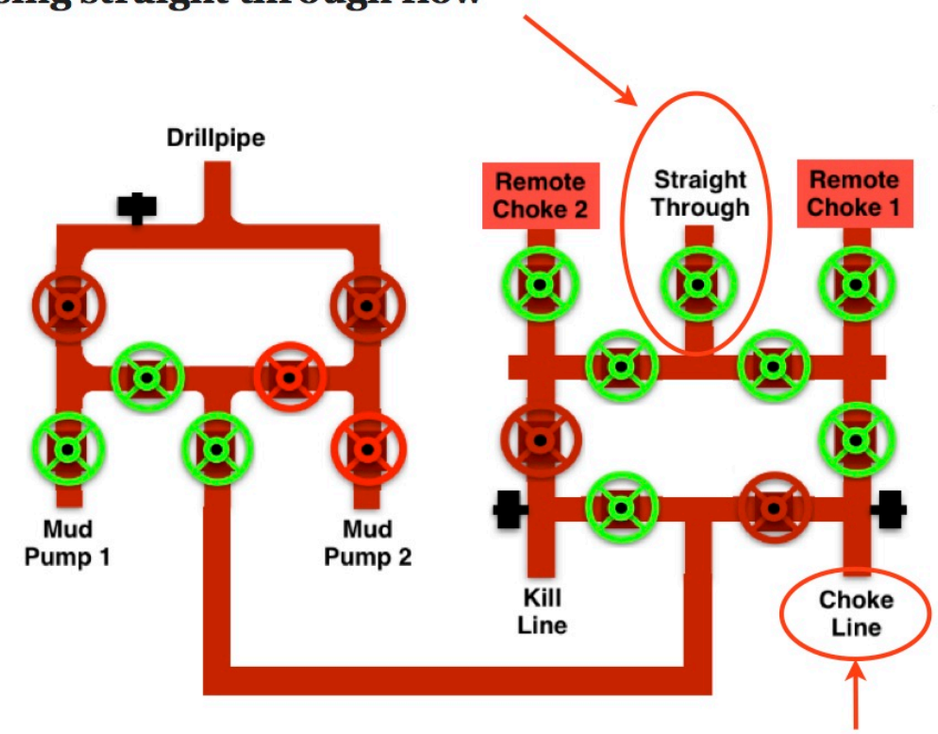


Using two chokes #1 and #2 in parallel



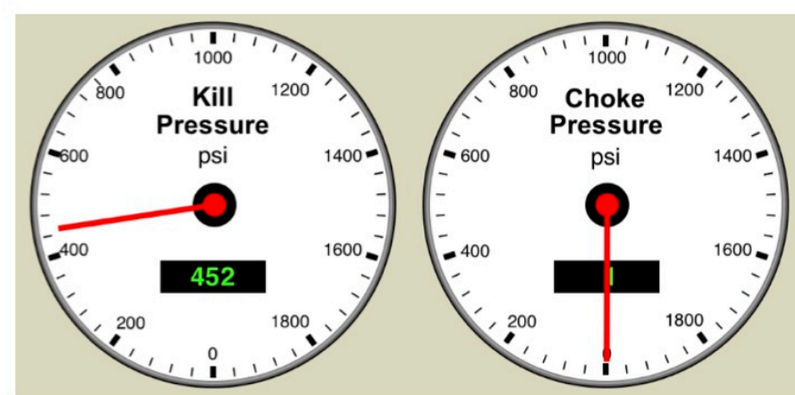


Using straight through flow



Pressure at choke = 0 (zero)

This is very important when recording the choke line friction losses.



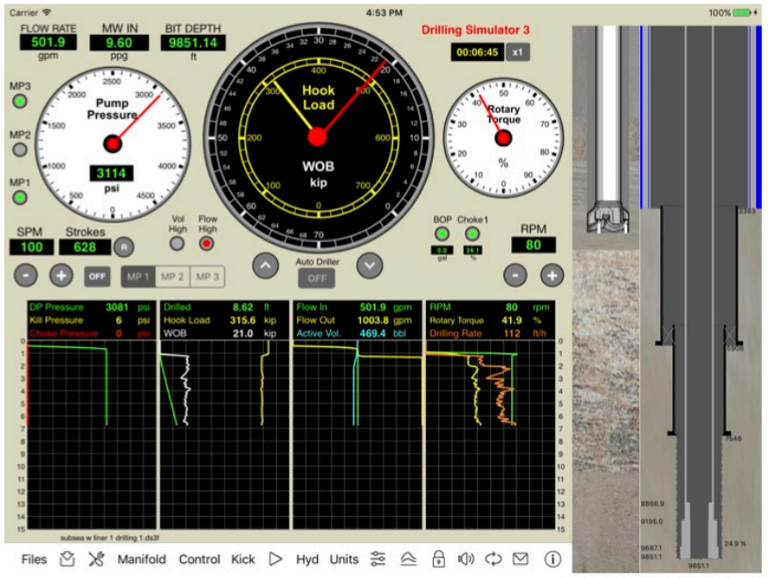
CHAPTER 10

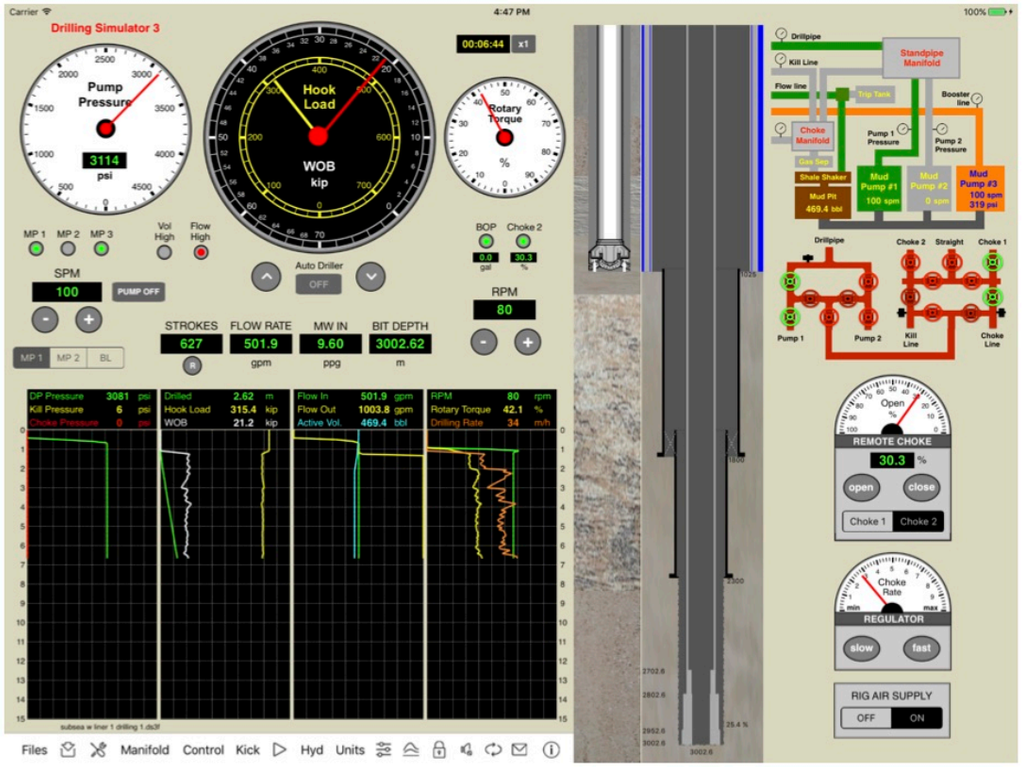
Drilling

Main Interface

iPad x iPad Pro on horizontal position

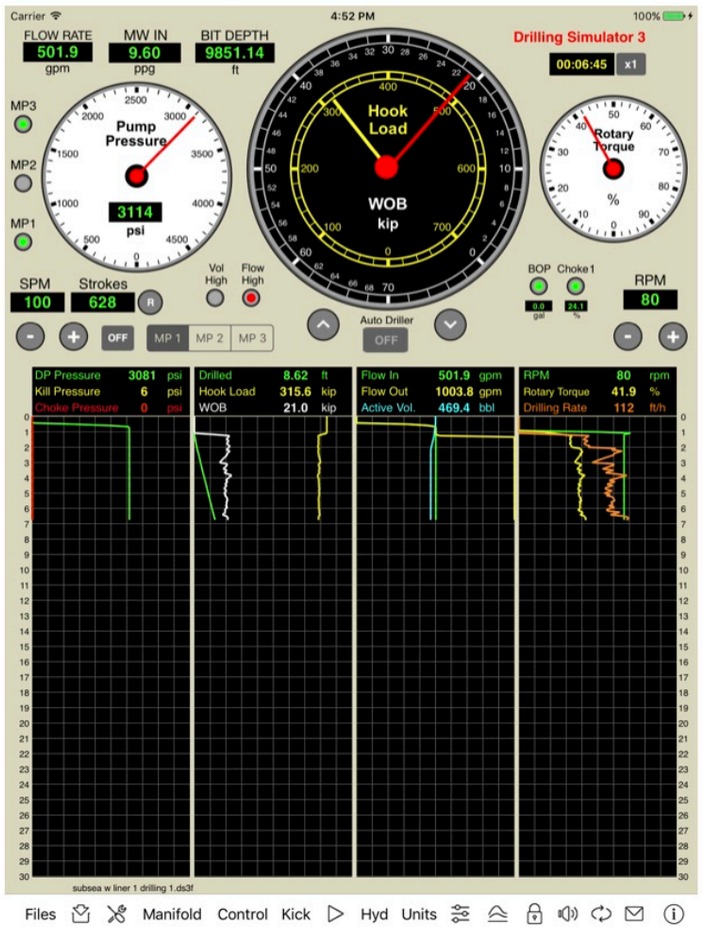
This app is optimized for iPad Pro



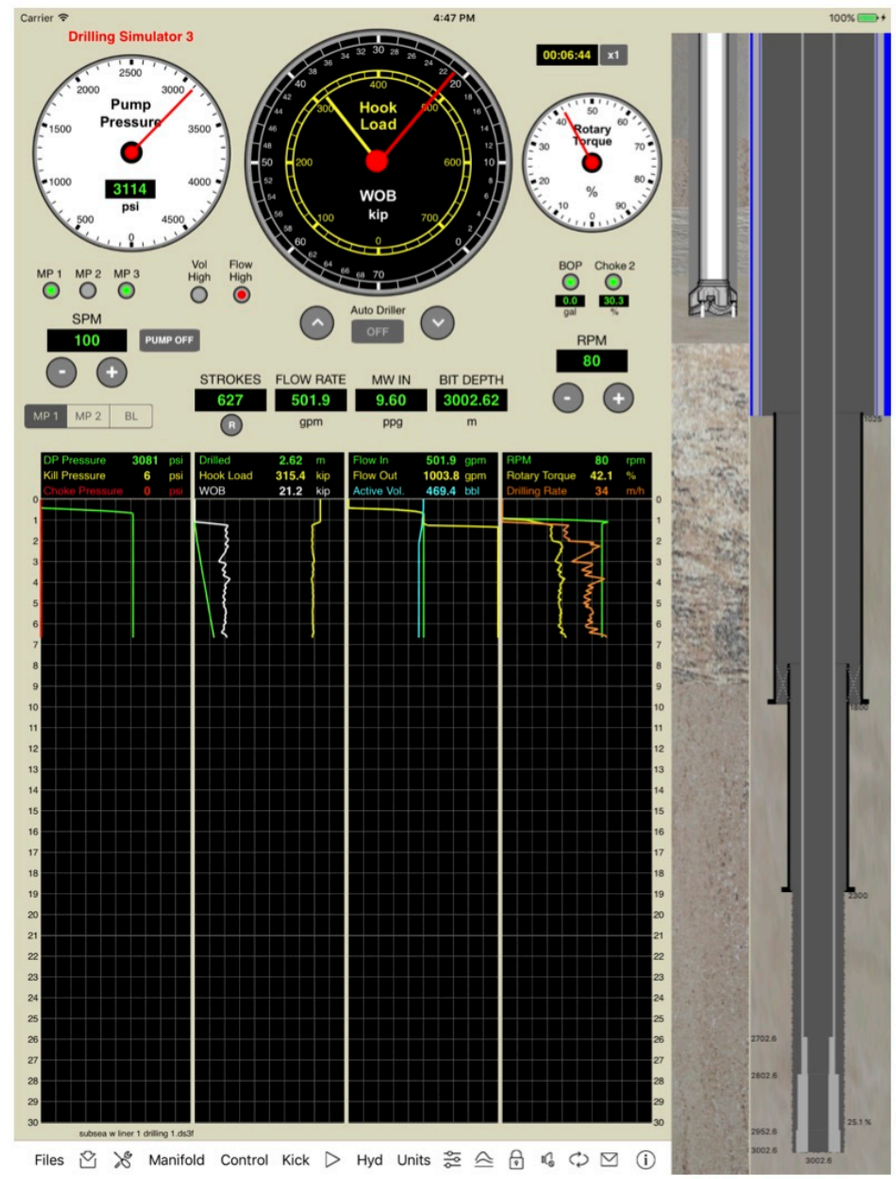


On vertical position

iPad, iPad Air, iPad Mini

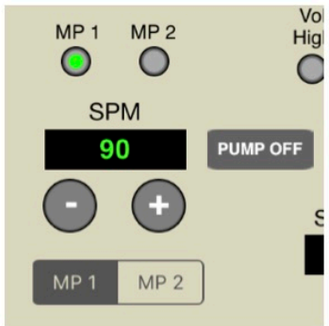


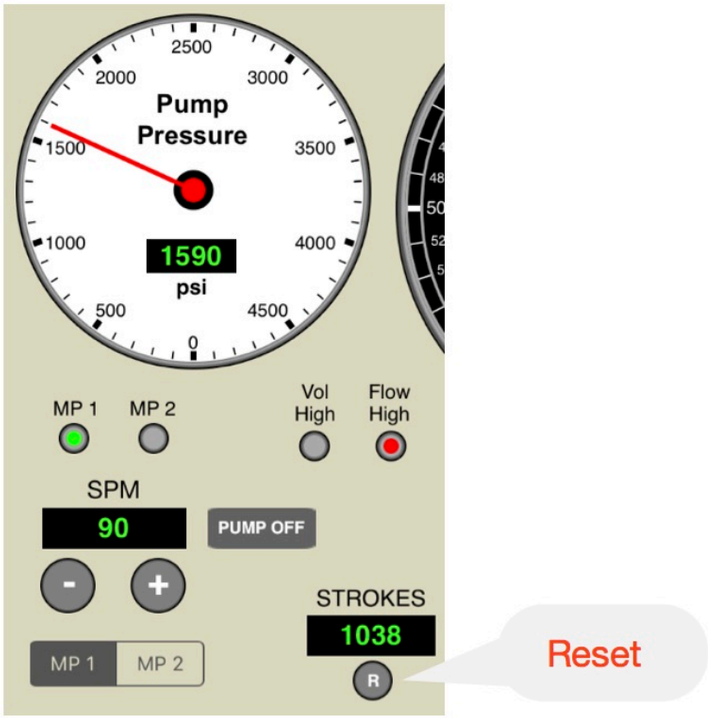
iPad Pro



Selecting Mud Pumps

For wells with surface stack:



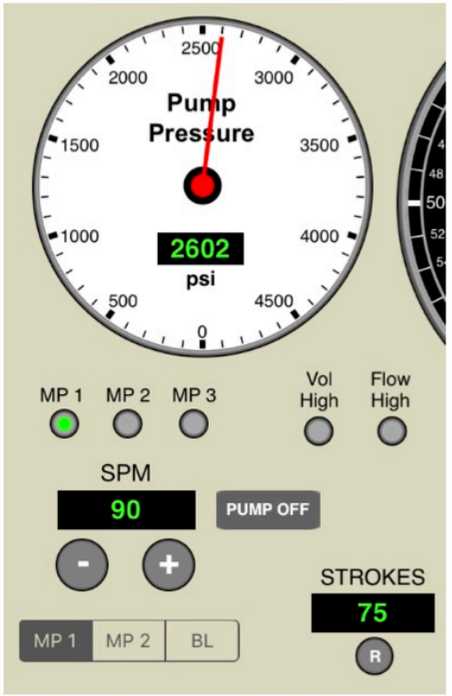


Select MP 1 for Mud Pump #1 and MP 2 for Mud Pump #2.

The color is GREEN for SPM > 0.

Tap on "R" button to reset total strokes.

For wells with subsea stack:



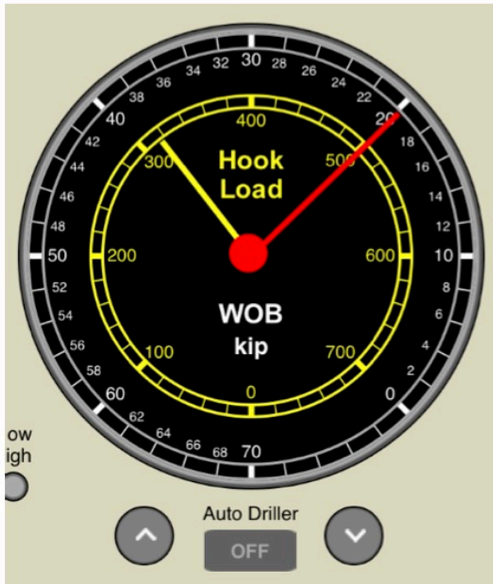
Select MP 1 for Mud Pump #1 and MP 2 for Mud Pump #2.

The color is GREEN for SPM > 0.

The mud pump #3 is for the Booster Line (BL) only.

Set SPM Inc/Dec: Mud Pump Speed Dec/Inc Factor — 5 +

The Weight Indicator



Move Drill-String to Up

- WOB

Tap on OFF button to enable the Auto Driller

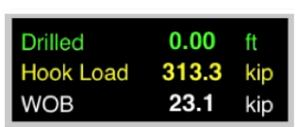
Move Drill-String to Down

+ WOB

Hook Load on Yellow Scale and WOB on White Scale.

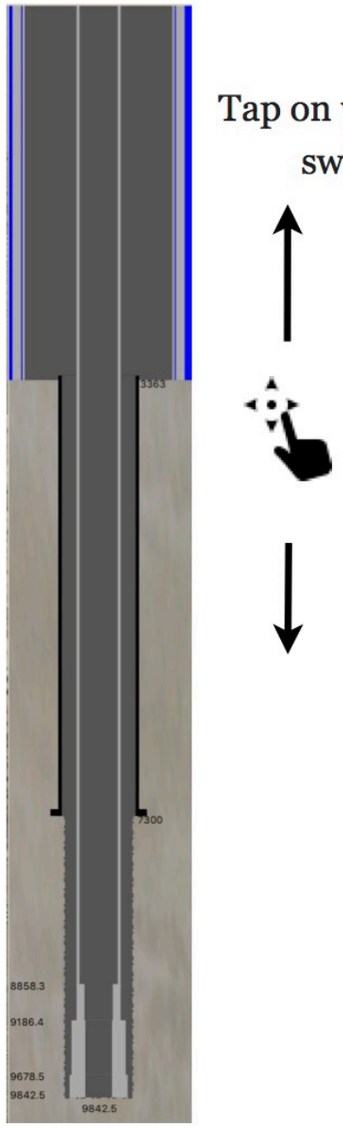
Auto Driller On -> Maintain WOB (Weight On Bit) constant

Digital Values on Graph:



Set Maximum Values:

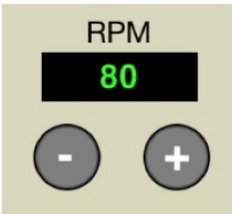
Using Finger Gesture to change the Hookload:



Tap on well schematic with the finger and swipe up / down.

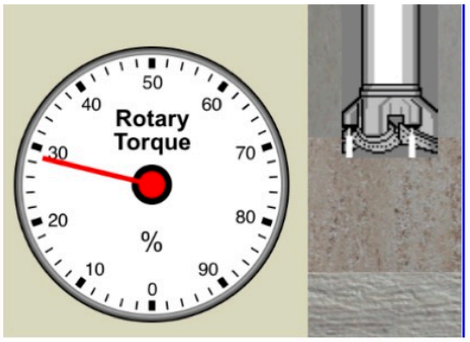
Drill Bit Rotation

Tap on " - " and " + " buttons to set RPM (max = 200 rpm)

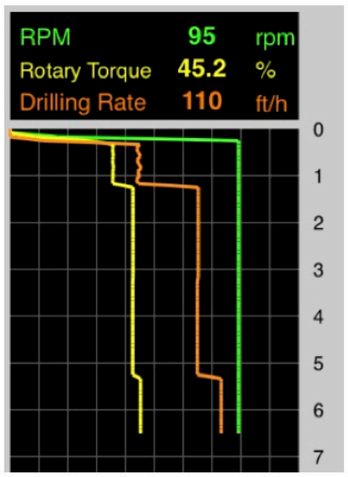


RPM Effects:

1. On Rotary Torque and Drill String Animation

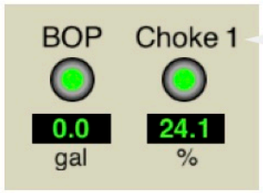


2. On Drilling Rate (ROP - Rate Of Penetration)



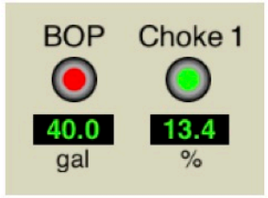
Well Safety Status

GREEN: OPEN

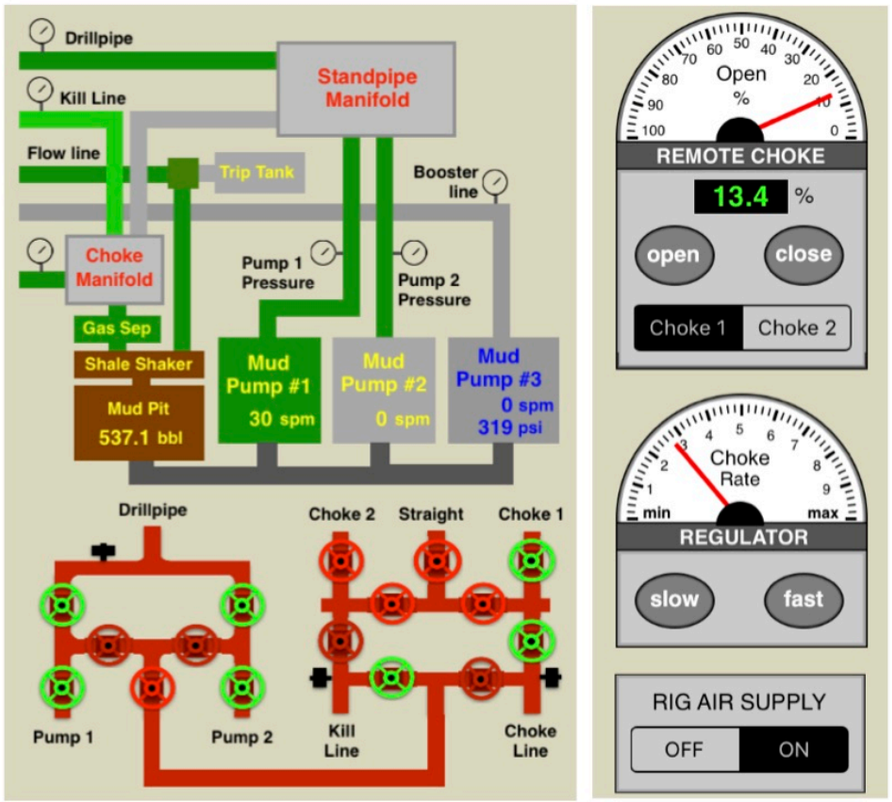


Choke Selected on control

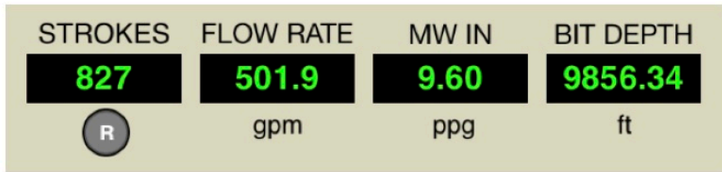
RED: CLOSED



The iPad Pro 12.9-inch version has this PLUS:

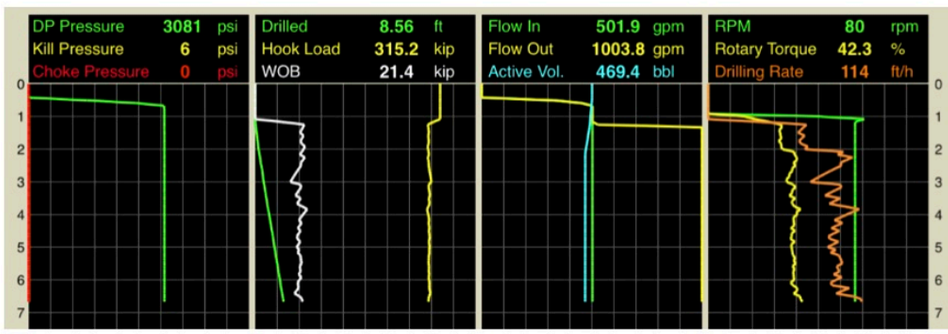


Drilling Parameters



Graph

On Drilling

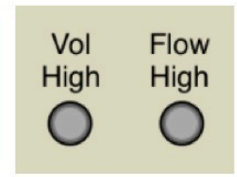


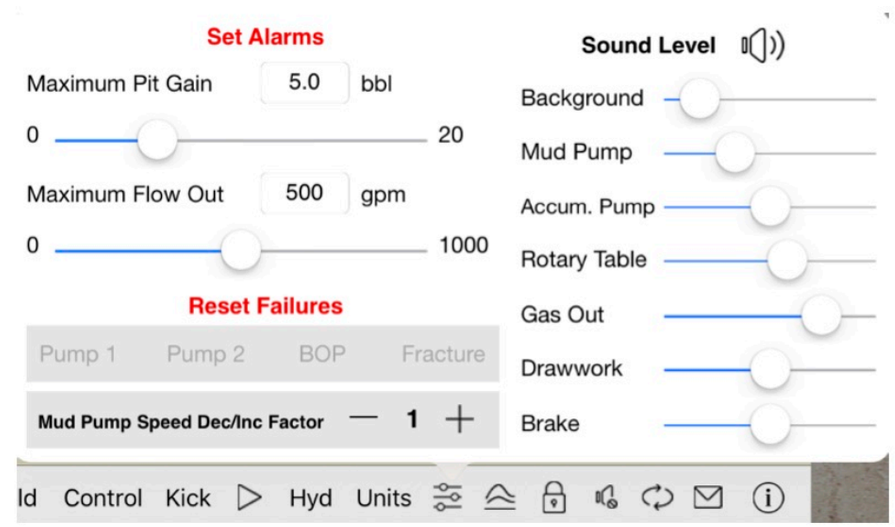
On Kick during drilling

Set Alarms

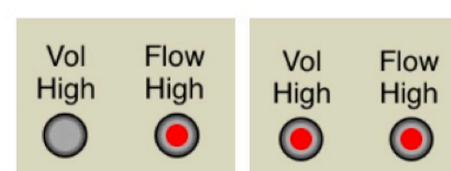
Maximum Pit Vol -> **"Vol High"** alarm

Maximum Flow Out -> **"Flow High"** alarm





On Kick



Informations with Code

Features by request from schools to apply test for students.

Parameters:

1. Lag Time
2. Kick Informations
3. Pressures at the borehole
4. Digital values in gauges
5. Enable Restart/remove buttons
6. Enable Files button (create/open/import)

With codes for ADMIN, INSTRUCTOR and STUDENT

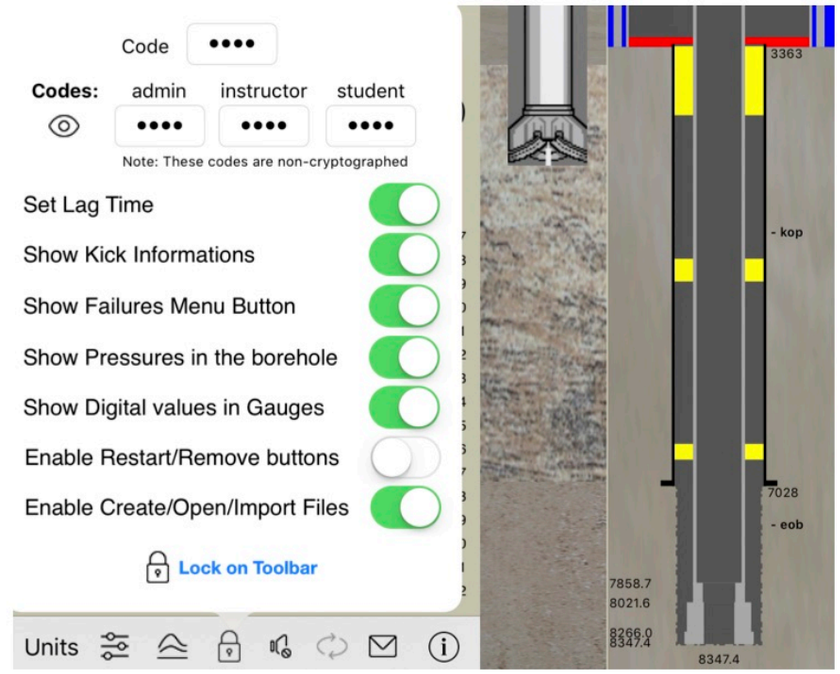
Attention: The Initial codes: "0000"

Notes:

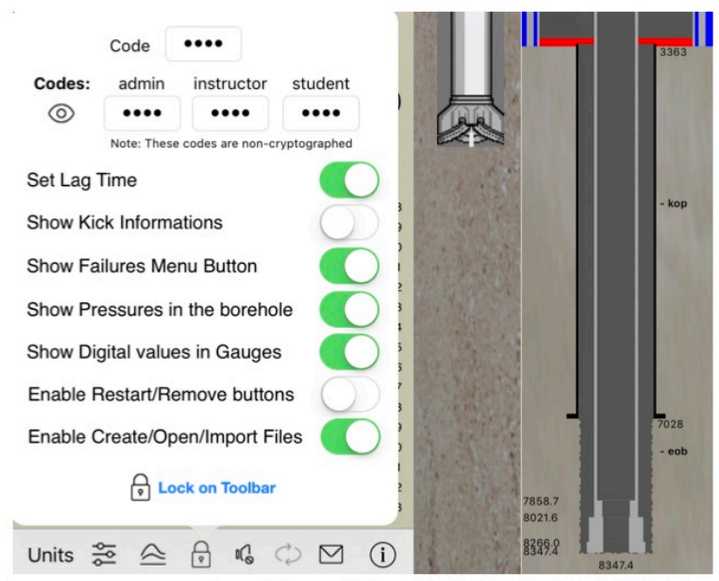
If lose the admin code:

1. Export all data files to iCloud;
2. Delete app on iPad
3. Re-install it from App Store.
4. Use the initial code: "0000"
5. Import data files from iCloud

Kick Informations ON:



Kick Informations OFF:



Hydraulics with "Pressures in the borehole ON":

MP 1	90.0	spm	MP 2	0.0	spm	MP 3	0.0	spm
	451.7	gpm		0.0	gpm	Booster Line	0.0	gpm

Drill Bit			Bottoms-up	139	min
Flow Rate on bit	451.7	gpm	**System Losses**		
Nozzles Loss	1643.6	psi	Surface	24.0	psi
Hydraulic Power	433.2	hp	Drill string	766.3	psi
HHP / Sq. Inch	7.634	hp/sq.in	Annular	141.4	psi
Perc Nozzles Loss	63.8	%	Choke Line	0.0	psi
Jet Velocity	437.5	ft/s	Percent	36.2	%
Force of Impact	979.0	lbf			

Absorption Pressure	5422.8	psi	Max. Kill Press, Abs	1712.6	psi
Fracture Pressure	5612.4	psi	Max. Kill Press, Fract	1902.2	psi
BOP Pressure	1681.8	psi	Max. BOP Pressure	5000.0	psi

	TVD ft	Hydrost psi	Friction psi	Pressure psi	ECD ppg	Critical ppg
Shoe Depth	7299.9	3640.5	74.5	3714.9	9.80	14.30
Bottom Hole	9842.5	4908.5	141.4	5049.9	9.88	9.50
Formation	9842.5			4857.3		

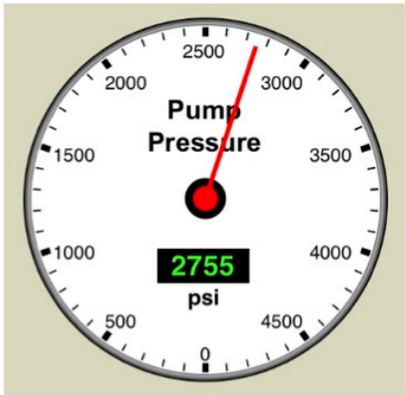
Hydraulics with "Pressures in the borehole OFF":

MP 1	90.0	spm	MP 2	0.0	spm	MP 3	0.0	spm
	451.7	gpm		0.0	gpm	Booster Line	0.0	gpm

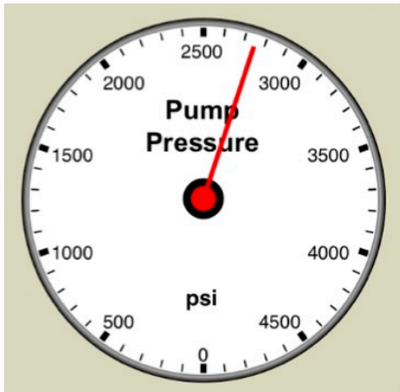
Drill Bit			Bottoms-up	139	min
Flow Rate on bit	451.7	gpm	**System Losses**		
Nozzles Loss	1643.6	psi	Surface	24.0	psi
Hydraulic Power	433.2	hp	Drill string	766.3	psi
HHP / Sq. Inch	7.634	hp/sq.in	Annular	141.4	psi
Perc Nozzles Loss	63.8	%	Choke Line	0.0	psi
Jet Velocity	437.5	ft/s	Percent	36.2	%
Force of Impact	979.0	lbf			

	TVD ft	Hydrost psi		TVD ft	Hydrost psi
Shoe Depth	7299.9	3640.5	Bottom Hole	9842.5	4908.5

Pressure Gauge with "Show Digital Values ON":



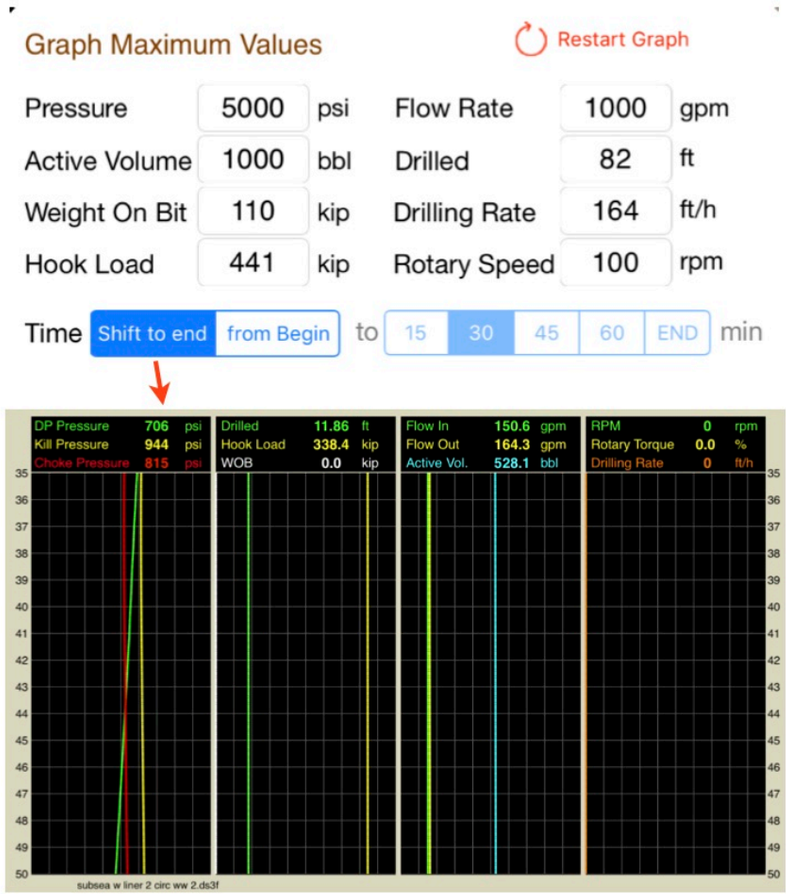
Pressure Gauge with "Show Digital Values OFF":

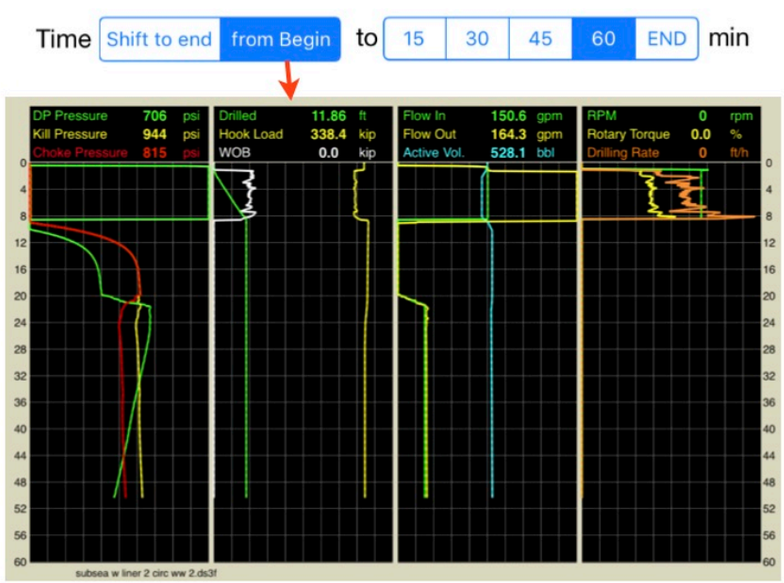


The **Pump Pressure** is the reading at the pump discharge.

For mud pumps aligned to the drill string, the Pump Pressure includes the losses in the line from the mud pump to stand-pipe.

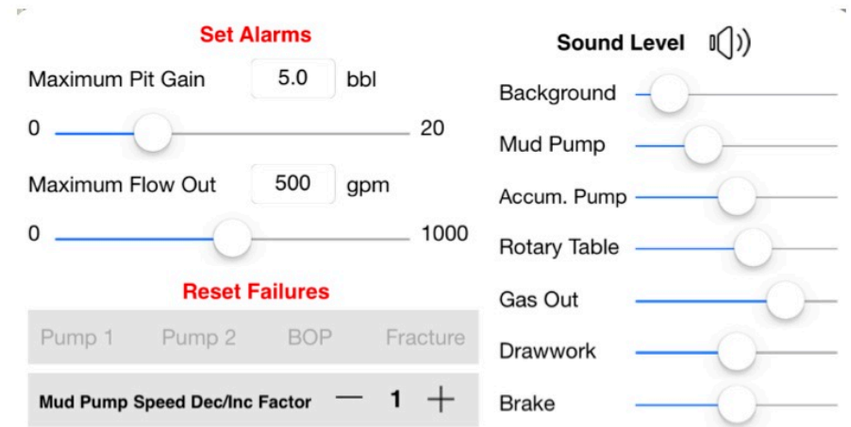
Set Maximum Values on Graph





Set Sound Level

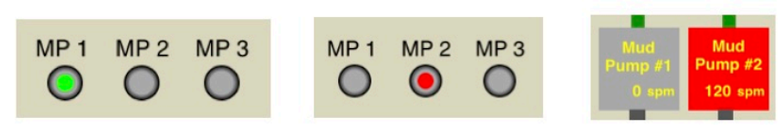
Tap on icon on toolbar:



Icon on toolbar:

Sound ON: Sound OFF:

Reset Failures (Red Color)

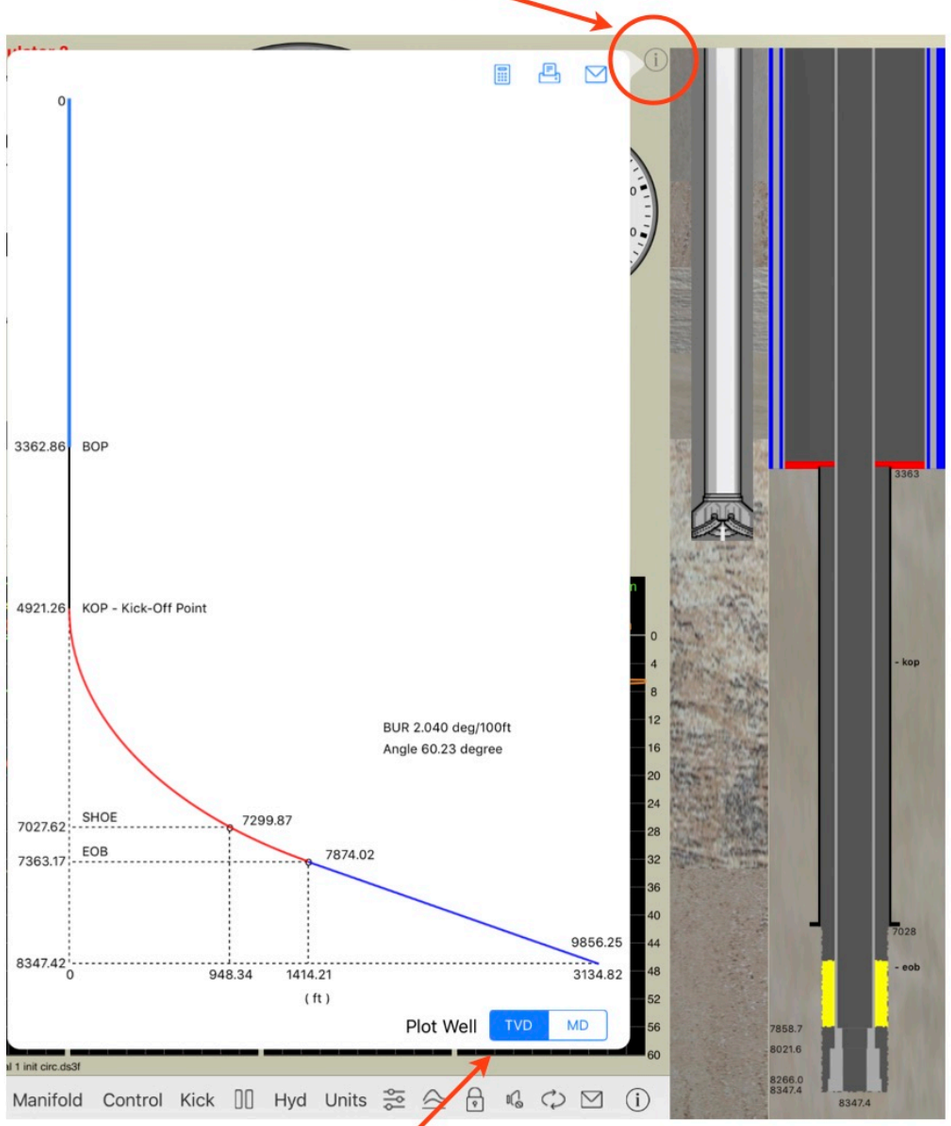


Example: SPM > 120 on Mud Pump #2

Tap on PUMP 2 button in red color:

Plot directional well on Main view

Tap on icon: this icon is hidden on vertical wells

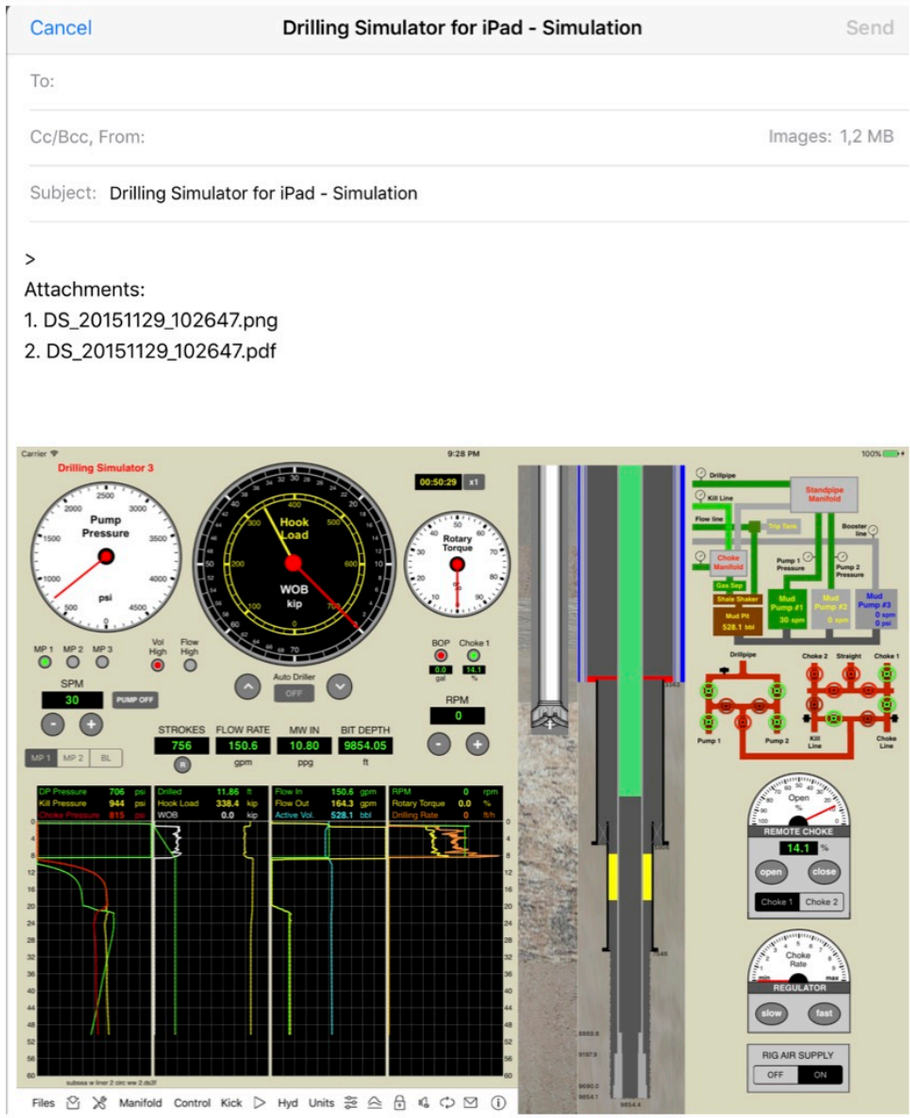


Select TVD / MD option to plot

Send Screenshot by email

Tap on icon on toolbar:

Attachments in PDF and PNG image formats:



CHAPTER 11

Kick Detection on Drilling

Warning signs of kick on drilling in this simulator:

