



## INTRODUCTION TO STEERABLE DRILLING LINER TECHNOLOGY

SASCHA SCHWARTZE  
MANAGER-  
HOLE ENLARGEMENT  
LINER DRILLING  
SLIM HOLE DRILLING

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# **TECHNOLOGY INTRODUCTION**



## Casing & Liner Drilling Systems

Non Steerable

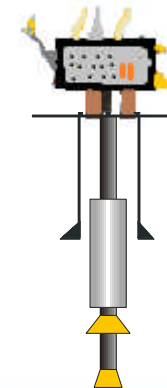
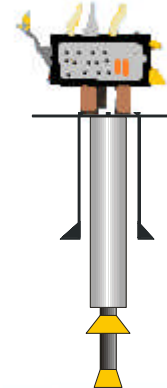
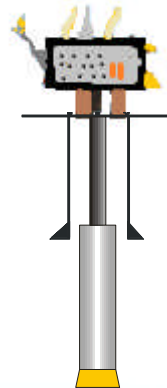
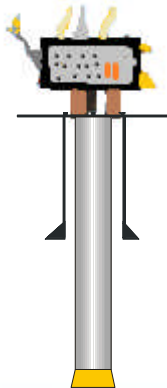
Steerable

Casing  
Drilling

Liner  
Drilling

Casing  
Drilling

Liner Drilling

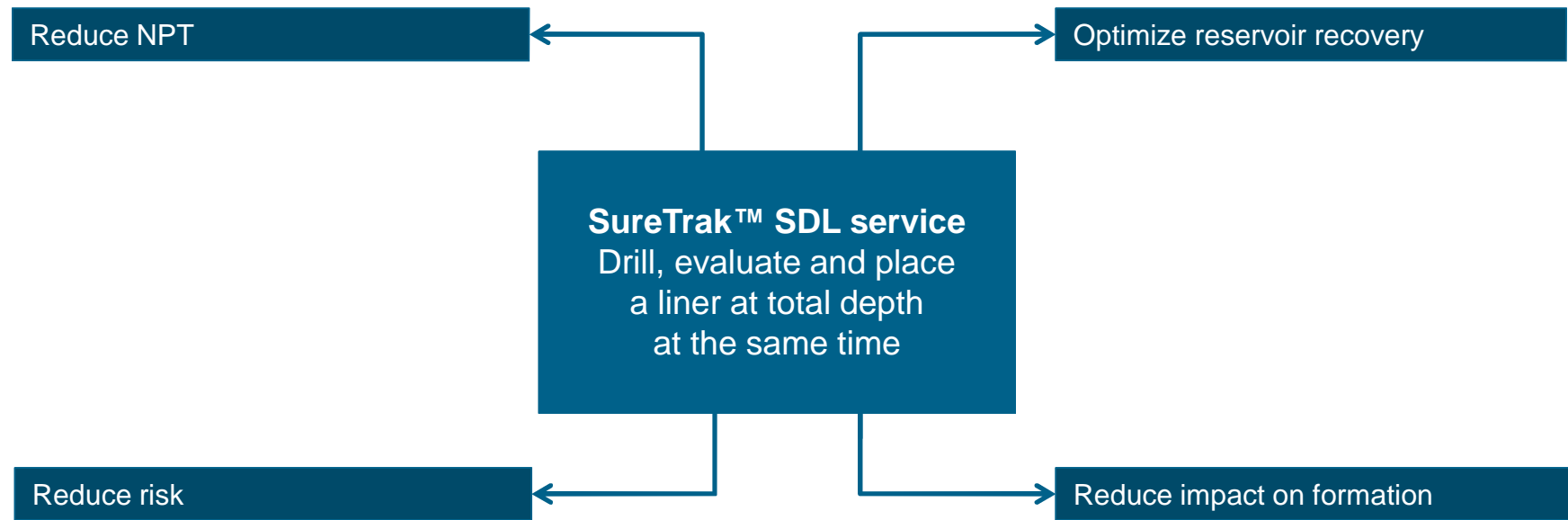


WHAT IS SDL?

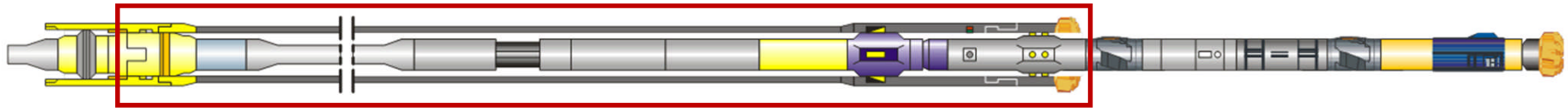


APPETIZER





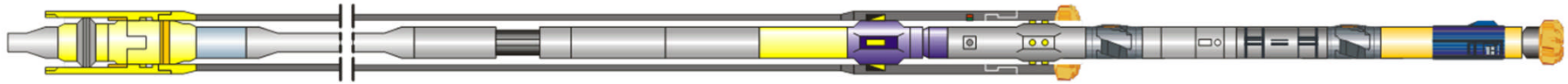
NOT A SYSTEM TO SOLVE ALL PROBLEMS



## OUTER STRING

- Liner Setting Sleeve
- Quick Connect
- Liner
- Reamer Bit

TWO IN ONE



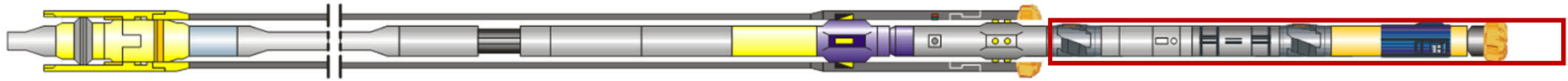
## OUTER STRING

- Liner Setting Sleeve
- Quick Connect
- Liner
- Reamer Bit

## INNER STRING

- Drill Pipe
- HRD-E Running Tool
- Inner BHA

TWO IN ONE



### OUTER STRING

- Liner Setting Sleeve
- Quick Connect
- Liner
- Reamer Bit