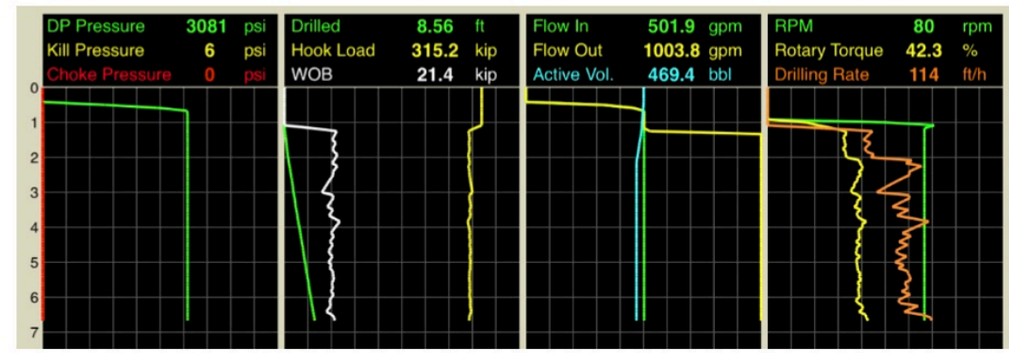
Positive Indicators of the Kick

1 Increase in Flow Out
2 Increase in Active Pit Volume
3 Flow out with pumps off

Secondary Indicators of the Kick

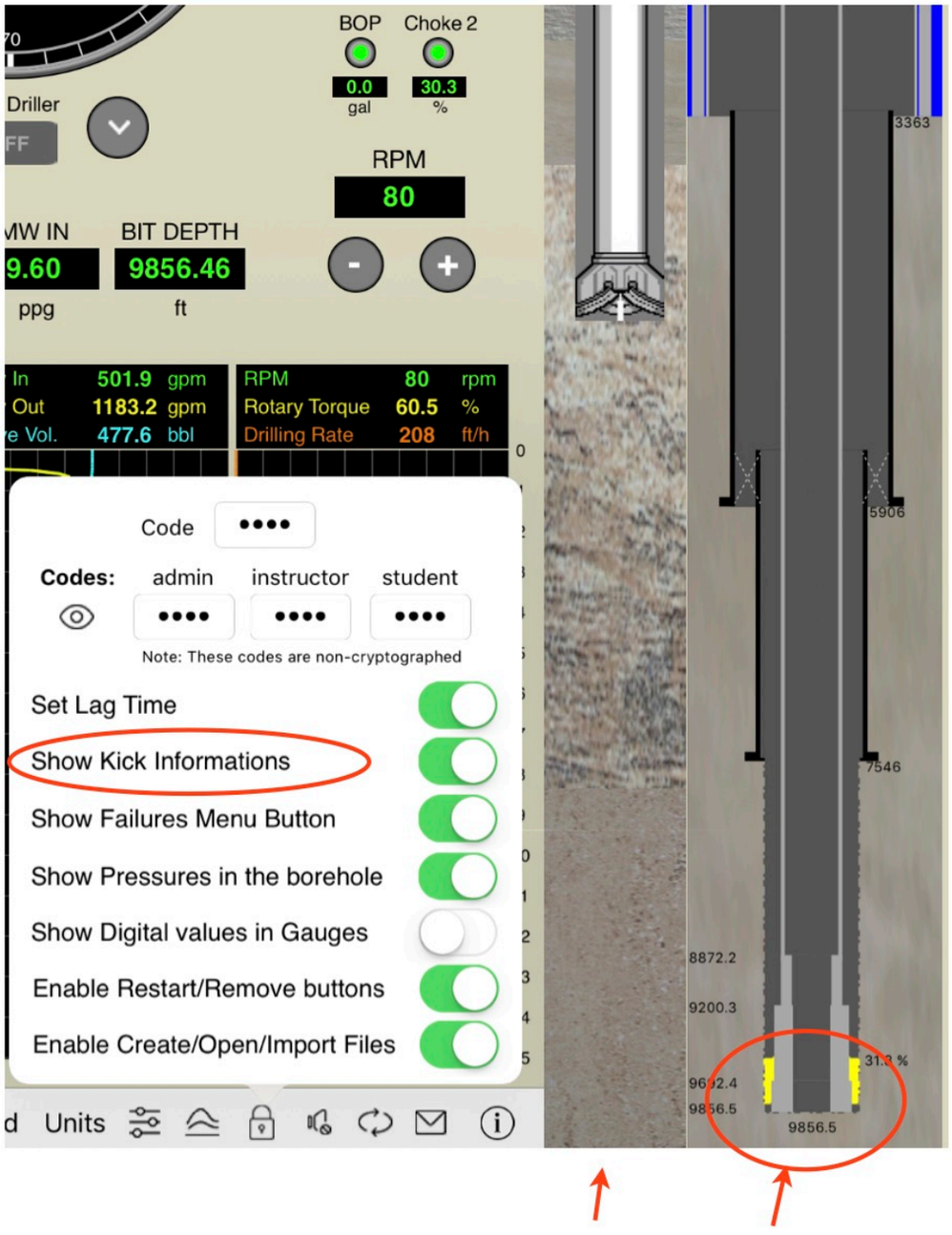
1 Decrease in DP Pressure
2 Increase in Drilling Rate
3 Increase in Rotary Torque
4. Decrease in Hook

On Drilling



On Drilling in Kick

The kick informations On show formations and kick in hole

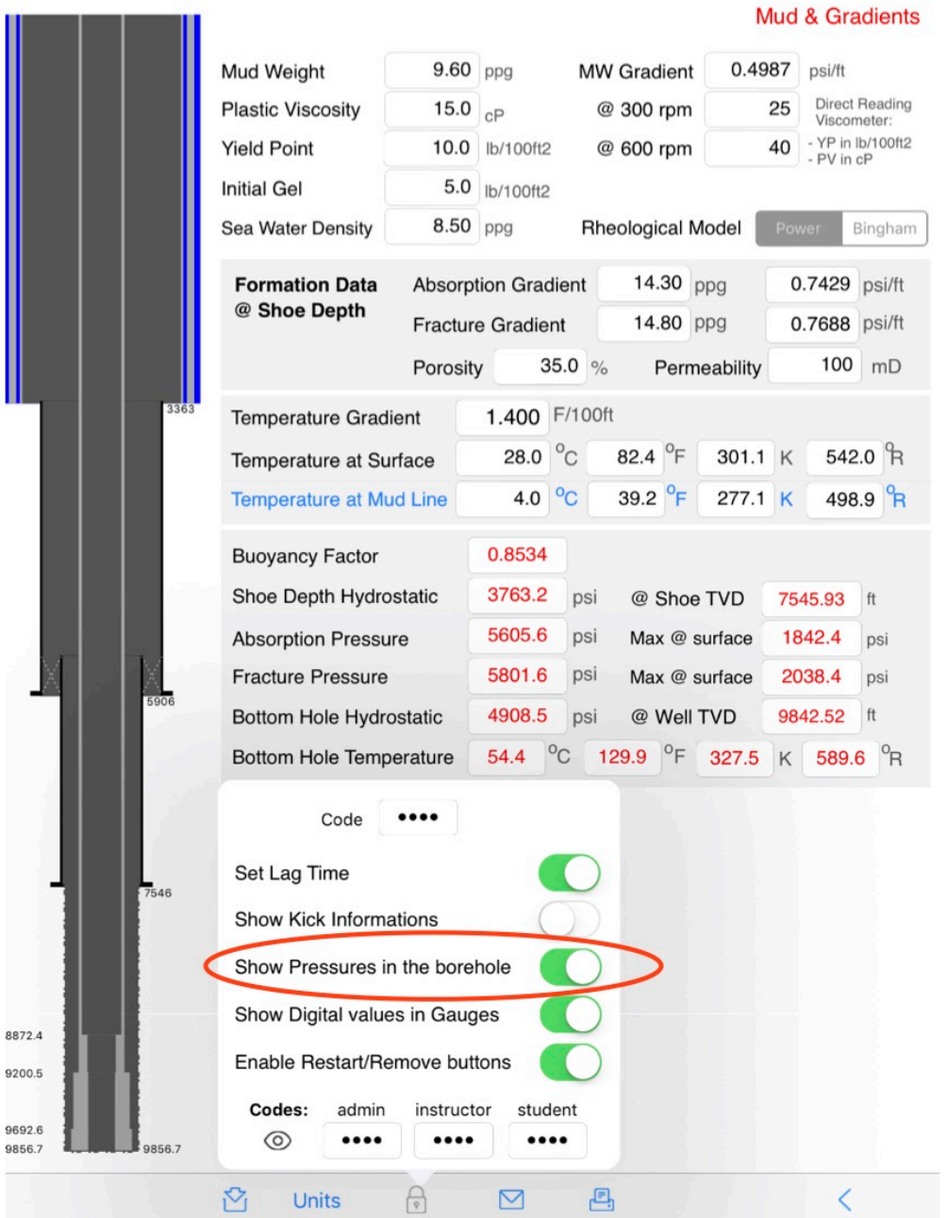


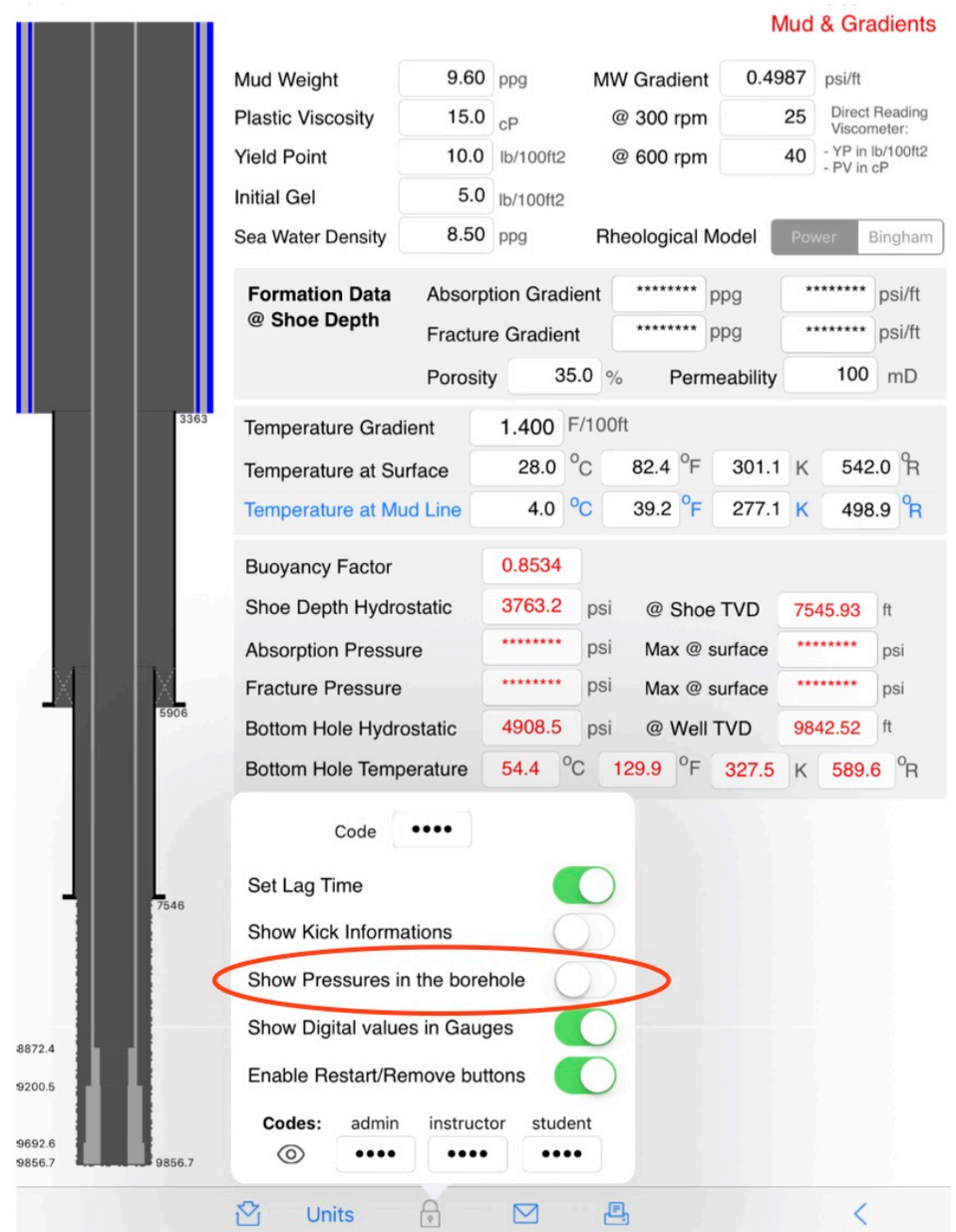
show formations kick in hole

The formations and kick in hole visual can be hidden

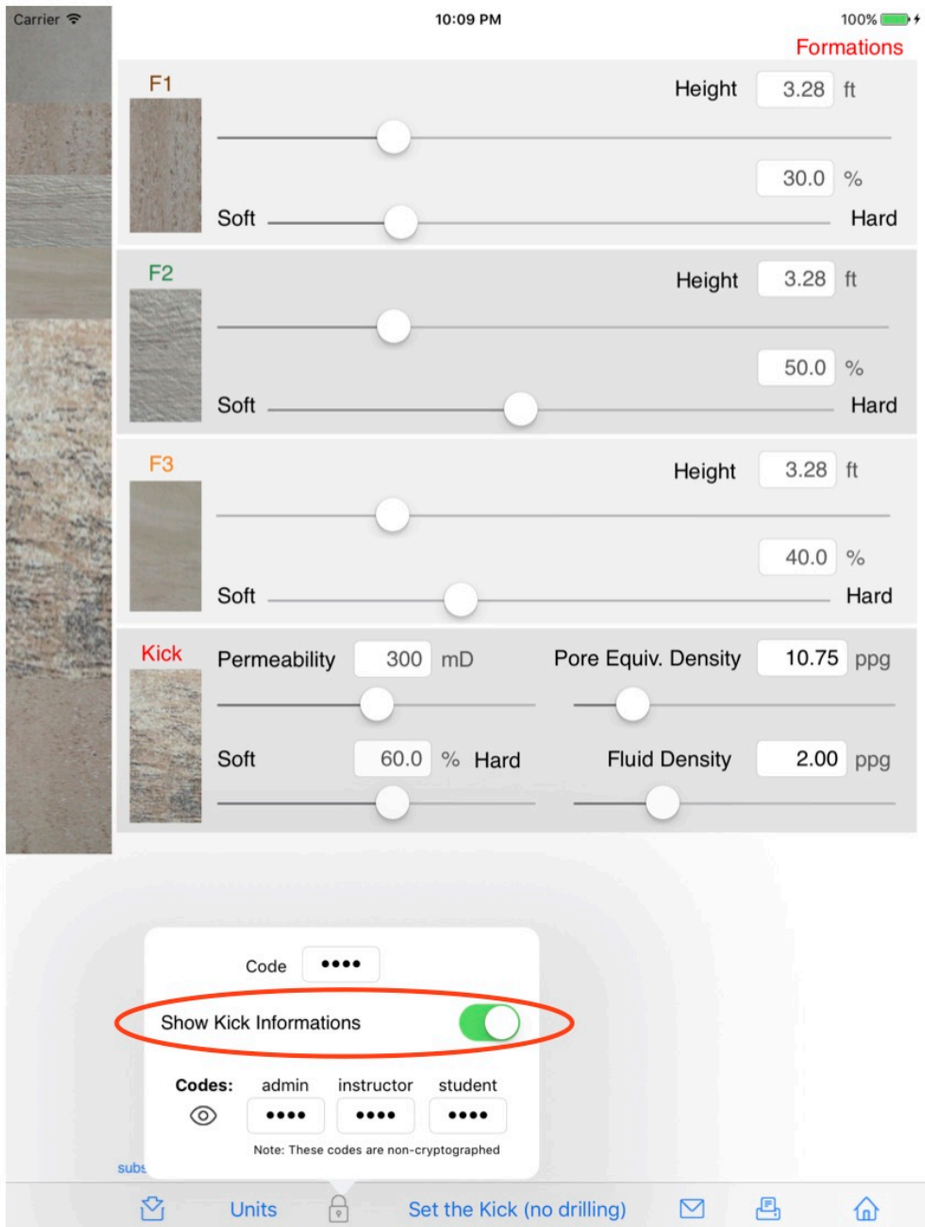
no formations no kick in hole

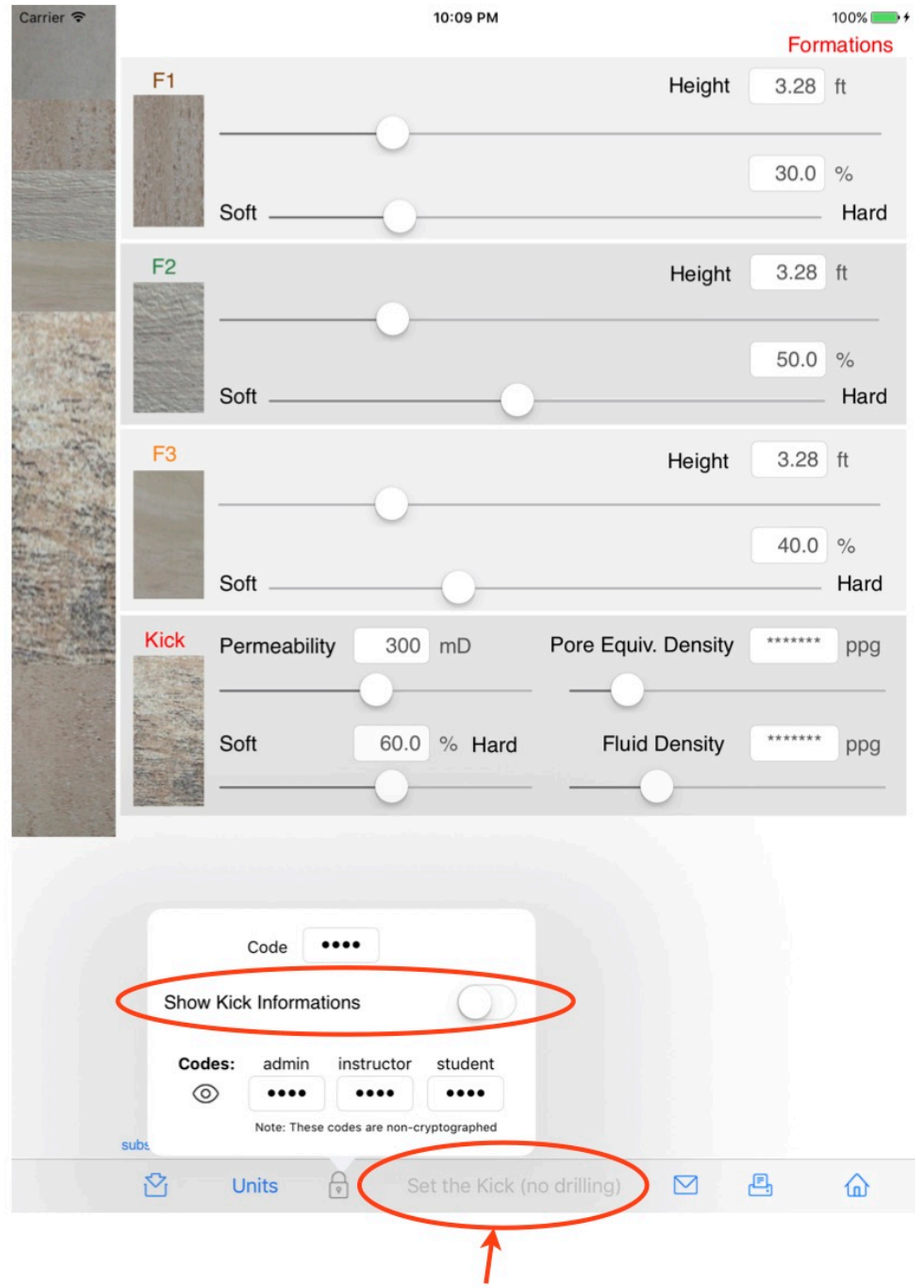
In Mud/Gradient view:





In Formations view





Set the Kick (no drilling) button disabled

CHAPTER 12

Shut-in

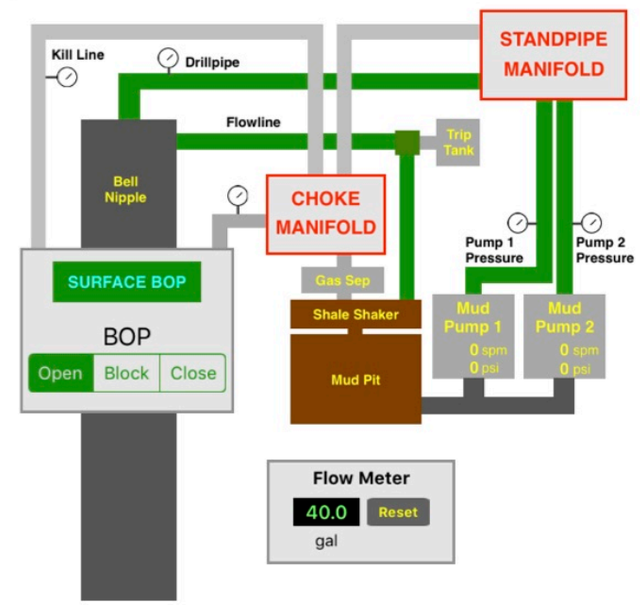
This simulator provides a simplified model to close the bop. There is not a full bop stack panel.

The shut-in in this simulator is executed only by closing the BOP and the remote choke.

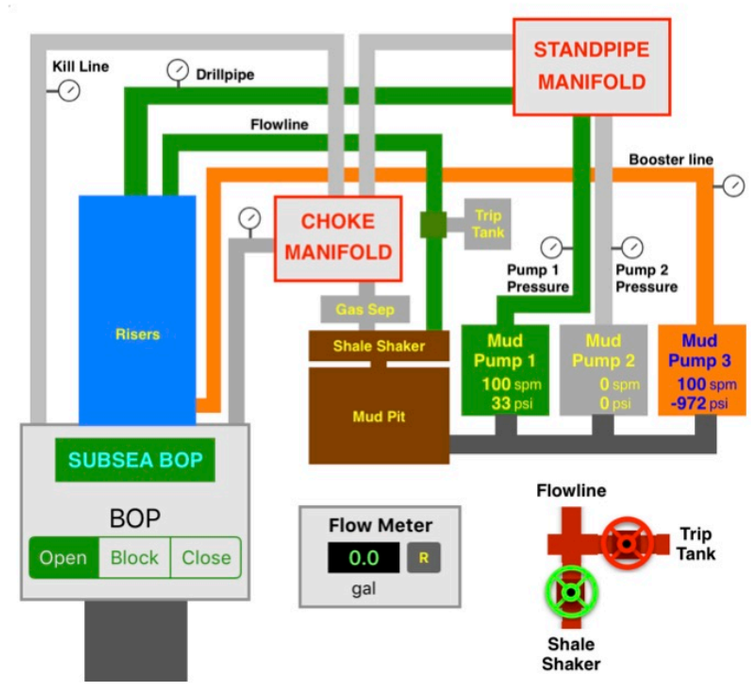
The shut-in can be "hard shut-in" or "soft shut-in".

There is a flow meter and the volume to close and to open can be entered on the settings.

Surface Stack

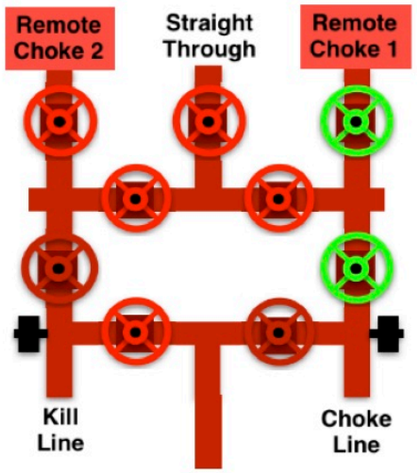


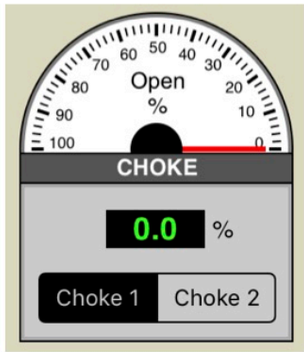
Subsea Stack



Hard Shut-in

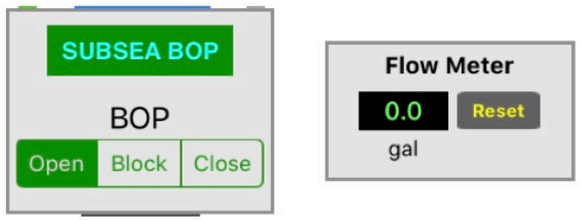
Maintain the remote choke closed on drilling:



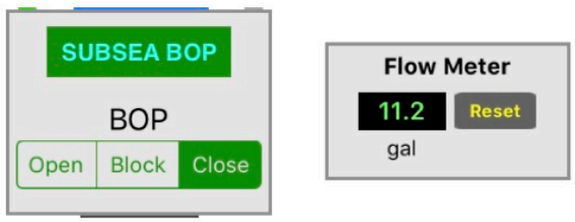


On kick detect (kick gain volume ~ 3 bbl) close the BOP. In this example, volume to CLOSE BOP = 25 gal.

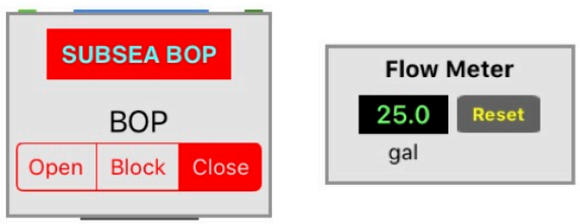
1)



2)



3)



The Kill and Choke pressures increase. On BHP (bottom hole pressure) > hydrostatic into the drillstring, the Drillpipe Pressure increase, too.

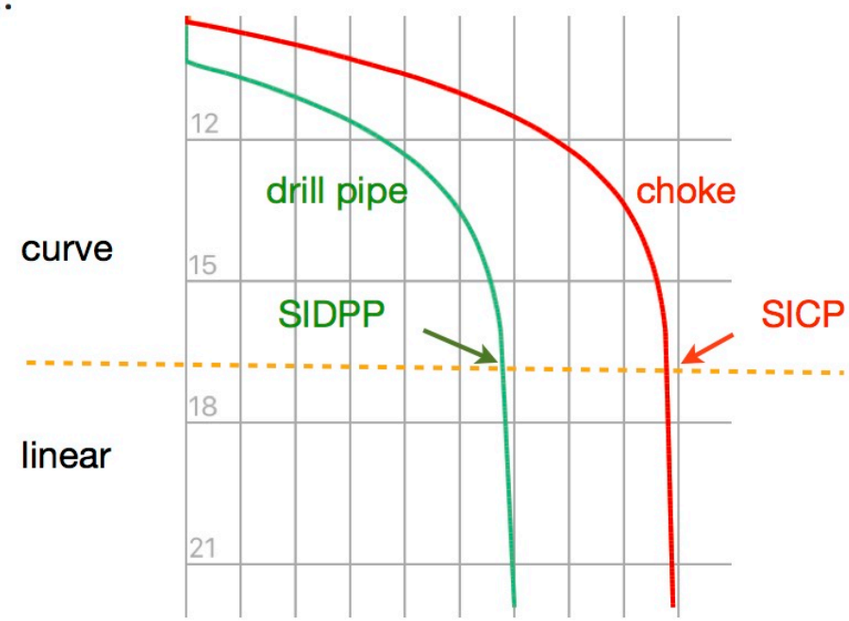
On BHP = Formation Pressure (stabilization of pressures),

Drillpipe Pressure = SIDPP (Shut-In Drillpipe Pressure) and

Kill and Choke Pressures = SICP (Shut-In Casing Pressure).

Before the stabilization of pressures, the graph is a curve.

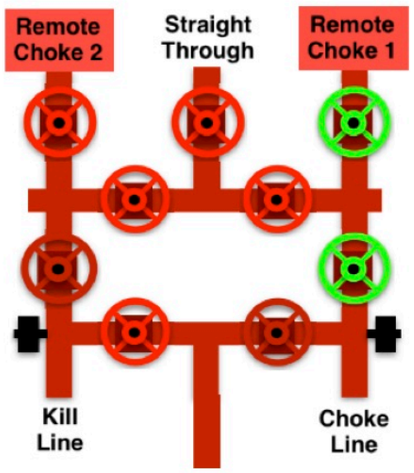
After the stabilization of pressures, the gas migration continues (constant in this Single Bubble Model) and the graph is linear.

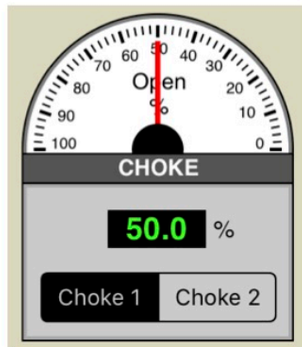


We recommend to record pressures x minutes (in regular intervals like 1 min) to detect the changing on graph from curve to linear (the stabilization of pressures).

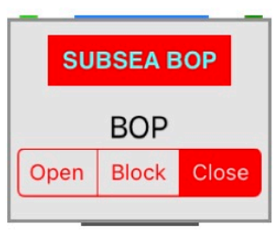
Soft Shut-In

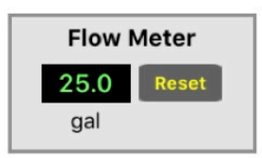
Maintain the choke open (50%) on drilling. After the kick detection, close the BOP following the closing of the choke.



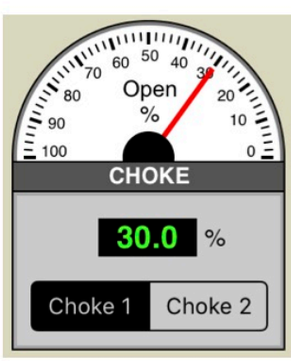


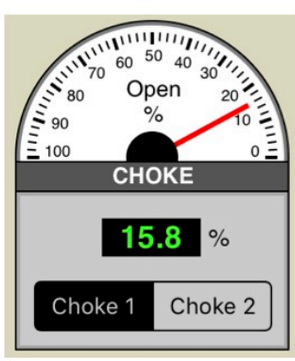
On kick detect (kick gain volume ~ 3 bbl) close the BOP. In this example, volume to CLOSE BOP = 25 gal.

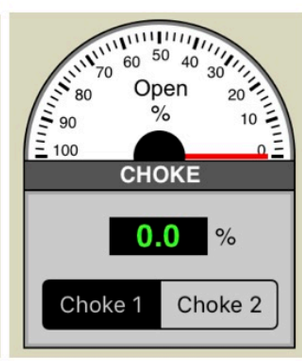




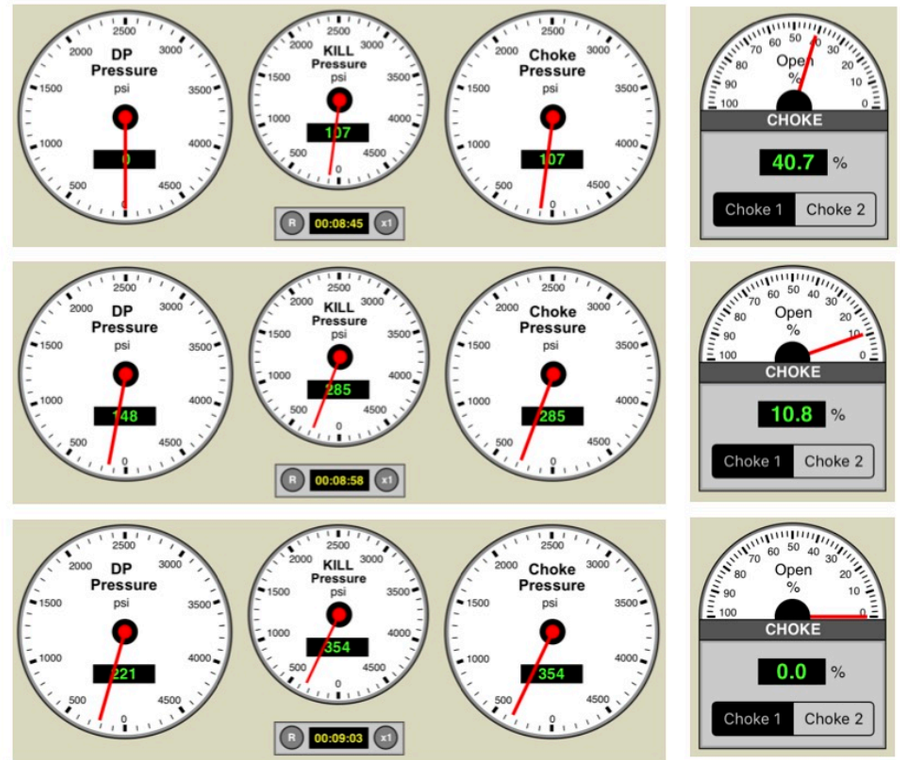
After BOP closed, start closing the choke...





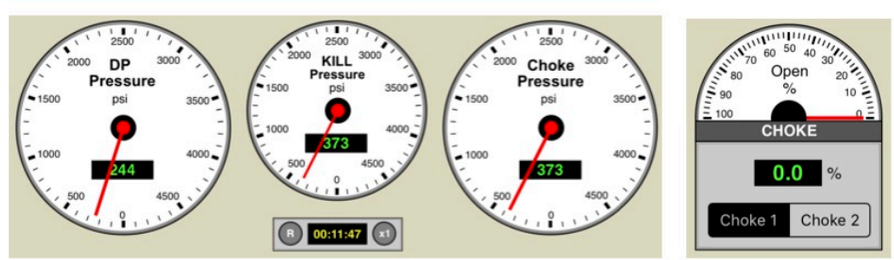


In this method, the pressures increase faster due gas expansion and migration effects during the closing the choke. These effects is greater on deepwater due choke line friction.

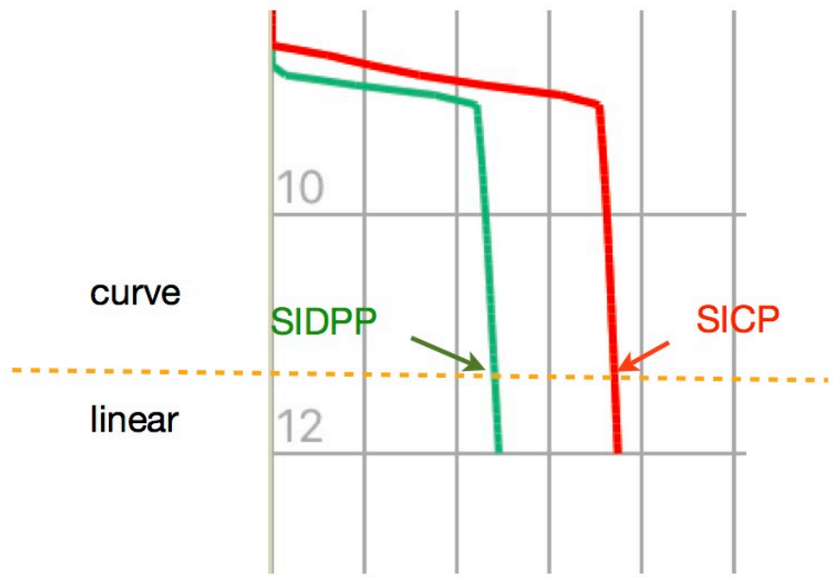


After choke fully closed, check for stabilization of pressures.

In this example, SIDPP = 244 psi and SICP = 373 psi.



After the stabilization of pressures, the gas migration continues (constant in this Single Bubble Model) and the graph is linear.



It is possible in this soft shut-in method the occurrence of the trapped pressure. To check, open the choke until pressure drops 50 psi, close and check if both pressures remain, is yes repeat this step until both pressures increase immediately after the closing the choke because there is no more trapped pressure.

Velocity of Migration of Gas Kick

A velocity of migration of the gas kick depends of yield point of drilling fluid (mud), of the kick volume and of inclination of well.

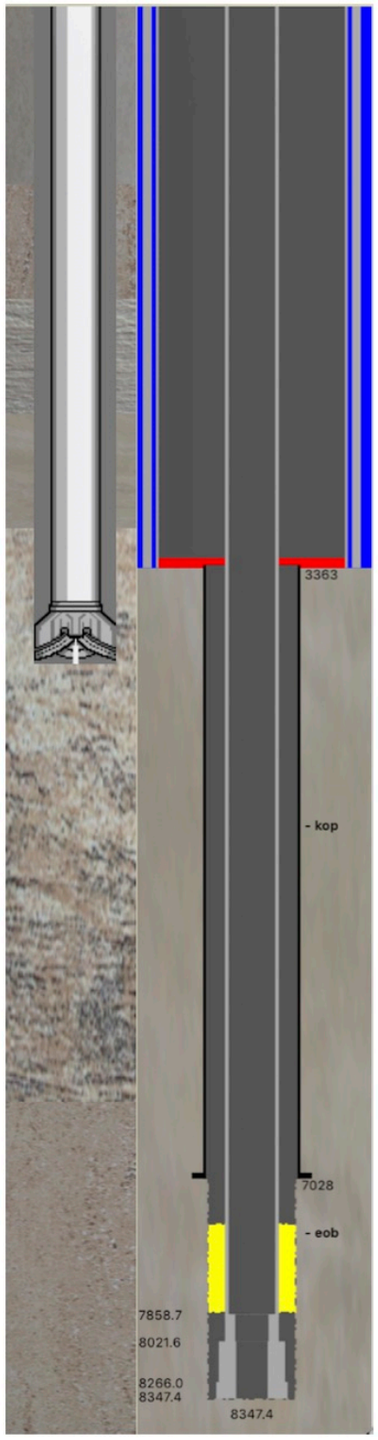
For example, for Yield Point = 10 lbf/100ft2, kick volume = 10 bbl on vertical well, the velocity of migration is near 1000 ft/h.

A small kick volume has a velocity of migration greater in this simulator.

CHAPTER 13

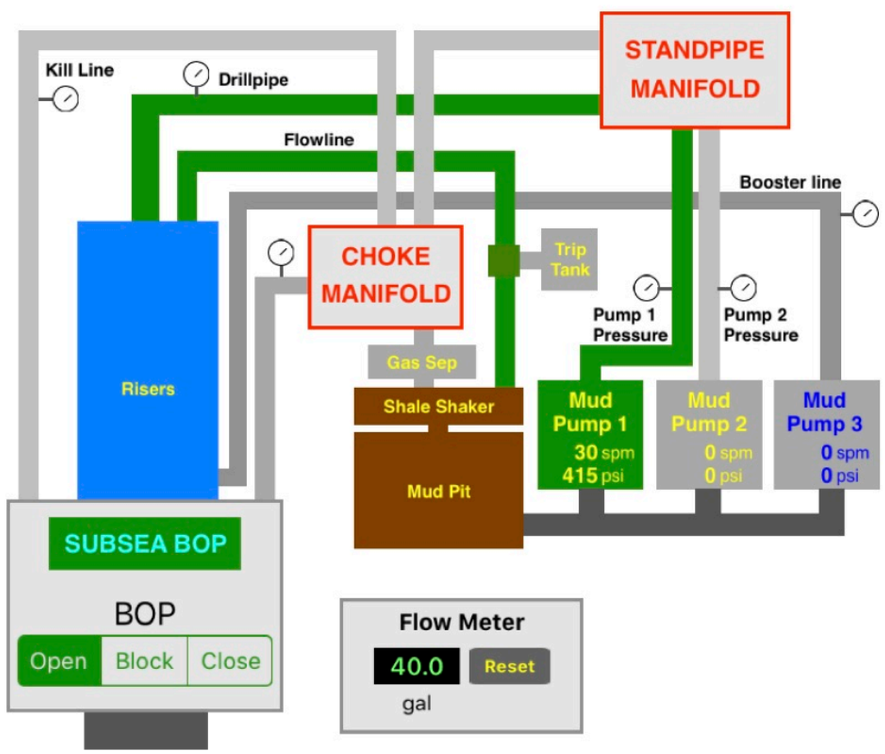
Setting a Kick (no drilling)

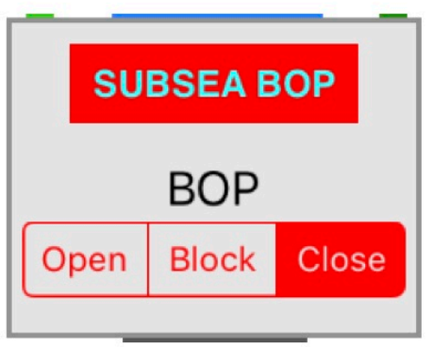
It is possible in this simulator to set a kick without need drill until the kick formation.



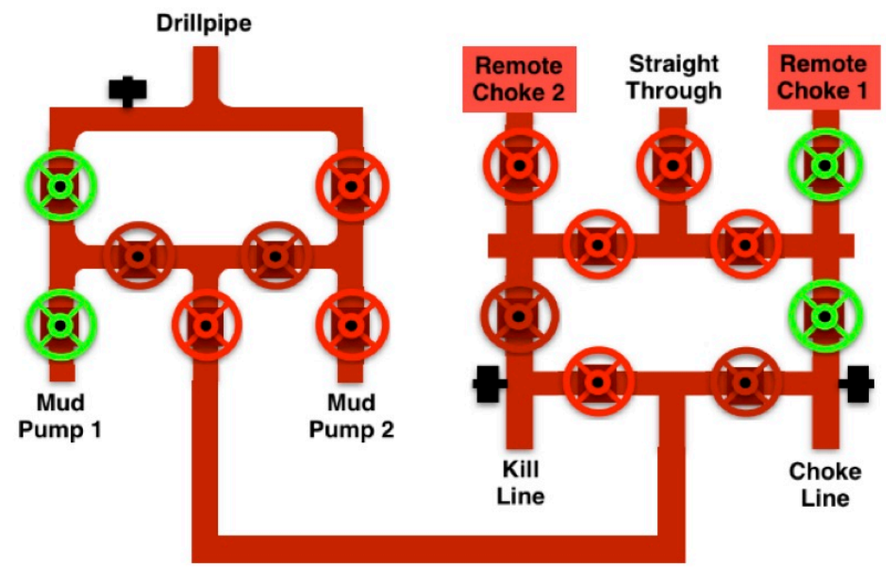
Before to set a kick without drilling

Set the BOP: Open or Closed

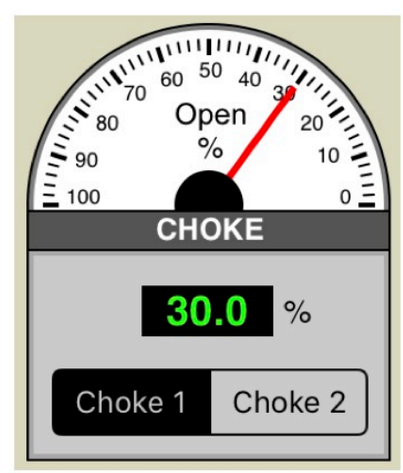


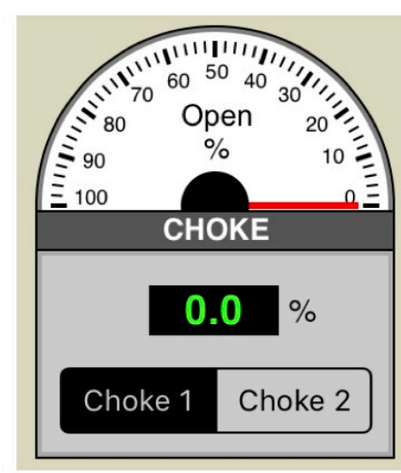


Set the standpipe manifold and the choke manifold

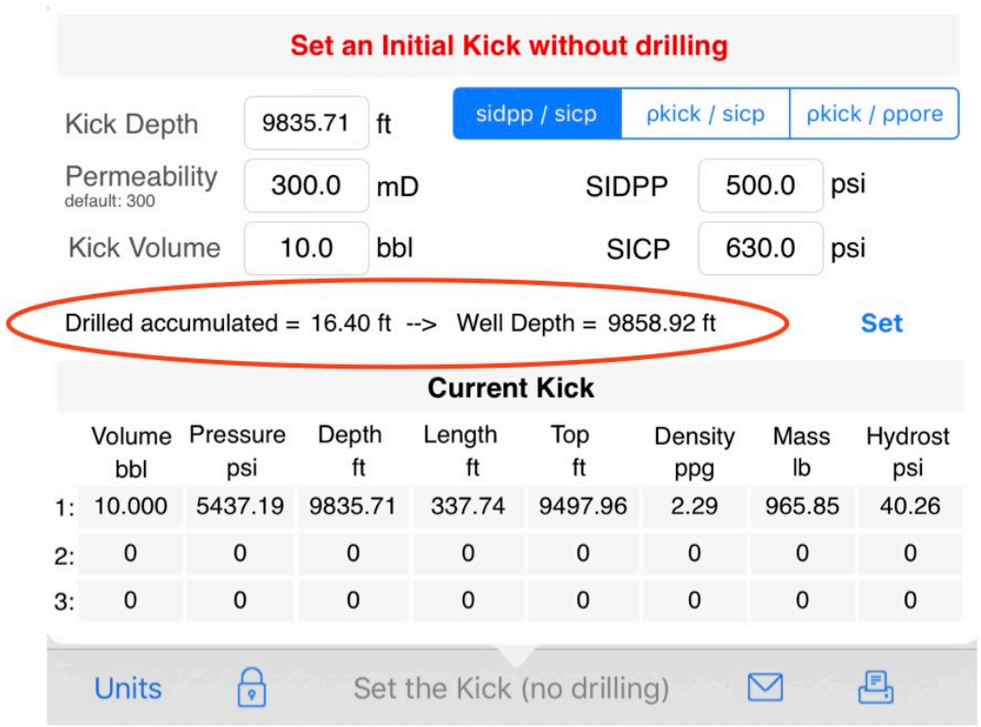


and set the choke: Open or Closed





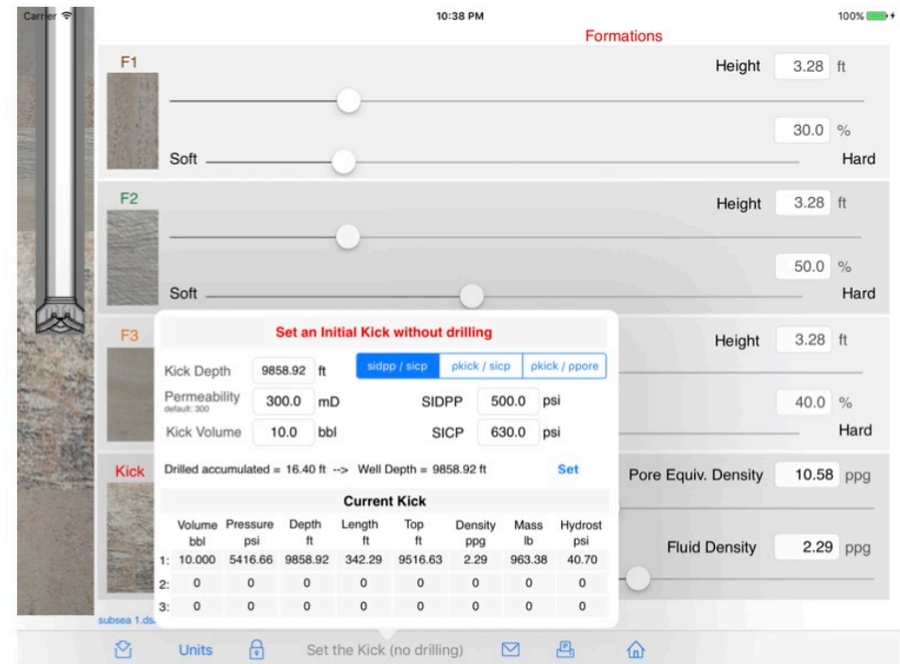
Set the kick in Formations View:

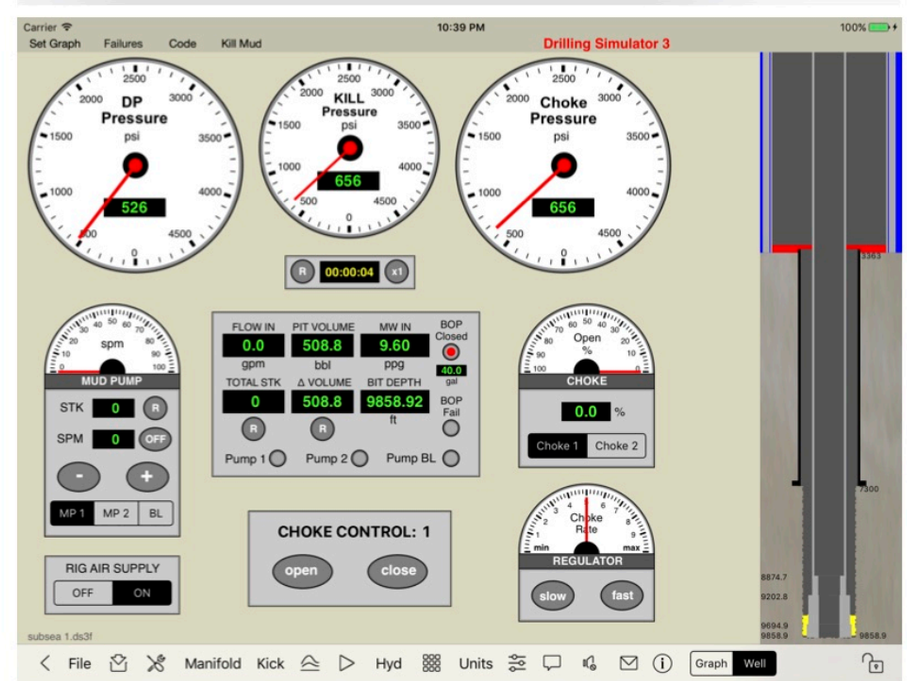


Note the "drilled accumulated = 16.40 ft" parameter on set the kick. This is necessary for flow from kick formation into borehole.

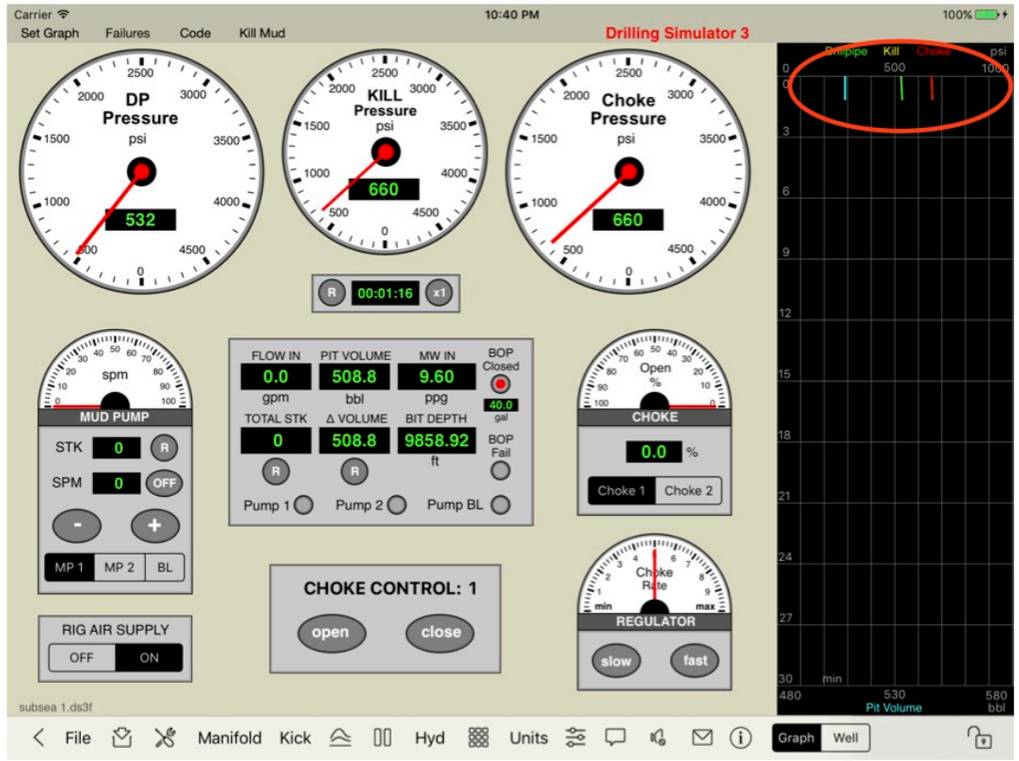
For a hard Shut-In Example:

Input this data on default subsea vertical well.





With BOP Closed and Choke Closed, there is not curve of stabilization of pressure:



In this hard shut-in example, the kick volume remain near same value.

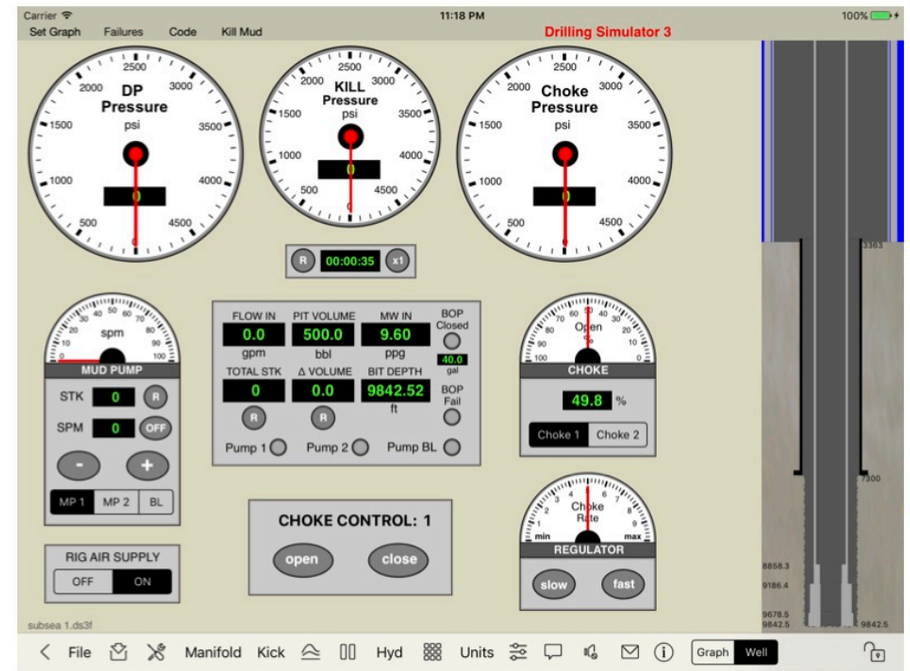
Note: Kick Volume entered = 10 bbl. But kick volume = 8.8 bbl.

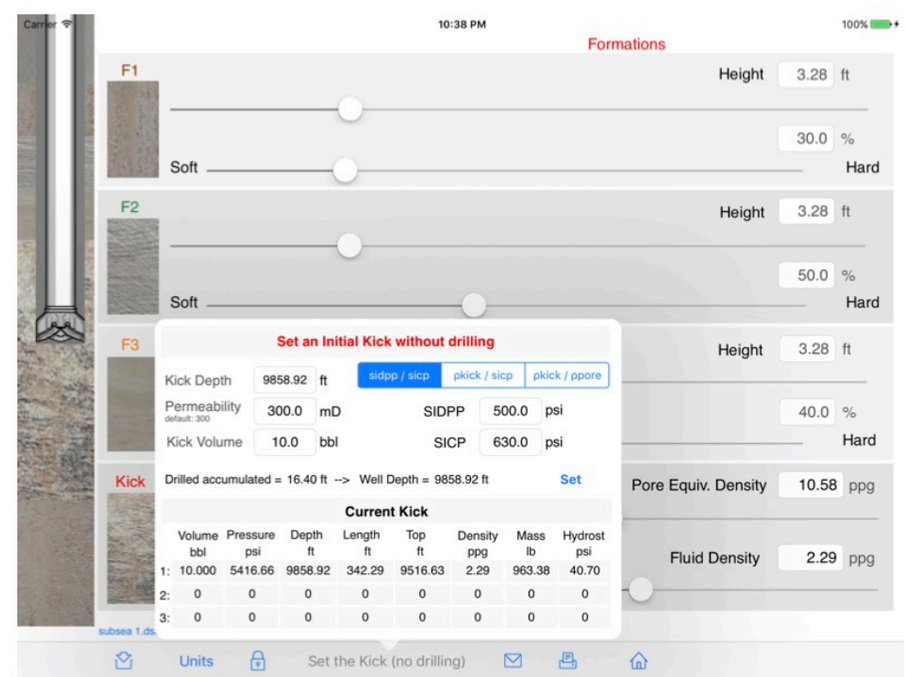
Drilled = 16.4 ft on hole size = 8.5 in => 0.0702 bbl/ft

Hole (drilled) volume= 16.4 x 0.0702 = 1.15 bbl

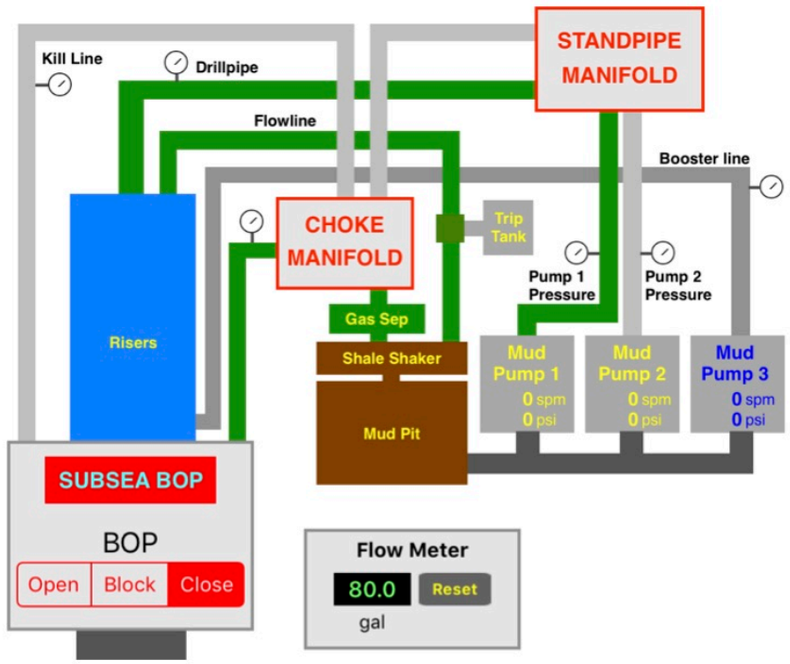
A Soft Shut-In example:

BOP Open and Choke Open (50%).

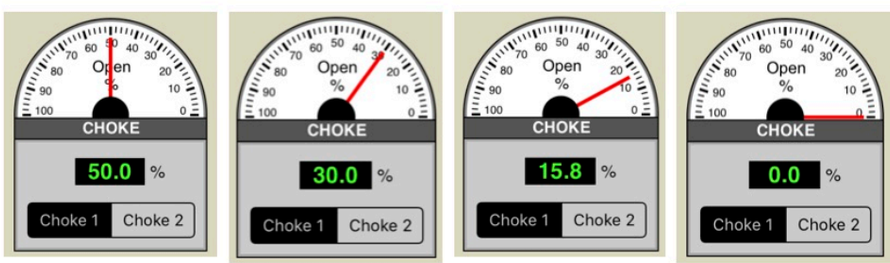




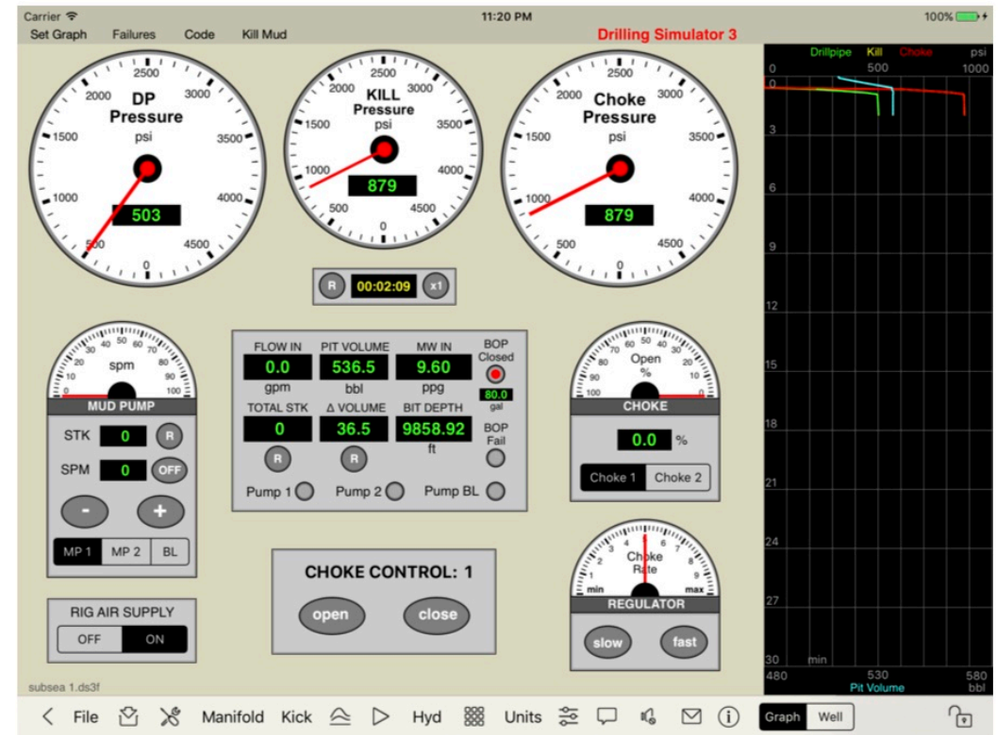
Set the BOP to Close and wait for conclusion.



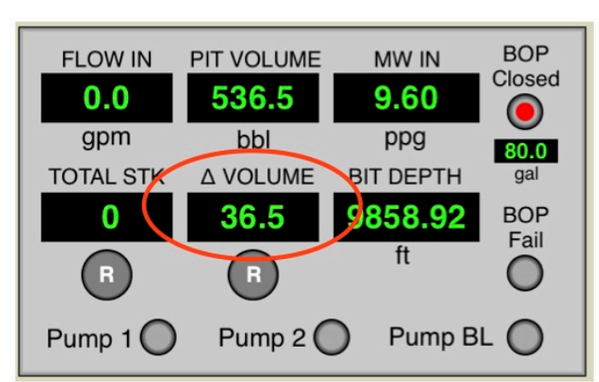
After Bop closed, close the Choke:

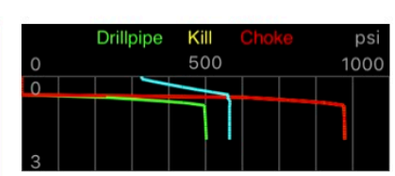


The pressures increase on closing the choke...



And the kick volume increased to 36.5 bbl.





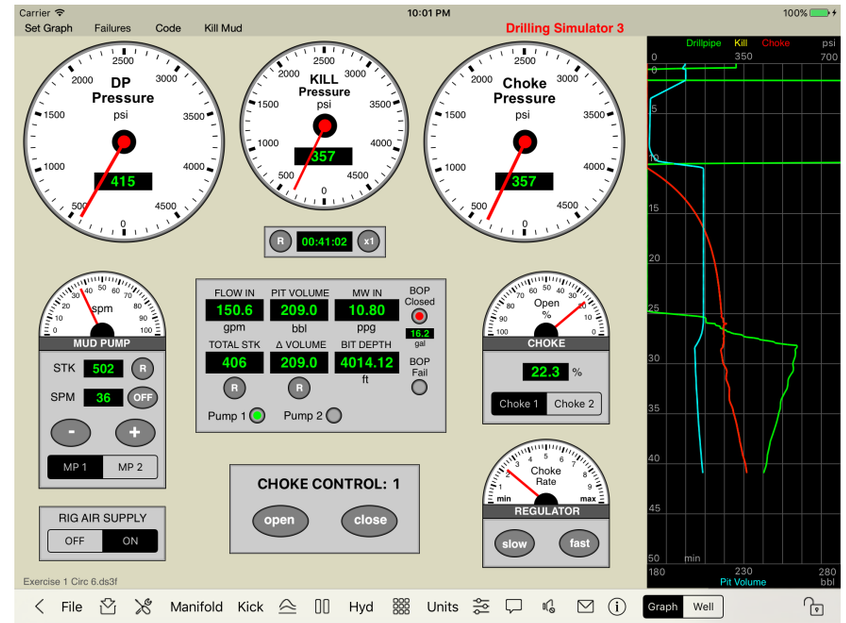
kick volume in cyan color in graph.

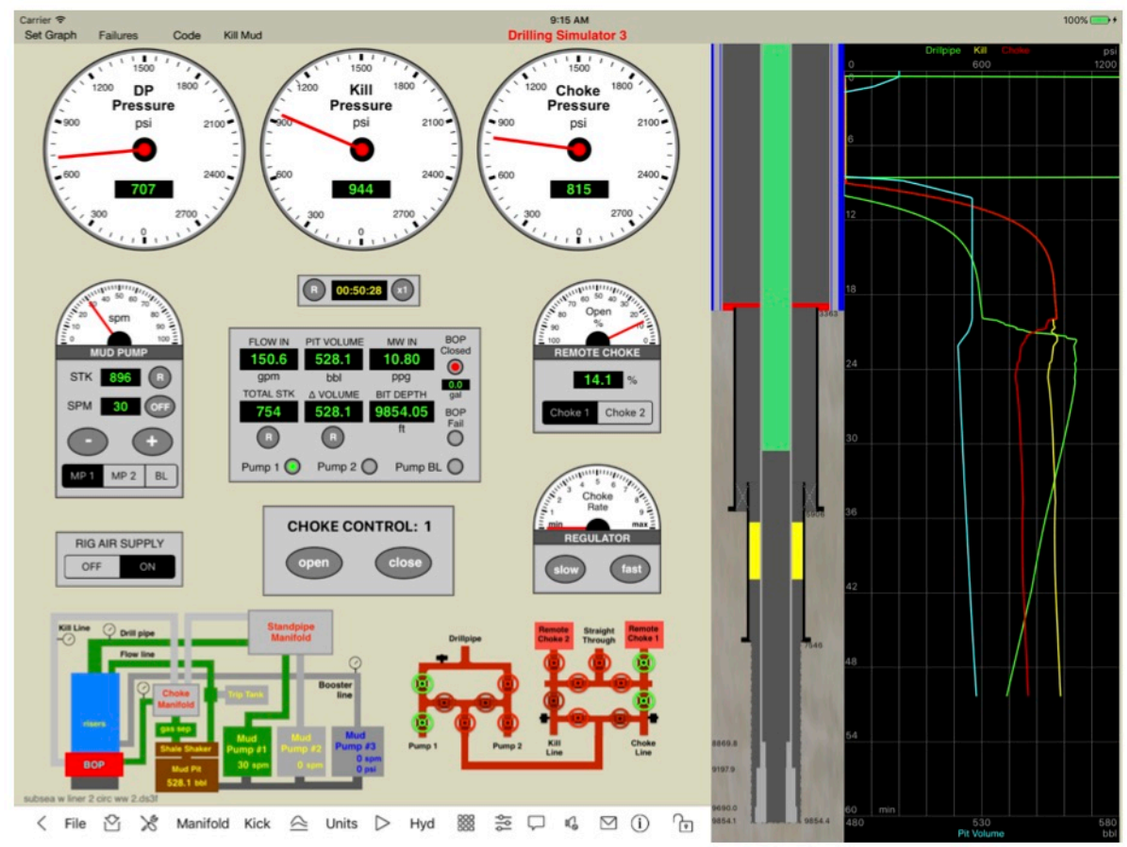
CHAPTER 14

Well Control

Choke Interface

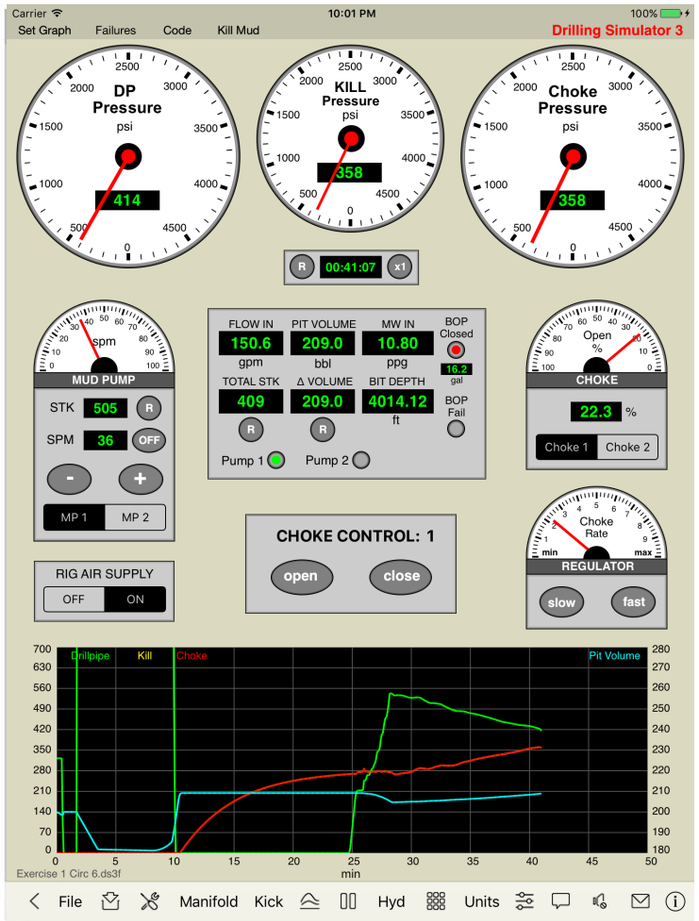
iPad x iPad Pro on horizontal position



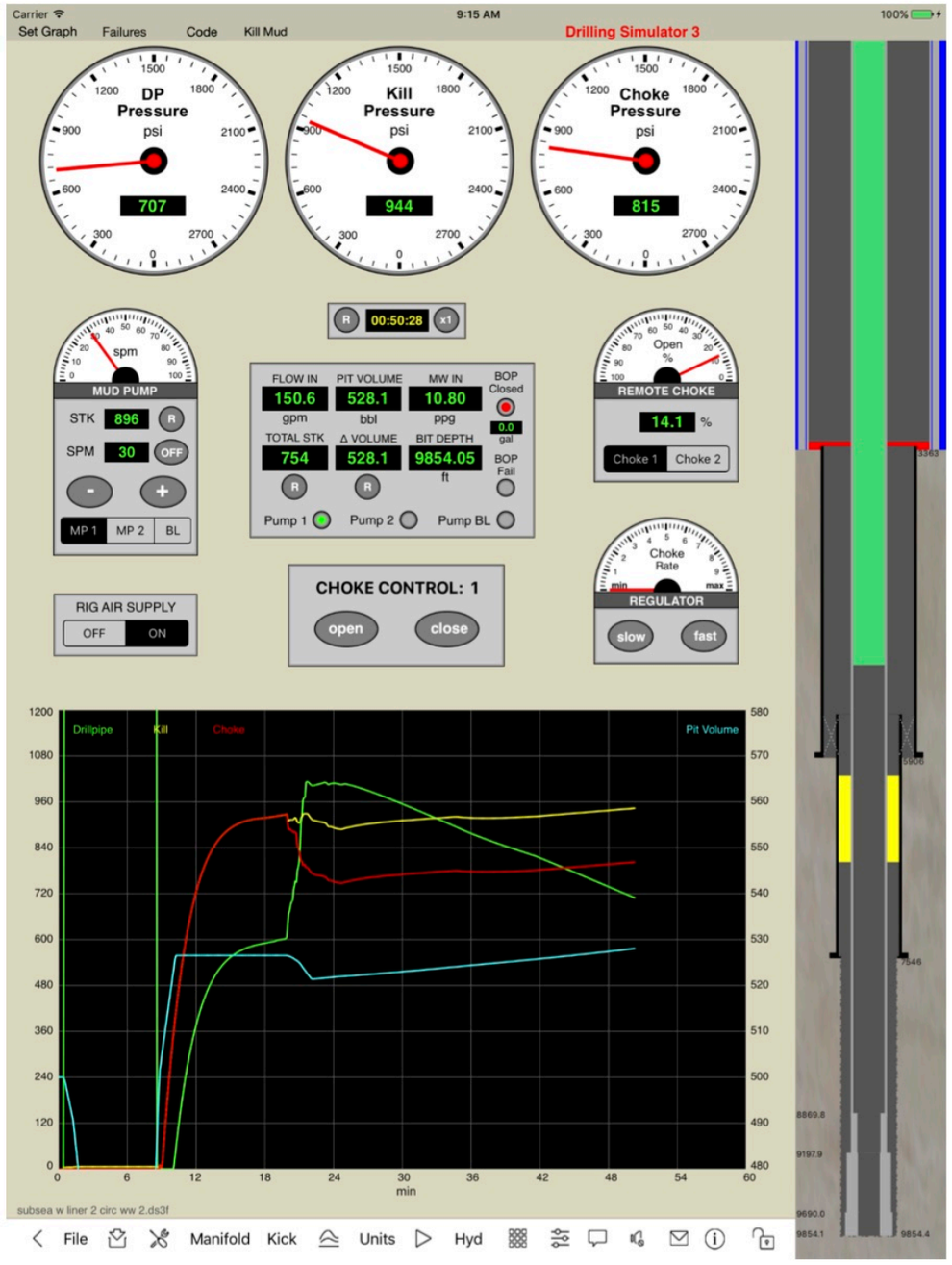


On vertical position

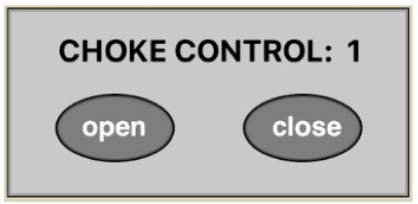
iPad, iPad Air, iPad Mini



iPad Pro

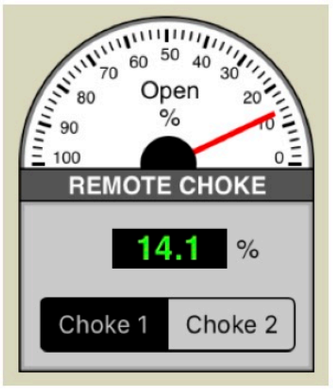


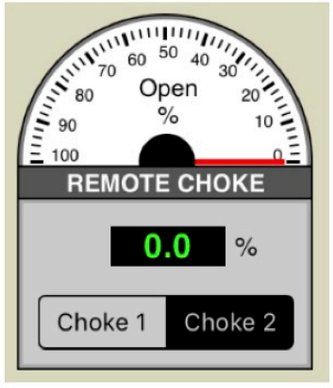
Choke Control



Rig Air Supply enable the Choke Control

Choke Open Gauge

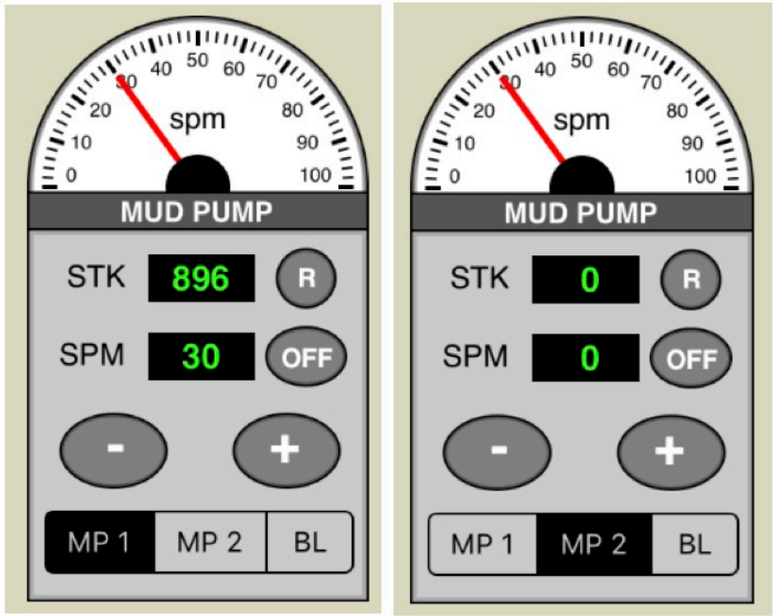




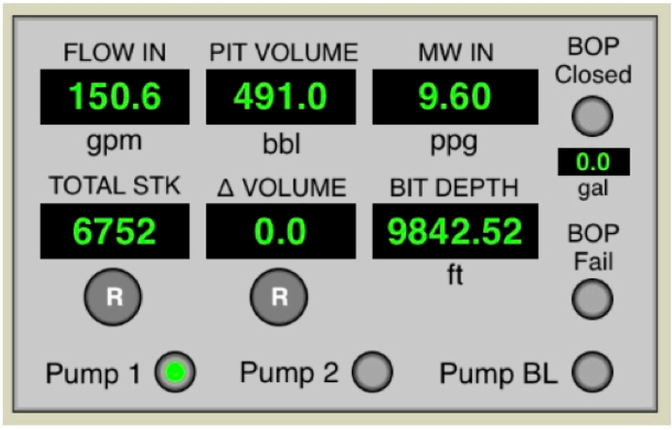
Slow/Fast Choke Rate

Mud Pumps 1 & 2

Both the mud pump 1 and 2 in paralell, but the digital Values are for each mud pump selected.



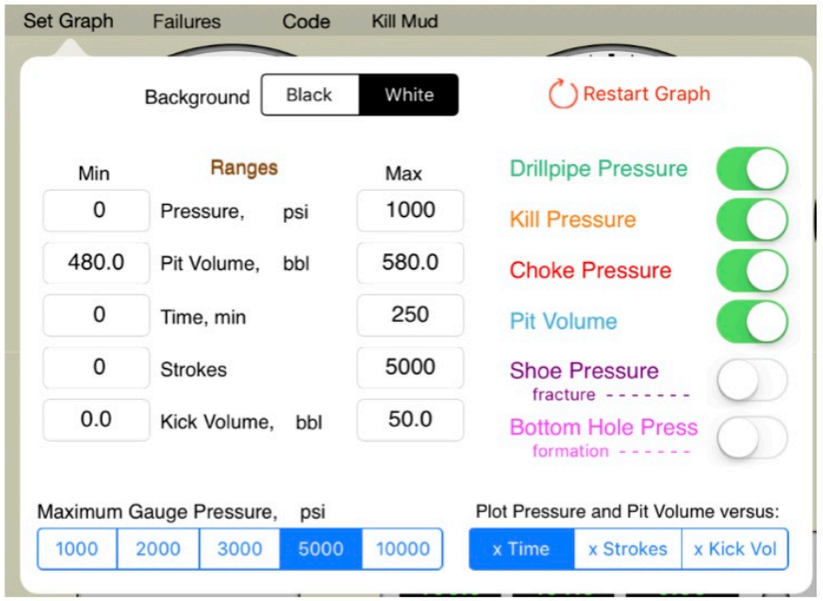
Digital Panel



Note: Mud Pump 3 to Booster Line (BL) only.

Graph Settings

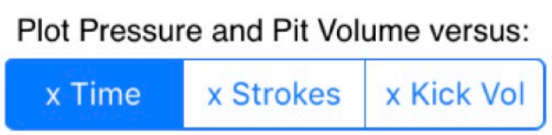
At top of the screen, on left



Graph Historical:

This app works with the last 360 min of simulation. Save the current data to dat file. After 360 min, occur a shift from begin.

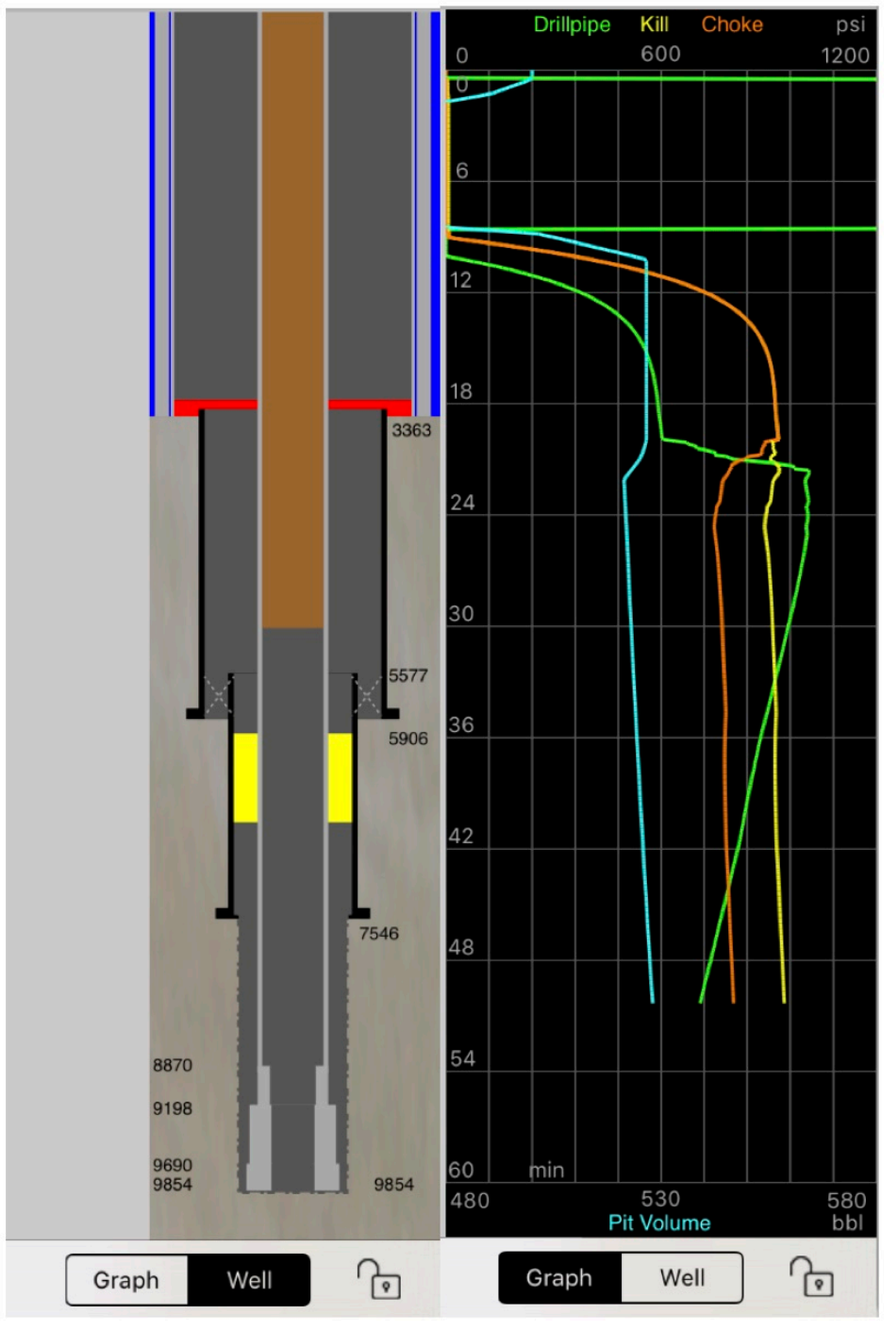
Select X axis to Plot:



Select the Maximum Pressure on Gauge:

Show Graph or Well options

For iPad / iPad Mini on Horizontal position:

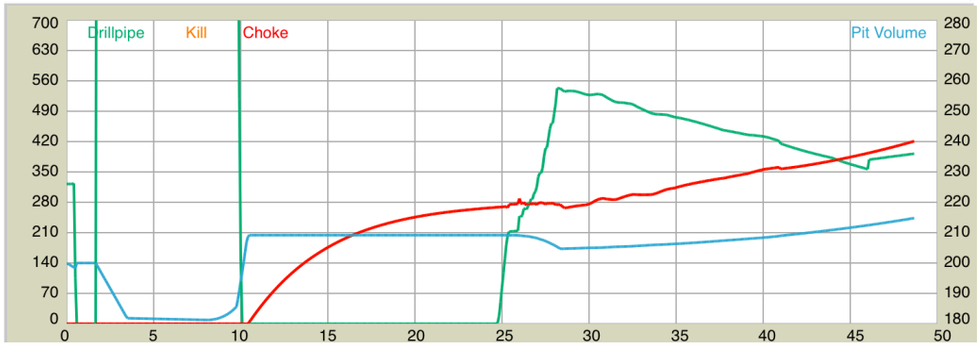


For iPad Pro on Horizontal position:

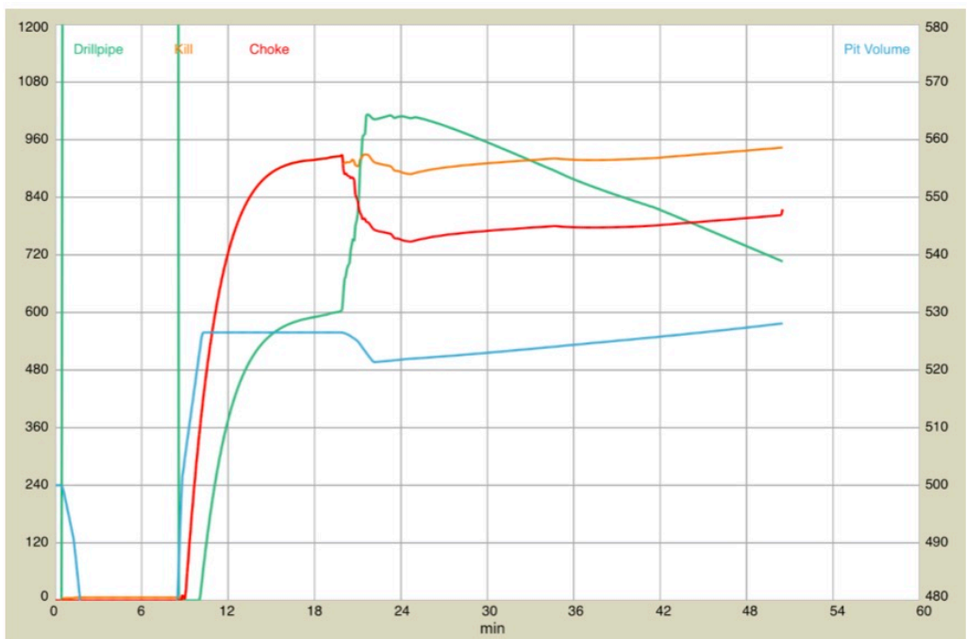
Shows Graph and Well on the same screen:

Graph on vertical position

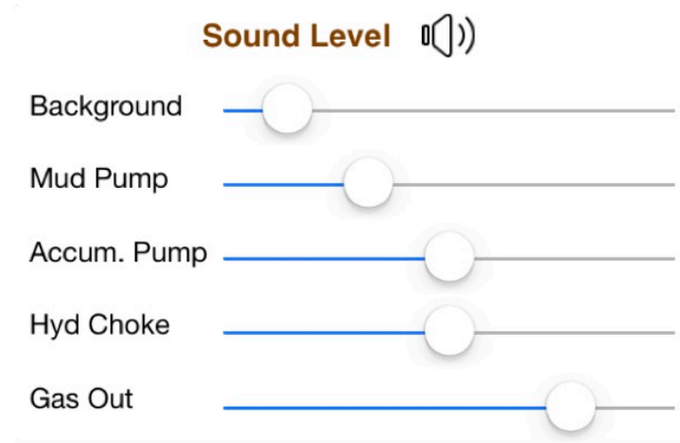
iPad and ipad Mini



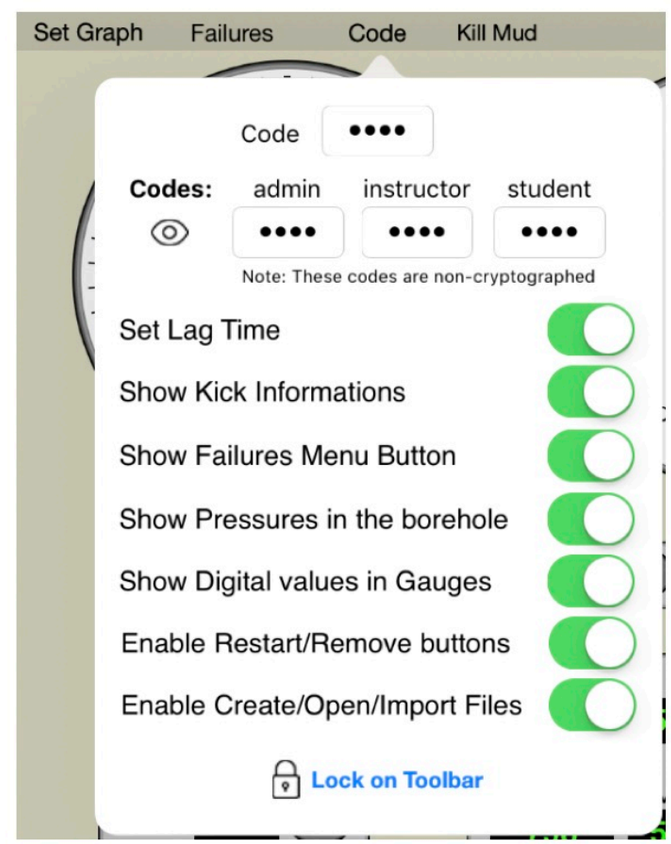
iPad Pro



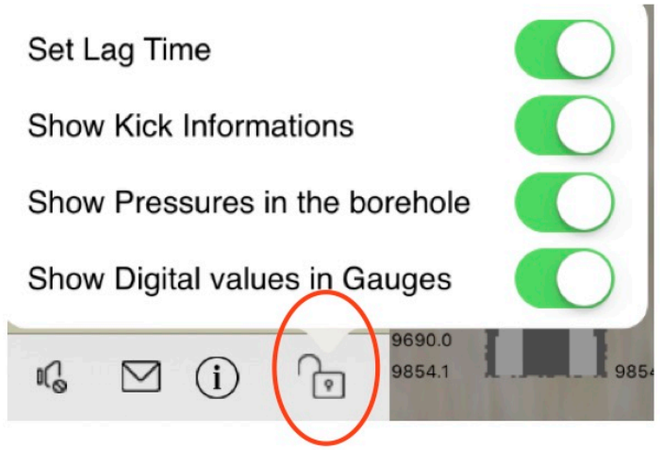
Set Sound Level



Informations with Code



Lock / Unlock options on toolbar



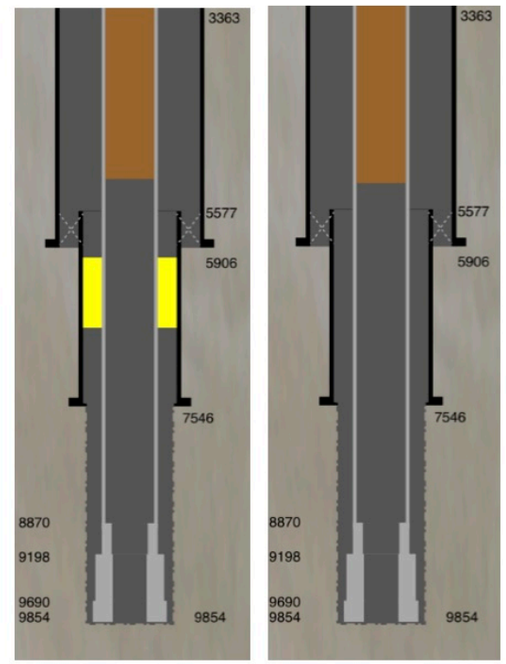
Attention: The Initial codes: "oooo"

Notes:

If lose the admin code:

1. Export all data files to iCloud;
2. Delete app on iPad
3. Re-install it from App Store.
4. Use the initial code: "oooo"
5. Import data files from iCloud

Show Kick Informations On / OFF



Show Digital values in Gauge ON / OFF

Show pressure in the borehole ON

MP 1	30.0	spm	MP 2	0.0	spm	MP 3	0.0	spm
	150.6	gpm		0.0	gpm	Booster Line	0.0	gpm

Drill Bit			Bottoms-up	155	min
Flow Rate on bit	150.6	gpm	**System Losses**		
Nozzles Loss	182.6	psi	Surface	4.3	psi
Hydraulic Power	16.0	hp	Drill string	130.9	psi
HHP / Sq. Inch	0.283	hp/sq.in	Annular	73.3	psi
Perc Nozzles Loss	26.1	%	Choke Line	140.8	psi
Jet Velocity	145.8	ft/s	Percent	73.7	%
Force of Impact	108.8	lbf			

Absorption Pressure	5605.6	psi	Max. Kill Press, Abs	1812.5	psi
Fracture Pressure	5801.6	psi	Max. Kill Press, Fract	2008.5	psi
BOP Pressure	2622.9	psi	Max. BOP Pressure	5000.0	psi

	TVD ft	Hydrost psi	Friction psi	Pressure psi	ECD ppg	Critical ppg
Shoe Depth	7545.9	3452.5	170.7	4427.9	11.30	14.30
Bottom Hole	9842.5	4597.8	214.1	5616.6	10.98	10.75
Formation	9842.5			5496.5		

Show pressure in the borehole OFF

MP 1	30.0	spm	MP 2	0.0	spm	MP 3	0.0	spm
	150.6	gpm		0.0	gpm	Booster Line	0.0	gpm

Drill Bit			Bottoms-up	155	min
Flow Rate on bit	150.6	gpm	**System Losses**		
Nozzles Loss	182.6	psi	Surface	4.3	psi
Hydraulic Power	16.0	hp	Drill string	130.9	psi
HHP / Sq. Inch	0.283	hp/sq.in	Annular	73.3	psi
Perc Nozzles Loss	26.4	%	Choke Line	140.8	psi
Jet Velocity	145.8	ft/s	Percent	73.5	%
Force of Impact	108.8	lbf			

	TVD ft	Hydrost psi		TVD ft	Hydrost psi
Shoe Depth	7545.9	3451.1	Bottom Hole	9842.5	4596.4

Show Kick Informations ON

Menu Item on toolbar: (Disabled if Kick Informations OFF)

Kick 1 | Kick 2 | Kick 3 | Remove

Volume bbl	Pressure psi	Depth ft	Top ft	Length ft	Height ft
7.165	4027.64	7041.38	6898.59	142.79	106.45

Density ppg	Mass lb	Hydrost psi	Temperat Rankine	Z Factor	Migration ft/min
1.91	575.04	10.54	547.61	0.8738	87.85

Set the Kill Mud Weight

Tap on “Kill Mud” item on top menu:

Failures | Code | Kill Mud

Kill Mud Weight 9.60 ppg

Total Volume pumped to drillstring 0.0 bbl

Total Volume pumped to kill line 0.0 bbl

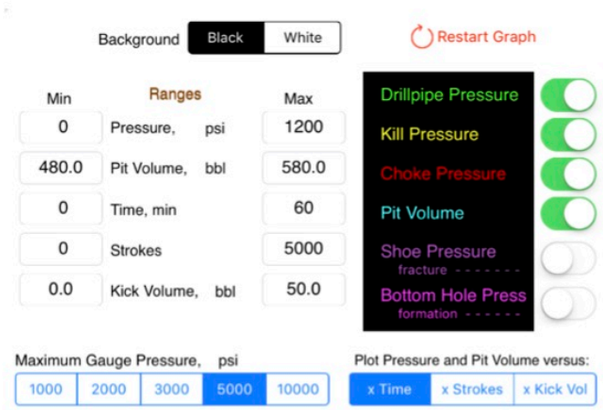
Kill Mud Color: Brown | Purple | Pink | Green

Disabled | Enabled | Set

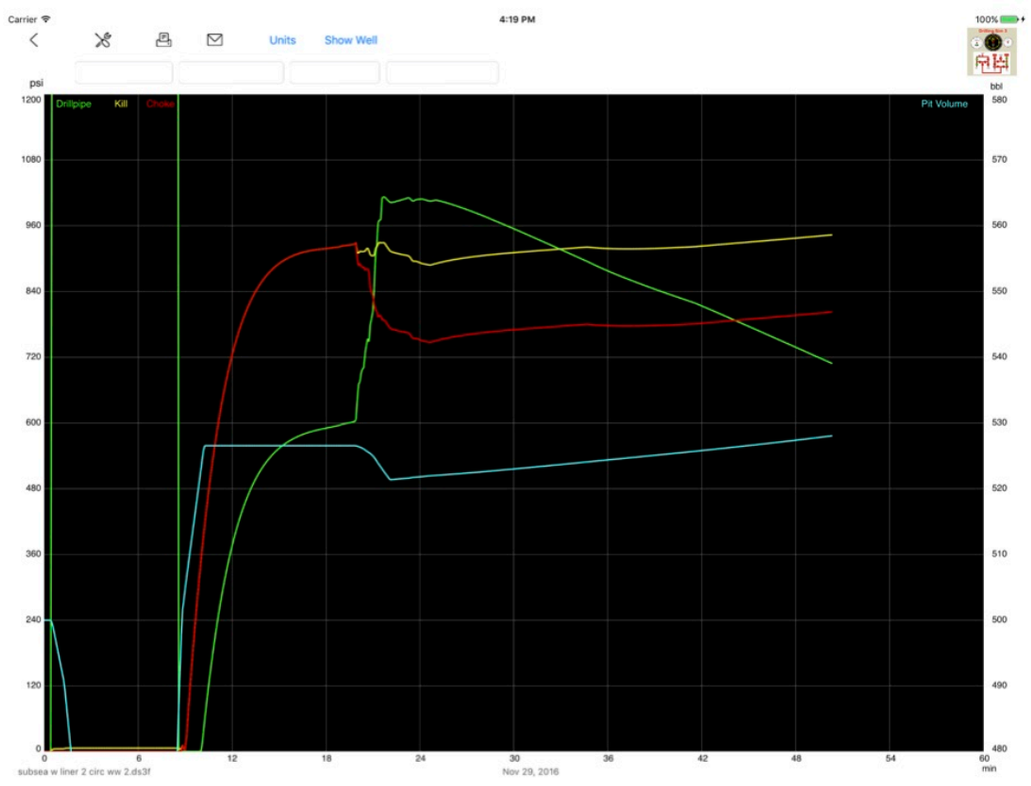
1. Input the Kill Mud Weight
2. Select Enable Option
3. Tap on “**Set**” button

Graph in Full Screen

iPad on Horizontal position



iPad on Vertical Position



Pre-Recorded Data menu item on toolbar:

Drilling Simulator 3 PRE-RECORDED - SUBSEA STACK

WELL: RIG: DATE: Oct 19, 2015 BY:

WELL, FLUID, LOT AND EQUIPMENTS	Sea Water Length (Lsw)			3280.84	ft	True Vertical Depth (TVD)	9842.52	ft
	Sea Water Density (ρsw)			8.50	ppg	Measured Depth (MD)	9854.38	ft
	Mud Line Depth (Dml)			3362.86	ft	Shoe Vertical Depth (TVD,shoe)	7545.93	ft
	Mud Weight (ρm)	9.60	ppg	0.4987	psi/ft	Shoe Measured Detph (MD,shoe)	7545.93	ft
	Fracture Gradient	14.80	ppg	0.7688	psi/ft	BOP Test Pressure (Pt,BOP)	5000	psi
	Active Surface Volume			500.0	bbl	Casing Burst Pressure	6330 x 0.80	5064 psi

MAXIMUM STATIC PRESSURES			
	Maximum Allowable At Surface Pressure, MAASP = 0.0519 x (ρf - ρm) x TVD,sap	2038	psi
	Maximum Casing Pressure: (Burst Pressure x DF) - 0.0519 x (ρm x Dml – 8.50 x Lsw)	4836	psi
	Maximum BOP Pressure = (Pt,BOP) - 0.0519 x (ρm x Dml – 8.50 x Lsw)	4772	psi
* DF = 1 / Design Factor	Maximum Subsea Equipment Pressure: Smaller of (Max Casing or Max BOP)	4772	psi

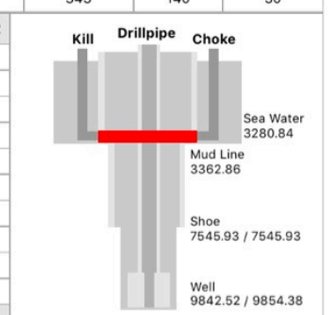
LENGTH, CAPACITY AND VOLUMES Cv,i = ID^2 / 1029.4147 Vi(bbl)=Cv,i x L Cv,a = (BoreD^2 - OD^2) / 1029.4147 Va (bbl)=Cv,a x L