### STICK OUT/PILOT BHA

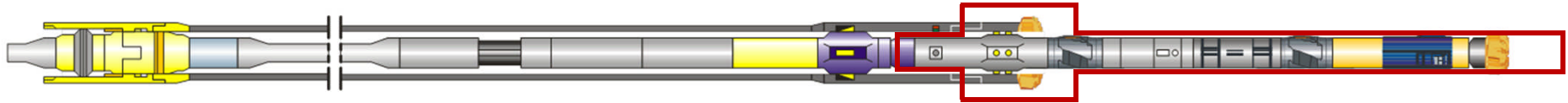
- Directional
- FE Tools

### INNER STRING

- Drill Pipe
- HRD-E Running Tool
- Inner BHA

TWO IN ONE





### OUTER STRING

- Liner Setting Sleeve
- Quick Connect
- Liner
- Reamer Bit

### STICK OUT/PILOT BHA

- Directional
- FE Tools

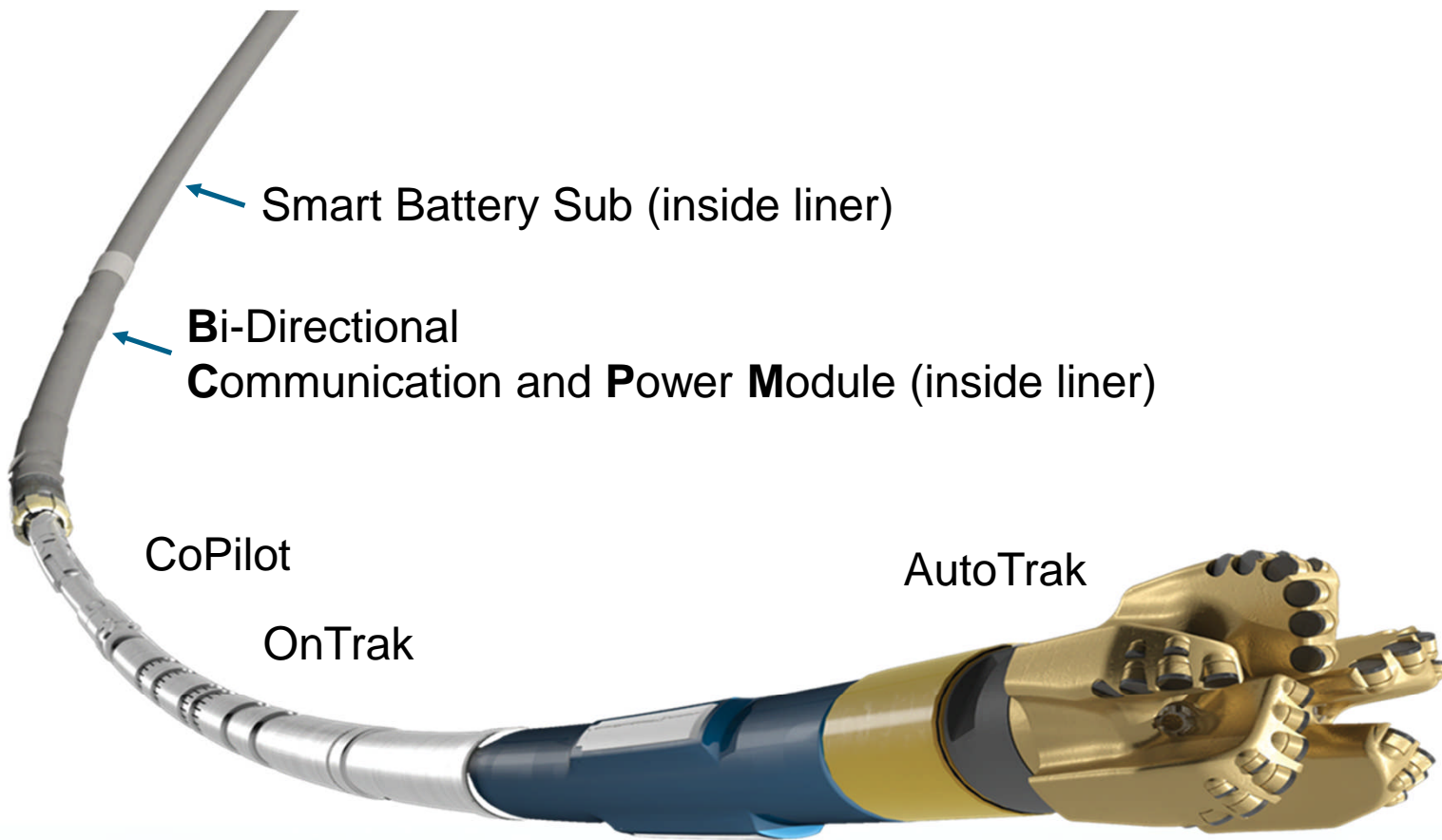
### INNER STRING

- Drill Pipe
- HRD-E Running Tool
- Inner BHA

### MOTOR DRIVEN COMPONENTS

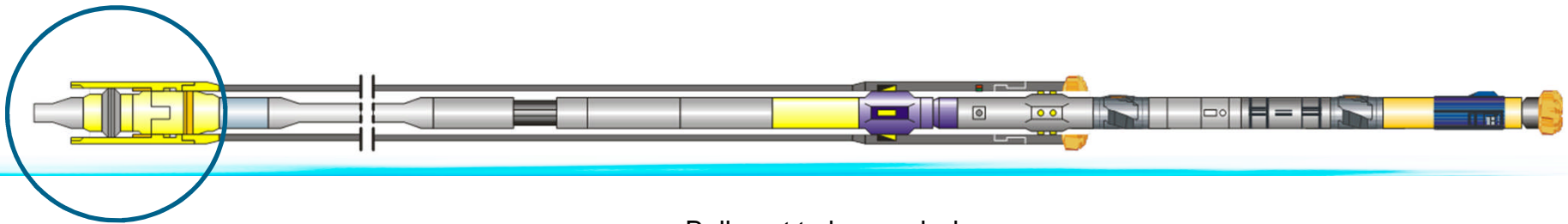
- Reamer Bit
- Pilot BHA

TWO IN ONE



PILOT BHA





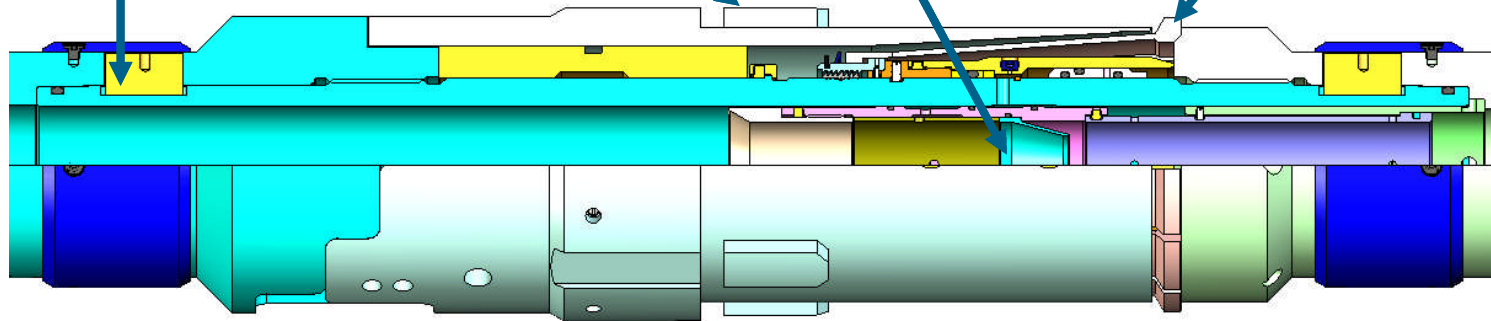