Drill String	ID (in)	OD (in)	Cv,i (bbl/ft)	L (ft)	Vi (bbl)	Annular	Cv,a (bbl/ft)	L (ft)	Va (bbl)
Drillpipe, DP1	4.2760	5.0000	0.0178	8869.80	157.6	Open Hole - DC2	0.0259	164.04	4.3
Drillpipe, DP2						Open Hole - DC1	0.0322	492.13	15.9
Heavy Weight, HW	3.0000	5.0000	0.0087	328.08	2.9	Open Hole - HW	0.0459	328.08	15.1
Drill Collar, DC1	2.8125	6.2500	0.0077	492.13	3.8	Open Hole - DP2			
Drill Collar, DC2	2.8125	6.7500	0.0077	164.04	1.3	Open Hole - DP1	0.0459	1323.87	60.8
Total Drill String				**9854.05**	**165.5**	**Total Open Hole**		**2308.12**	**95.9**
Open Hole	8.5000		0.0702	2308.45	162.0	Liner - DP2			
Liner	8.7550	9.6750	0.0745	1968.50	146.6	Liner - DP1	0.0502	1968.50	98.8
Casing	13.3750	9.6250	0.1738	2214.57	384.9	Casing - DP2			
Riser	19.7500		0.3789	3362.86	1274.3	Casing - DP1	0.1495	2214.57	331.1
Kill / Choke Line	3.0000		0.0087	3362.86	29.4	Riser - DP2			
Booster Line	4.0000		0.0155	3362.86	52.3	Riser - DP1	0.3547	3362.86	1192.7

MUD PUMPS δmp = δ x ε SPM = Flow / (42.00 x δmp) **SLOW CIRCULATION RATE** pressure in (psi)

Nº	δ (bbl/stk)	ε (%)	δmp (bbl/stk)	100.0 gpm	150.0 gpm	Flow (gpm)	SPM	Pump Pressure	Ch Line Loss	Casing Friction
PUMP 1	0.1232	97.0	0.1195	20	30	100.0	20	191	72	26
PUMP 2	0.1232	97.0	0.1195	20	30	150.0	30	343	140	30

VOLUMES AND STROKES	Vol (bbl)	Stk, MP1	Stk, MP2
Surface Connections (Lines)	9.6	80	80
Internal Drill String	165.5	1385	1385
Surface to Bit (Surface Connections + Drill String)	175.0	1465	1465
Bit to Shoe	95.9	803	803
Bit to BOP	525.8	4400	4400
Choke Line	29.4	246	246
Bit to Choke	555.2	4646	4646
Booster Line	52.3	437	437
Riser Annular	1192.7	9980	9980
Surface+Drill String+Annular+CL+KL+Booster L+Riser Ann	2004.6	16774	16774
Total Active Fluid System Volume	2514.2		



Pre-recorded Data on surface stack:

Drilling Simulator 3 PRE-RECORDED - SURFACE STACK

WELL: RIG: DATE: 9 de jun de 2016 BY:

WELL, FLUID, LOT AND EQUIPMENTS						True Vertical Depth (TVD)	3937.01	ft
						Measured Depth (MD)	3937.01	ft
						Shoe Vertical Depth (TVD,shoe)	2296.59	ft
Active Surface Volume			200.00	bbl		Shoe Measured Detph (MD,shoe)	2296.59	ft
Mud Weight (ρm)	9.60	ppg	0.4987	psi/ft		BOP Test Pressure	5000	psi
Fracture Gradient (ρf)	16.50	ppg	0.8571	psi/ft		Casing Burst Pressure	6330 x 0.80	5064 psi

MAXIMUM STATIC PRESSURES			
	Maximum Allowable At Surface Pressure, MAASP = 0.0519 x (ρf - ρm) x TVD,sap	823	psi
	Maximum Casing Pressure: IPR = Casing Burst Pressure x DF (DF = 1/Design Factor)	7912	psi
	Maximum BOP Pressure = BOP Test Pressure	5000	psi
	Maximum Equipment Pressure: Smaller of (Maximum Casing or Maximum BOP)	5000	psi

LENGTH, CAPACITY AND VOLUMES

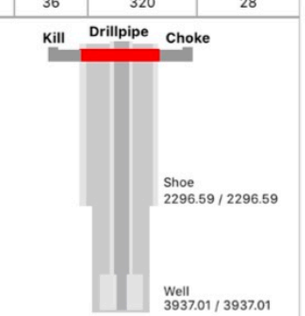
Drill String	ID (in)	OD (in)	Cv,i (bbl/ft)	L (ft)	Vi (bbl)	Annular	Cv,a (bbl/ft)	L (ft)	Va (bbl)
Drillpipe, DP1	4.2760	5.0000	0.0178	2985.56	53.03	Open Hole - DC2	0.0259	164.04	4.25
Drillpipe, DP2	4.2760	5.0000	0.0178			Open Hole - DC1	0.0322	459.32	14.81
Heavy Weight, HW	3.0000	5.0000	0.0087	328.08	2.87	Open Hole - HW	0.0459	328.08	15.06
Drill Collar, DC1	2.8125	6.2500	0.0077	459.32	3.53	Open Hole - DP2	0.0459		
Drill Collar, DC2	2.8125	6.7500	0.0077	164.04	1.26	Open Hole - DP1	0.0459	688.98	31.63
Total Drill String				**3937.01**	**60.69**	**Total Open Hole**		**1640.42**	**65.75**
WellBore	**ID (in)**	**OD (in)**	**Cv,i (bbl/ft)**	**L (ft)**	**Vi (bbl)**	Liner - DP2			
Open Hole	8.5000		0.0702	1640.42	115.14	Liner - DP1			
Liner						Casing - DP2	0.0502		
Casing	8.7550	9.6250	0.0745	2296.59	171.01	Casing - DP1	0.0502	2296.59	115.24

Cv,i = ID^2 / 1029.4147 Vi = Cv,i x L Cv,a = (BoreD^2 - OD^2) / 1029.4147 Va = Cv,a x L

MUD PUMPS δmp = δ x ε SPM = Flow / (42.00 x δmp) **SLOW CIRCULATION RATE** pressure in (psi)

Nº	δ (bbl/stk)	ε (%)	δmp (bbl/stk)	100.0 gpm	150.0 gpm	Flow (gpm)	SPM	Pump Pressure	Casing Friction
PUMP 1	0.1027	97.0	0.0996	24	36	100.0	24	175	24
PUMP 2	0.1027	97.0	0.0996	24	36	150.0	36	320	28

VOLUMES AND STROKES	Vol (bbl)	Stk, MP1	Stk, MP2
Surface Connections	6.00	60	60
Internal Drill String	60.69	609	609
Surface to Bit (Surface Connections + Drill String)	66.69	670	670
Bit to Shoe	65.75	660	660
Bit to BOP	180.98	1817	1817
Bit to Surface	180.98	1817	1817
Drill String + Annular	241.68	2427	2427
Total Active Fluid System Volume	447.68		

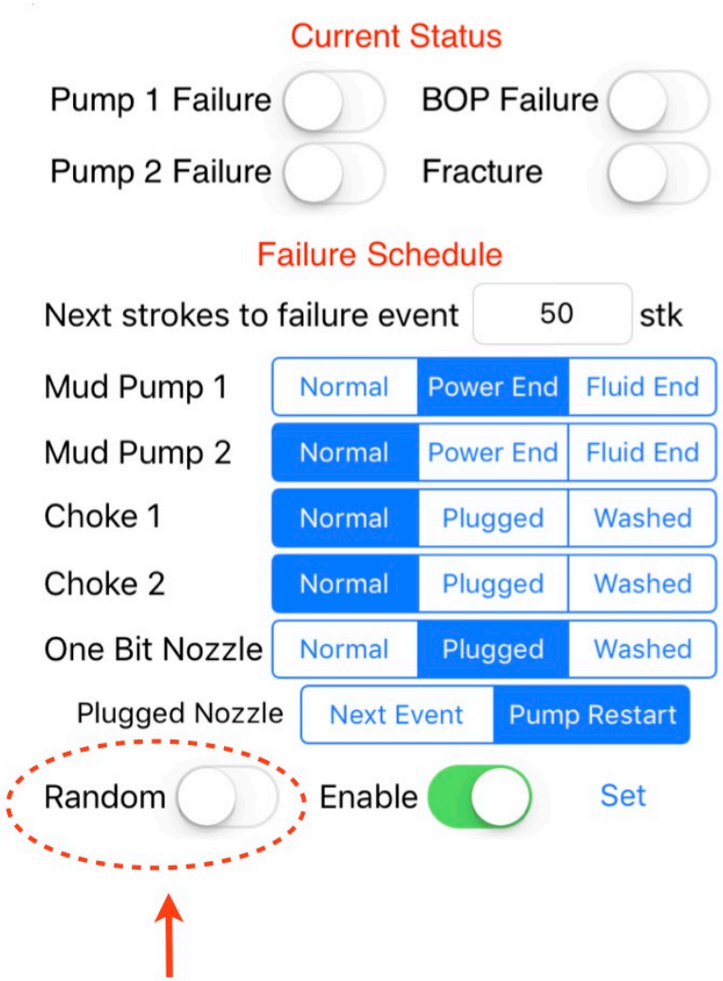


CHAPTER 15

Failures Schedule

This simulator has a failures schedule with random option based on pump strokes as a delay parameter:

- Mud Pumps 1 and 2 “power end failure” or “fluid end failure”,
- Chokes 1 and 2 “plugged” or “washed”,
- One Drill Bit Nozzle “plugged” or “washed”



Random option is applied only for:

1. Mud Pump 1
2. Choke 1
3. One Bit Nozzle

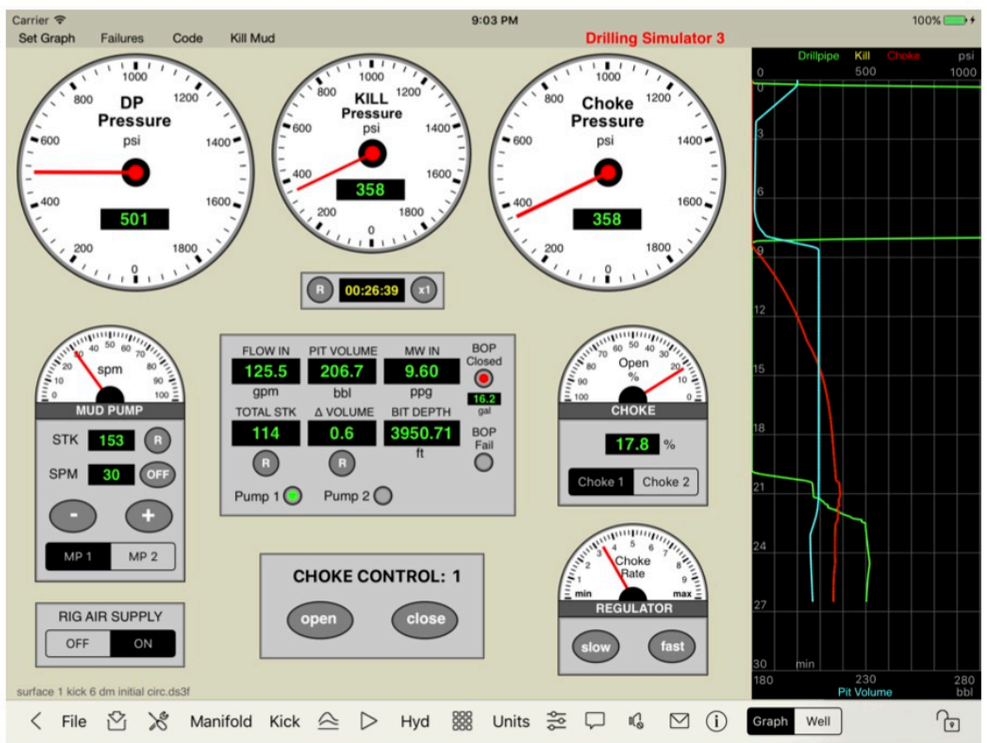
Mud Pump failures

Power End: The mud pump stops. Flow rate to zero. DP Pressure and Choke Pressure drops the friction losses.

=> Start closing the choke trying to maintain the Choke Pressure (on surface stack) until to close the choke fully (0 %).

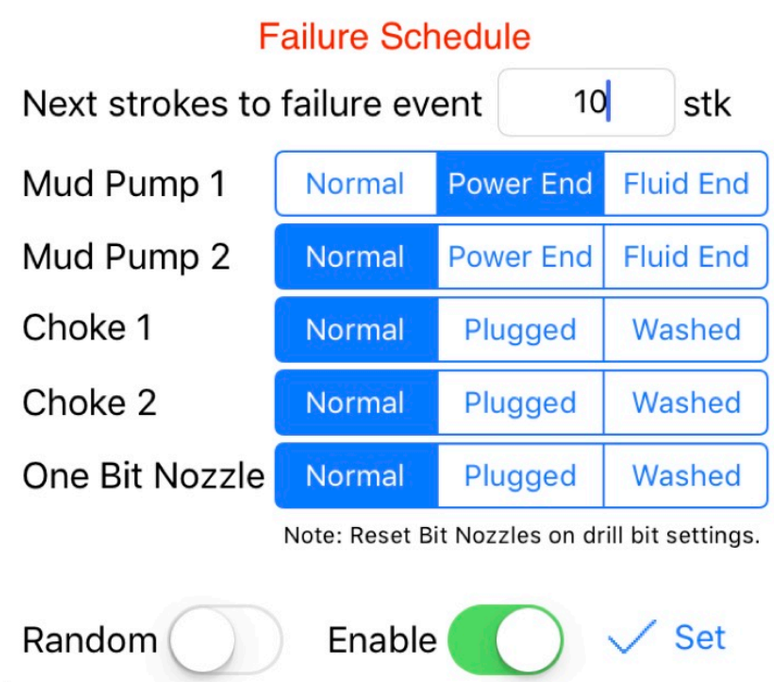
Example:

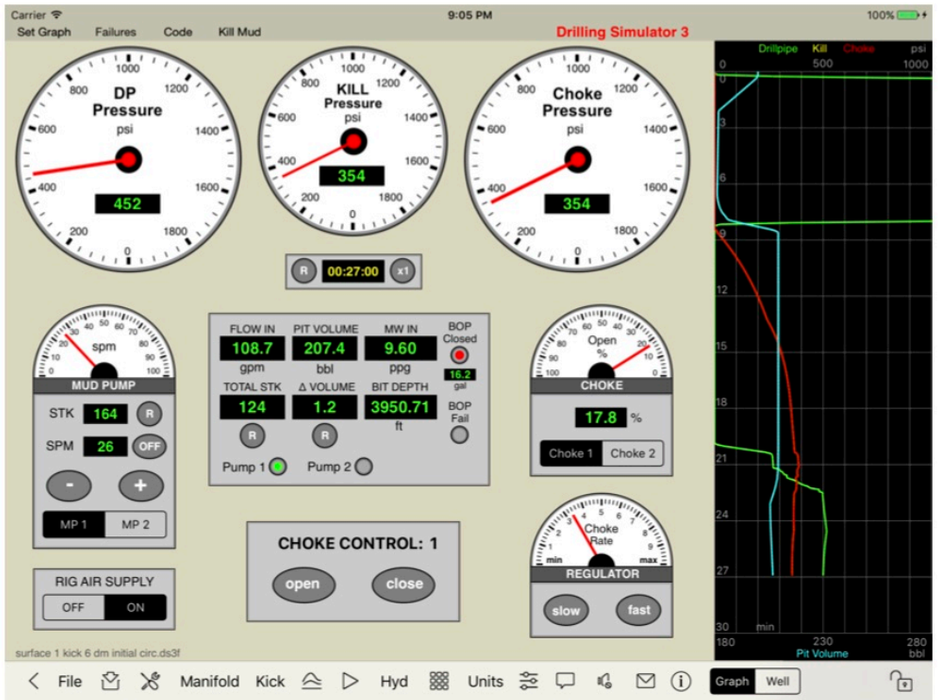
Vertical well on landing rig, drillpipe float valve, circulating a kick by the driller's method:

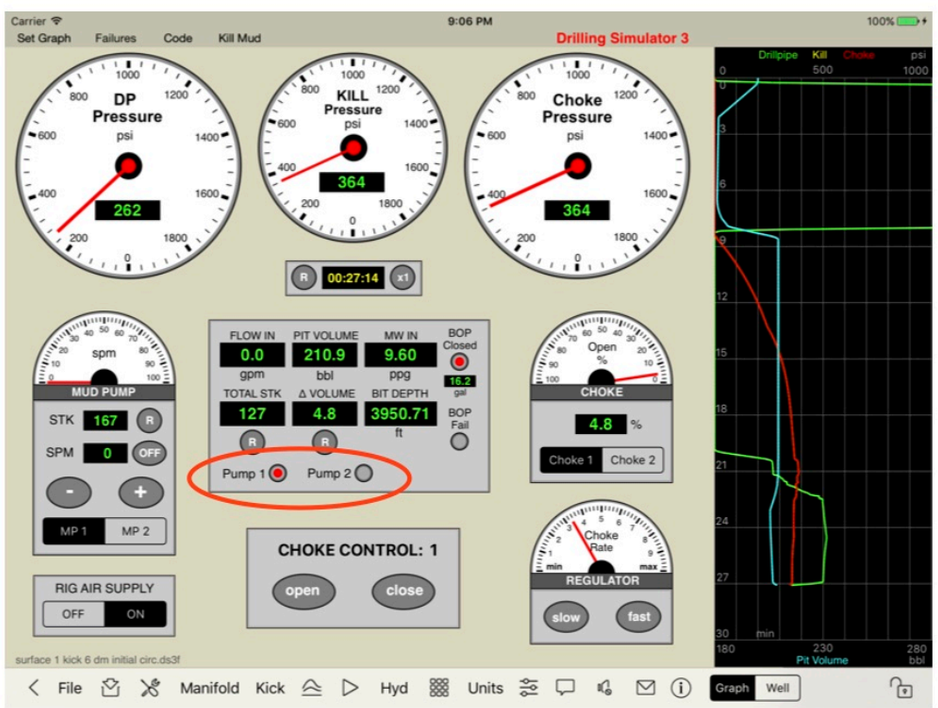


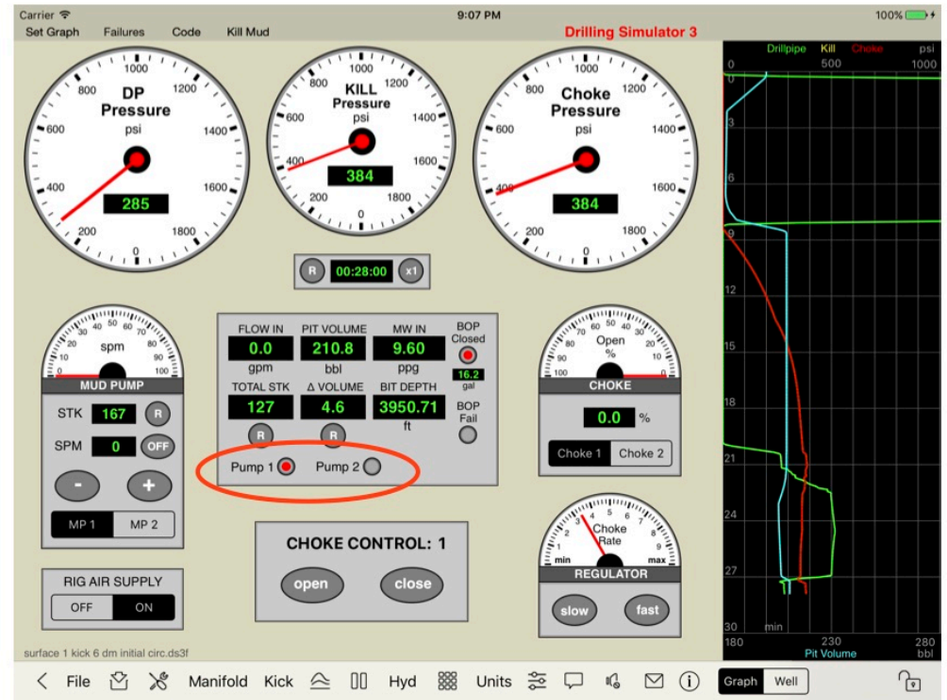
Set the failure scheduled to the next 10 strokes:

1. Input 10 strokes
2. Select the Mud Pump 1 "Power End" option
3. Select "Enable"
4. Tap on Set button.
5. close the popup view
6. Check parameters on 10 strokes (114 + 10 = 124)

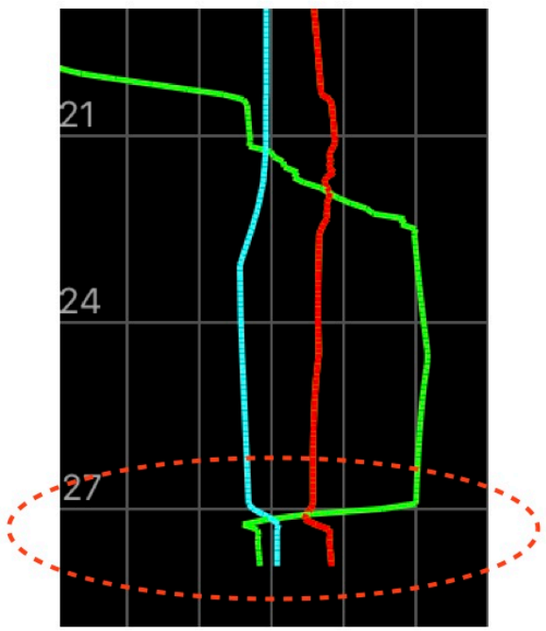






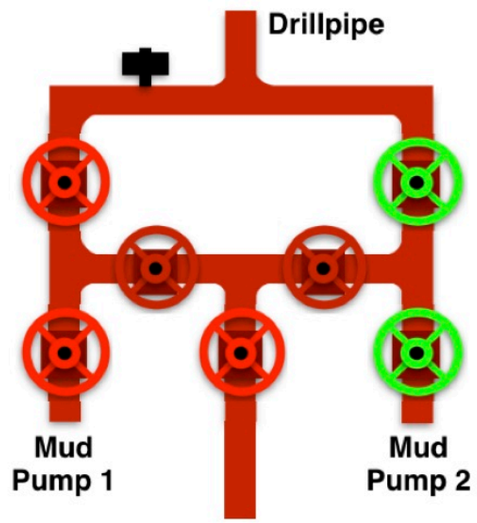


Look for trapped pressure after shut-in.

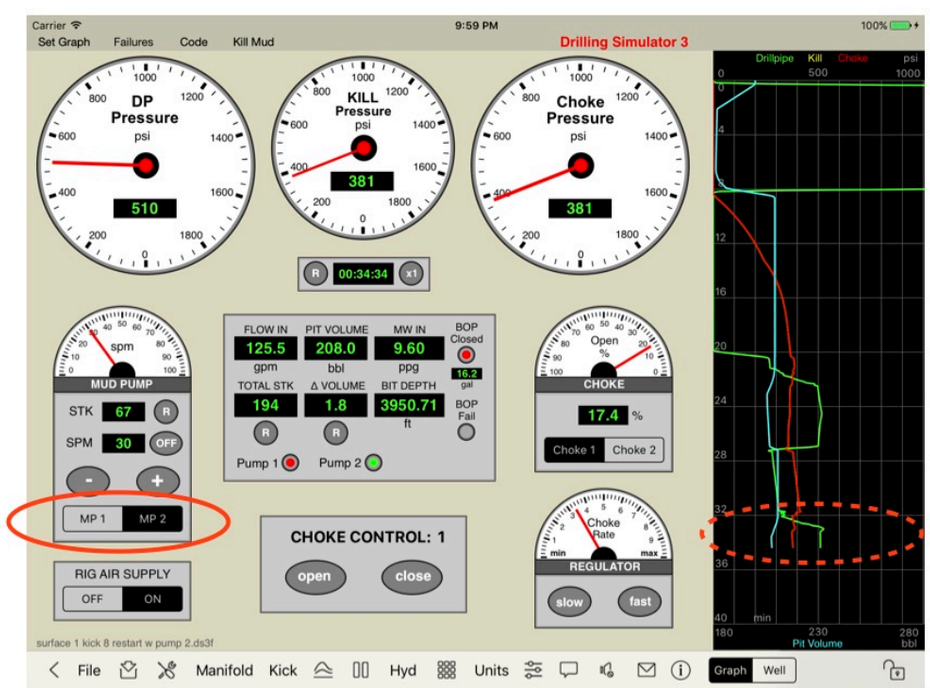


Restart circulation with mud pump 2

Align the mud pump 2 on the standpipe manifold:



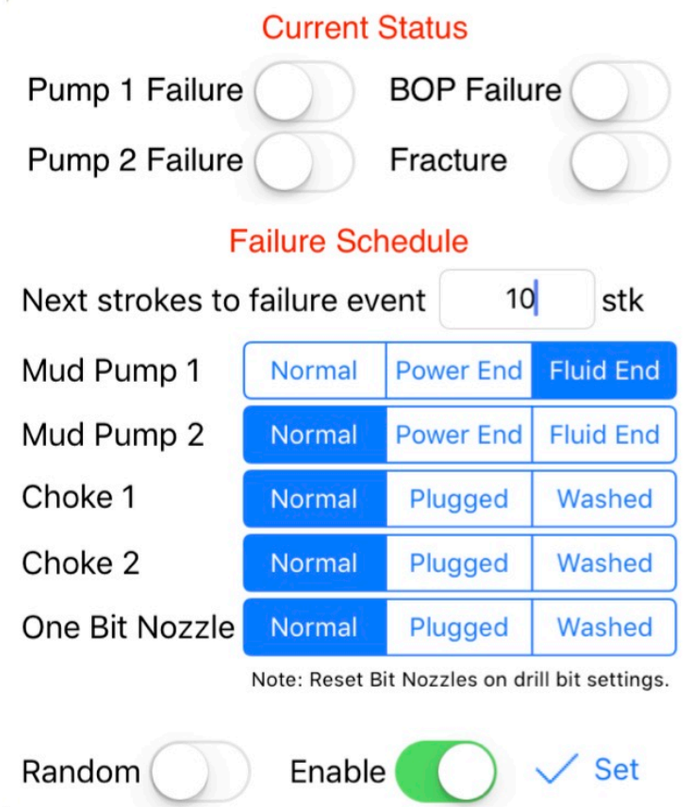
Start mud pump 2 trying maintaining the choke pressure

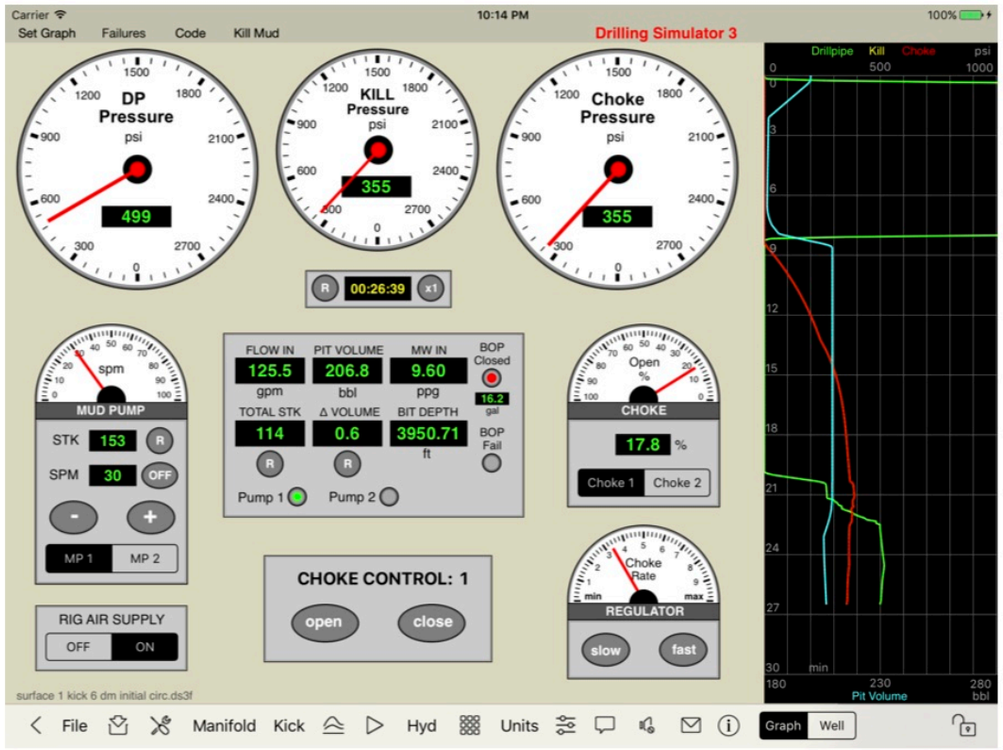


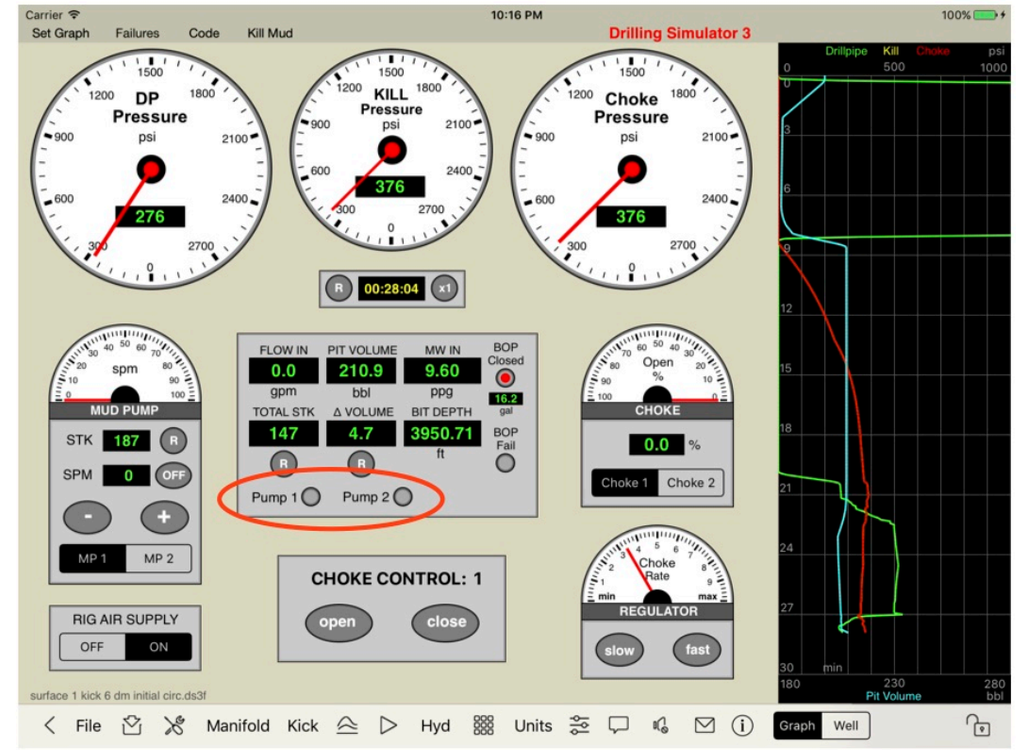
Fluid End

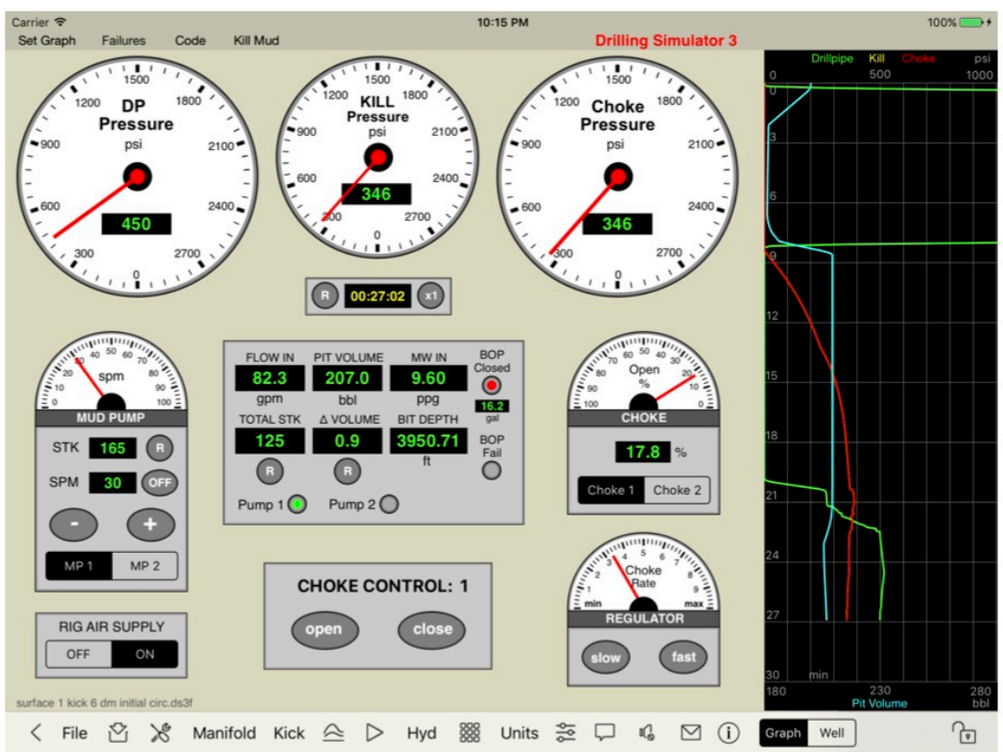
The circulation flow drops slowly until zero. DP Pressure and Choke Pressure drops by reduction of the friction losses.

=> Start closing the choke trying to maintain the Choke Pressure (on surface stack) and stopping the mud pump until to zero spm and choke closed (shut-in).

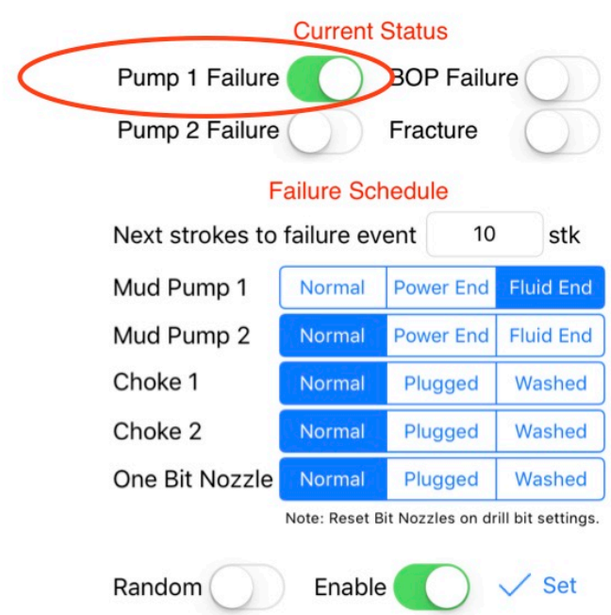








Note: In this case the simulator does not detects the failure in mud pump 1. So set the mud pump 1 to fail manually.

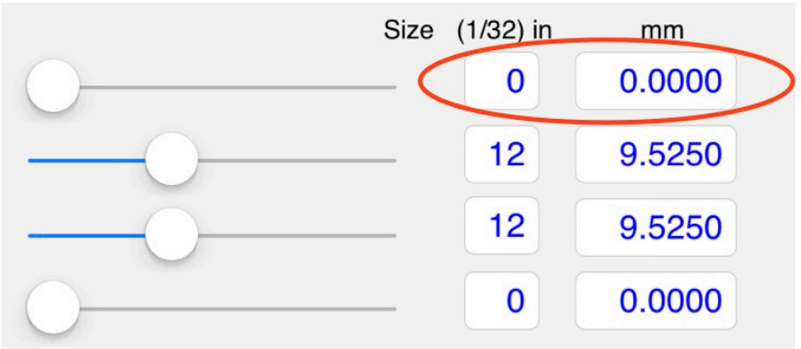


One Bit Nozzle Plugged

DP Pressure increases without effects on the Choke pressure.

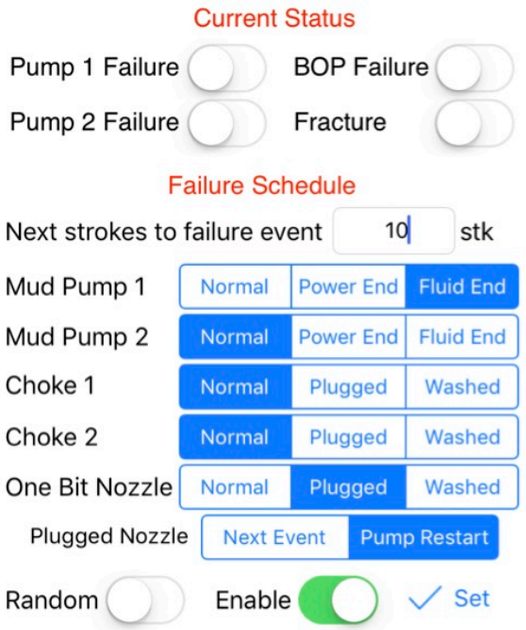
Usually when set a failure on mud pump, also set “One Bit Nozzle” plugged option on the next restart. This effect will occur after shut-in and the next restart a mud pump.

In this event, the simulator set one nozzle to zero, on starting on nozzle 1,...

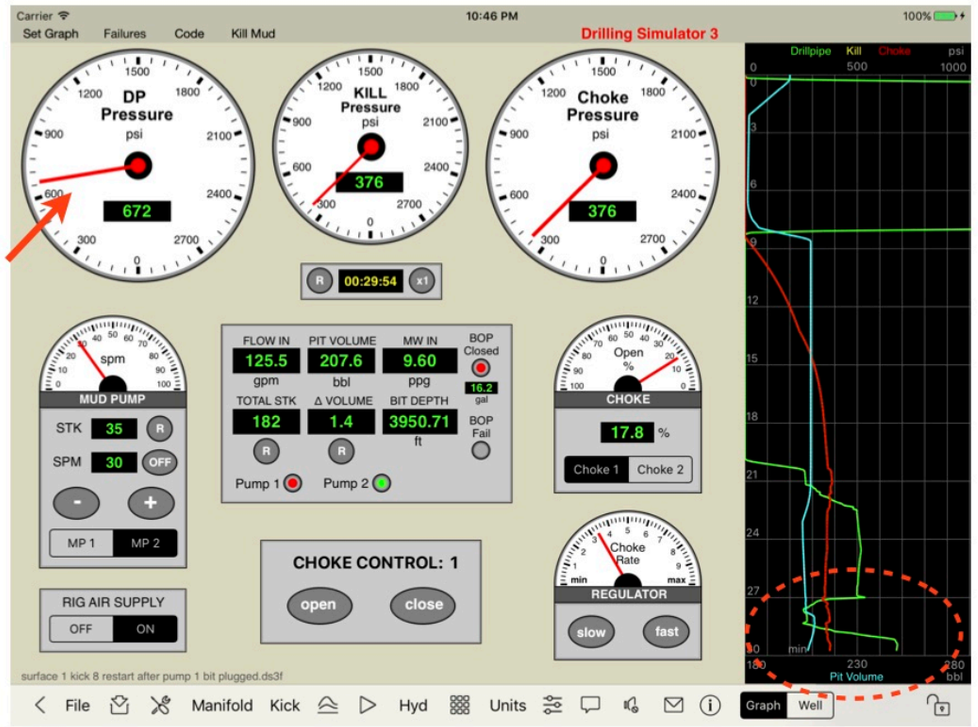


To reset this failure, set a new value to the nozzle on settings.

On restart, the DP Pressure is greater for a same value to flow rate and choke pressure.

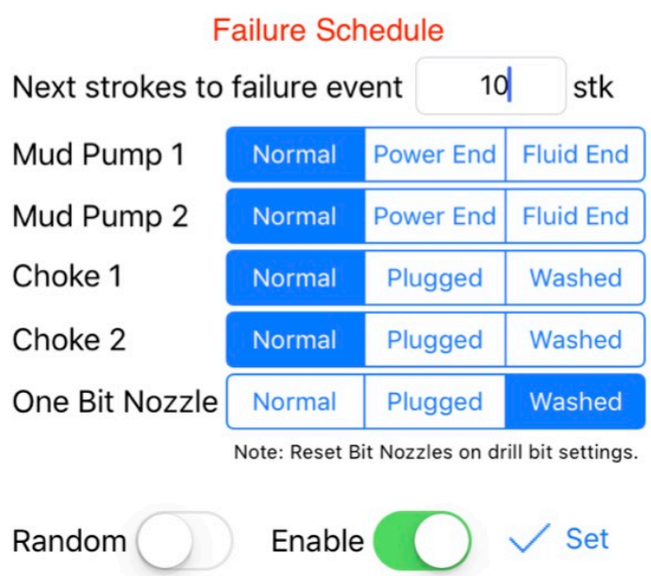


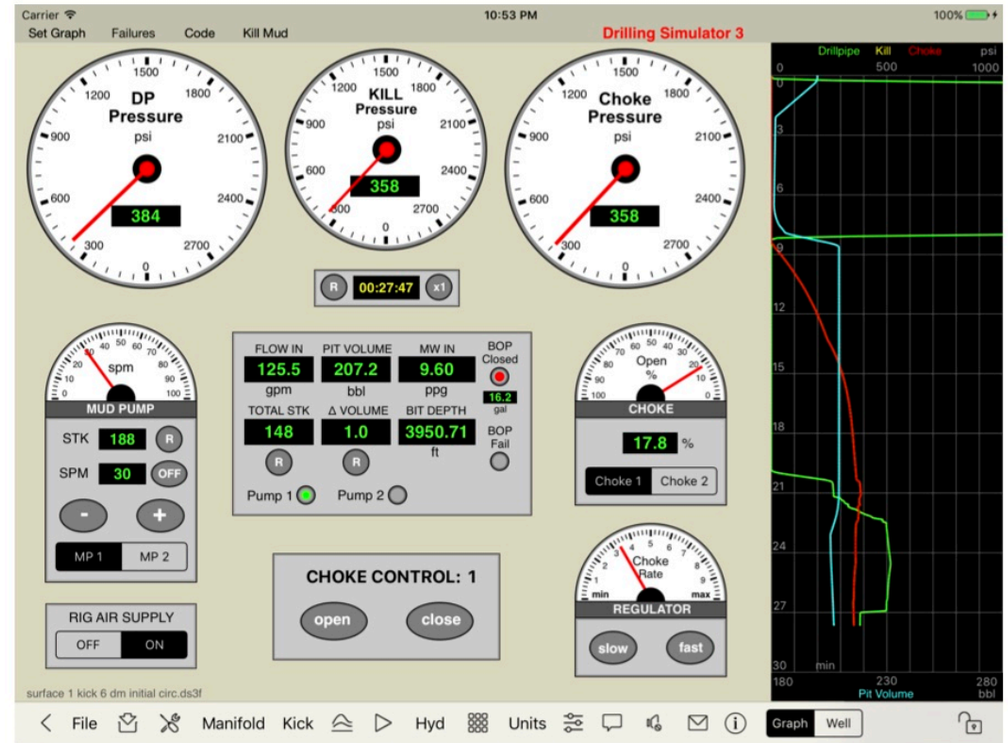
On restart:

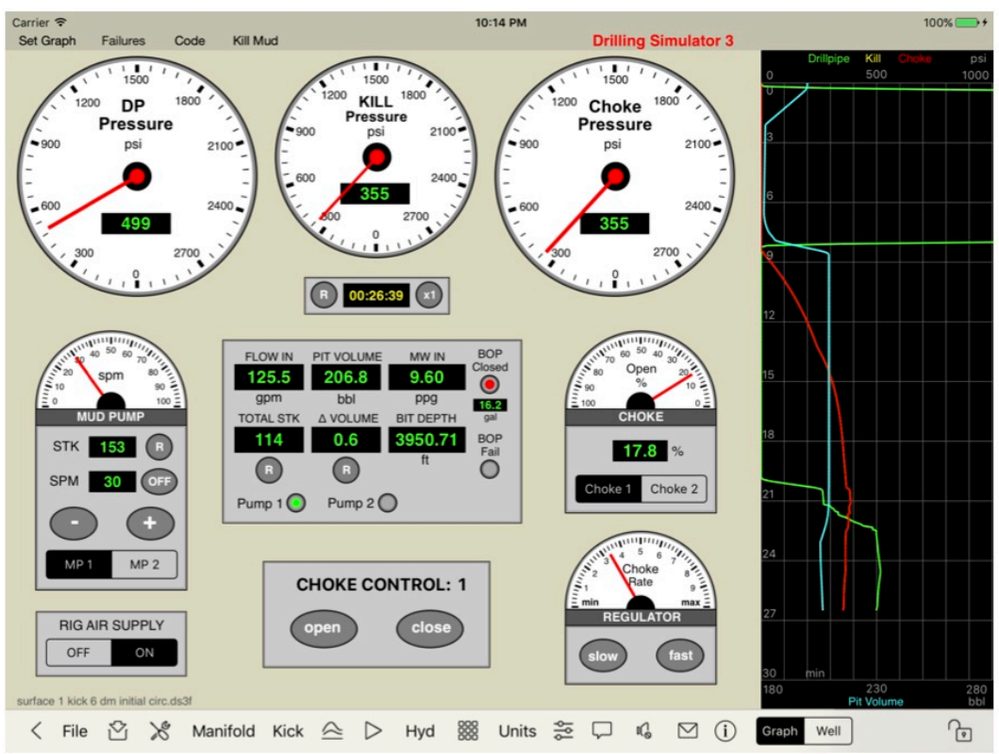


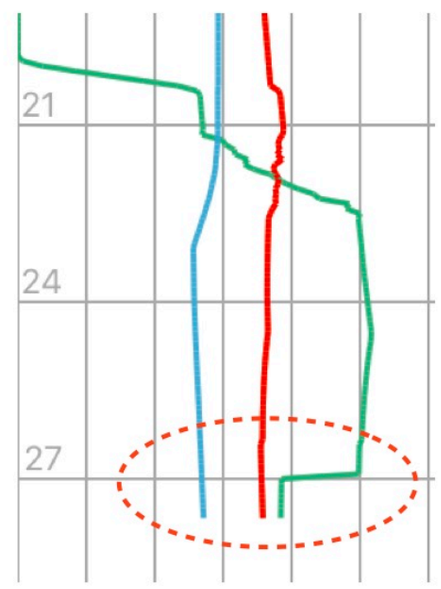
One Bit Nozzle Washed

DP Pressure decreases without effects on the Choke pressure.







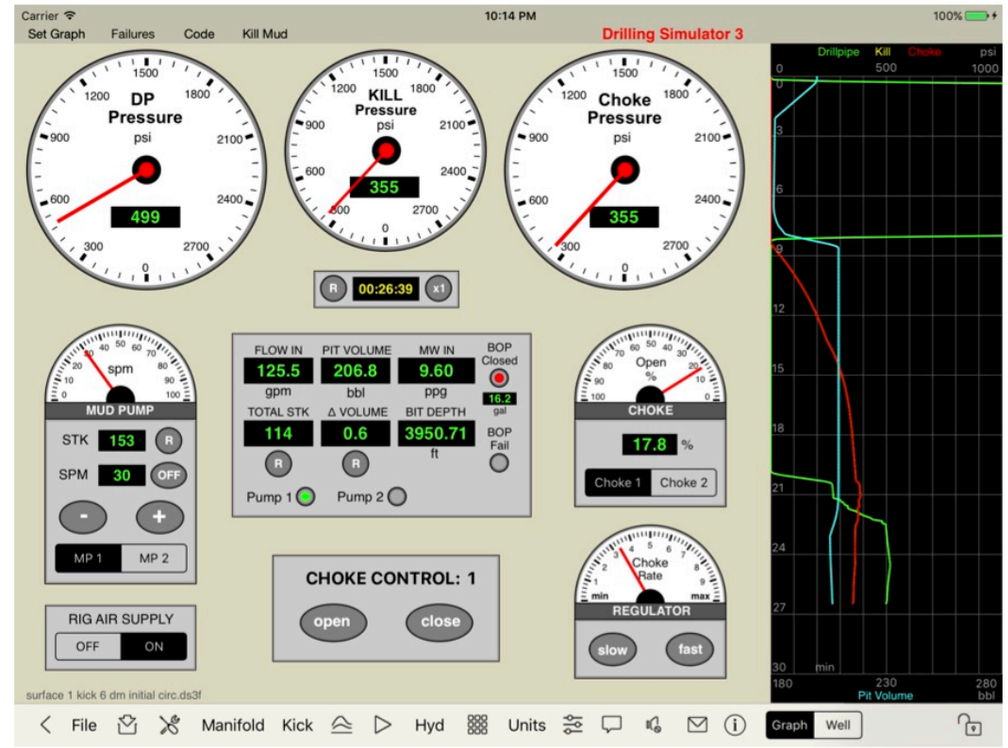


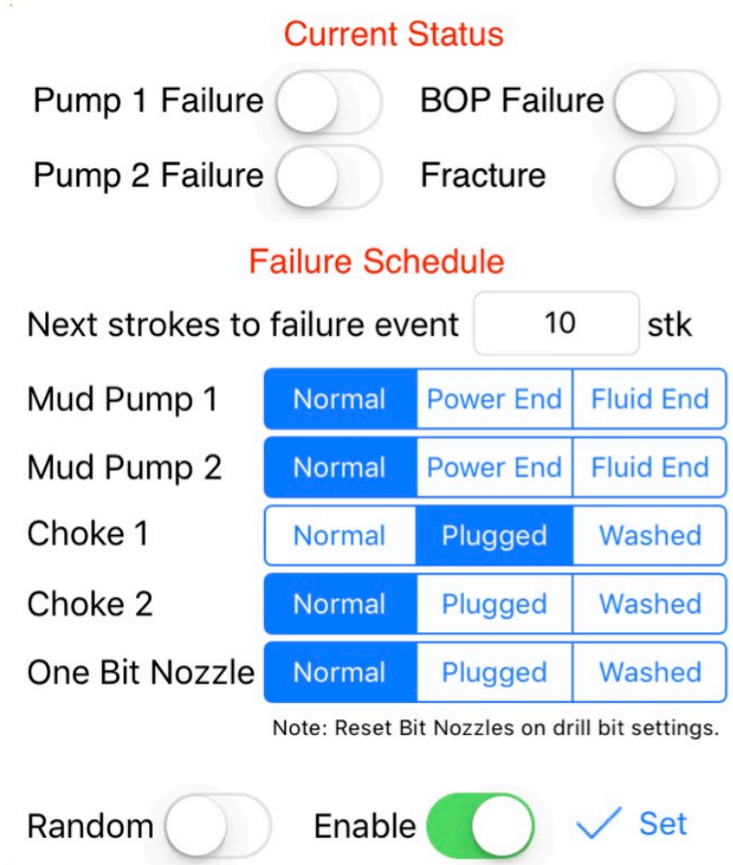
Choke Plugged

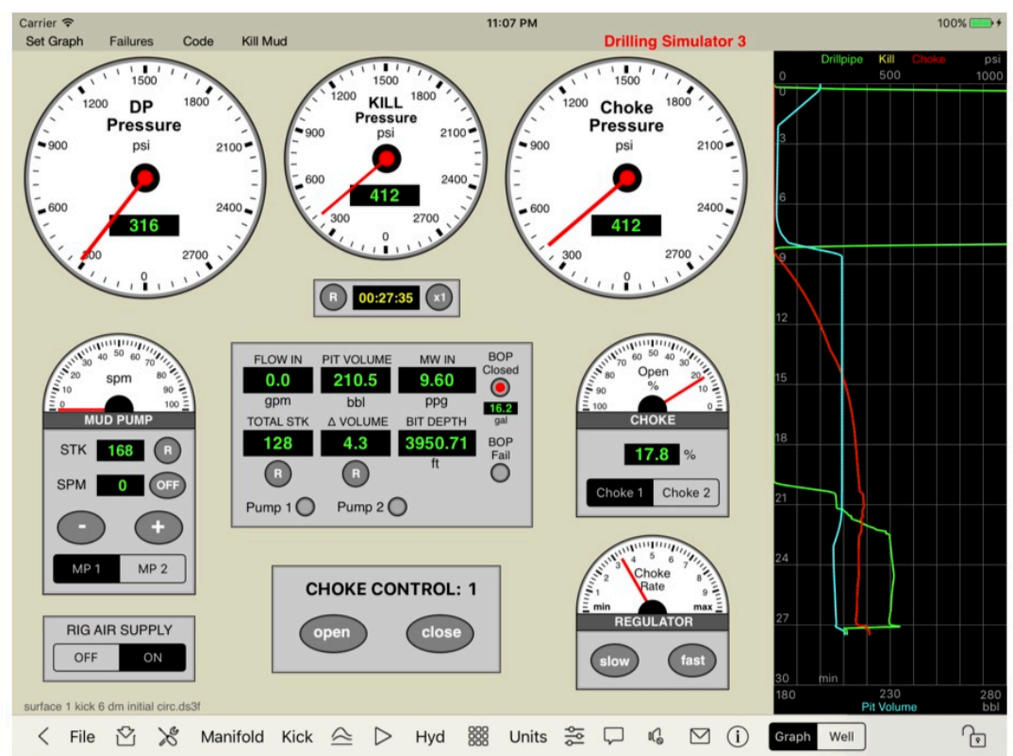
Both DP Pressure and Choke Pressure increase.

=> Stop mud pump immediately due possibility of fracture of formation.

Normally in this case, can to occur trapped pressure.





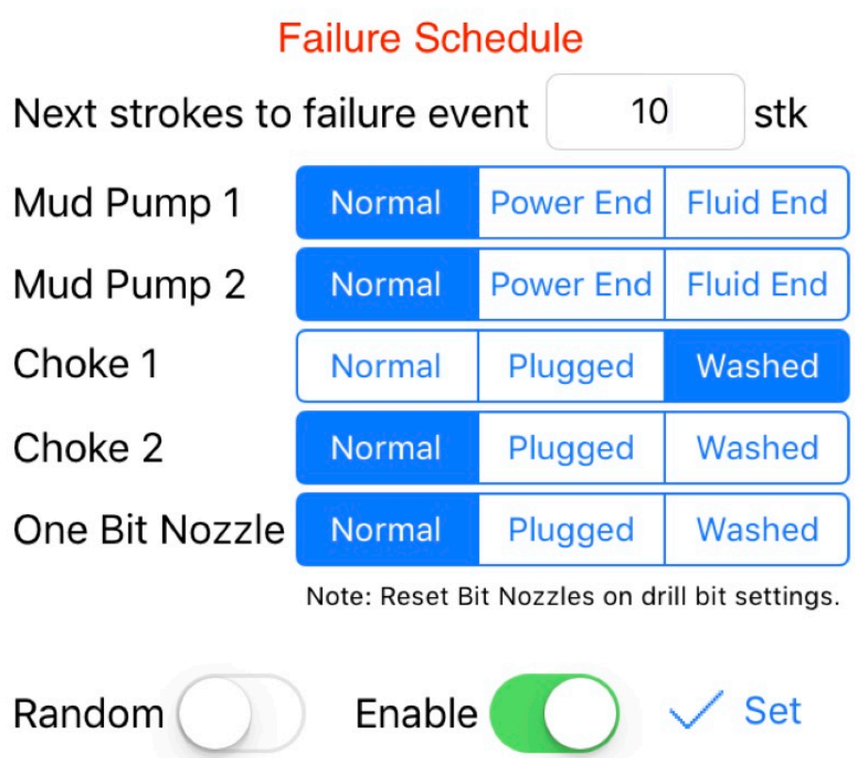


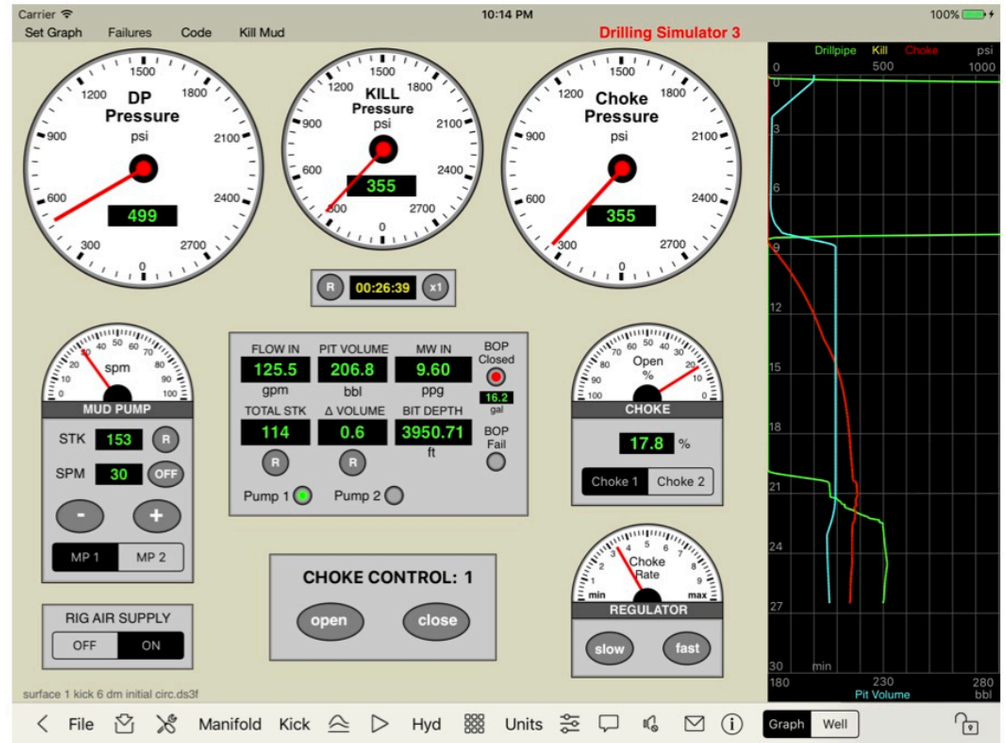
Choke Washed

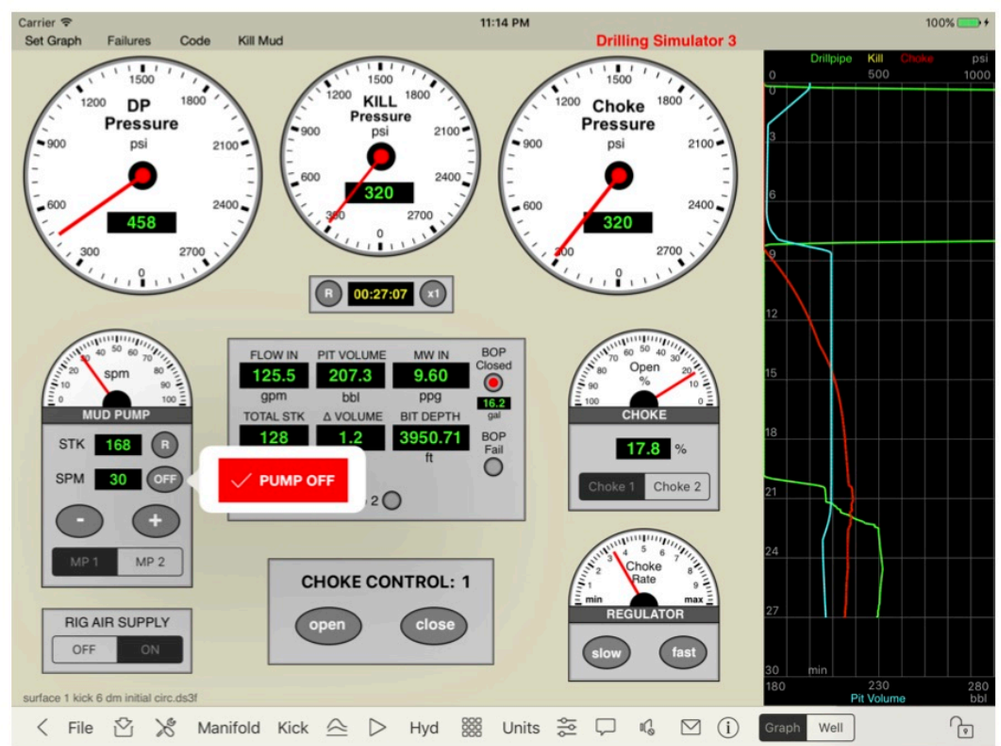
Both DP Pressure and Choke Pressure decrease.

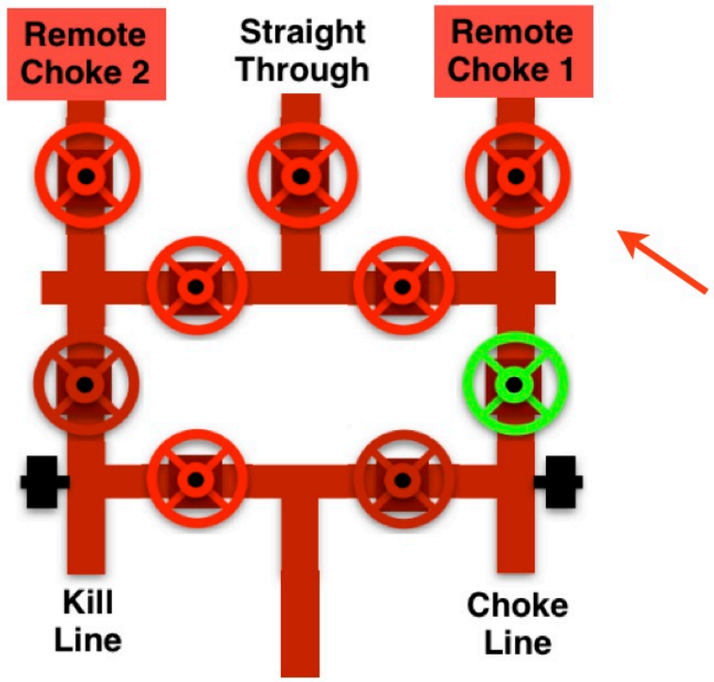
=> Stop mud pump immediately and close the valve to isolate the choke.

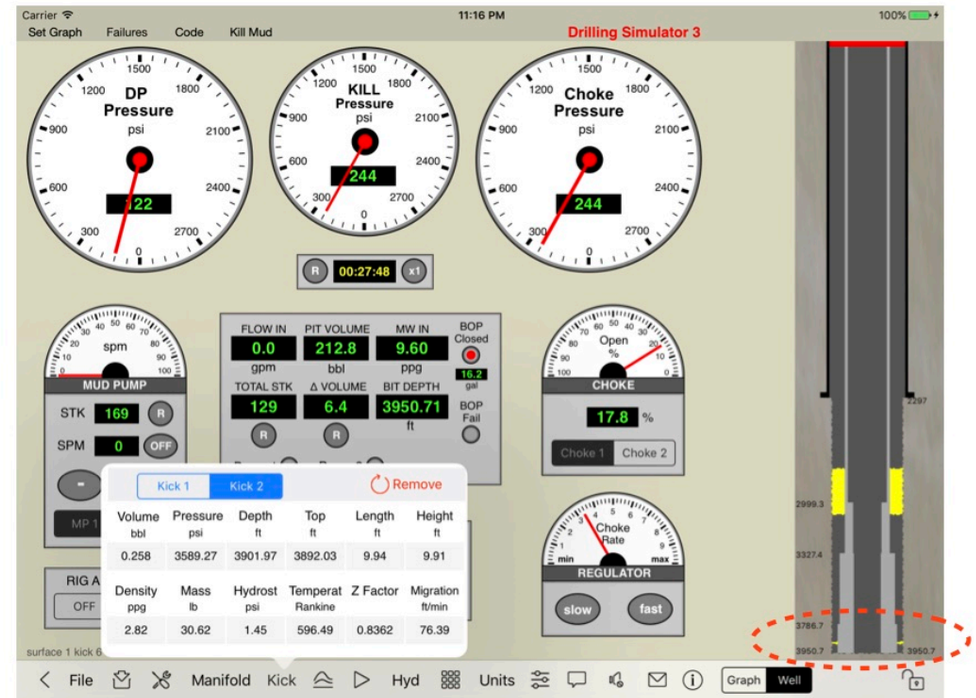
Normally in this case, can to occur a new kick at bottom.

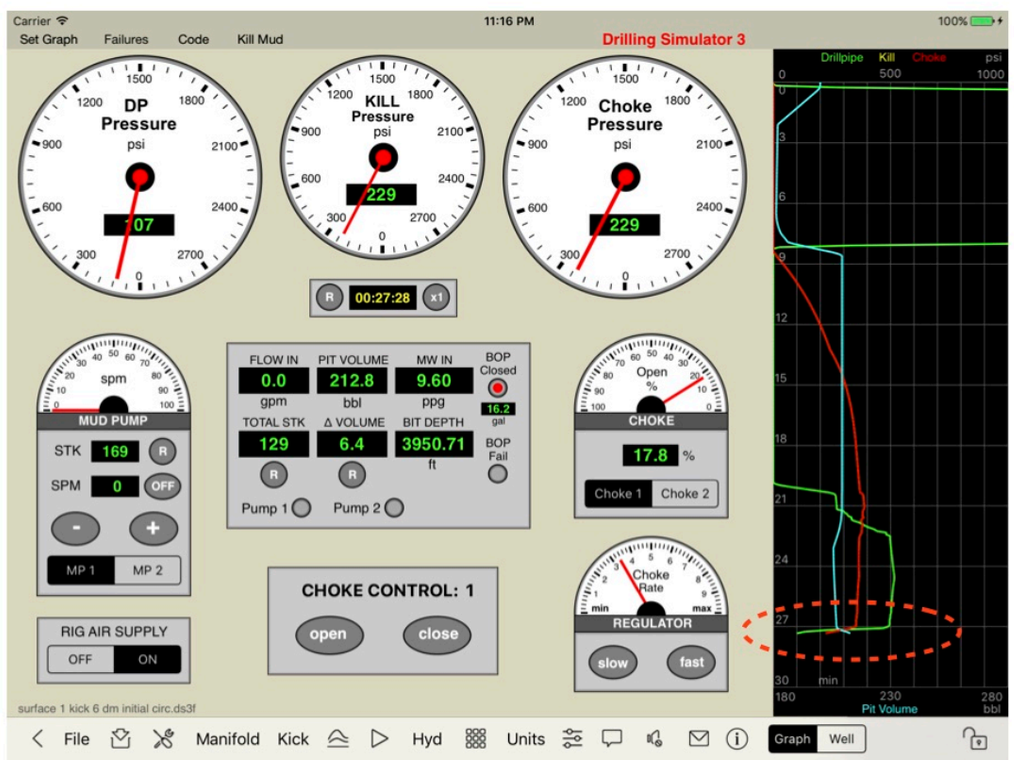




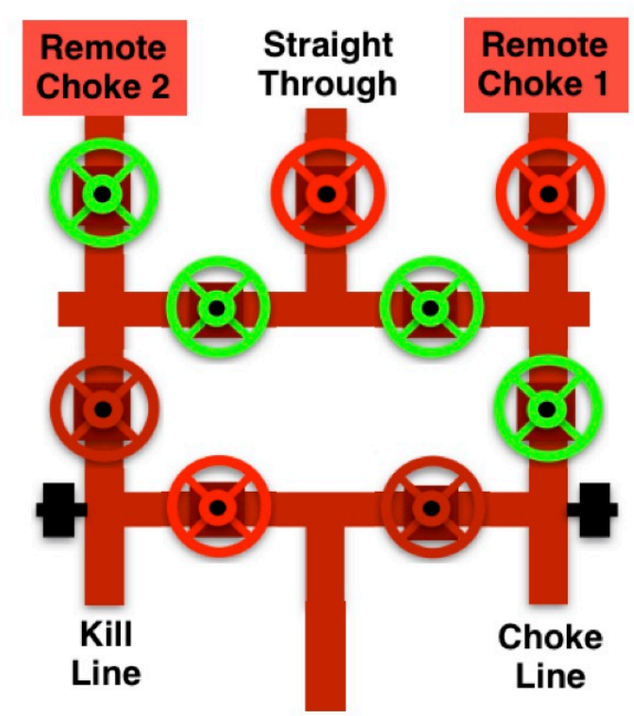




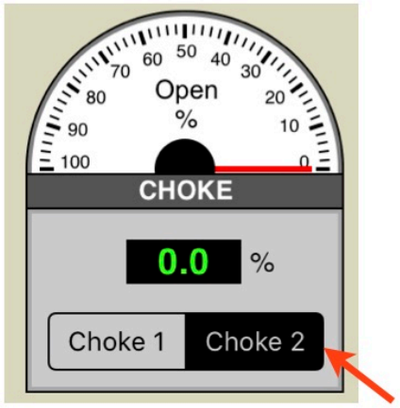




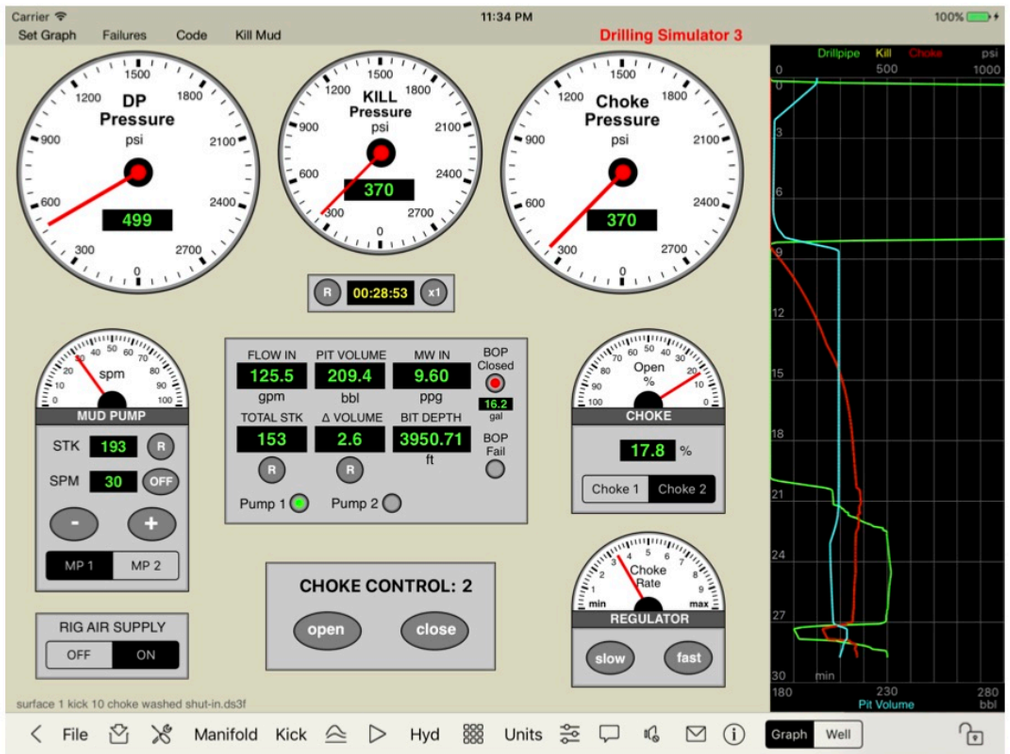
Align to choke 2 on choke manifold:

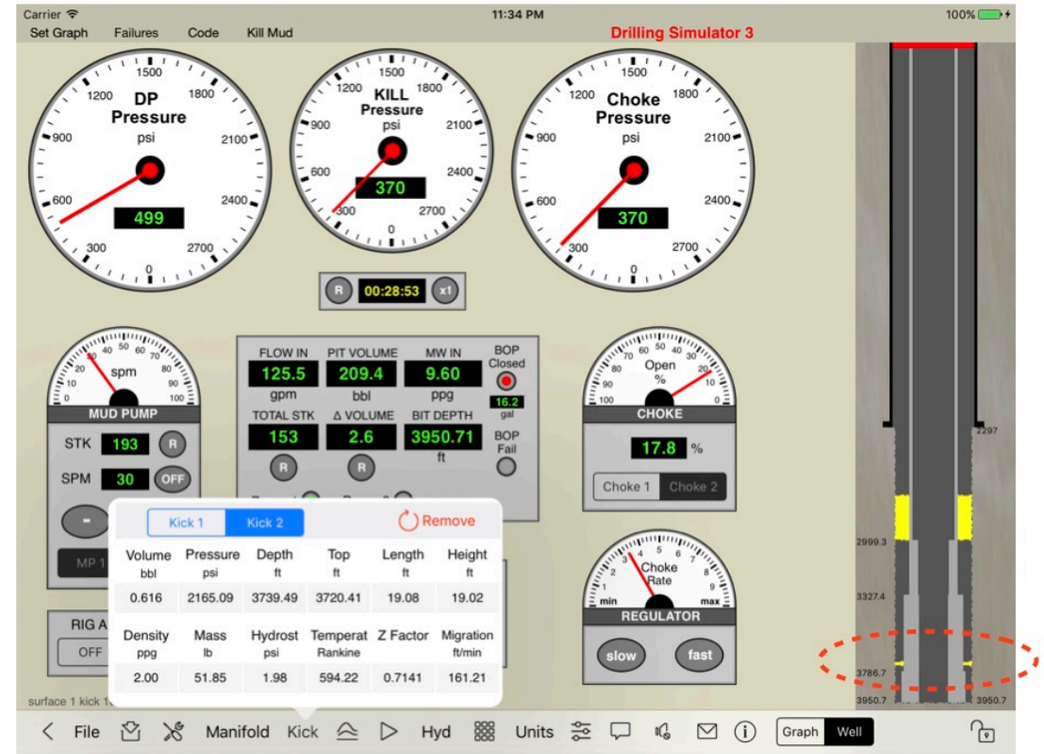


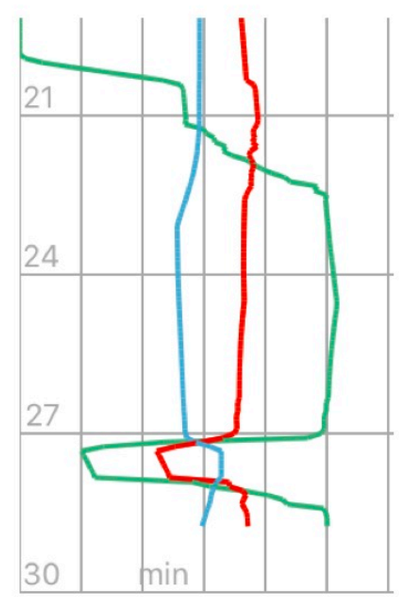
Select the choke 2 to operate:



Restart the circulation with the choke 2, maintaining the last choke pressure:







CHAPTER 16

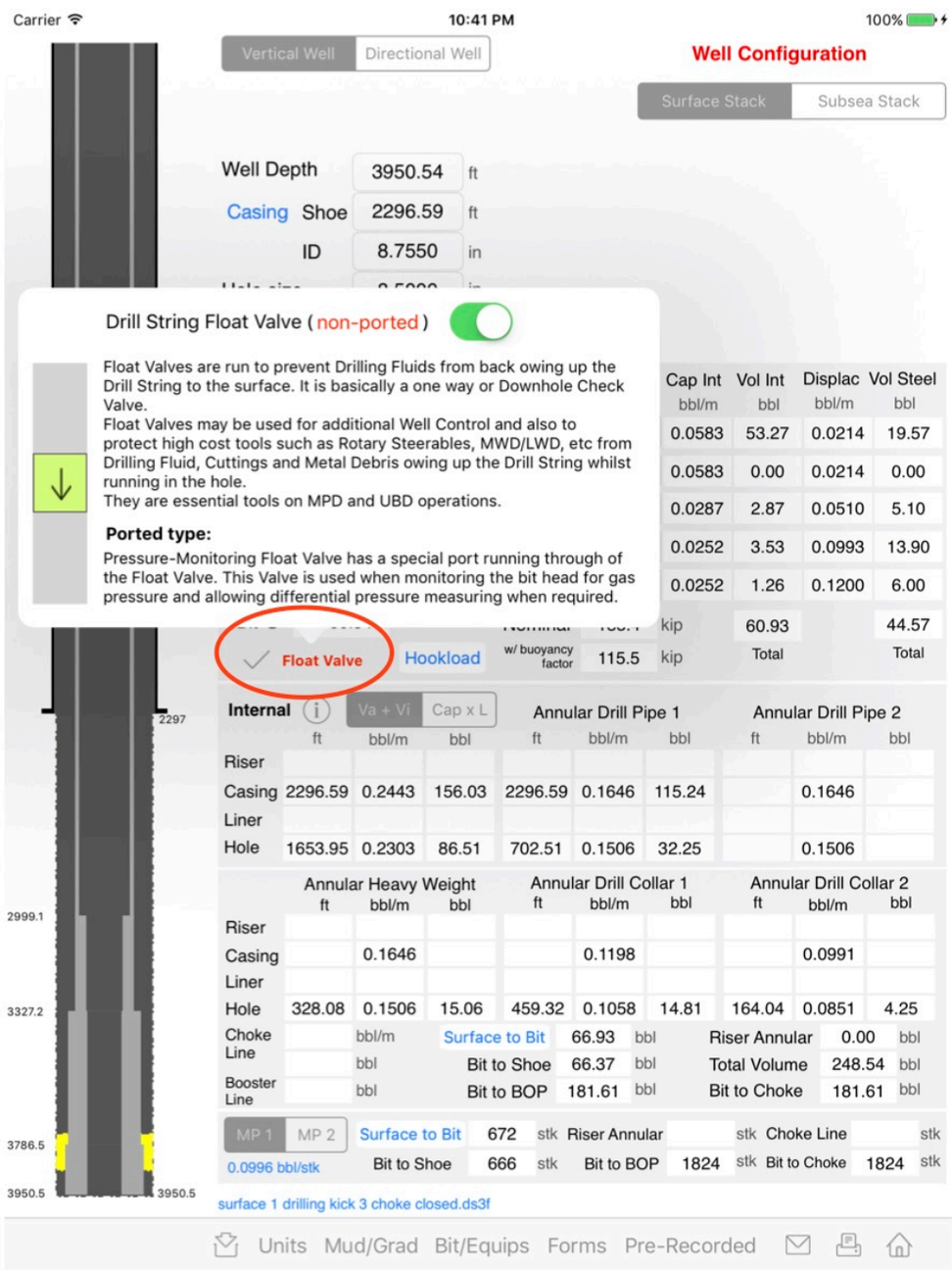
Float Valve (non-ported)

Float Valves are run to prevent Drilling Fluids from back owing up the Drill String to the surface. It is basically a one way or Downhole Check Valve.
Float Valves may be used for additional Well Control and also to protect high cost tools such as Rotary Steerables, MWD/LWD, etc from Drilling Fluid, Cuttings and Metal Debris owing up the Drill String whilst running in the hole.

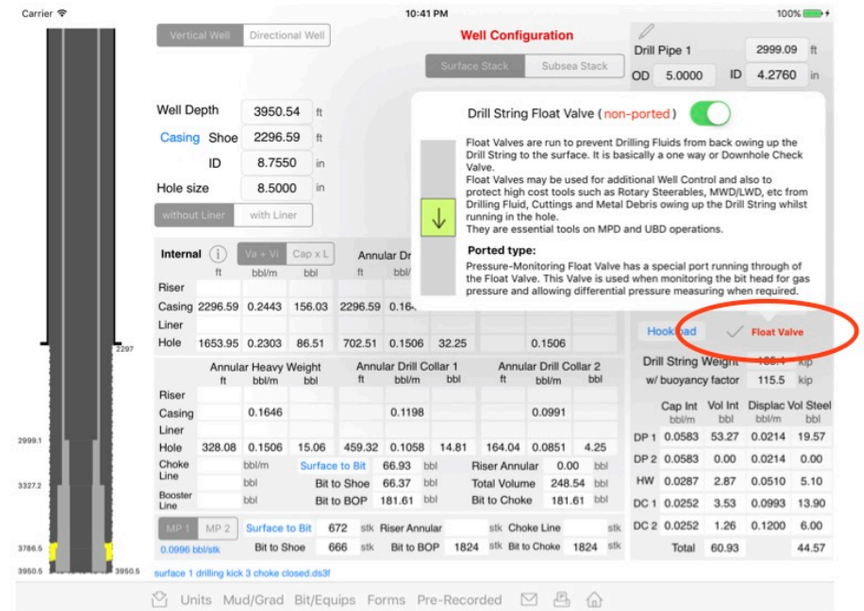
They are essential tools on MPD and UBD operations.

This feature in this simulator shows the effects of a float valve into the drill string on shut-in and definition of the SIDPP.

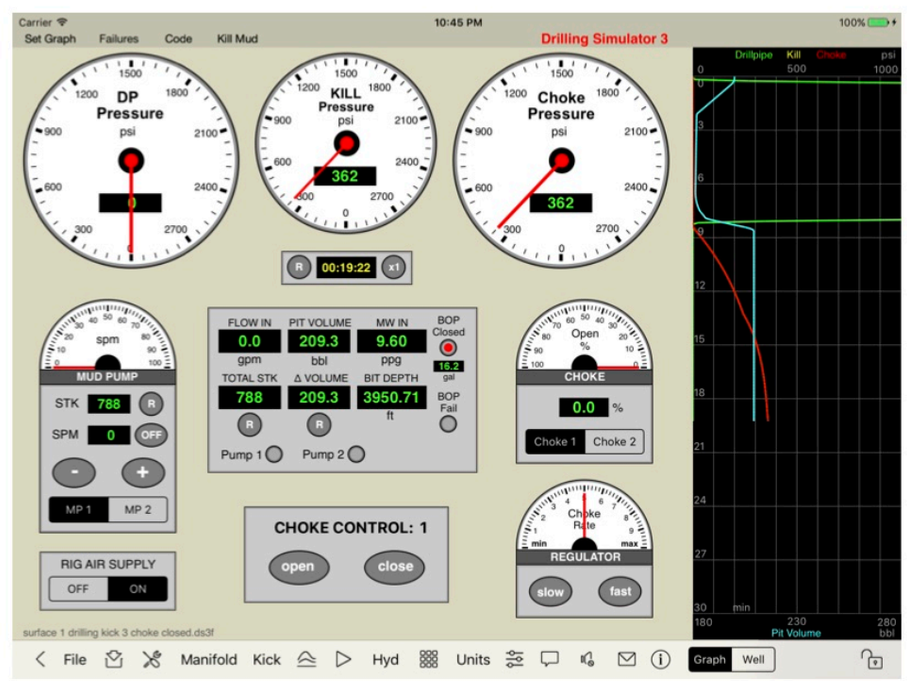
Set the Float Valve in Setting view



iPad on landscape position



Set the kick and perform the shut-in. Look that the Drill Pipe Pressure is ZERO.



How to get the SIDPP with float valve in the drillstring?

Bring the mud pump slowly until the opening of the float valve, checking changing on the choke pressure. Stop mud pump immediately.

Before to start the mud pump, record the choke pressure.

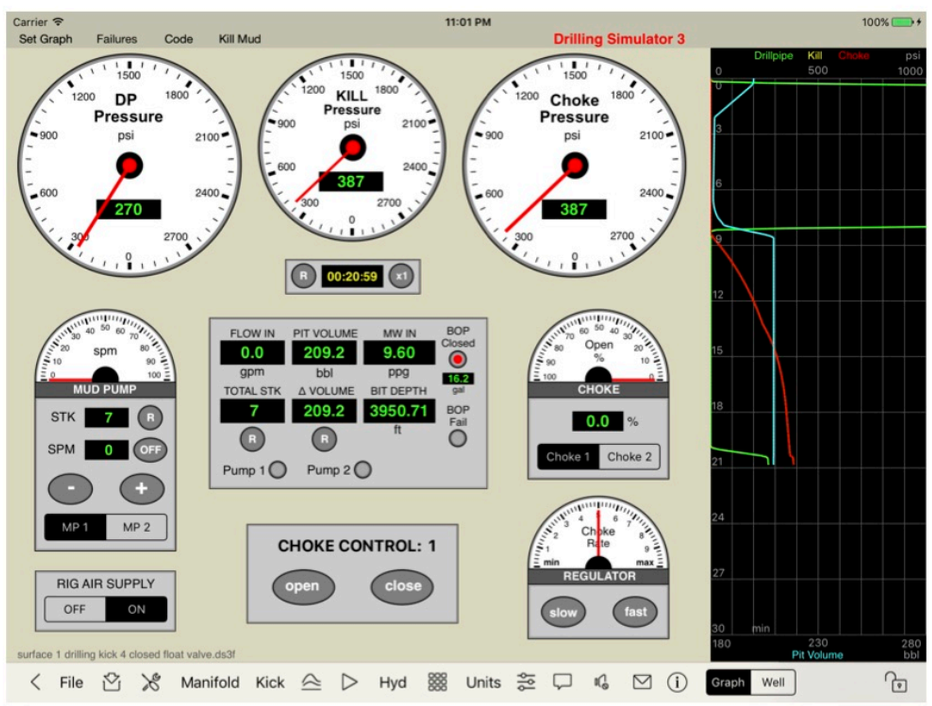
SICP = 362 psi

After the occurrence of the changing on choke pressure, stop immediately the mud pump and record the the DP Pressure and the new choke pressure.

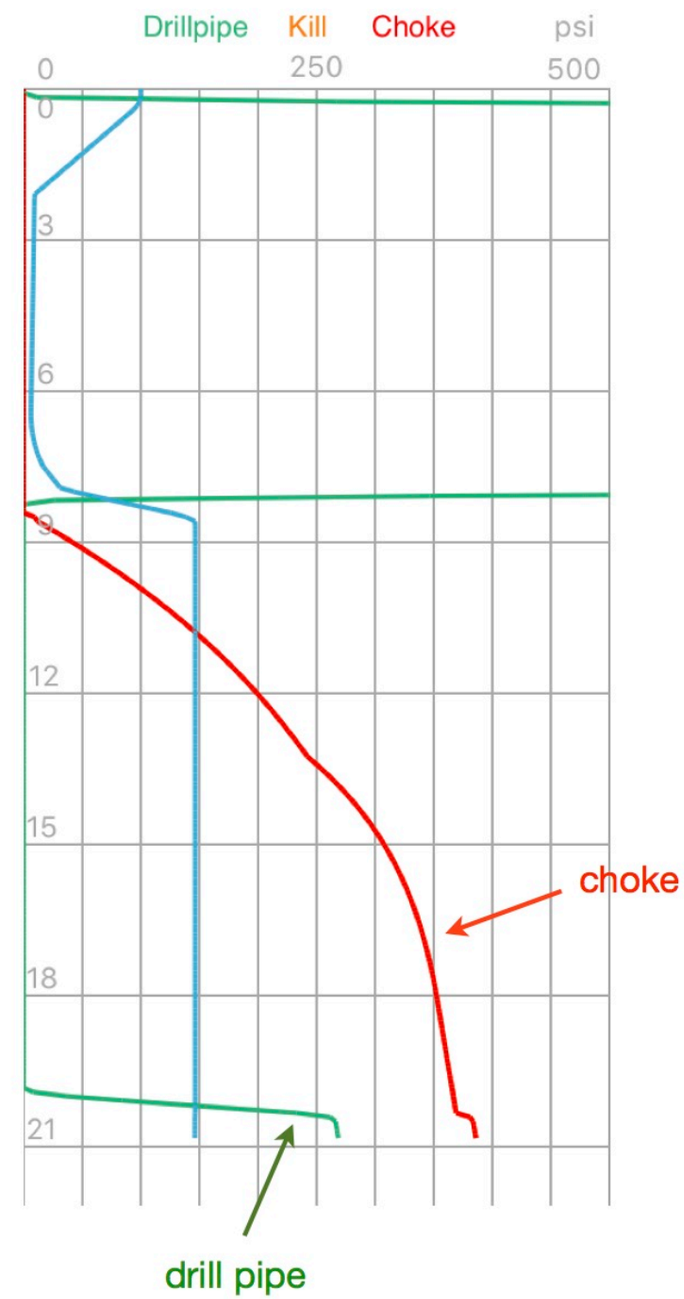
Choke Pressure = 387 psi and DP Pressure = 270 psi

SIDPP = DP Pressure - (Difference on Choke Pressure)

SIDPP = 270 - (387 - 362) => SIDPP = 245 psi



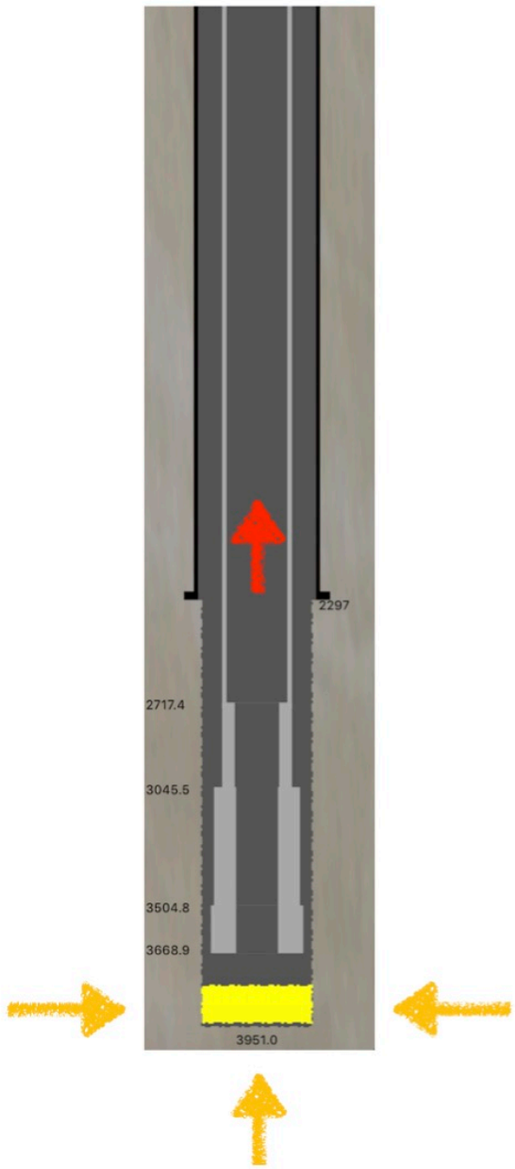
Changing on the pressures on graph



CHAPTER 17

Kick Induced by Swabbing

It is possible in this simulator to induce a kick by swabbing to practice the volumetric method (lubricate and bleed) on surface stack and dynamic volumetric method on subsea stack.



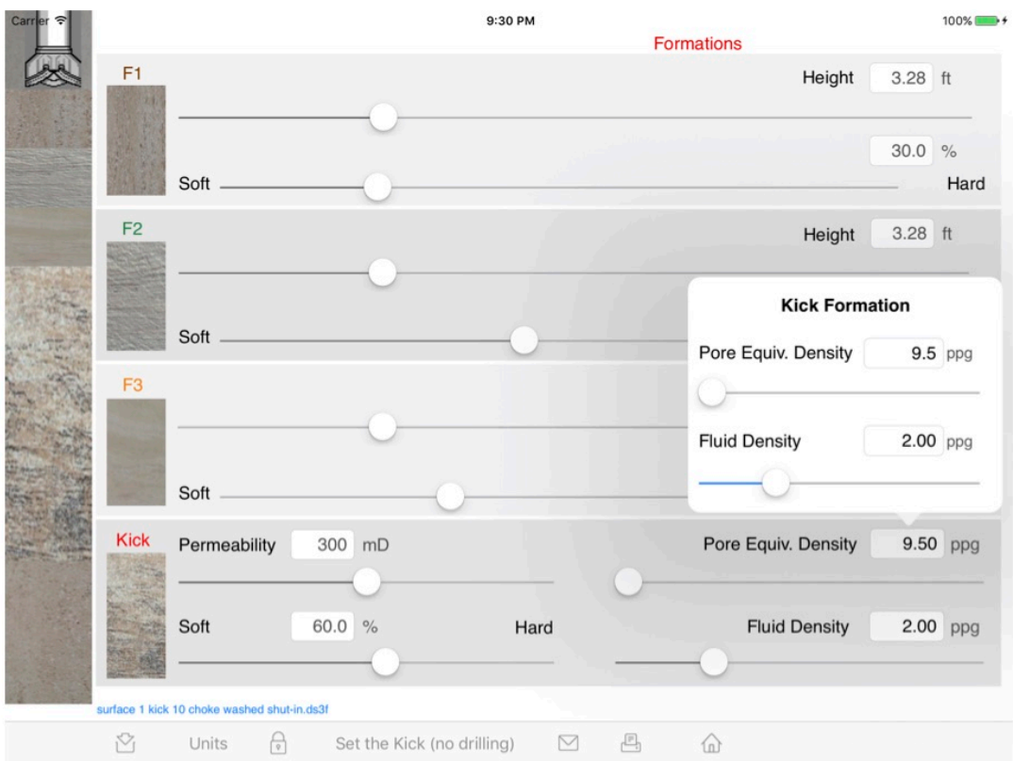
Step by Step on surface stack

Preparing the well to induce a kick by swabbing

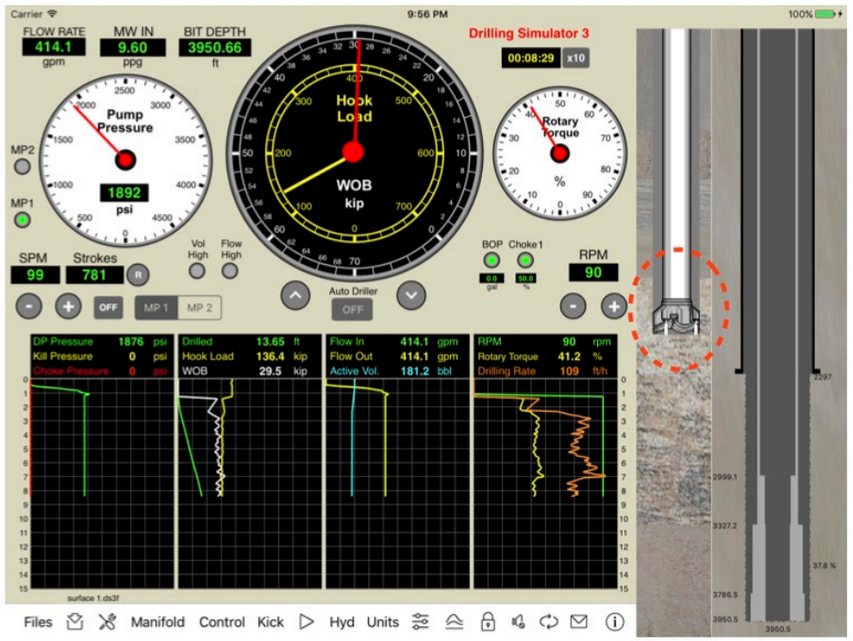
On formation view, set the Pore Equivalent Density near to Mud Weight.

For example: Mud Weight = 9.6 ppg

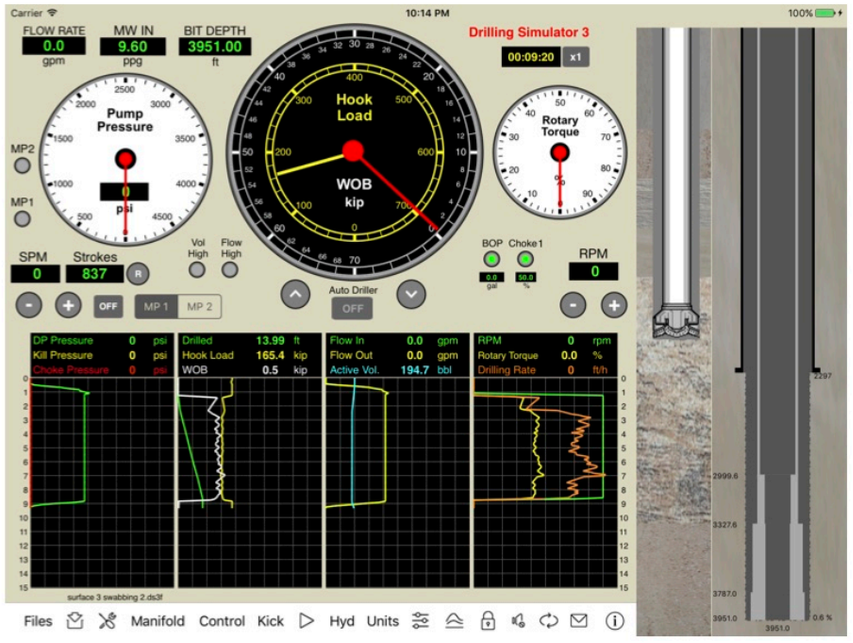
=> Pore Equivalent Density = 9.5 ppg



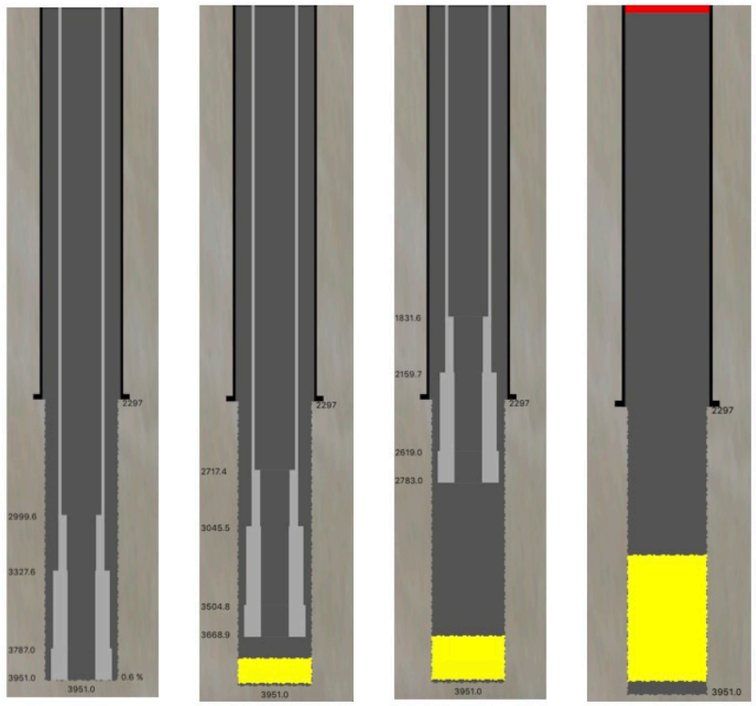
On main view, drill until 3 ft (~ 1.0 m) into the kick formation



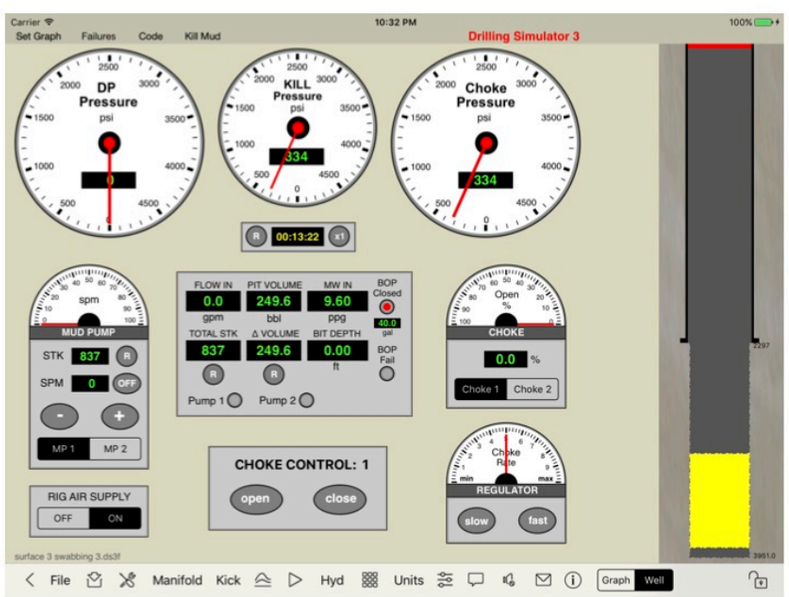
Prepare to trip up: RPM = 0, SPM = 0 and WOB = 0



swipe the finger up on well picture until tripping out

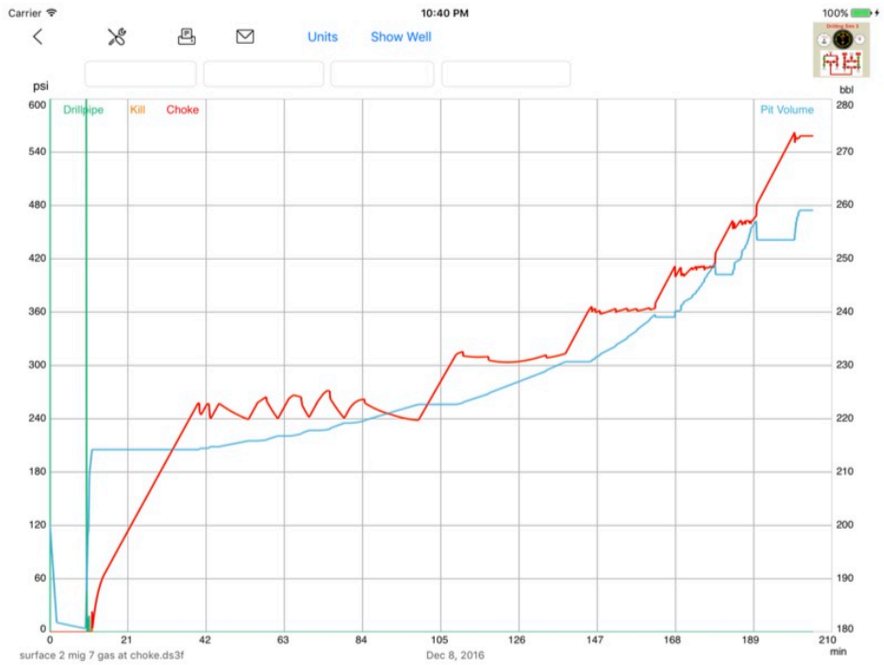


Perform the shut-in



Apply the volumetric method to control.