Locked internal connections

Fingers to transmit torque into the liner

Ball seat to be used when releasing from liner

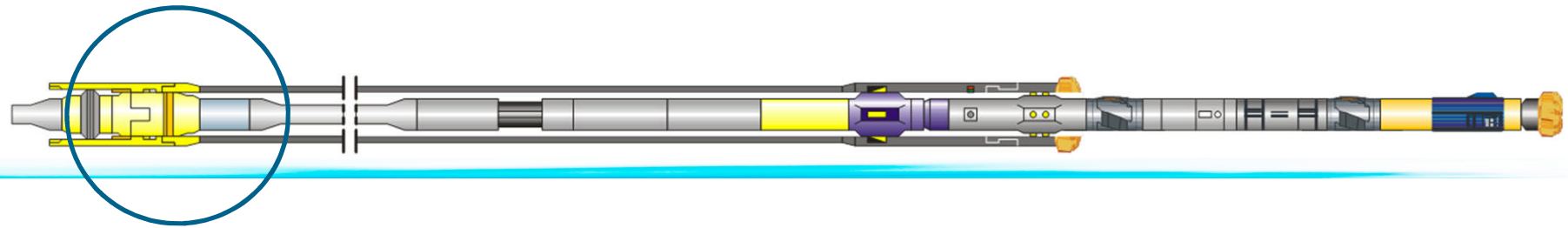


Collet carrying liner weight



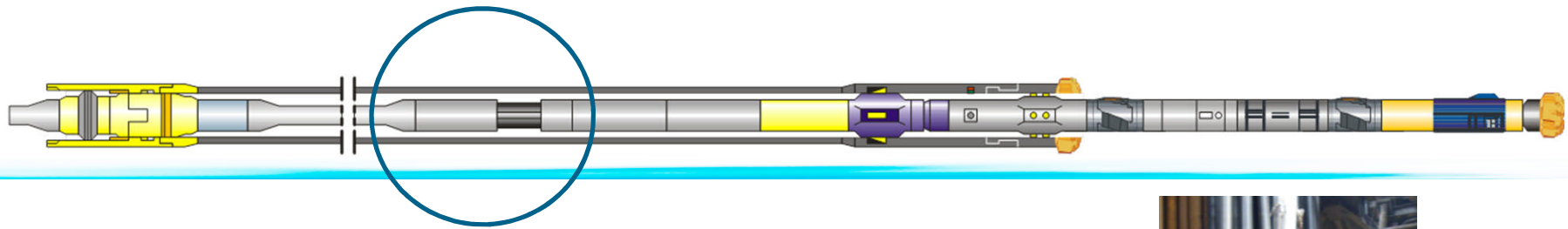
PORT ISOLATED HRD-E RUNNING TOOL





QUICK CONNECT





Thrust Force



Stroke 2.8m / 9.2ft  
Length  
Compensation

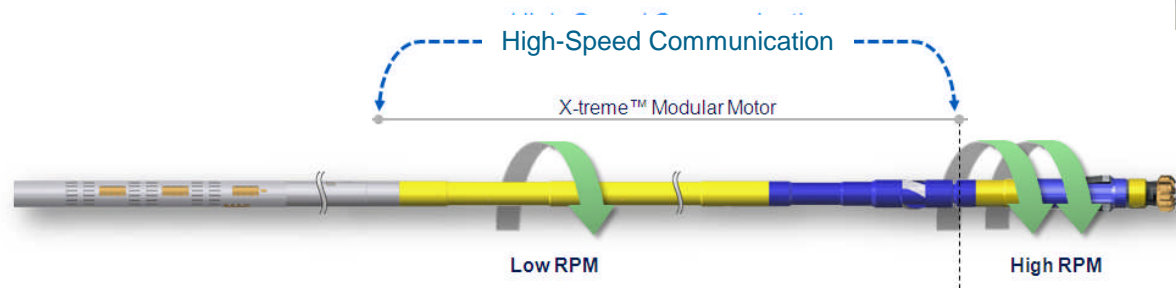
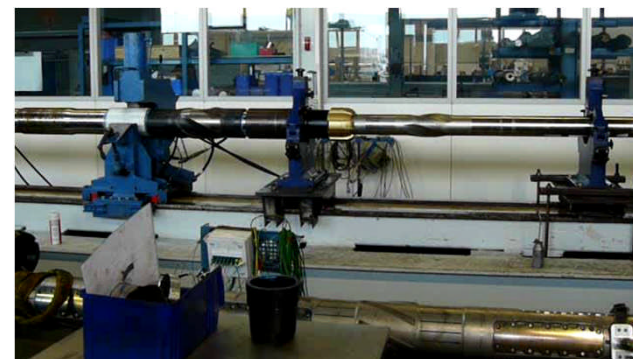
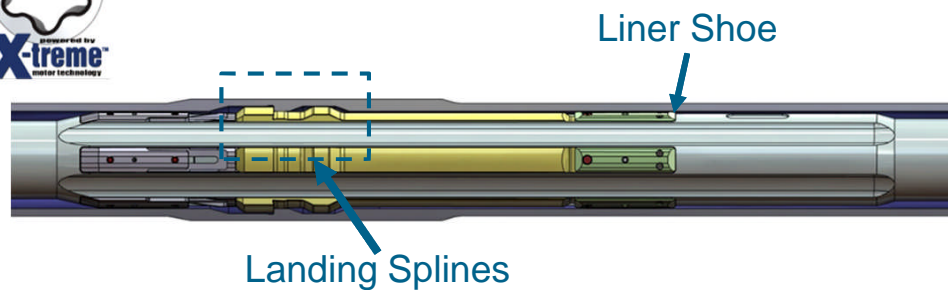
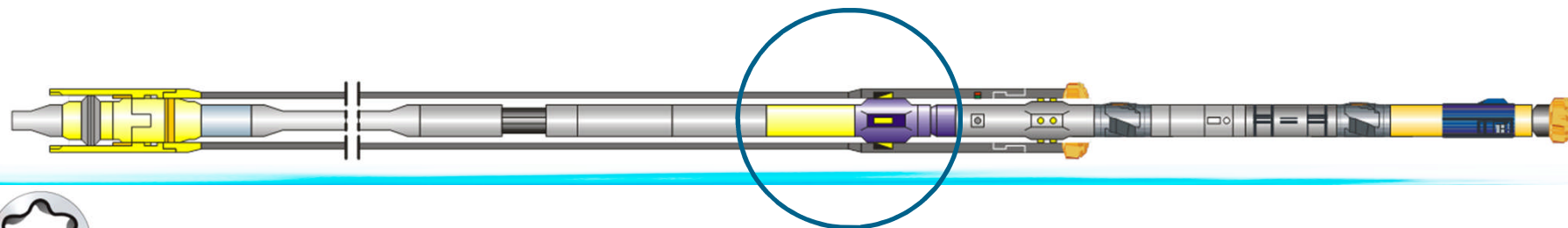