Like this graph from another example:



CHAPTER 18

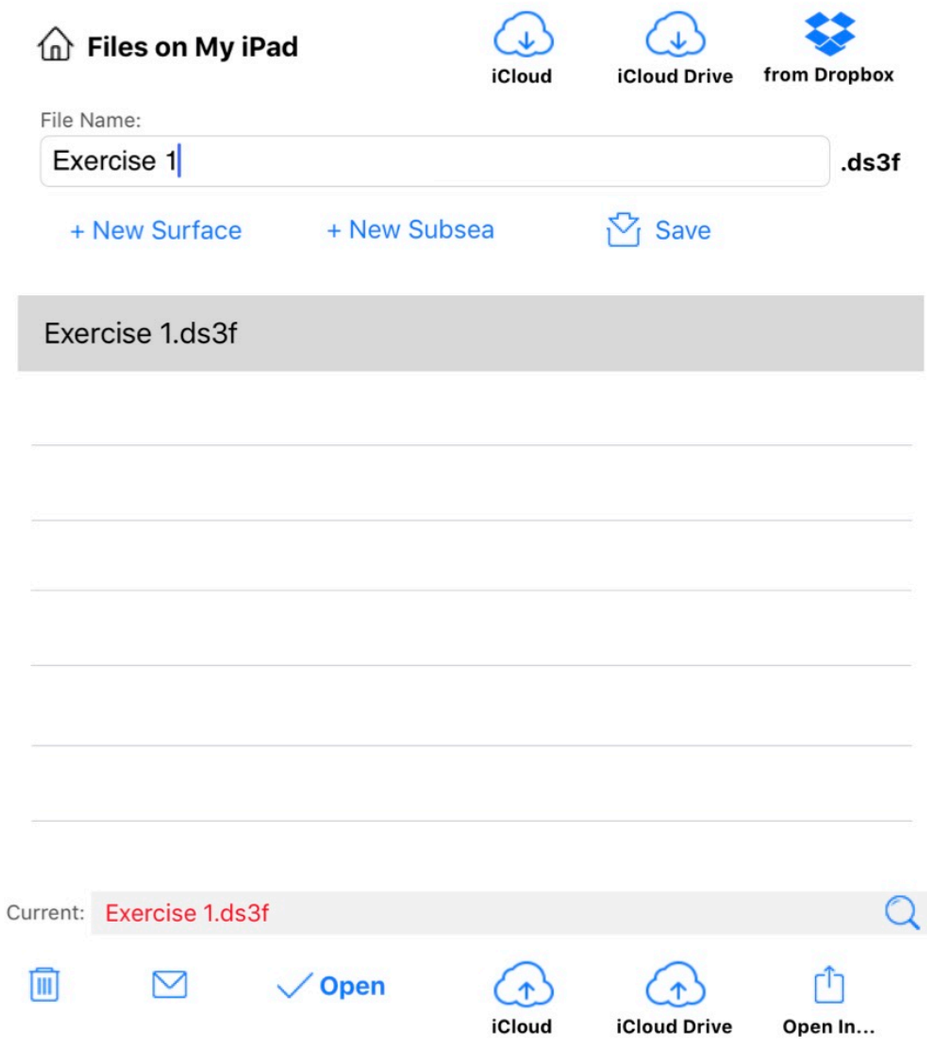
Exercise

This is an example using the default with surface stack well.

1. Creating a data file
2. Well Configuration
3. Pre-Recorded Data
4. Drilling
5. Kick Detection
6. Shut-in and stabilization of pressures
7. Calculating well control parameters
8. The App "Well Control Methods"
9. Applying the wait and weight method
10. Graphical Analysis

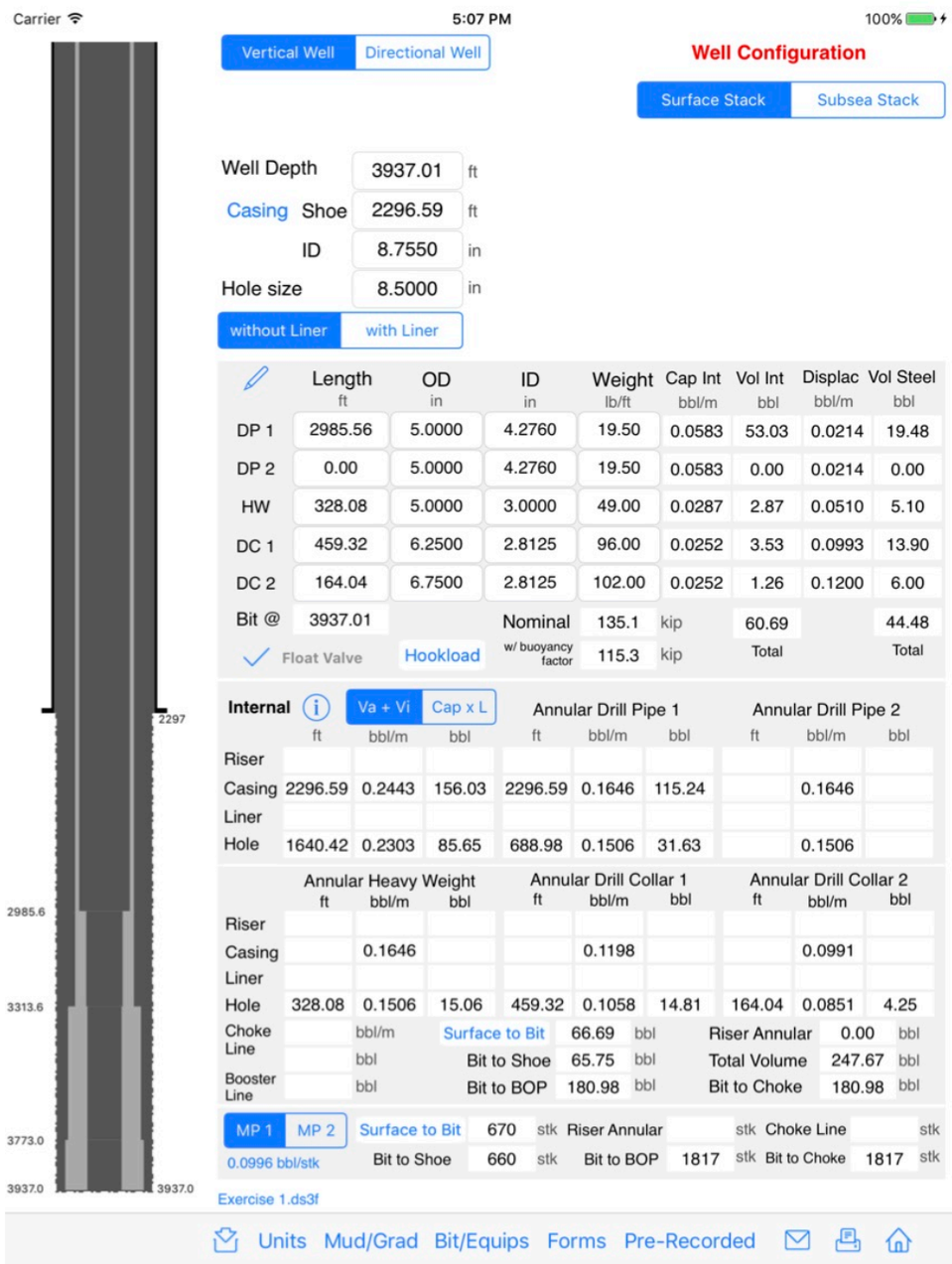
Creating a data file:

Input the text "Exercise 1" in the text box and tap on "**+ new Surface**" button.



SECTION 1

Well Configuration



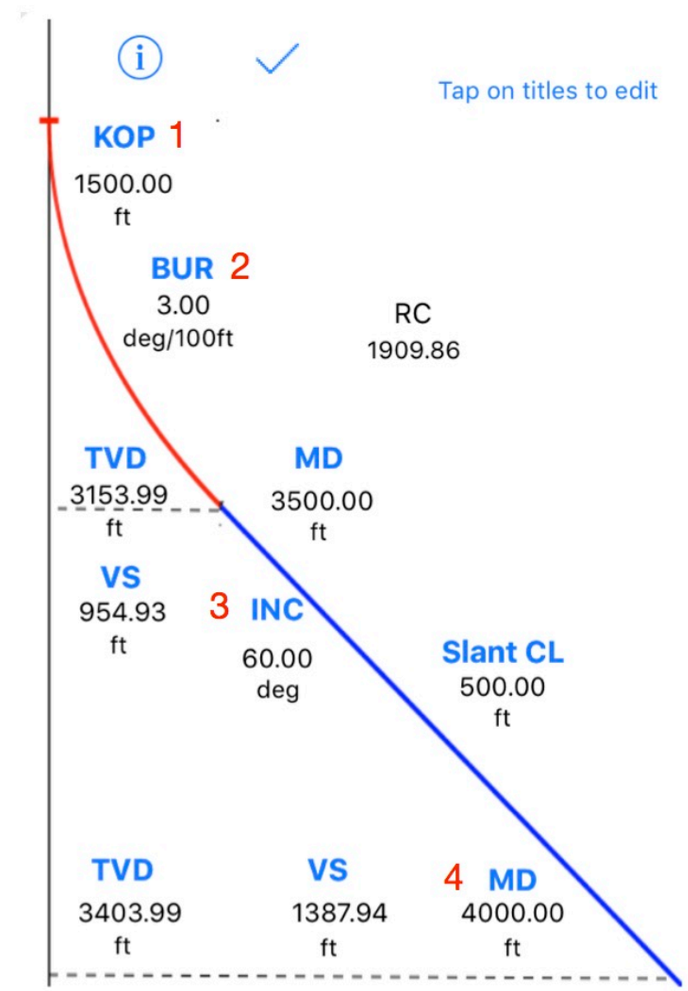
Set to Directional Well

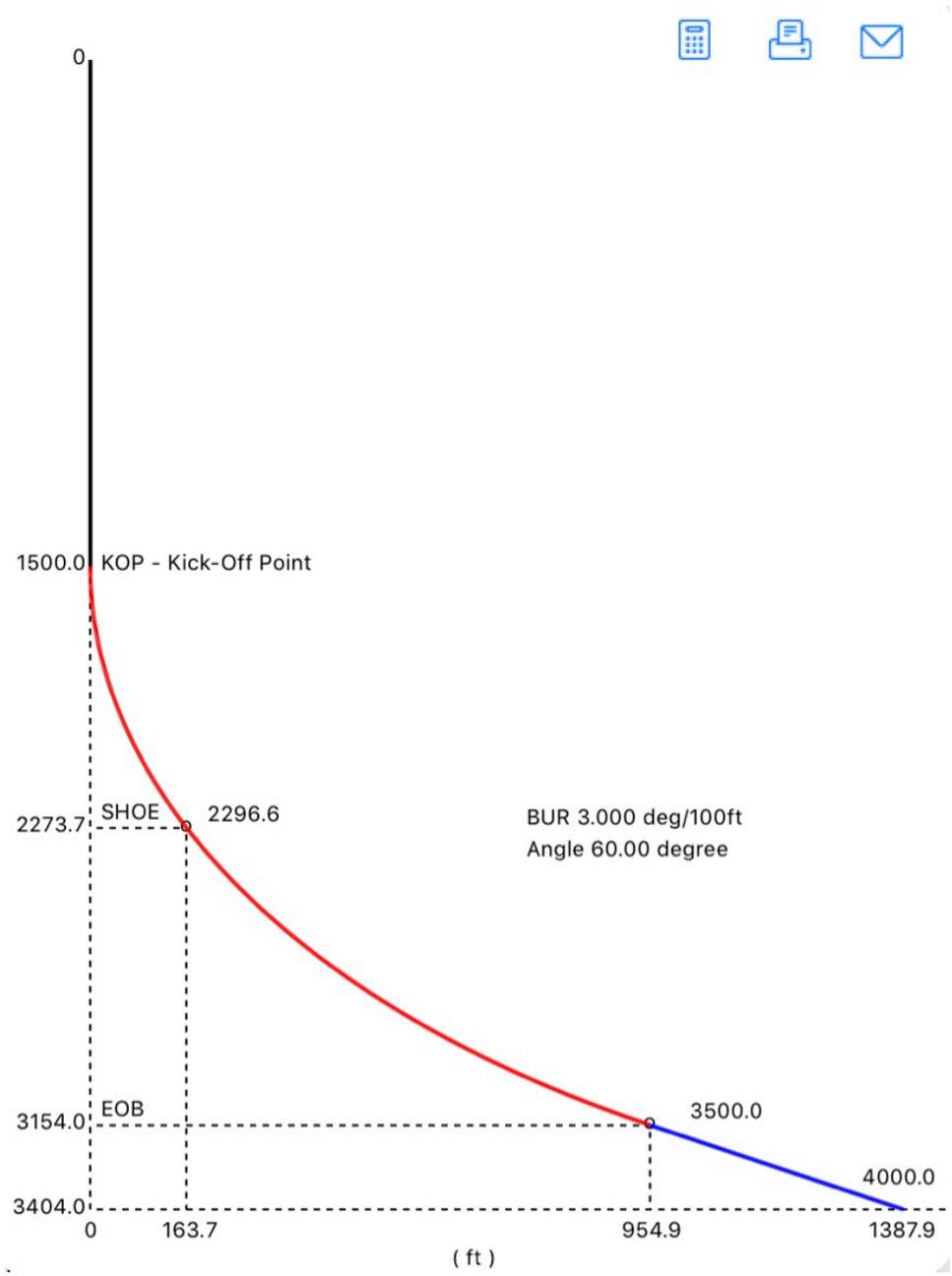
(1) KOP = 2000 ft,

(2) BUR = 3 degree/100ft

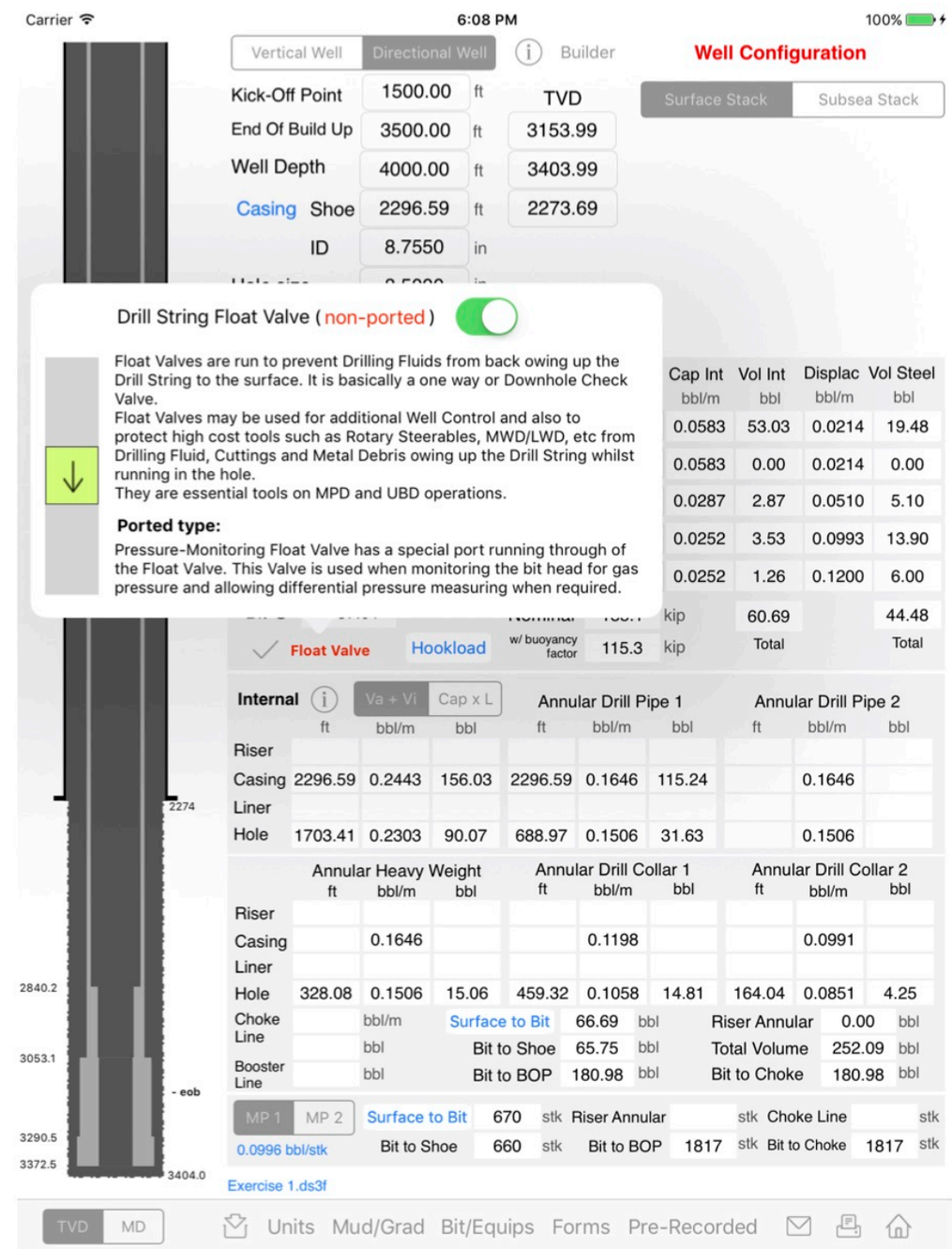
(3) Angle = 60 degree

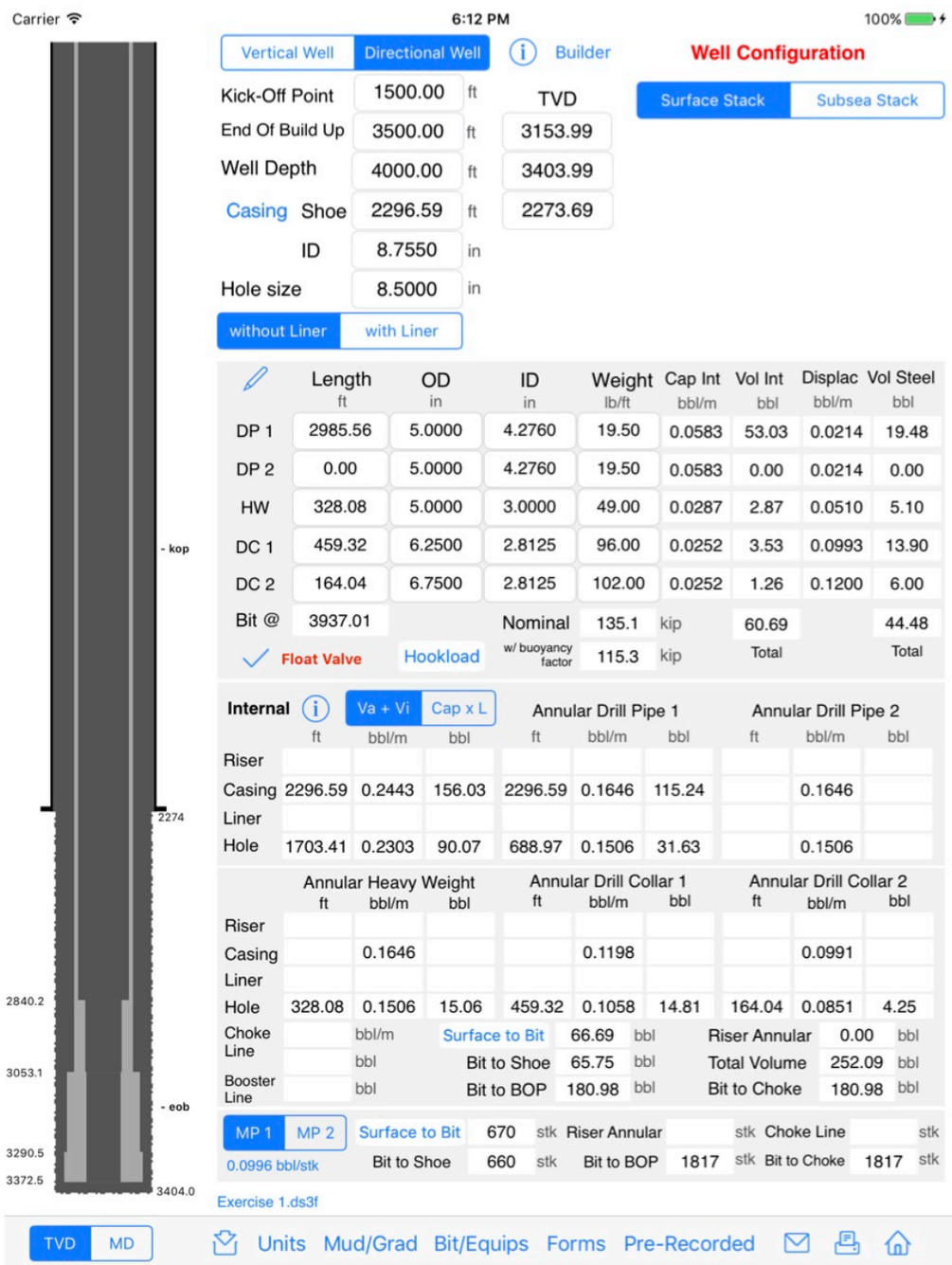
(4) MD = 4000 ft



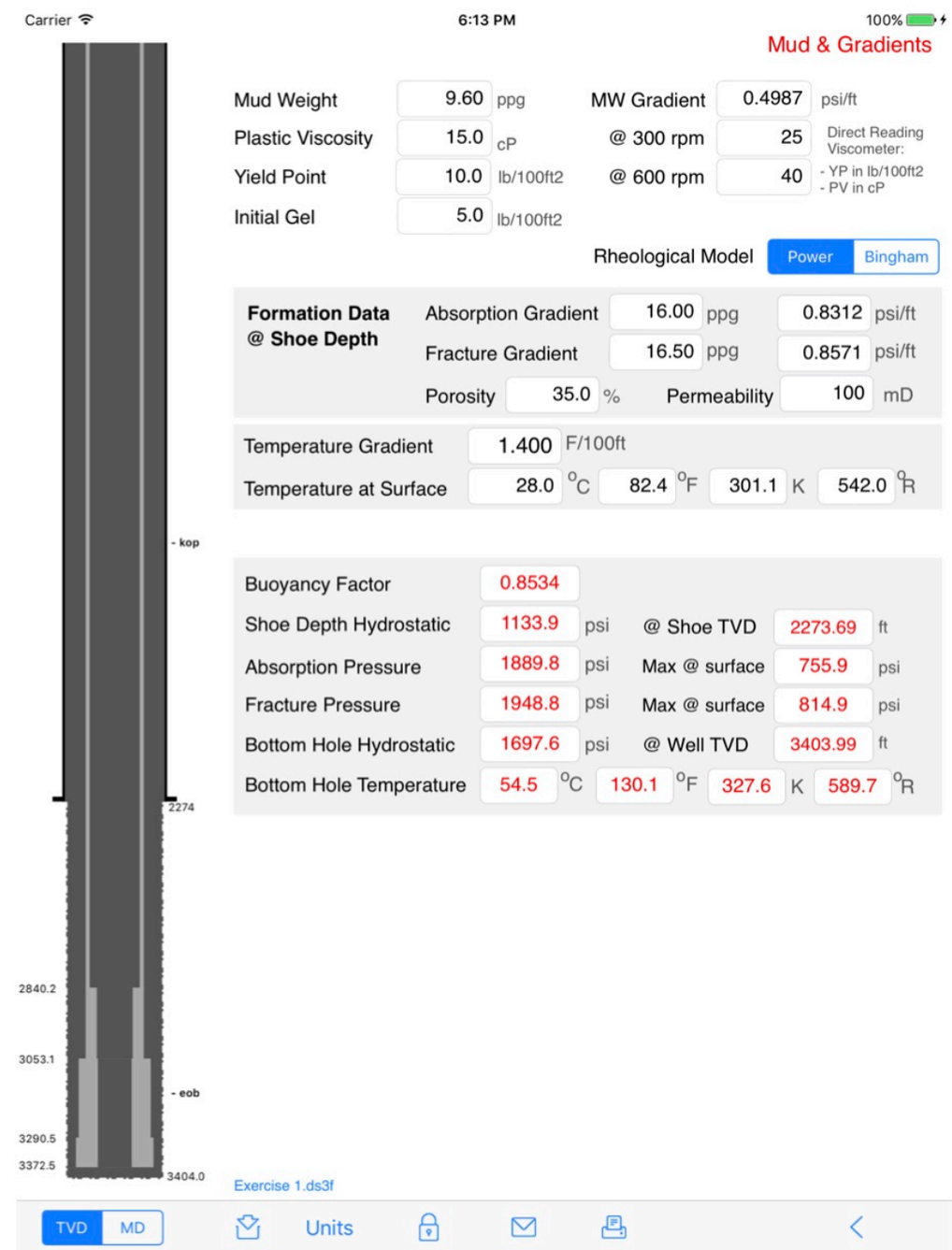


Set Float Valve

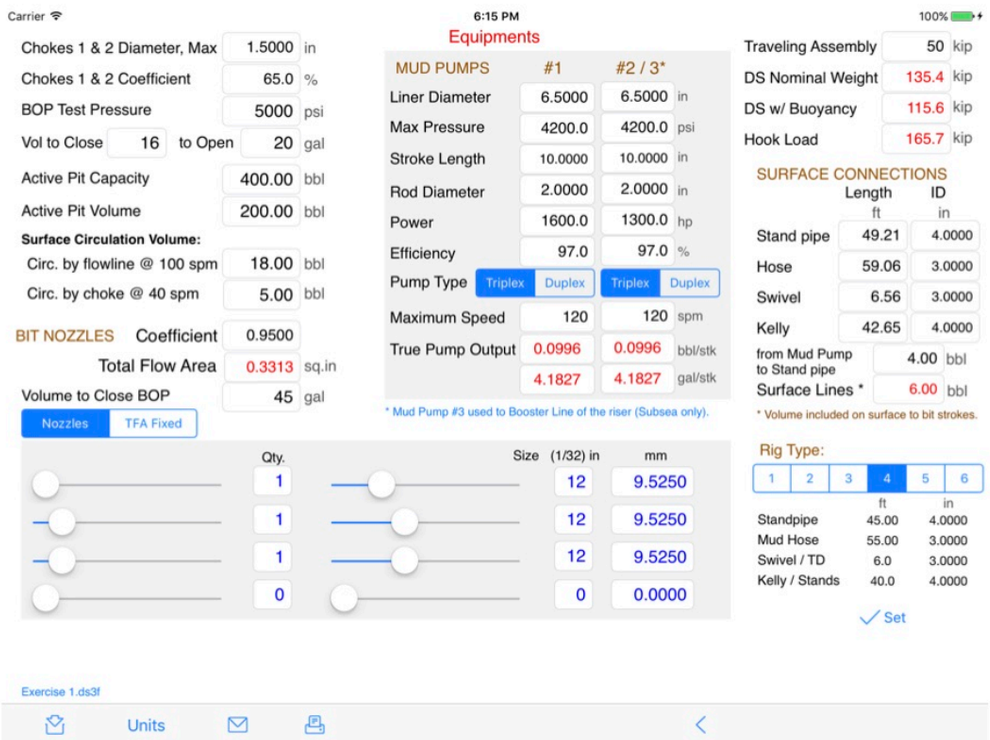




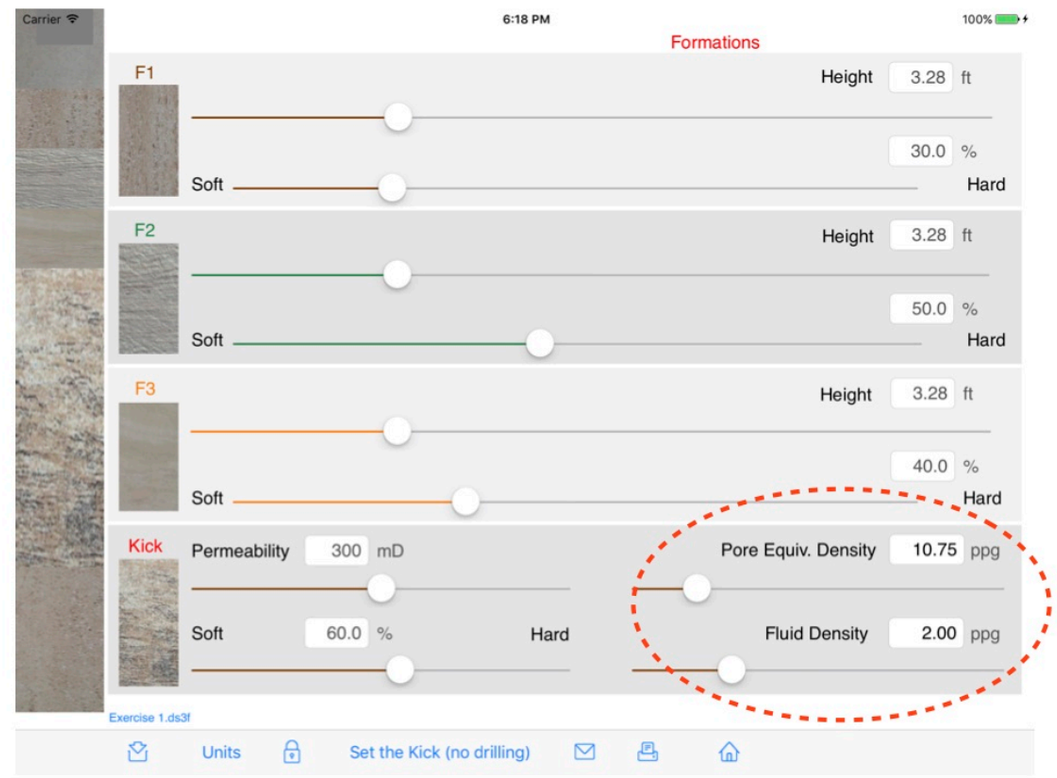
Set Mud and Gradients



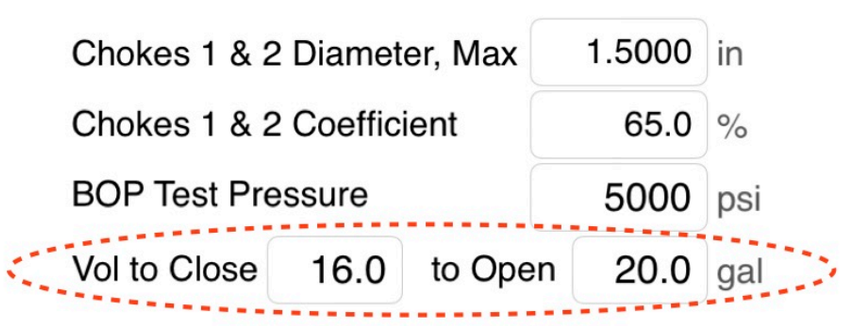
Set Drill Bit and Equipments



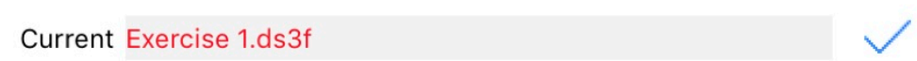
Set Formations



Note:



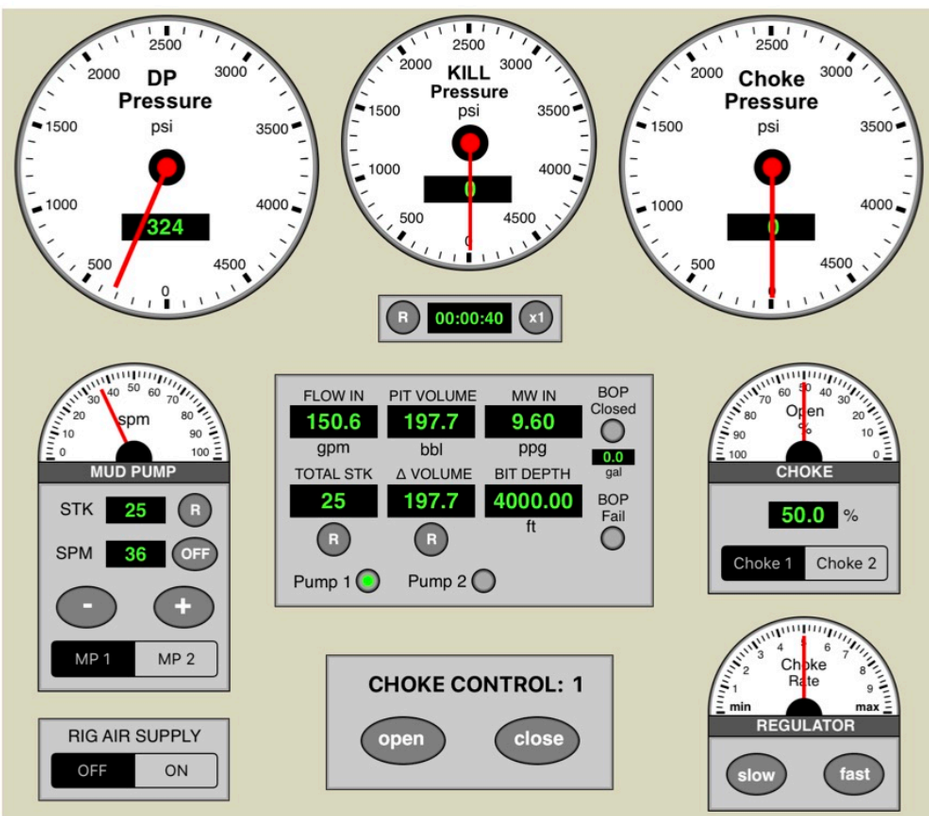
Save to file



SECTION 2

Pre-recorded Data

1. Align the circulation to the drill string
2. Set pump #1 speed to 30 spm
3. Record the "DP Pressure" on Choke Panel



Initial Circulation Pressure = 324 psi

@ 36 spm => Slow Circulation Rate = 150 gpm

Carrier 6:26 PM 100%

Drilling Simulator 3 — PRE-RECORDED - SURFACE STACK

WELL: RIG: DATE: Oct 29, 2016 BY:

WELL, FLUID, LOT AND EQUIPMENTS							
					True Vertical Depth (TVD)	3403.99	ft
					Measured Depth (MD)	4000.00	ft
					Shoe Vertical Depth (TVD,shoe)	2273.69	ft
Active Surface Volume			200.00	bbl	Shoe Measured Detph (MD,shoe)	2296.59	ft
Mud Weight (ρm)	9.60	ppg	0.4987	psi/ft	BOP Test Pressure	5000	psi
Fracture Gradient (ρf)	16.50	ppg	0.8571	psi/ft	Casing Burst Pressure 6330 x 0.80	5064	psi

MAXIMUM STATIC PRESSURES		
Maximum Allowable At Surface Pressure, MAASP = 0.0519 x (ρf - ρm) x TVD,sap	815	psi
Maximum Casing Pressure: IPR = Casing Burst Pressure x DF (DF = 1/Design Factor)	7912	psi
Maximum BOP Pressure = BOP Test Pressure	5000	psi
Maximum Equipment Pressure: Smaller of (Maximum Casing or Maximum BOP)	5000	psi

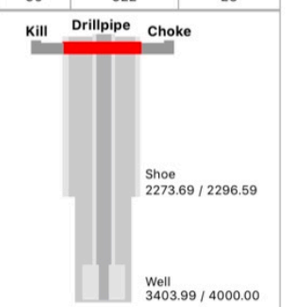
LENGTH, CAPACITY AND VOLUMES

Drill String	ID (in)	OD (in)	Cv,i (bbl/m)	L (ft)	Vi (bbl)	Annular	Cv,a (bbl/m)	L (ft)	Va (bbl)
Drillpipe, DP1	4.2760	5.0000	0.0583	3048.56	54.15	Open Hole - DC2	0.0851	164.04	4.25
Drillpipe, DP2	4.2760	5.0000	0.0583			Open Hole - DC1	0.1058	459.32	14.81
Heavy Weight, HW	3.0000	5.0000	0.0287	328.08	2.87	Open Hole - HW	0.1506	328.08	15.06
Drill Collar, DC1	2.8125	6.2500	0.0252	459.32	3.53	Open Hole - DP2	0.1506		
Drill Collar, DC2	2.8125	6.7500	0.0252	164.04	1.26	Open Hole - DP1	0.1506	751.97	34.52
Total Drill String				**4000.00**	**61.81**	**Total Open Hole**		**1703.41**	**68.64**
WellBore	**ID (in)**	**OD (in)**	**Cv,i (bbl/m)**	**L (ft)**	**Vi (bbl)**	Liner - DP2			
Open Hole	8.5000		0.2303	1703.41	119.56	Liner - DP1			
Liner						Casing - DP2	0.1646		
Casing	8.7550	9.6250	0.2443	2296.59	171.01	Casing - DP1	0.1646	2296.59	115.24
			Cv,i = ID^2 / 313.7656		Vi = Cv,i x L	Cv,a = (BoreD^2 - OD^2) / 313.7656			Va = Cv,a x L

MUD PUMPS			δmp = δ x ε	SPM = Flow / (42.00 x δmp)	
Nº	δ (bbl/stk)	ε (%)	δmp (bbl/stk)	100.0 gpm	150.0 gpm
PUMP 1	0.1027	97.0	0.0996	24	36
PUMP 2	0.1027	97.0	0.0996	24	36

SLOW CIRCULATION RATE			pressure in (psi)
Flow (gpm)	SPM	Pump Pressure	Casing Friction
100.0	24	176	24
150.0	36	322	28

VOLUMES AND STROKES	Vol (bbl)	Stk, MP1	Stk, MP2
Surface Connections	6.00	60	60
Internal Drill String	61.81	621	621
Surface to Bit (Surface Connections + Drill String)	67.81	681	681
Bit to Shoe	68.64	689	689
Bit to BOP	183.88	1846	1846
Bit to Surface	183.88	1846	1846
Drill String + Annular	245.69	2467	2467
Total Active Fluid System Volume	451.69		



Exercise 1.ds3f Units Control Methods

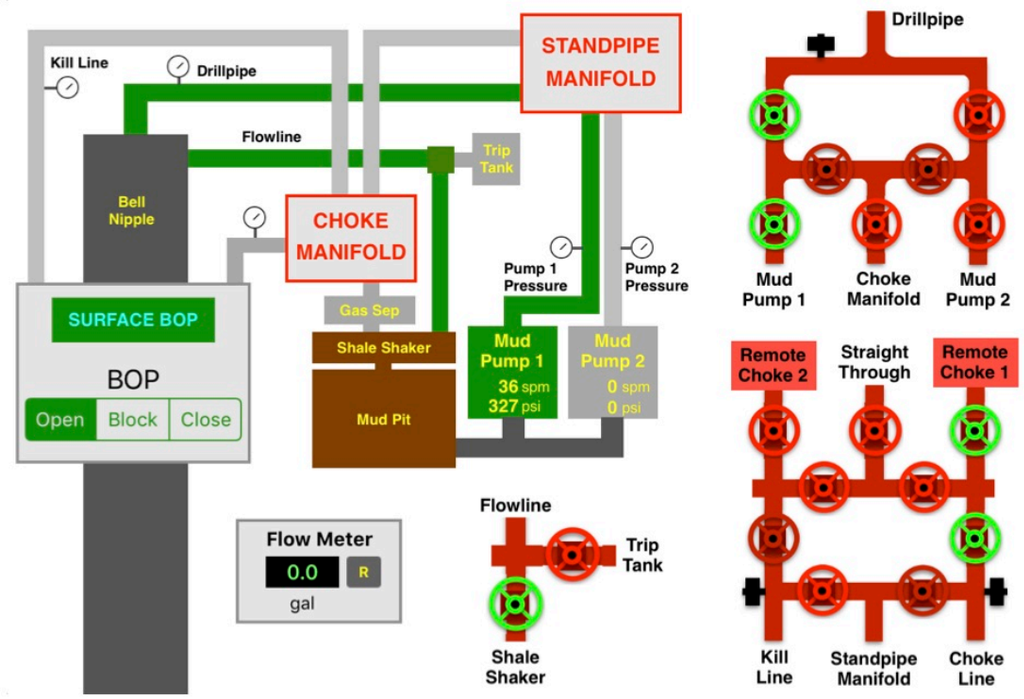
SECTION 3

Drilling

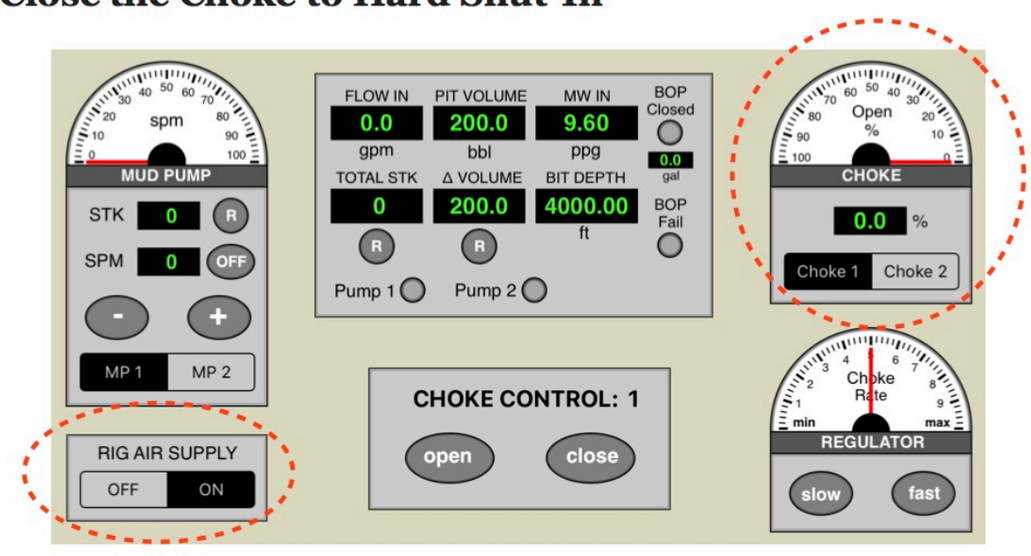
STEPS

1. Set circulating system
2. Close the choke to hard shut-in
3. Drilling
4. Kick Detection
5. Stop Drilling and save to data file
6. Shut-In
7. Stabilisation of pressures
8. Record Kick Volume, SIDPP and SICP
9. Get SIDPP with float valve
10. Save to iCloud

Set circulating system

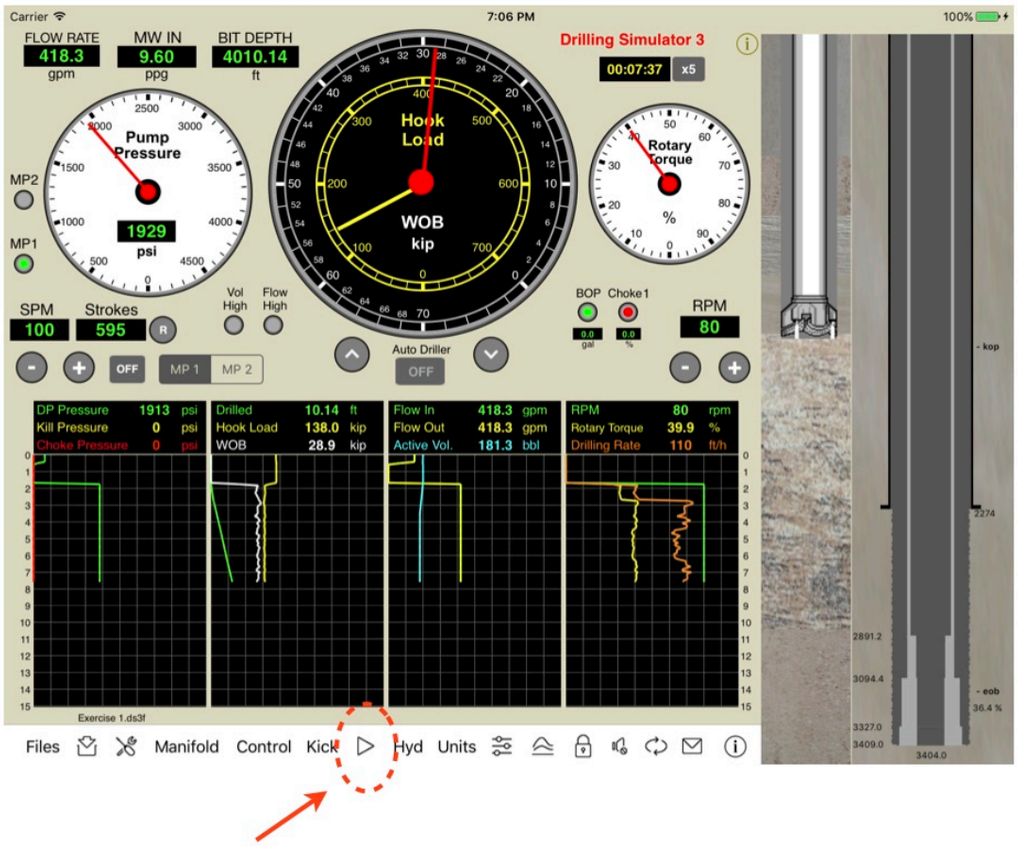


Close the Choke to Hard Shut-In



Drilling

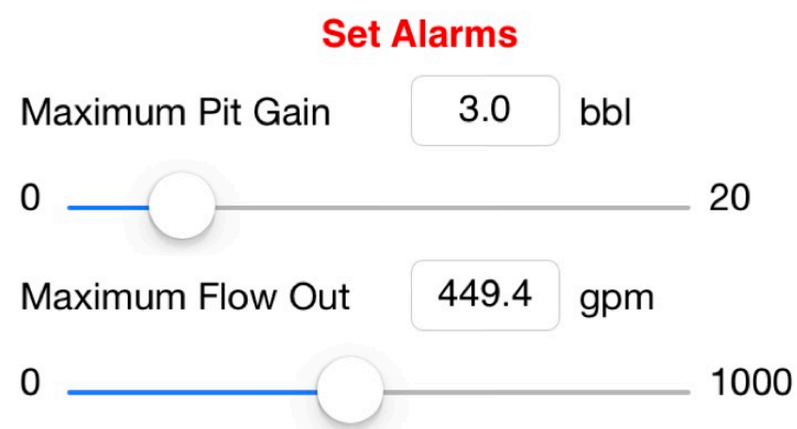
SPM = 100, RPM = 80 and WOB = 30 kip



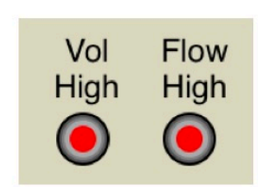
Set Pause and save to a new data file "Exercise 1 Drilling"

Kick Detection

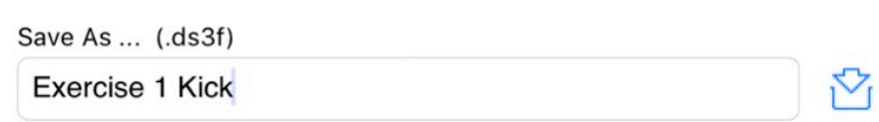
Set Alarms: Max Pit Vol = 3 bbl and Max Flow Out = 450 gpm

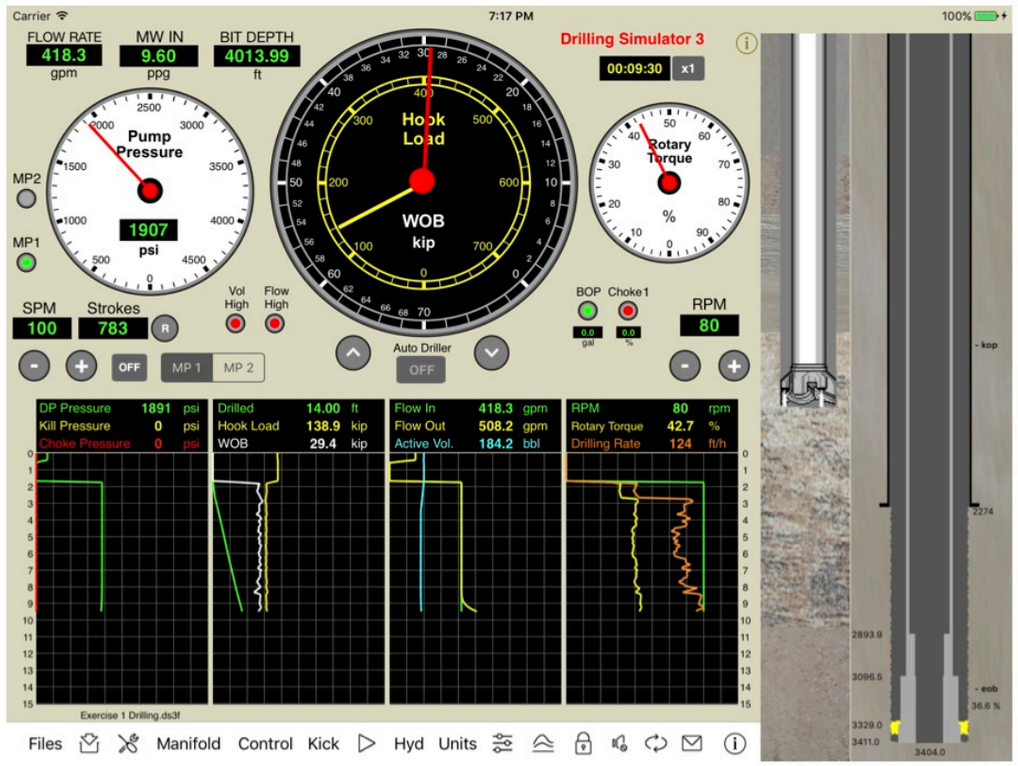


Continue drilling until alarms ON



Set Pause and save to a new data file "Exercise 1 Kick"



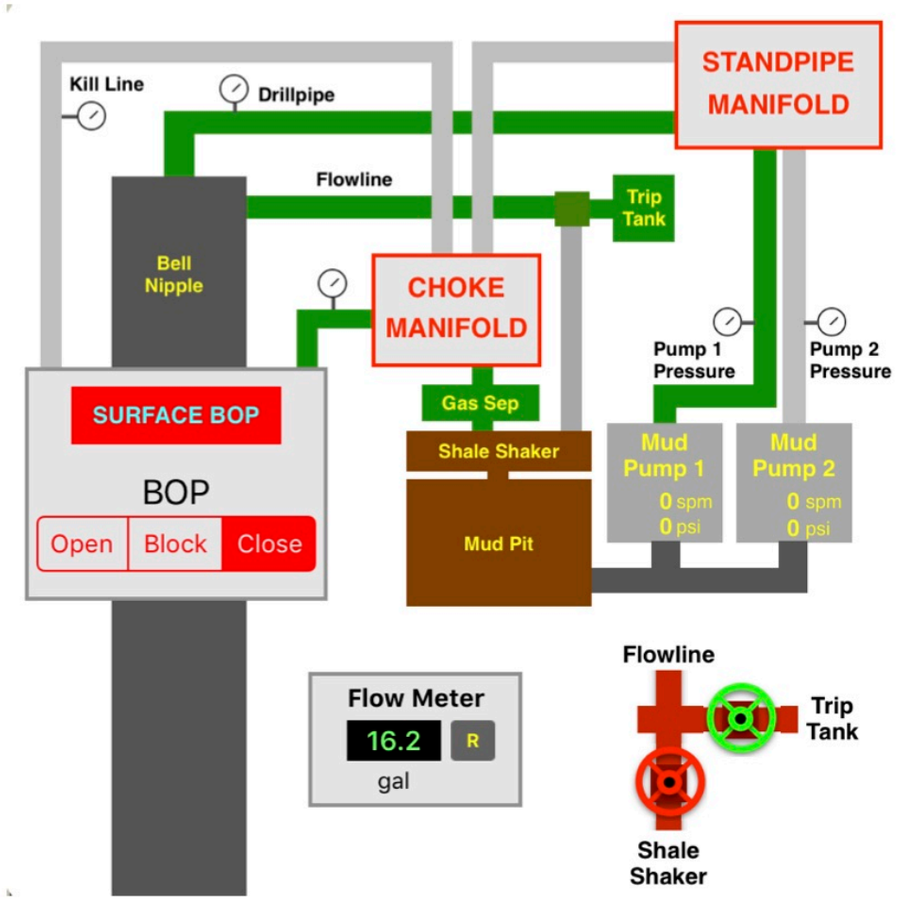


Shut-In

RPM = 0, WOB = 0 and SPM = 0

=> Close the BOP

=> Set return to Trip Tank



Stabilization of Pressures

Record the parameters:

TIME	DP PRESS	CHOKE PRESS	DIFF
1 min	0 psi	60 psi	60
2 min	0 psi	100 psi	40
3 min	0 psi	136 psi	36
4 min	0 psi	165 psi.	29

TIME	DP PRESS	CHOKE PRESSURE
5 min	0 psi	188 psi
6 min	0 psi	205 psi
7 min	0 psi	221 psi
8 min	0 psi	233 psi
9 min	0 psi	242 psi
10 min	0 psi	250 psi
11 min	0 psi	256 psi
12 min	0 psi	261 psi
13 min	0 psi	265 psi
14 min	0 psi	268 psi

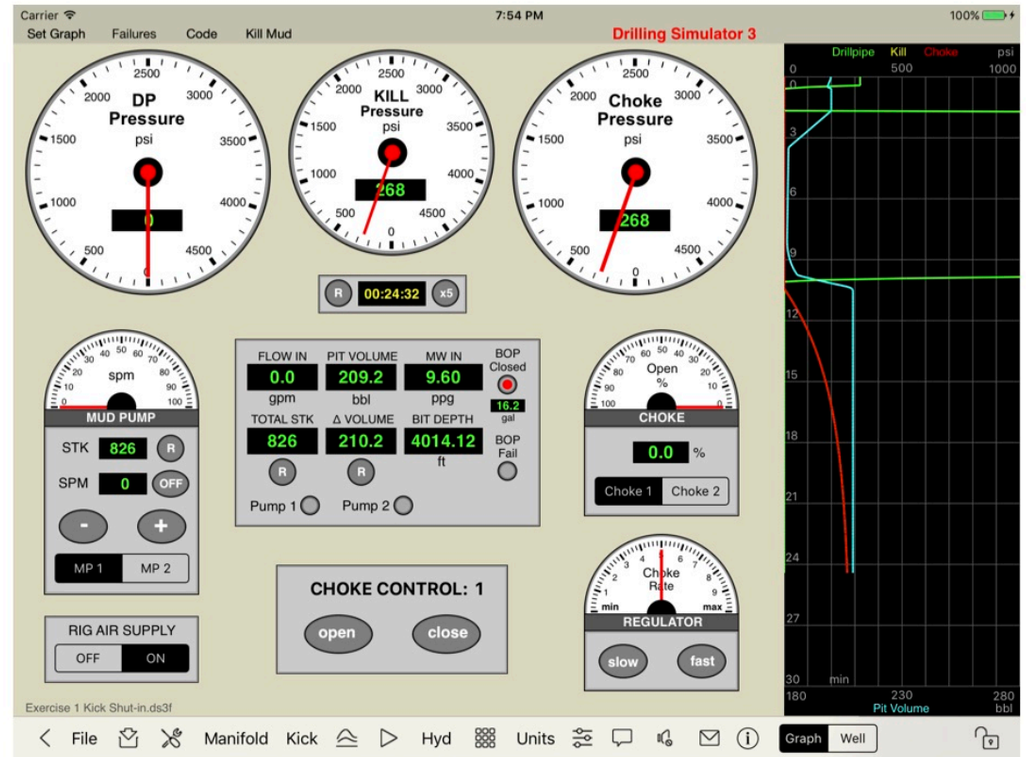
=> SIDPP = 0 psi (drillstring with FLOAT VALVE)

=> SICP = 268 psi (drop due changing annular in BHA)

Kick Remove

Volume bbl	Pressure psi	Depth ft	Top ft	Length ft	Height ft
10.163	1830.24	3697.52	3384.82	312.70	159.44

Density ppg	Mass lb	Hydrost psi	Temperat Rankine	Z Factor	Migration ft/min
2.38	1017.49	19.70	587.59	0.7255	15.31



Save to a new data file "Exercise 1 Stab"

Save As ... (.ds3f)

Exercise 1 Stab

How to get the SIDPP with float valve in the drillstring?

Bring the mud pump slowly until the opening of the float valve, checking changing on the choke pressure. Stop mud pump immediately.

Before to start the mud pump, record the choke pressure.

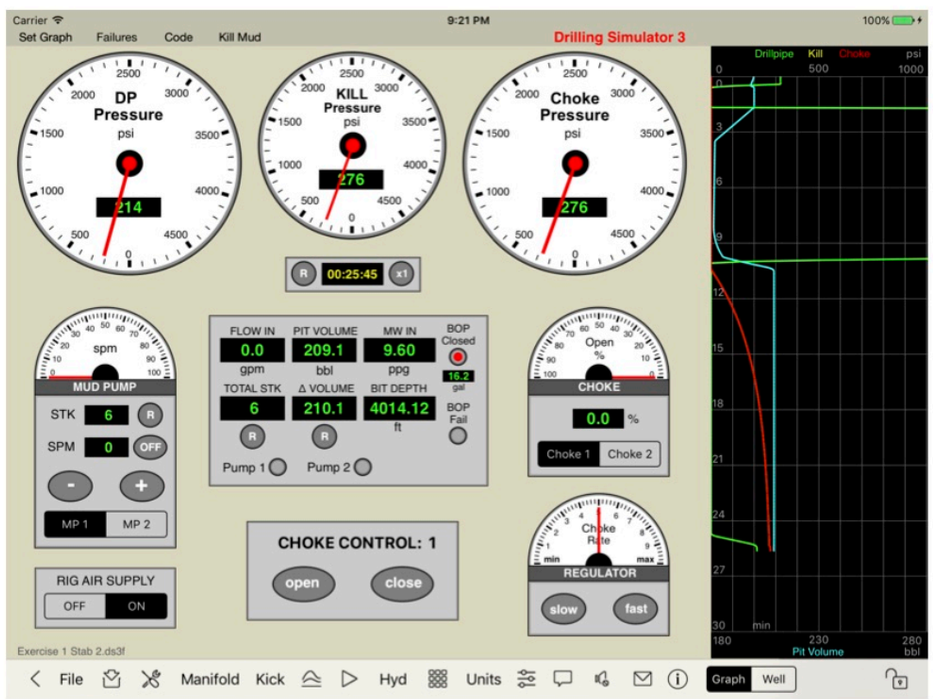
SICP = 269 psi

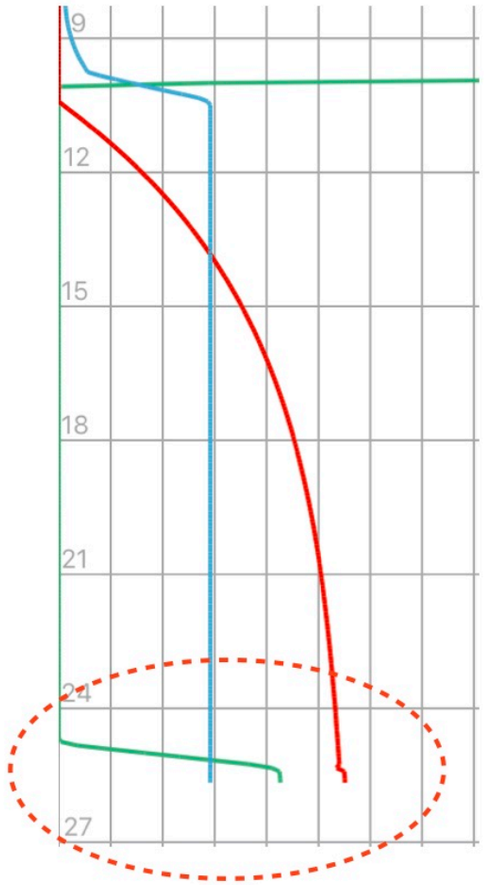
After the occurrence of the changing on choke pressure, stop immediately the mud pump and record the the DP Pressure and the new choke pressure.

Choke Pressure = 276 psi and DP Pressure = 214 psi

SIDPP = DP Pressure - (Difference on Choke Pressure)

SIDPP = 214 - (276 - 269) => SIDPP = 207 psi





Save to new data file “Execise 1 Stab 2”

Fill the your Kill Sheet for Control applying the Wait and Weight Method.

We recommend the our App “Wait and Weight Worksheets” to calculations.

It is available on our Portfolio on the App Store

Please, see the next section.

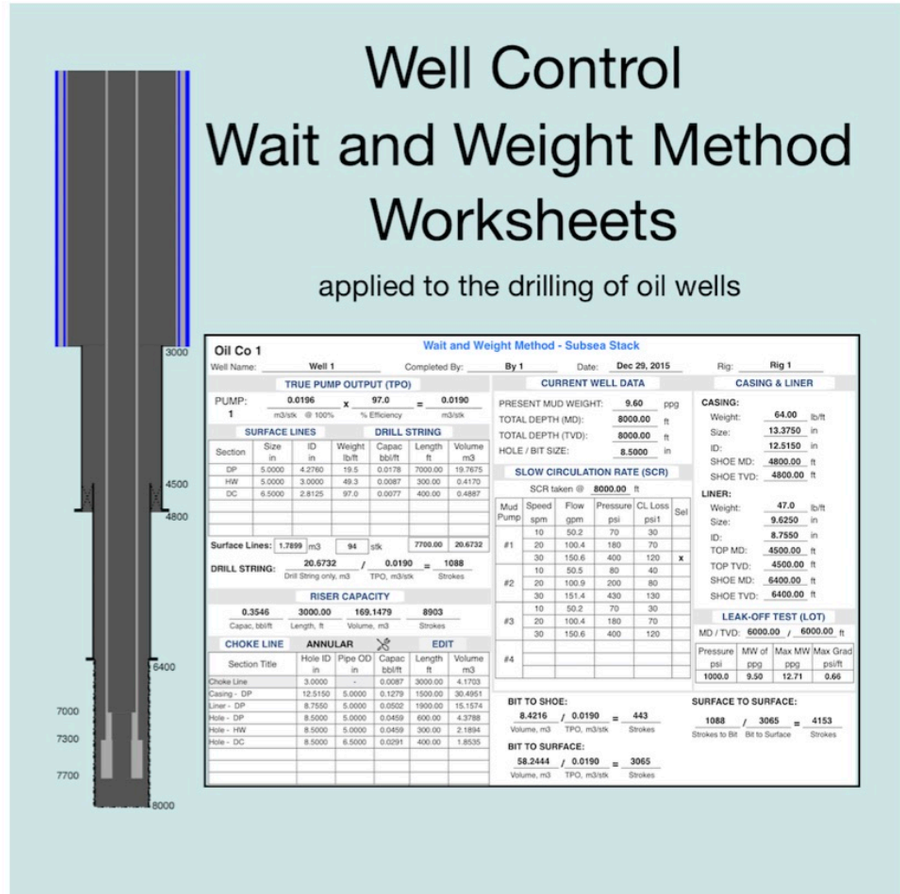
SECTION 4

Well Control Method

STEPS

1. The our Apps “Wait and Weight Worksheets”
2. The Wait and Weight Method
3. Export data file to iCloud
4. Open “Wait and Weight Worksheets”
5. Import data file from iCloud
6. Calculations
7. Worksheets

The “Wait and Weight Worksheets” for iPad



Available in our Portfolio on the App Store

About the Wait and Weight Method

Carrier 7:00 PM 100%

Well Control Worksheets — The Wait and Weight Method

During drilling operation of oil wells, there may be inflow of formation fluids into the well, which is an undesirable condition. The driller should detect such events and closing the well immediately. Record information after the closing of the well corresponding to stabilization of pressure, volume gain, SIDPP (Shut-in Drillpipe Pressure) and SICP (Shut-in Casing Pressure). In the case of operations on floating units (subsea stack), this term could be redefined as Shut-in Choke Pressure).
The control method to be applied is the Wait and Weight method. The circulation should be made with the Kill Mud Weight in two steps:
1. Fill the drill string until the bit by keeping the pressure following the table strokes versus pressure.
2. Complete circulation of the annular to the surface keeping the pressure of circulation with the kill mud constant named FCP - Final Circulation Pressure. On subsea stack, after the choke fully open, the pump pressure increases until FCP 2.

Attention: about drill bit off bottom
This method should only be applied with the drill bit in the bottom hole or when the kick is completely in annular of the drill string.

ICP = Pks + SIDPP

ICP - Initial Circulating Pressure, psi
Pks - Recorded pump pressure at the kill rate speed, psi
SIDPP - Shut-in Drillpipe Pressure, psi

Notes about floating units:
a) Pks must be recorded by circulating riser;
b) Record the friction loss in the choke line at the kill rate speed, psi;

KM = OM + SIDPP / (0.052 x TVD)

KM - Kill Mud Weight, ppg
OM - Original Mud Weight, ppg
SIDPP - Shut-In DP Pressure, psi
TVD - True Vertical Depth, ft

Δstk = 100 strokes
Δp = (ICP - FCP) / StkToBit x 100

per Strokes/10 | per 100 Strokes

	Strokes	Pressure
	0	ICP
1	100	ICP - Δp
2	200	ICP - 2xΔp
3	300	ICP - 3xΔp
4	400	ICP - 4xΔp
5	500	ICP - 5xΔp
6	600	ICP - 6xΔp
7	700	ICP - 7xΔp
8	800	ICP - 8xΔp
...	...	...
...	Stk to Bit	FCP

Stk to Bit = Drill String only

FCP = Pks x KM / OM

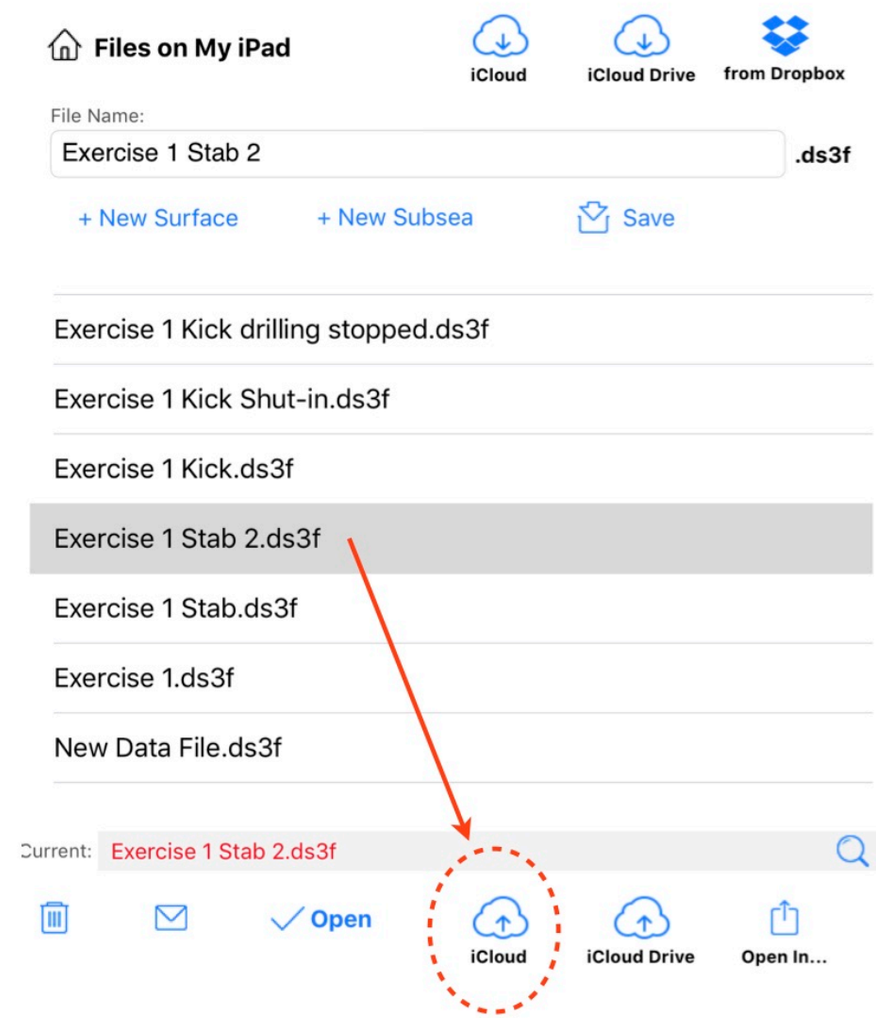
FCP - Final Circulating Pressure, psi

Summary:

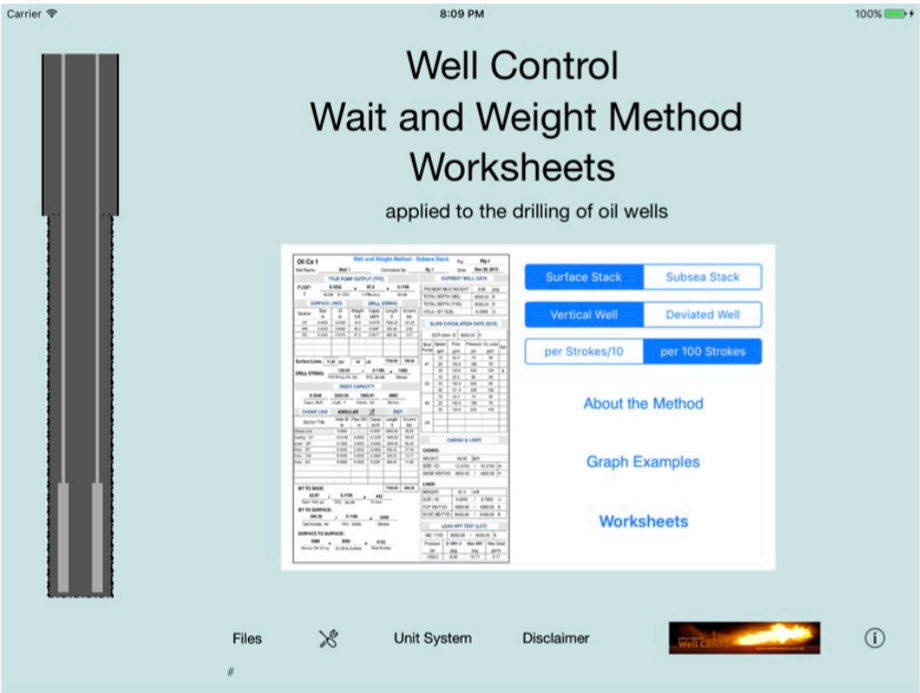
STEPS	DP Pressure	CHOKE Pressure	STROKES to pump
1. Bring the pump to kill speed		SICP	
2. Circulate to fill drill string with kill mud following the table strokes vs. pressure	TABLE		DRILL STRING
3. Circulate to fill annular with kill mud	FCP		BIT to Surface

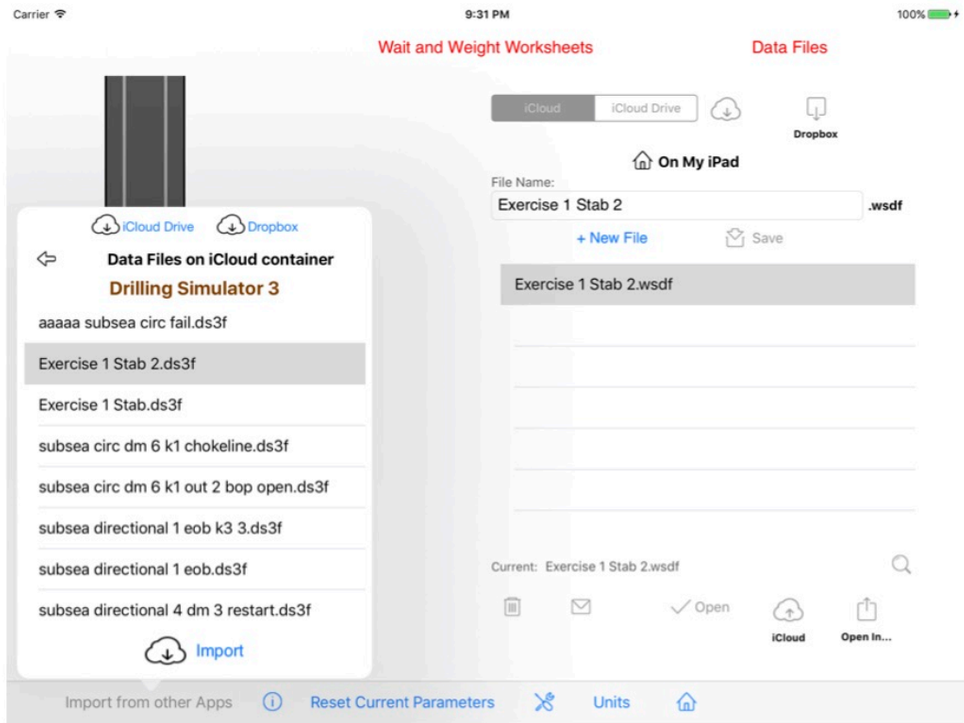
Surface Stack | Subsea Stack — Deviated Well

Export the data file "Exercise 1 Stab 2" to **iCloud**

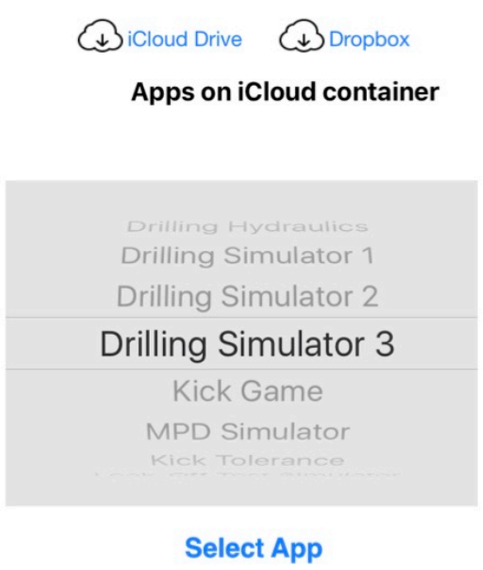


Open the "Wait and Weight Worksheets" app

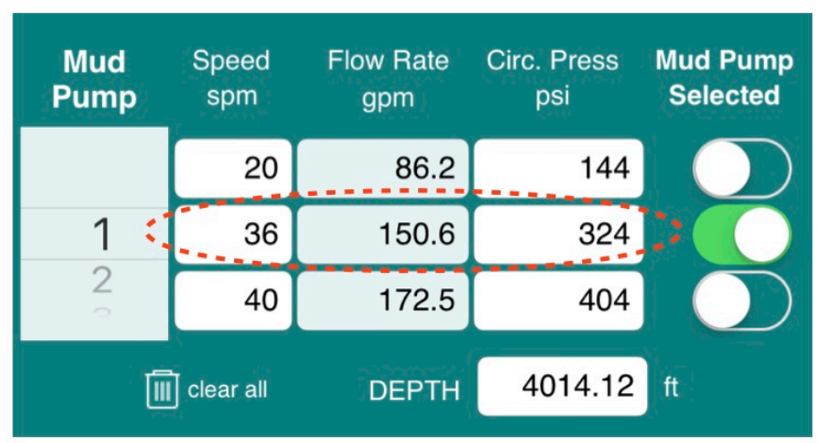




Import the data file from "Drilling Simulator 3"



On form 1, edit the Pressure at Slow Circulating Rate (SCR)



Edit volume of surface lines, SCR and others

Carrier 9:38 PM 100%

Wait and Weight Method - Surface Stack

Well Name: _____ Completed By: _____ Rig: _____ Date: Dec 11, 2016

TRUE PUMP OUTPUT (TPO)

PUMP: 1 — 0.1027 bbl/stk @ 100% x 97.0 % Efficiency = 0.0996 bbl/stk

DRILL STRING **KOP & EOB**

Section	Size in	ID in	Weight lb/ft	Capac bbl/ft	Length ft	Volume bbl
DP 1	5.0000	4.2760	19.5	0.0178	3062.67	54.40
HW	5.0000	3.0000	49.0	0.0087	328.08	2.87
DC 1	6.2500	2.8125	96.0	0.0077	459.32	3.53
DC 2	6.7500	2.8125	102.0	0.0077	164.04	1.26
					4014.12	62.06

SURFACE LINES

9.57 Surface Vol, bbl / 0.0996 TPO, bbl/stk = 96 Strokes / 3 Min

DRILL STRING:

62.06 Drill String only, bbl / 0.0996 TPO, bbl/stk = 623 Strokes / 17 Min

ANNULAR **EDIT**

Section Title	Hole ID in	Pipe OD in	Capac bbl/ft	Length ft	Volume bbl
CASING - DP 1	8.7550	5.0000	0.0502	2296.59	115.24
OPEN HOLE - DP 1	8.5000	5.0000	0.0459	766.08	35.17
OPEN HOLE - HW	8.5000	5.0000	0.0459	328.08	15.06
OPEN HOLE - DC 1	8.5000	6.2500	0.0322	459.32	14.81
OPEN HOLE - DC 2	8.5000	6.7500	0.0259	164.04	4.25
				4014.12	184.52

BIT TO SHOE:

69.29 Open Hole, bbl / 0.0996 TPO, bbl/stk = 696 Strokes / 19 Min

BIT TO SURFACE:

184.52 Total Annular, bbl / 0.0996 TPO, bbl/stk = 1852 Strokes / 51 Min

SURFACE TO SURFACE:

623 Strokes Drill String + 1852 Stk Bit to Surface = 2475 Total Strokes / 69 Min

WELL DATA **BOP**

ORIGINAL MUD WEIGHT:		9.60	ppg
KOP (MD/TVD):	1499.34	1499.34	ft
EOB (MD/TVD):	3500.00	3153.99	ft
WELL (MD/TVD):	4014.12	3403.99	ft
OPEN HOLE / BIT SIZE:		8.5000	in

SLOW CIRCULATION RATE (SCR)

SCR taken @ 4014.12 ft

Mud Pump	Speed spm	Flow gpm	Pressure psi	Sel
#1	20	86.2	144	
	36	150.6	324	x
	40	172.5	404	
#2	20	86.2	144	
	30	129.4	252	
	40	172.5	404	
#3				
#4				

CASING

WEIGHT:	43.50	lb/ft	
SIZE / ID:	9.6250 / 8.7550		in
SHOE MD/TVD:	2296.59 / 2273.69		ft

LINER

WEIGHT:		lb/ft	
SIZE / ID:	/		in
TOP MD/TVD:	/		ft
SHOE MD/TVD:	/		ft

LEAK-OFF TEST (LOT)

MD / TVD: 2296.59 / 2273.69 ft

PRESSURE	@ MW of	EQ. MW	EQ. GRAD
psi	ppg	ppg	psi/ft
815	9.60	16.50	0.8571

Exercise 1 Stab 2.wsdf

Header Units Clear All Sheet 2

Print this form 1

On form 2, edit the "casing Friction", the Kick Data (SIDPP, SICP, Volume and Time)

CASING+LINER LOSSES

Calculate 28 psi

@ 36.0 spm / Mud Pump #1

SIDPP 207 psi SICP 268 psi

PIT GAIN 10.13 bbl TIME 00 : 24

Set real values for KMW

KILL MUD WEIGHT (KMW):

(207 SIDPP, psi / 0.0519 / 3403.99 TVD, ft) + 9.60 Orig Mud Weight, ppg = 10.77

SET THE KMW VALUE TO USE

KMW 10.8 ppg

When start the circulation of the method, set ICP and FCP to real values.

Print the form 2 updated

Carrier 9:49 PM 100%

Wait and Weight Method - Surface Stack (Deviated Well) Rig: _____

Well Name: _____ Completed By: _____ Date: Dec 11, 2016

MAXIMUM ALLOWABLE ANNULUS SURFACE PRESSURE (MAASP) at Choke

MAASP WITH PRESENT MUD WEIGHT:

(16.50 - 9.60) x 0.0519 x 2273.69 = 815 - 28 = 787 psi

EQ. MW (LOT), ppg — Original MW, ppg — LOT TVD, ft — Static — Casing Friction — Dynamic

MAASP WITH KILL MUD WEIGHT:

(16.50 - 10.80) x 0.0519 x 2273.69 = 673 psi

EQ. MW (LOT), ppg — Kill Mud Weight, ppg — LOT TVD, ft

KICK DATA

SIDPP:	207	psi	SICP:	268	psi	VOLUME:	10.13	bbl	Time of Incident:	00 : 24	h

CALCULATIONS

KILL MUD WEIGHT (KMW):

(207 / 0.0519 / 3403.99) + 9.60 = 10.77 — KMW: 10.80 ppg

SIDPP, psi — TVD, ft — Orig Mud Weight, ppg

INITIAL CIRCULATING PRESSURE (ICP):

207 + 324 = 531.0 — ICP: 531 psi

SIDPP, psi — DP Pressure, psi — @ SCR of 36 spm

FINAL CIRCULATING PRESSURE (FCP):

324 x 10.80 / 9.60 = 364.5 — FCP: 364 psi

DP Pressure, psi — Kill Mud Weight, ppg — Orig Mud Weight, ppg

SURFACE TO BIT (DRILL STRING ONLY) FORMULAS Recorded

KILL MUD AT:		SURFACE		KOP		EOB		BIT		
STROKES	MINUTES	0	0	267	7	584	16	623	17	stk I min
DP PRESSURE		531		453		370		364		psi

PRESSURE DROP PER 100 STROKES	SURFACE TO KOP	KOP TO EOB	EOB TO BIT	
	29.3	26.2	13.2	psi / 100 stk

Nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Strokes	0	100	200	267	300	400	500	584	600	623					
DP Press	531	502	472	453	444	418	392	370	368	364					
Recorded															

Nr.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Strokes															
DP Press															
Recorded															

Exercise 1 Stab 2.wsdf

Header Units Sheet 1 Sheet 3

Set the ranges for the graph

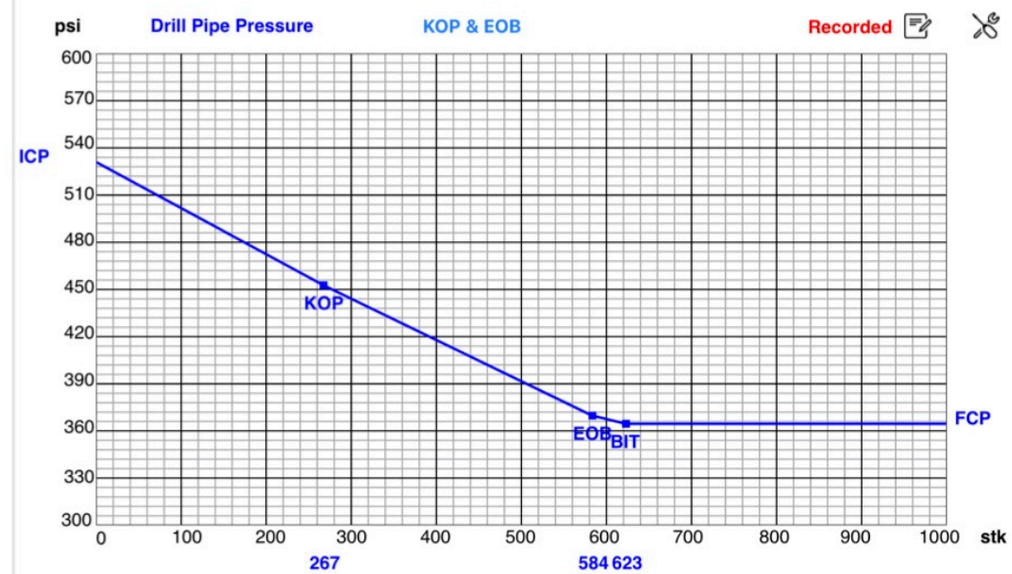
Carrier 9:55 PM 100%

Wait and Weight Method - Surface Stack (Deviated Well) Rig: _____

Well Name: _____ Completed By: _____ Date: Dec 11, 2016

STEP BY STEP

1. Bring mud pump up to slow circulation rate 36 spm, keeping Choke Pressure = SICP,real 268 psi
2. Reset Strokes Counter after pump the surface lines volume 9.57 bbl / 96 strokes
3. Maximum Pressure at Choke 787 psi until 696 strokes (open hole)
4. Pump the Kill Mud to fill the drill string following the table / graph, starting with DP Pressure = ICP,real 531 psi
5. Keep Drill Pipe Pressure = FCP 364 psi until kill mud reaches the surface: 1852 strokes (bit to choke)



Nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Strokes	0	100	200	267	300	400	500	584	600	623					
DP Press	531	502	472	453	444	418	392	370	368	364					
Recorded															

Nr.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Strokes															
DP Press															
Recorded															

Exercise 1 Stab 2.wsdf

Header Units Sheet 2

SECTION 5

Killing the Well

STEPS

1. The Kill Sheet
2. Reset Total Strokes
3. Set the Kill Mud (KM)
4. Starting the circulating
5. Set the Initial Circulation Pressure
6. Set a Safety Margin ~ 36 psi
7. Reset again at 96 strokes (surfaces lines)
8. Apply the “DP Pressure x Strokes” table
9. Reset Strokes when KM reaches the Drill Bit
10. Set the Final Circulation Pressure (FCP)
11. Maintain FCP until Kill Mud out (Annular filled with Kill Mud)

The Kill Sheet

Carrier 9:55 PM 100%

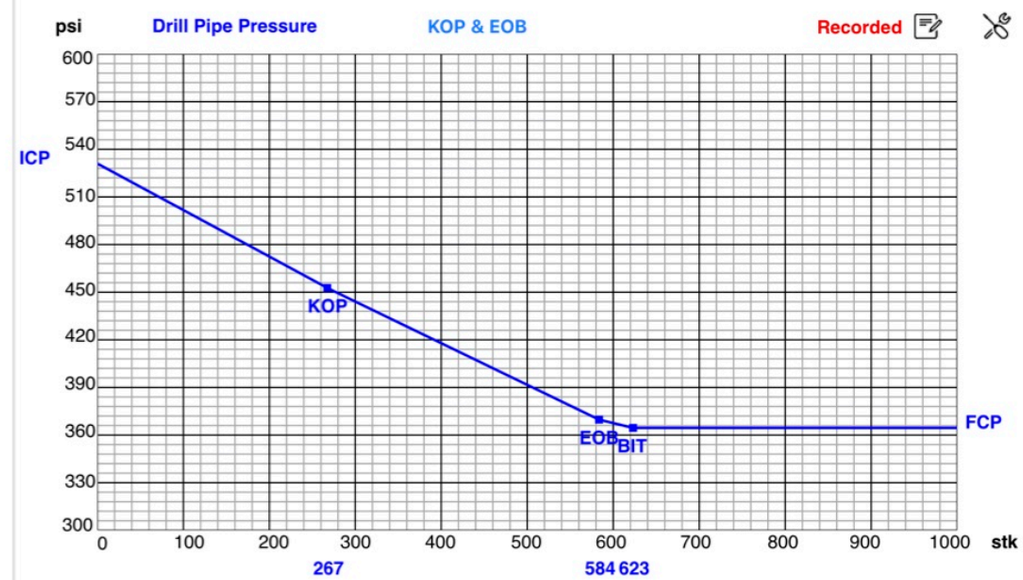
Wait and Weight Method - Surface Stack (Deviated Well)

Rig: _____

Well Name: _____ Completed By: _____ Date: Dec 11, 2016

STEP BY STEP

1. Bring mud pump up to slow circulation rate 36 spm, keeping Choke Pressure = SICP,real 268 psi
2. Reset Strokes Counter after pump the surface lines volume 9.57 bbl / 96 strokes
3. Maximum Pressure at Choke 787 psi until 696 strokes (open hole)
4. Pump the Kill Mud to fill the drill string following the table / graph, starting with DP Pressure = ICP,real 531 psi
5. Keep Drill Pipe Pressure = FCP 364 psi until kill mud reaches the surface: 1852 strokes (bit to choke)



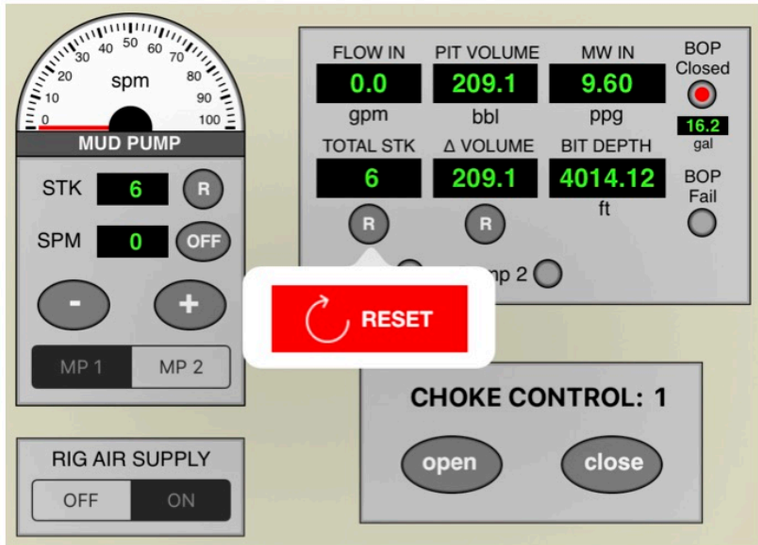
Nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Strokes	0	100	200	267	300	400	500	584	600	623					
DP Press	531	502	472	453	444	418	392	370	368	364					
Recorded															

Nr.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Strokes															
DP Press															
Recorded															

Exercise 1 Stab 2.wsdf

Header Units Sheet 2

Reset Strokes

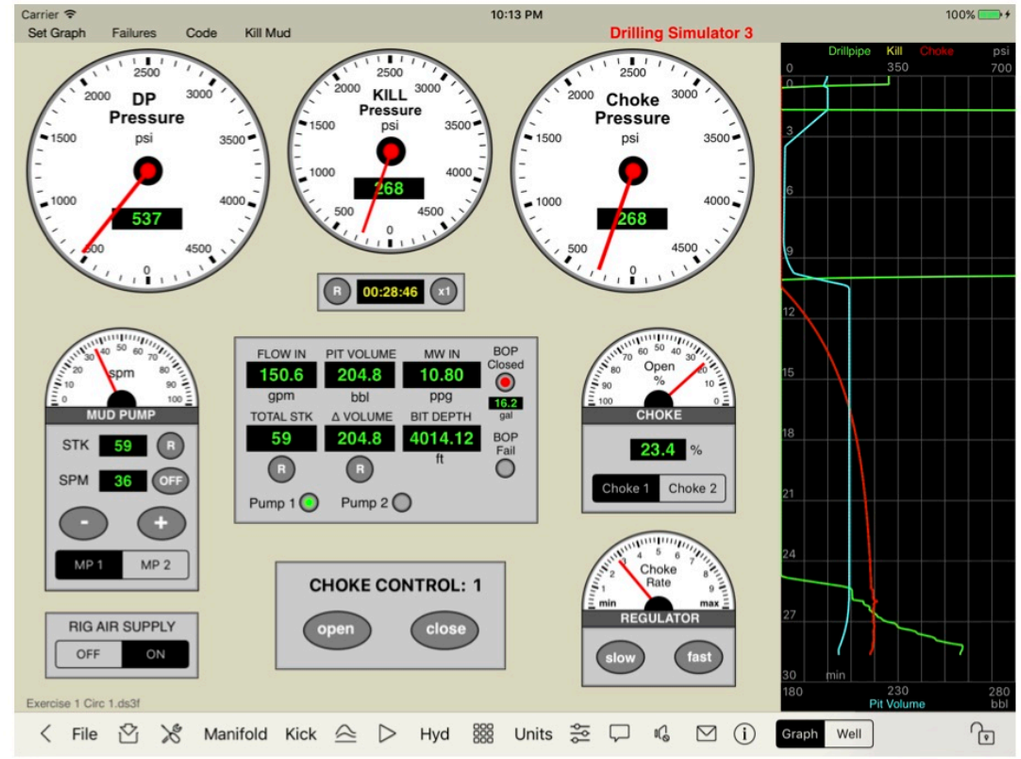


Set the Kill Mud Weight

1. Select Enabled
2. Input KMW = 10.8 ppg
3. Tap on "SET" button

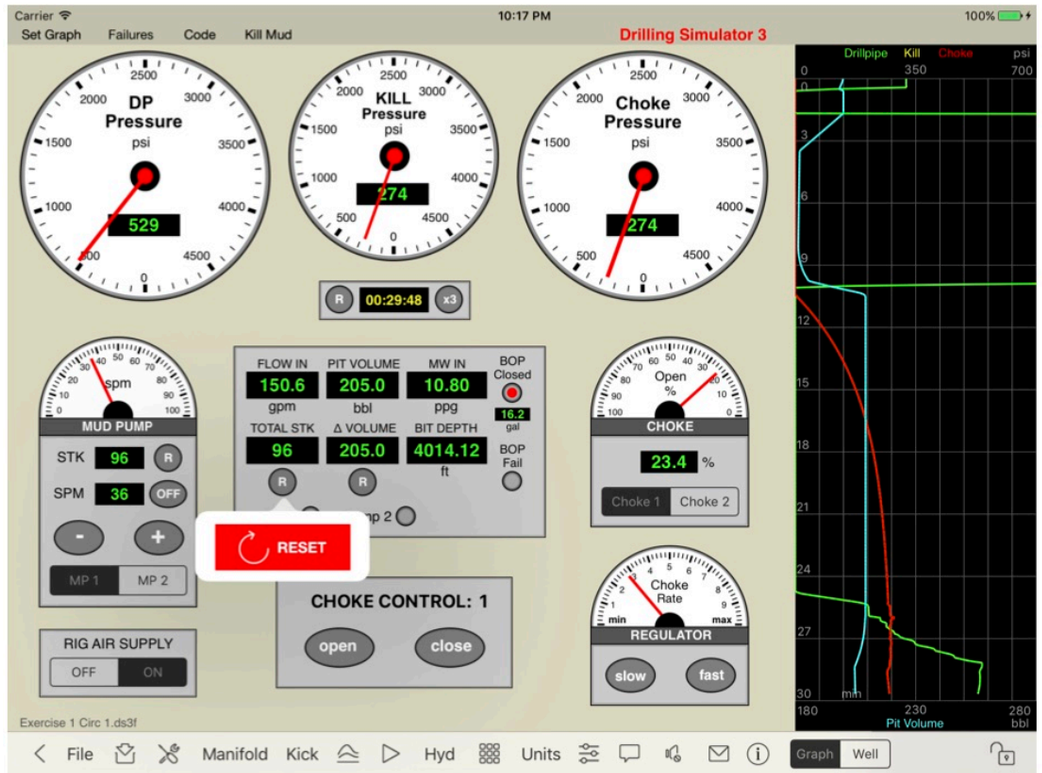
Starting Circulating

1. Set Choke Rate to a slow value (3 of 10)
2. Set Rig Air Supply to ON
3. Open the choke slowly
4. Increment SPM and open choke trying maintain Choke Pressure constant ~ SICP = 368.
5. When SPM reaches 36 spm, set choke to DP Pressure = ICP + Safety margin (= 531) (Safety Margin = 0 psi in this example)



Reset Total Strokes (Surface Lines)

-> when reaches 96 strokes (Surface Lines)



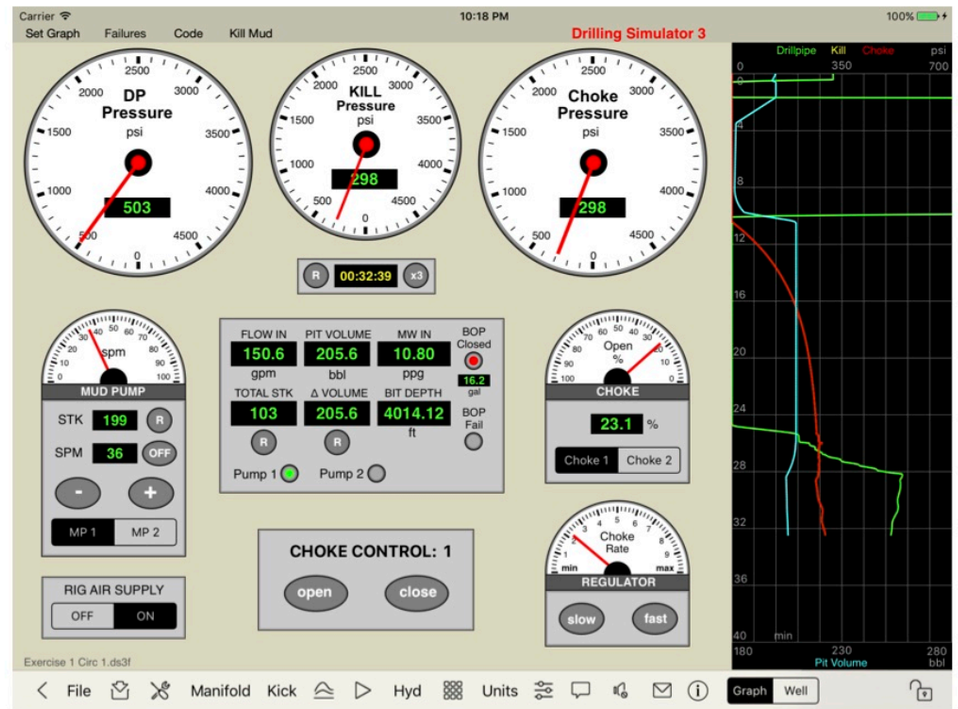
Adjust choke to Apply the table "DP Pressure x Strokes"