Torque  
Transmission



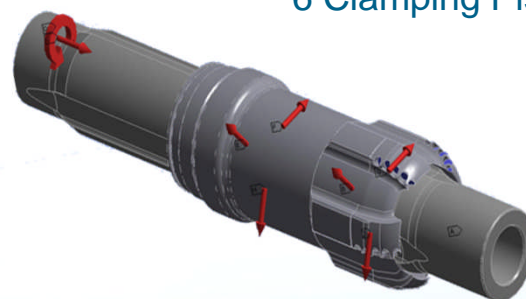
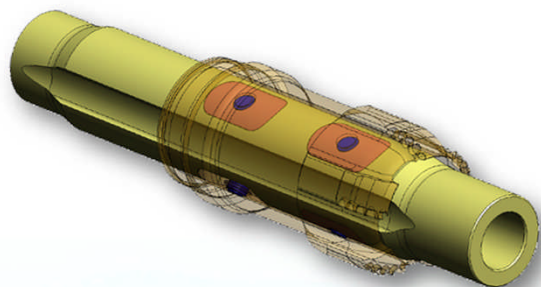
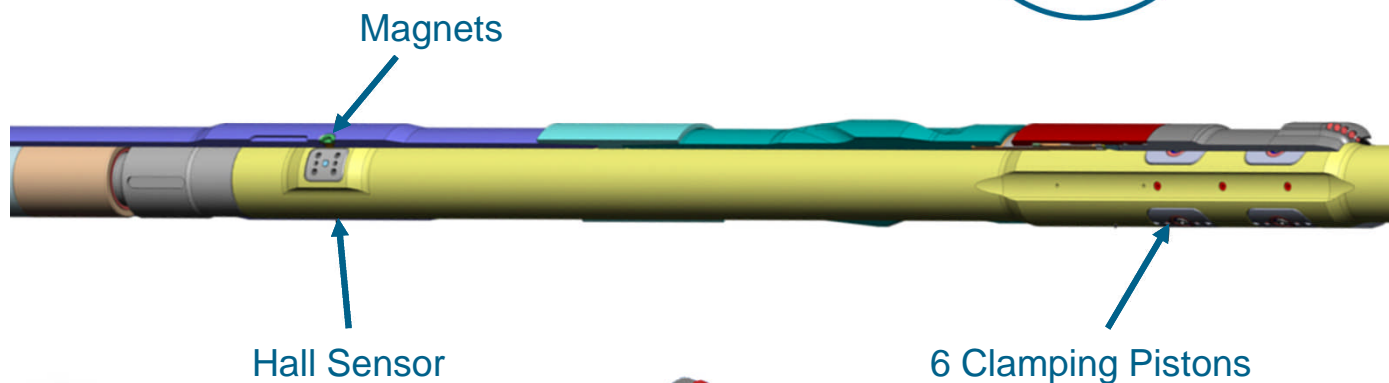
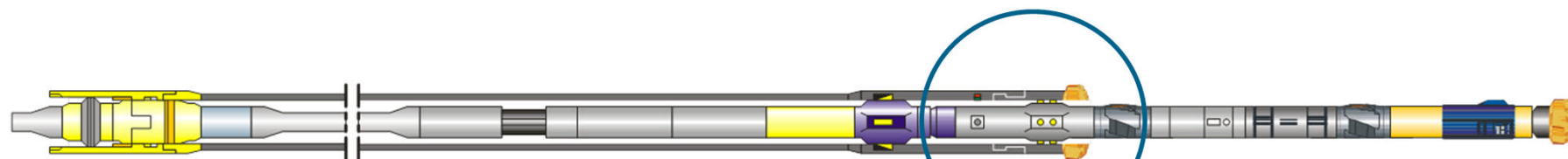
THRUSTER