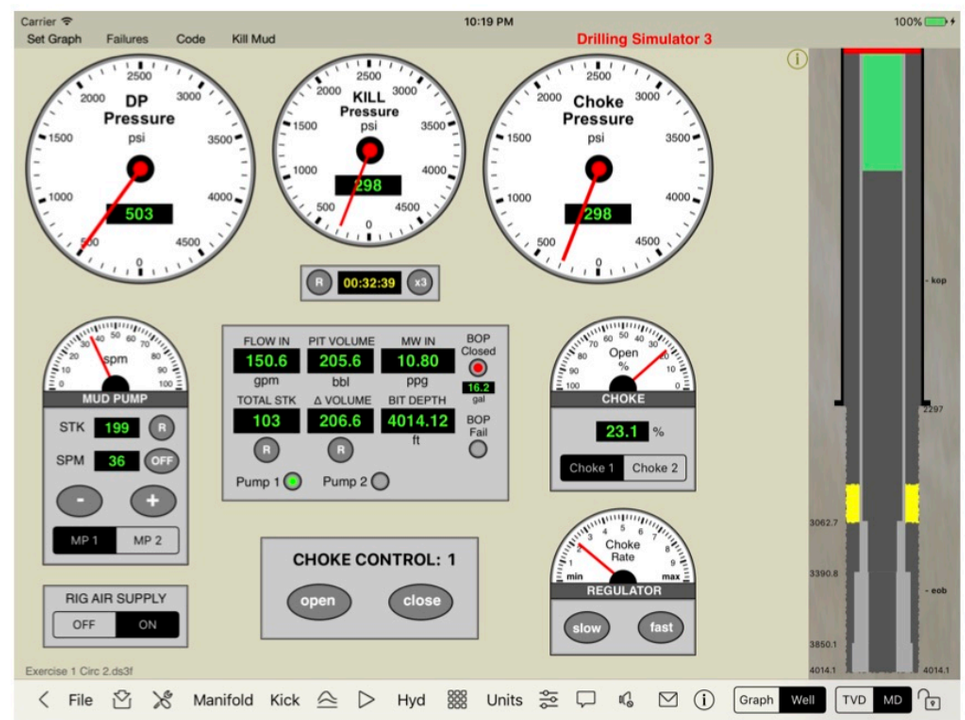
KILL MUD AT:		SURFACE		KOP		EOB		BIT		
STROKES	MINUTES	0	0	267	7	584	16	623	17	stk I min
DP PRESSURE		531		453		370		364		psi

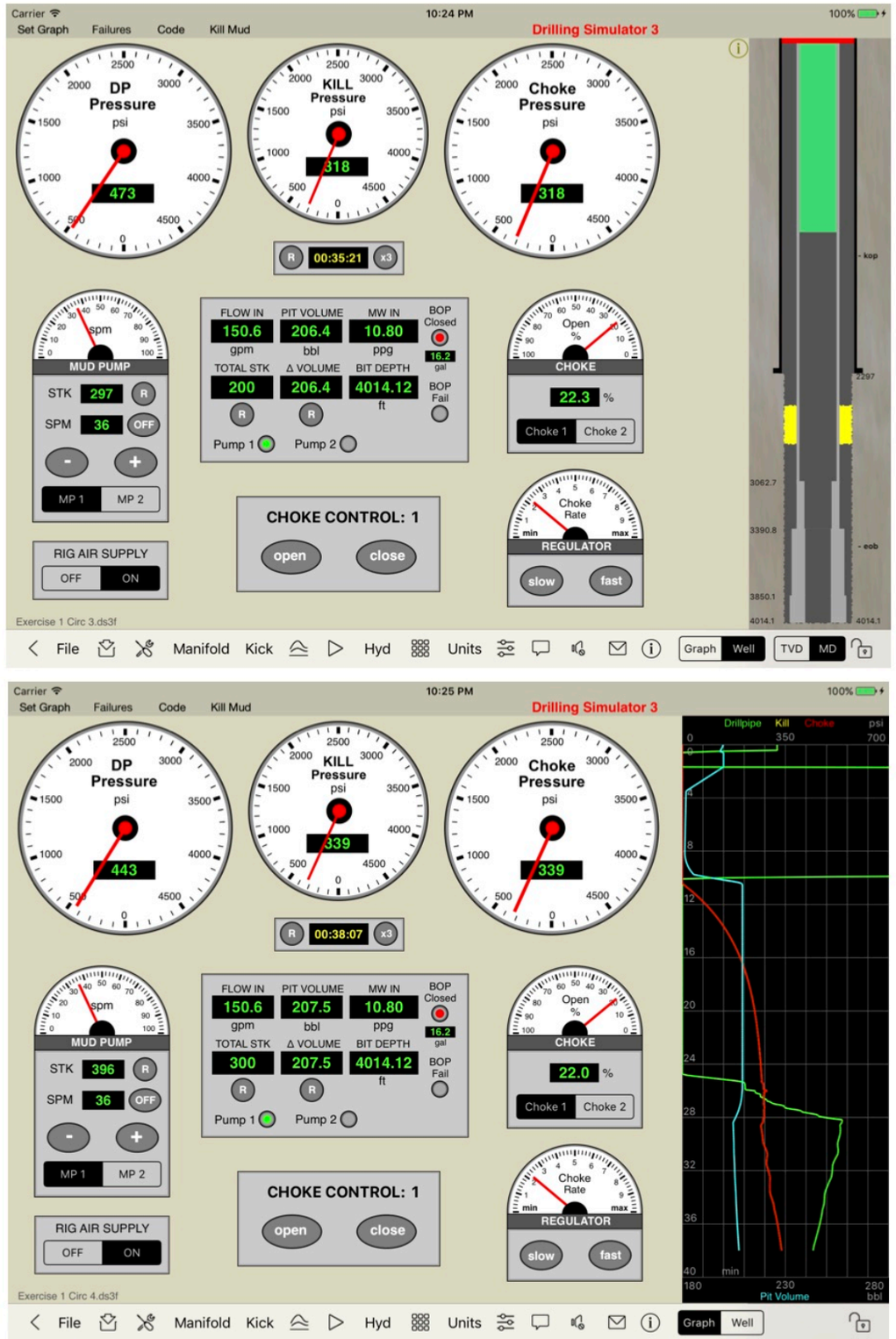
PRESSURE DROP PER 100 STROKES	SURFACE TO KOP	KOP TO EOB	EOB TO BIT	
	29.3	26.2	13.2	psi / 100 stk

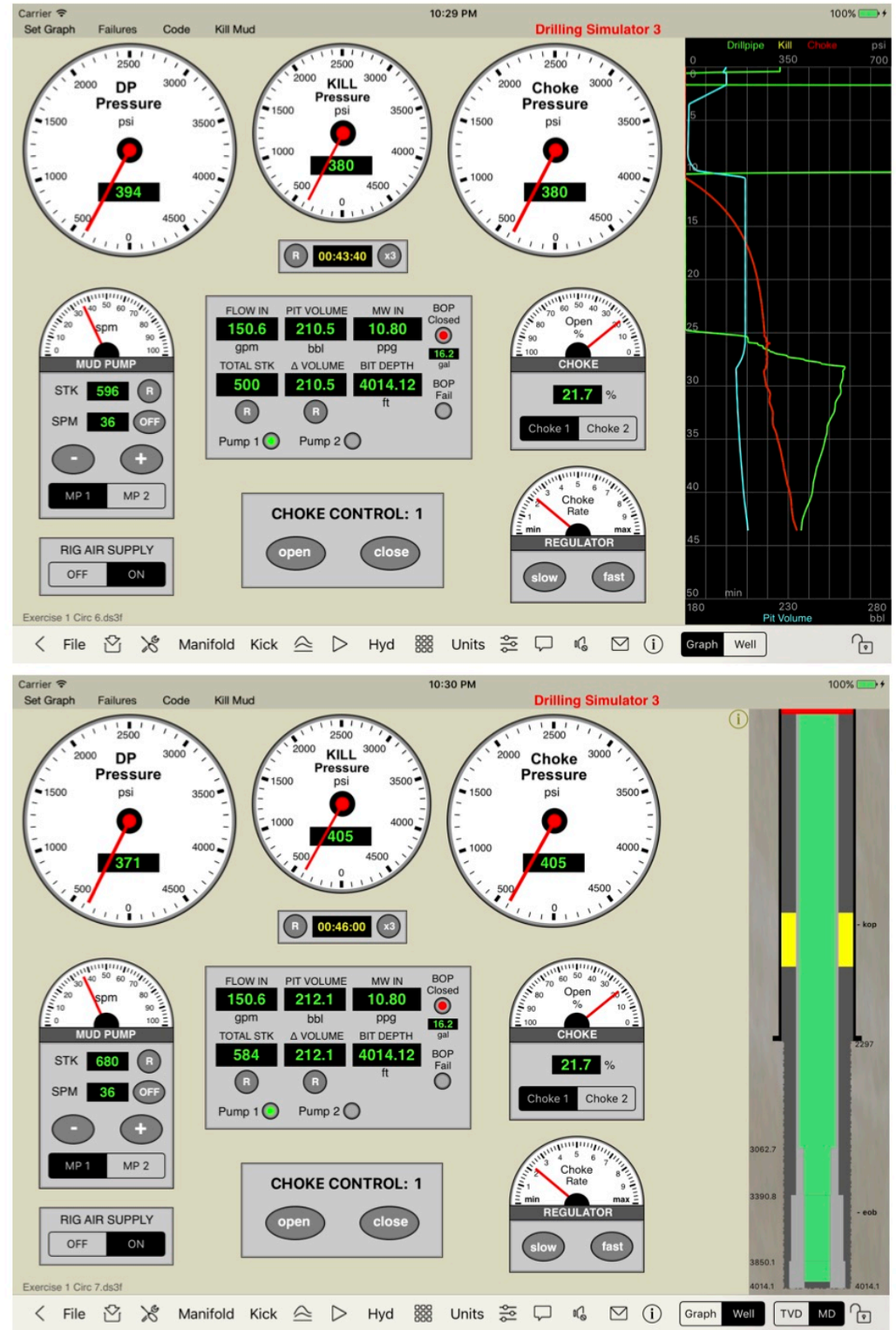
Nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Strokes	0	100	200	267	300	400	500	584	600	623					
DP Press	531	502	472	453	444	418	392	370	368	364					
Recorded															

Kill Mud in the Drill String

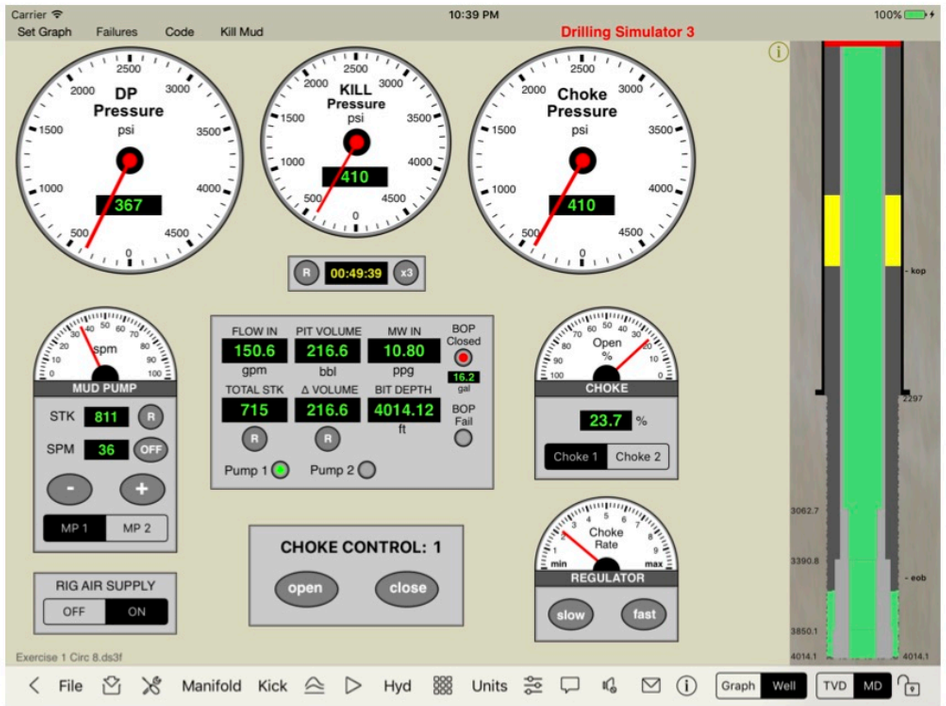


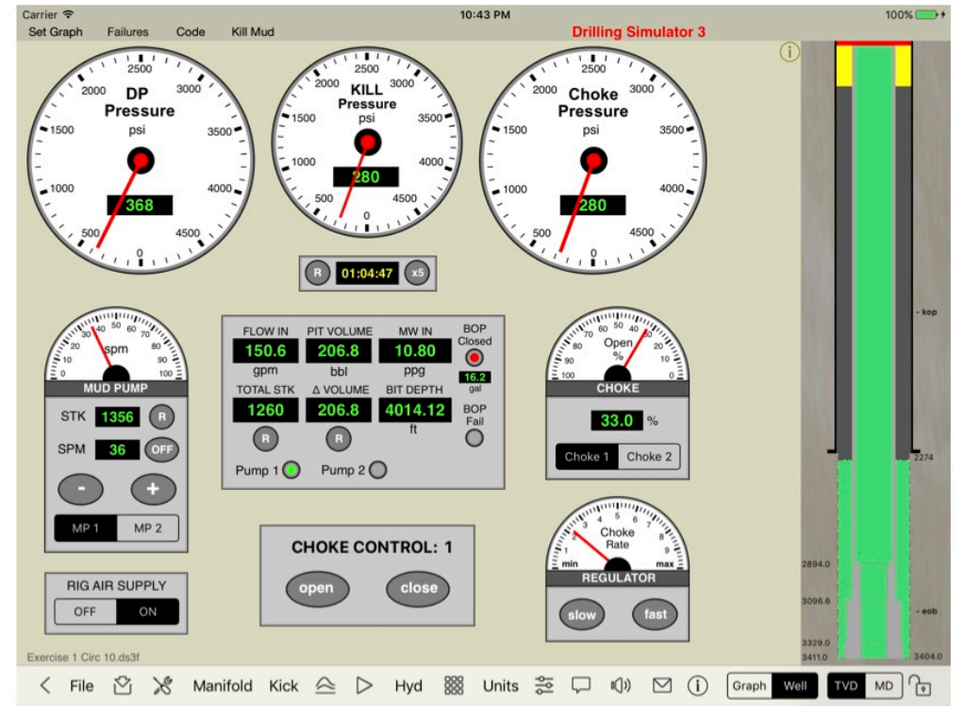


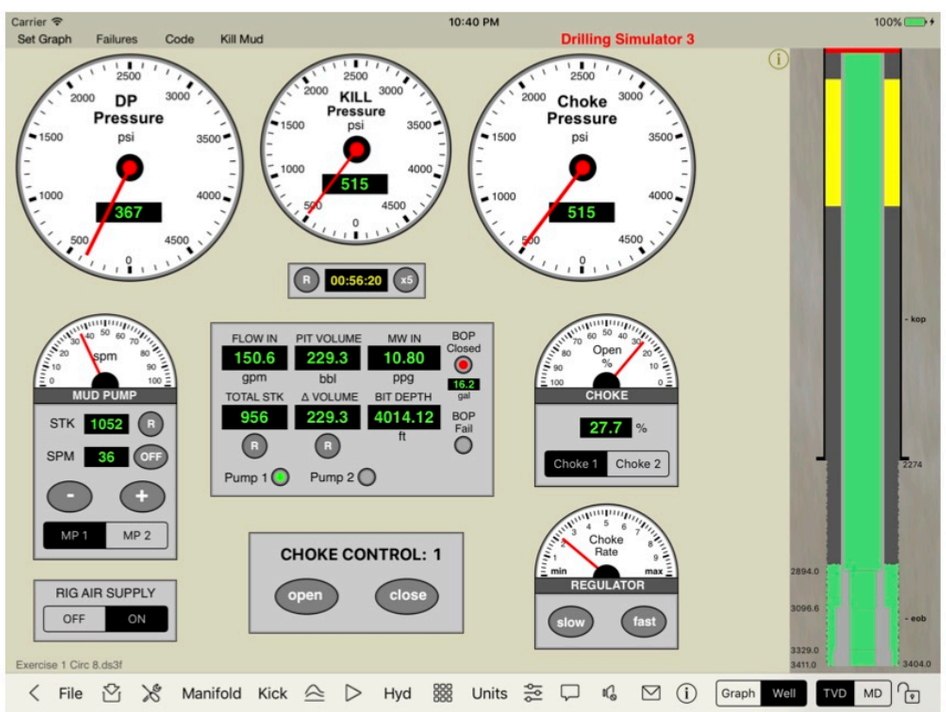

Carrier
10:24 PM
100%
Set Graph
Failures
Code
Kill Mud
Drilling Simulator 3
DP Pressure
psi
473
KILL Pressure
318
Choke Pressure
318
00:35:21
x3
spm
MUD PUMP
STK 297
SPM 36
MP 1
MP 2
RIG AIR SUPPLY
OFF
ON
FLOW IN 150.6 gpm
PIT VOLUME 206.4 bbl
MW IN 10.80 ppg
BOP Closed
16.2 gal
TOTAL STK 200
Δ VOLUME 206.4
BIT DEPTH 4014.12 ft
BOP Fail
Pump 1
Pump 2
Open %
CHOKE
22.3 %
Choke 1
Choke 2
CHOKE CONTROL: 1
open
close
Choke Rate
min
max
REGULATOR
slow
fast
Exercise 1 Circ 3.ds3f
File
Manifold
Kick
Hyd
Units
Graph
Well
TVD
MD
Carrier
10:25 PM
100%
Set Graph
Failures
Code
Kill Mud
Drilling Simulator 3
DP Pressure
psi
443
KILL Pressure
339
Choke Pressure
339
00:38:07
x3
spm
MUD PUMP
STK 396
SPM 36
MP 1
MP 2
RIG AIR SUPPLY
OFF
ON
FLOW IN 150.6 gpm
PIT VOLUME 207.5 bbl
MW IN 10.80 ppg
BOP Closed
16.2 gal
TOTAL STK 300
Δ VOLUME 207.5
BIT DEPTH 4014.12 ft
BOP Fail
Pump 1
Pump 2
Open %
CHOKE
22.0 %
Choke 1
Choke 2
CHOKE CONTROL: 1
open
close
Choke Rate
min
max
REGULATOR
slow
fast
Drillpipe
Kill
Choke
psi
350
700
min
180
230
280
Pit Volume
bbl
Exercise 1 Circ 4.ds3f
File
Manifold
Kick
Hyd
Units
Graph
Well

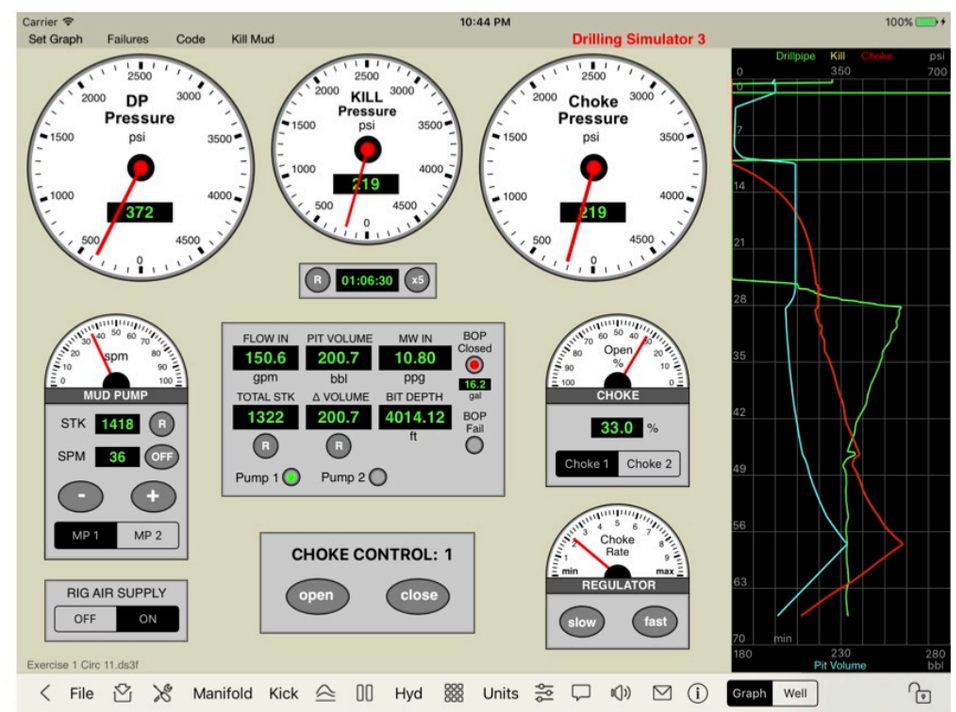

Carrier
10:29 PM
100%
Set Graph
Failures
Code
Kill Mud
Drilling Simulator 3
DP Pressure
psi
394
KILL Pressure
380
Choke Pressure
380
00:43:40
x3
spm
MUD PUMP
STK 596
SPM 36
MP 1
MP 2
RIG AIR SUPPLY
OFF
ON
FLOW IN 150.6 gpm
PIT VOLUME 210.5 bbl
MW IN 10.80 ppg
BOP Closed
16.2 gal
TOTAL STK 500
Δ VOLUME 210.5
BIT DEPTH 4014.12 ft
BOP Fail
Pump 1
Pump 2
Open %
CHOKE
21.7 %
Choke 1
Choke 2
CHOKE CONTROL: 1
open
close
Choke Rate
min
max
REGULATOR
slow
fast
Drillpipe
Kill
Choke
psi
350
700
min
180
230
280
Pit Volume
bbl
Exercise 1 Circ 6.ds3f
File
Manifold
Kick
Hyd
Units
Graph
Well
Carrier
10:30 PM
100%
Set Graph
Failures
Code
Kill Mud
Drilling Simulator 3
DP Pressure
psi
371
KILL Pressure
405
Choke Pressure
405
00:46:00
x3
spm
MUD PUMP
STK 680
SPM 36
MP 1
MP 2
RIG AIR SUPPLY
OFF
ON
FLOW IN 150.6 gpm
PIT VOLUME 212.1 bbl
MW IN 10.80 ppg
BOP Closed
16.2 gal
TOTAL STK 584
Δ VOLUME 212.1
BIT DEPTH 4014.12 ft
BOP Fail
Pump 1
Pump 2
Open %
CHOKE
21.7 %
Choke 1
Choke 2
CHOKE CONTROL: 1
open
close
Choke Rate
min
max
REGULATOR
slow
fast
Exercise 1 Circ 7.ds3f
File
Manifold
Kick
Hyd
Units
Graph
Well
TVD
MD

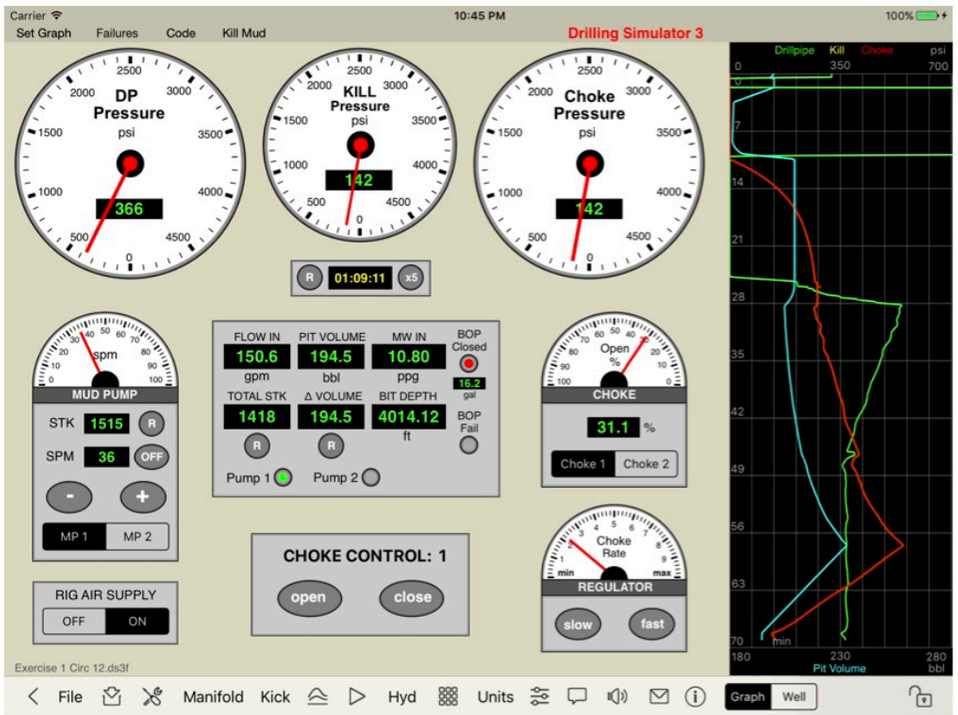
Set the Final Circulating Pressure = 364 psi

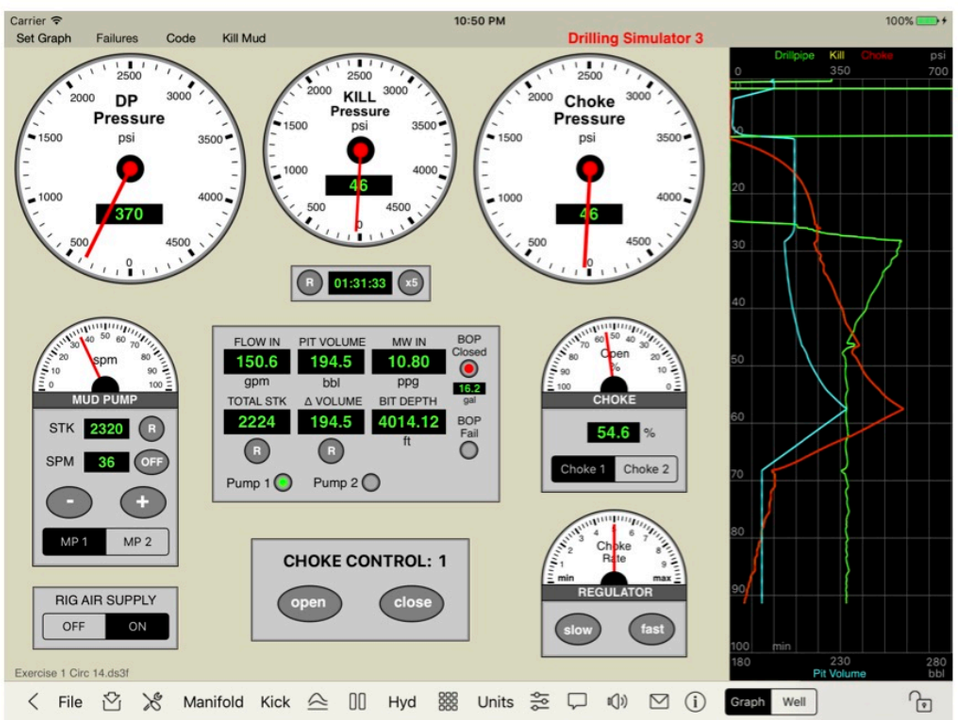


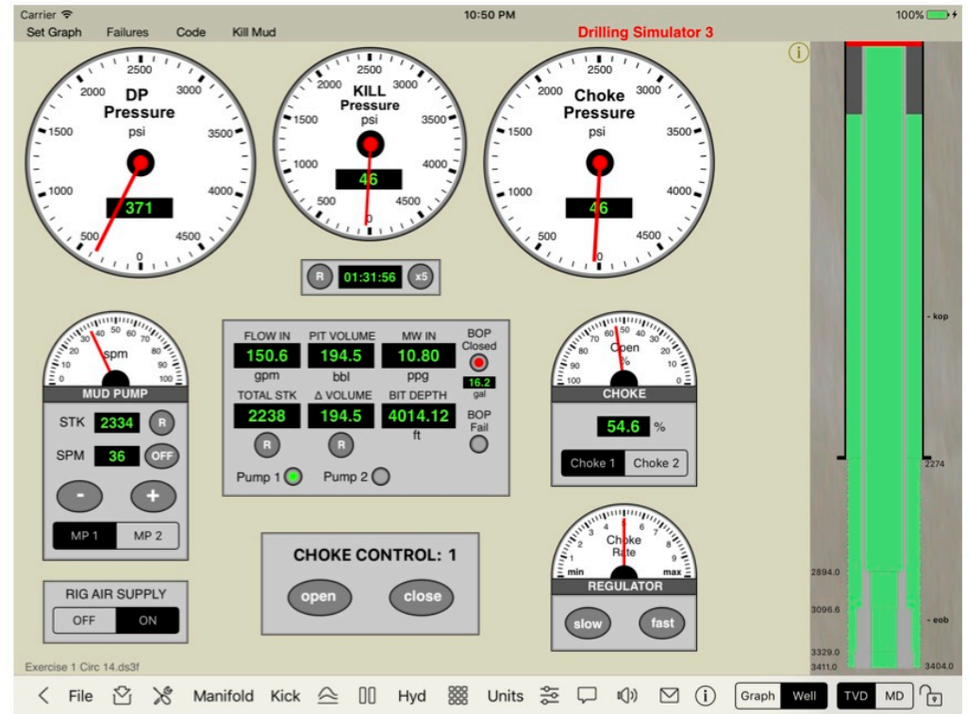


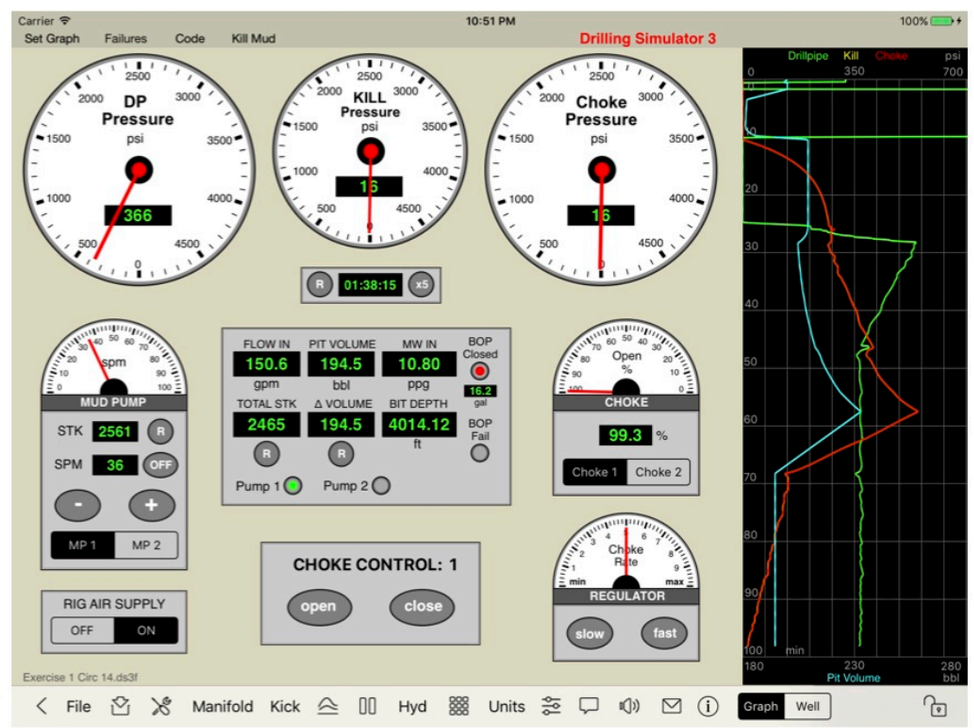


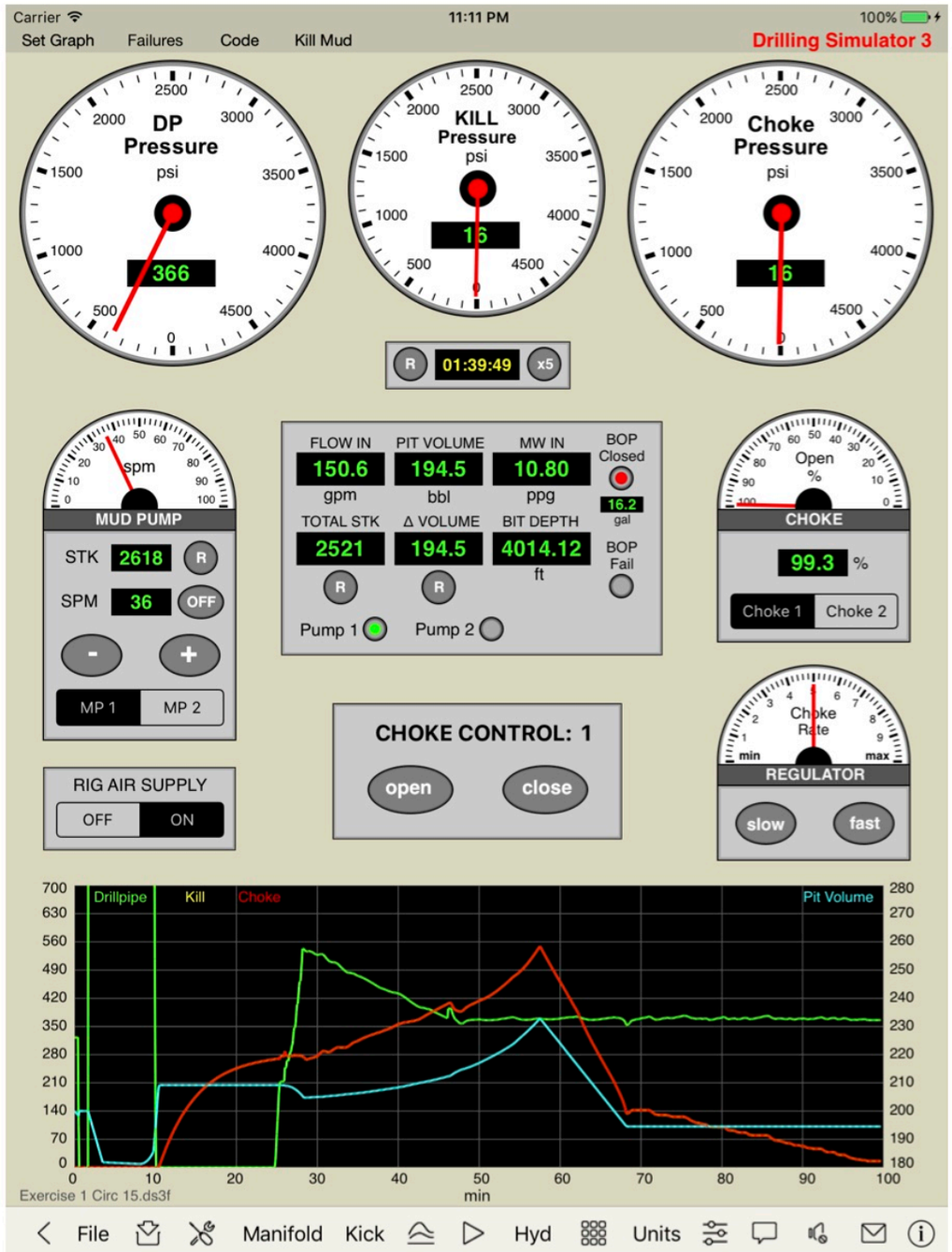



Carrier
10:45 PM
100%
Set Graph
Failures
Code
Kill Mud
Drilling Simulator 3
DP Pressure
psi
366
KILL Pressure
psi
142
Choke Pressure
psi
142
01:09:11
x5
MUD PUMP
STK 1515
SPM 36
MP 1
MP 2
FLOW IN 150.6 gpm
PIT VOLUME 194.5 bbl
MW IN 10.80 ppg
BOP Closed
TOTAL STK 1418
Δ VOLUME 194.5
BIT DEPTH 4014.12 ft
BOP Fail
Pump 1
Pump 2
CHOKE
31.1 %
Choke 1
Choke 2
CHOKE CONTROL: 1
open
close
Choke Rate
REGULATOR
slow
fast
RIG AIR SUPPLY
OFF
ON
Drillpipe
Kill
Choke
psi
Pit Volume
bbl
Exercise 1 Circ 12.ds3f
File
Manifold
Kick
Hyd
Units
Graph
Well

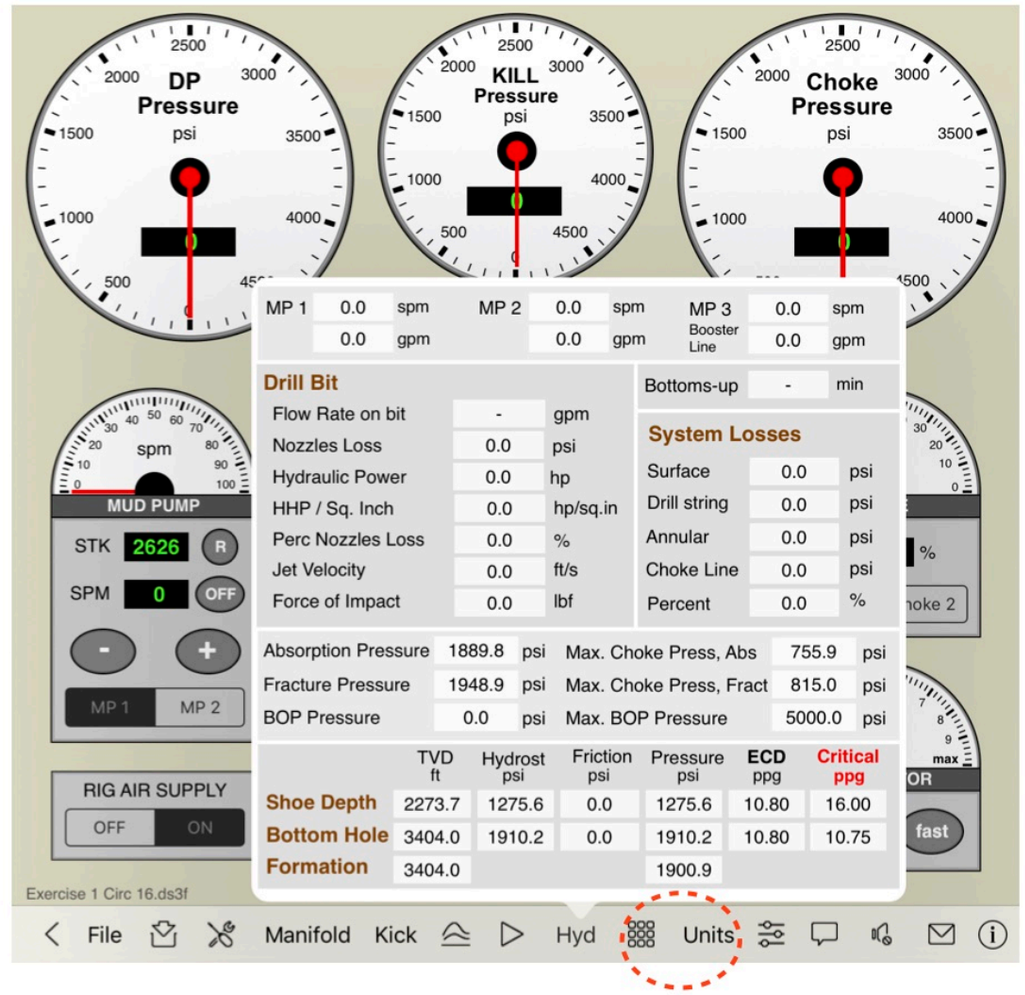

Carrier
10:50 PM
100%
Set Graph
Failures
Code
Kill Mud
Drilling Simulator 3
DP Pressure
psi
370
KILL Pressure
psi
46
Choke Pressure
psi
46
01:31:33
x5
MUD PUMP
STK 2320
SPM 36
MP 1
MP 2
FLOW IN 150.6 gpm
PIT VOLUME 194.5 bbl
MW IN 10.80 ppg
BOP Closed
TOTAL STK 2224
Δ VOLUME 194.5
BIT DEPTH 4014.12 ft
BOP Fail
Pump 1
Pump 2
CHOKE
54.6 %
Choke 1
Choke 2
CHOKE CONTROL: 1
open
close
Choke Rate
REGULATOR
slow
fast
RIG AIR SUPPLY
OFF
ON
Drillpipe
Kill
Choke
psi
Pit Volume
bbl
Exercise 1 Circ 14.ds3f
File
Manifold
Kick
Hyd
Units
Graph
Well


Carrier
10:50 PM
100%
Set Graph
Failures
Code
Kill Mud
Drilling Simulator 3
DP Pressure
psi
371
KILL Pressure
psi
46
Choke Pressure
psi
46
01:31:56
x5
MUD PUMP
STK 2334
SPM 36
MP 1
MP 2
FLOW IN 150.6 gpm
PIT VOLUME 194.5 bbl
MW IN 10.80 ppg
BOP Closed
TOTAL STK 2238
Δ VOLUME 194.5
BIT DEPTH 4014.12 ft
BOP Fail
Pump 1
Pump 2
CHOKE
54.6 %
Choke 1
Choke 2
CHOKE CONTROL: 1
open
close
Choke Rate
REGULATOR
slow
fast
RIG AIR SUPPLY
OFF
ON
Exercise 1 Circ 14.ds3f
File
Manifold
Kick
Hyd
Units
Graph
Well
TVD
MD


Carrier
10:51 PM
100%
Set Graph
Failures
Code
Kill Mud
Drilling Simulator 3
DP Pressure
psi
366
KILL Pressure
psi
16
Choke Pressure
psi
16
01:38:15
x5
MUD PUMP
STK 2561
SPM 36
MP 1
MP 2
FLOW IN 150.6 gpm
PIT VOLUME 194.5 bbl
MW IN 10.80 ppg
BOP Closed
TOTAL STK 2465
Δ VOLUME 194.5
BIT DEPTH 4014.12 ft
BOP Fail
Pump 1
Pump 2
CHOKE
99.3 %
Choke 1
Choke 2
CHOKE CONTROL: 1
open
close
Choke Rate
REGULATOR
slow
fast
RIG AIR SUPPLY
OFF
ON
Drillpipe
Kill
Choke
psi
Pit Volume
bbl
Exercise 1 Circ 14.ds3f
File
Manifold
Kick
Hyd
Units
Graph
Well



Kill Mud Out (complete)



Stop Mud Pump

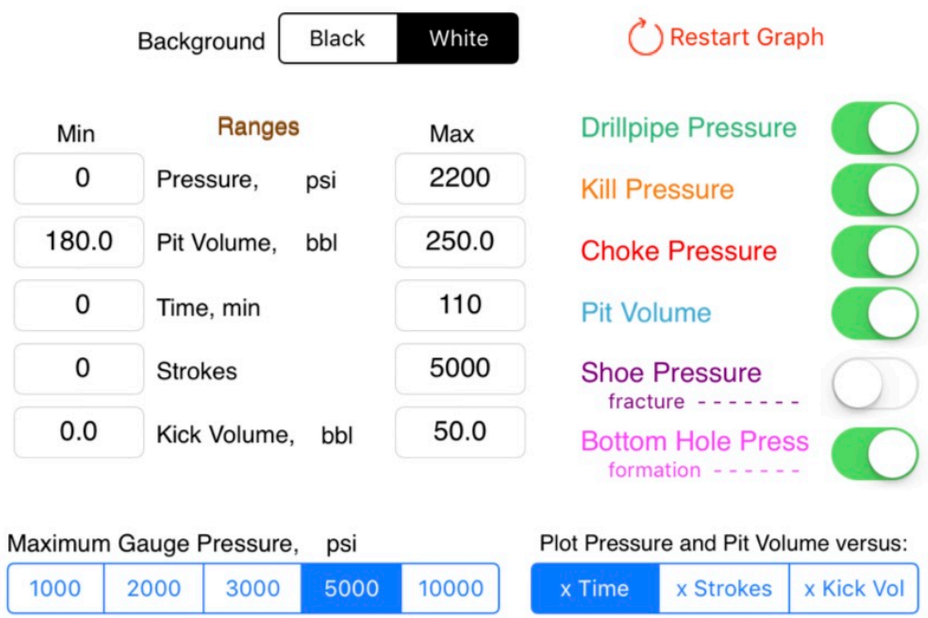
Bottom Hole Pressure x Formation Pressure

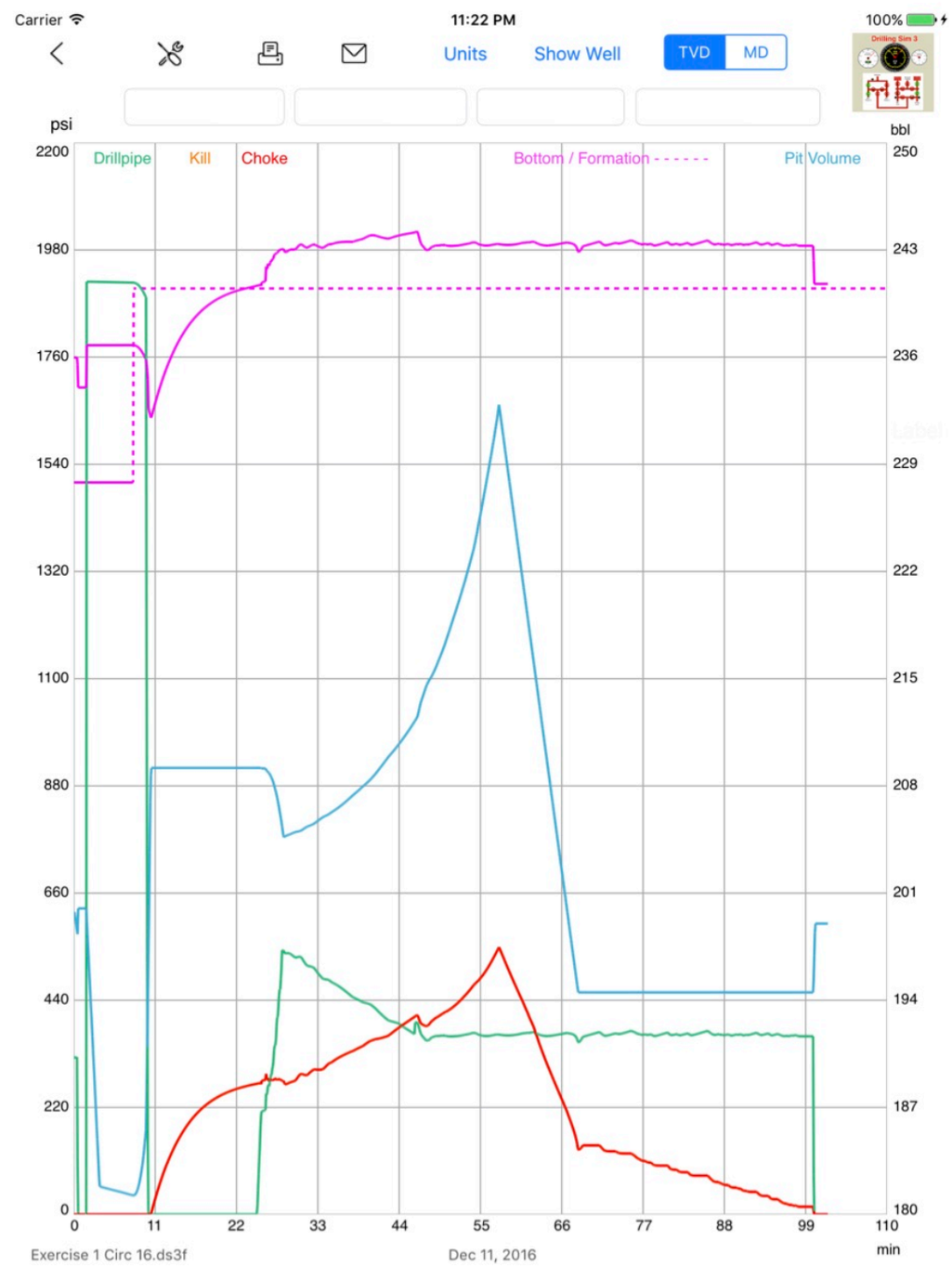
It is very important to apply a Safety Margin to Kill Mud Weight, the Trip Margin.

=> The Trip Margin (normally 0.2 to 0.5 ppg)

SECTION 6

Graphical Analysis





About

This app was developed based on our experience. There is no comparison with any other software.

Our goal was to create a low-cost application with the help of experts to share with drilling engineers, technicians, drillers, students and teachers of drilling engineering.

There is no intention to replace the professional softwares.

You can contribute with suggestions for improvements, correcting the translation to english, reporting bugs and spreading it to your friends.

Please visit our support url and see other applications for Oil & Gas for iPhone, iPod Touch, iPhone and Mac.

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