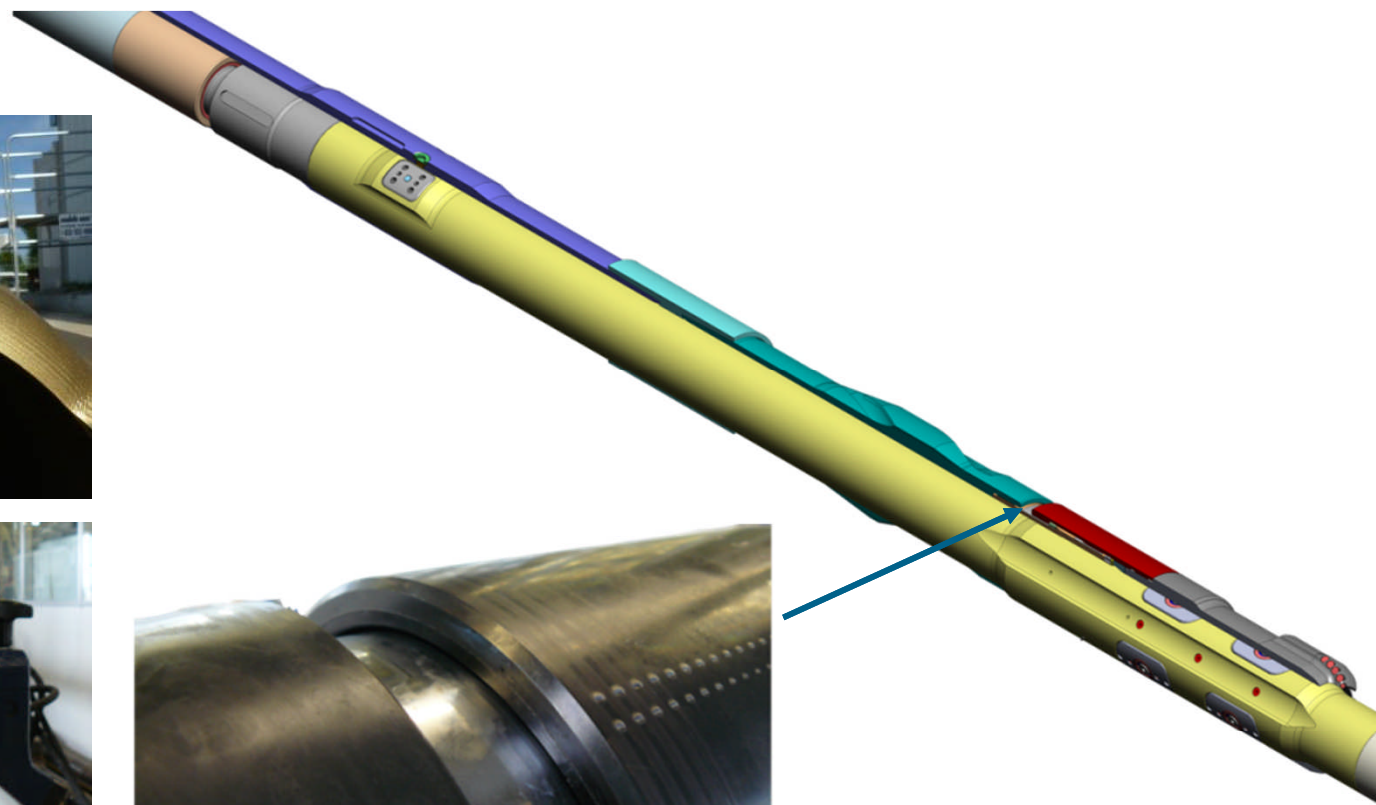
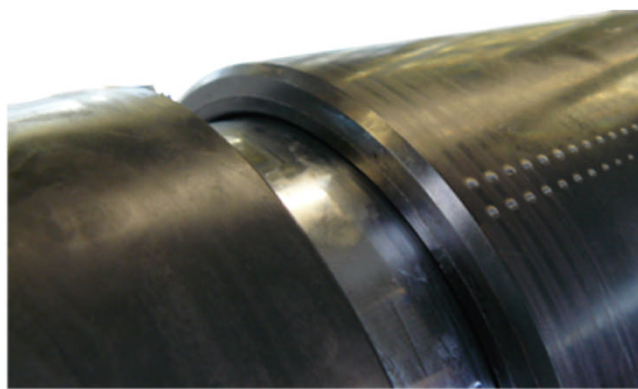
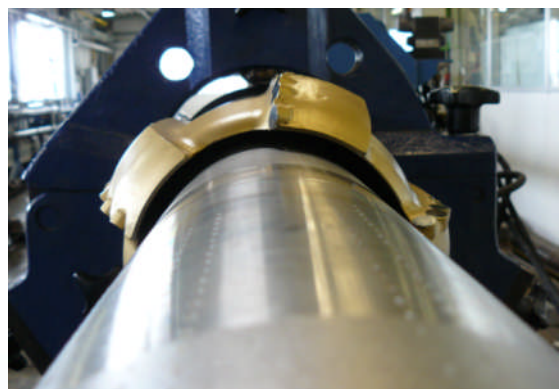
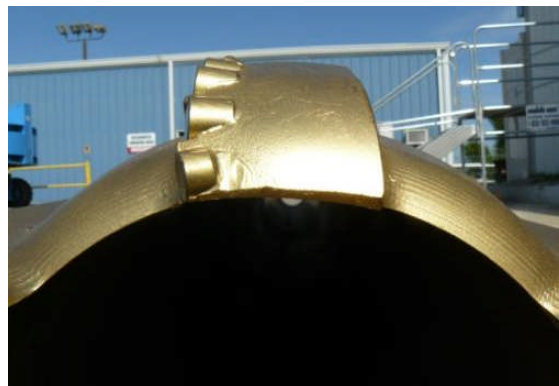
ELONGATED X-TREME MOTOR





POWERFUL TOOL ON DEMAND TO TRANSMIT AXIAL LOAD AND TORQUE





BASED ON EASYCASE DESIGN

**BAKER  
HUGHES**





# **BENEFITS OF SURETRAK**

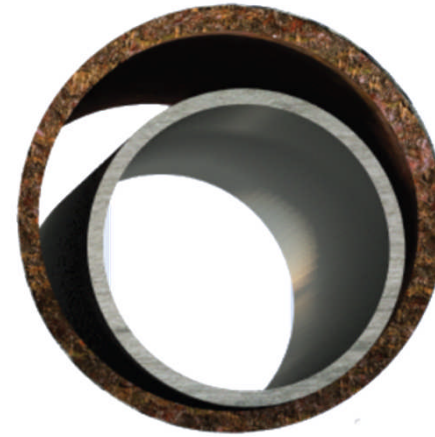
BESIDE CASED HOLE WHILE DRILLING



## LOW RPM // STRENGTHENS OF WELLBORE WALL



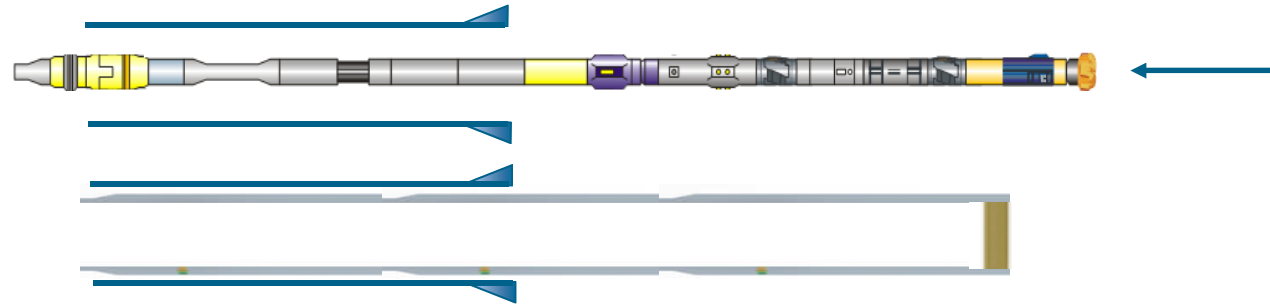
Conventional drilling  
120 - 180 rpm



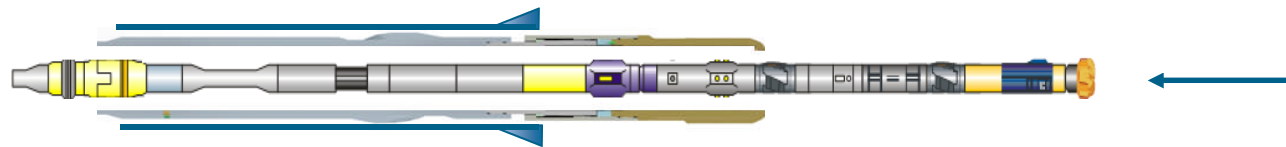
SureTrak service  
30 - 50 rpm

LESS MECHANICAL IMPACT

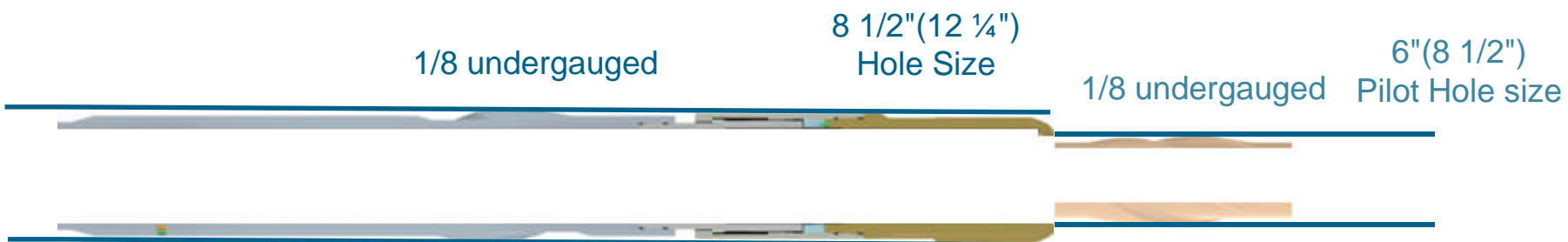
Conventional



SureTrak SDL



LESS SWAB & SURGE (PRESSURE FLUCTUATION)



WELL STABILIZED SYSTEM

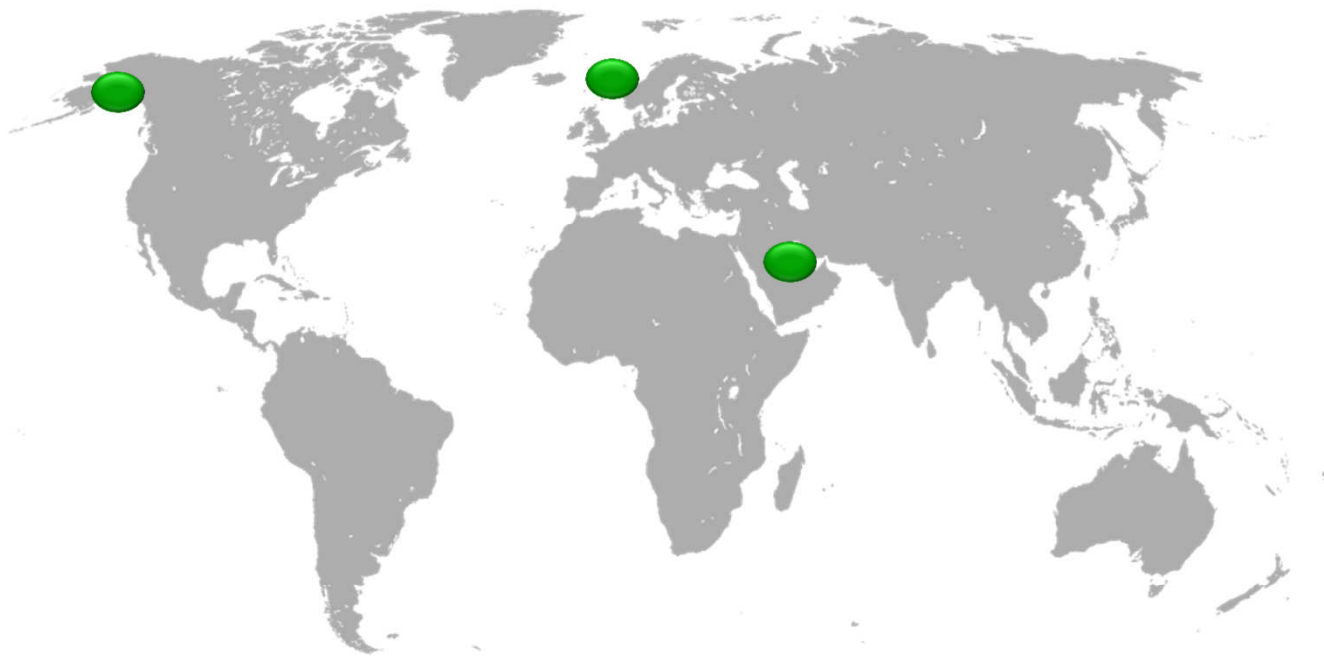




# **BAKER HUGHES' EXPERIENCE**

SURETRAK





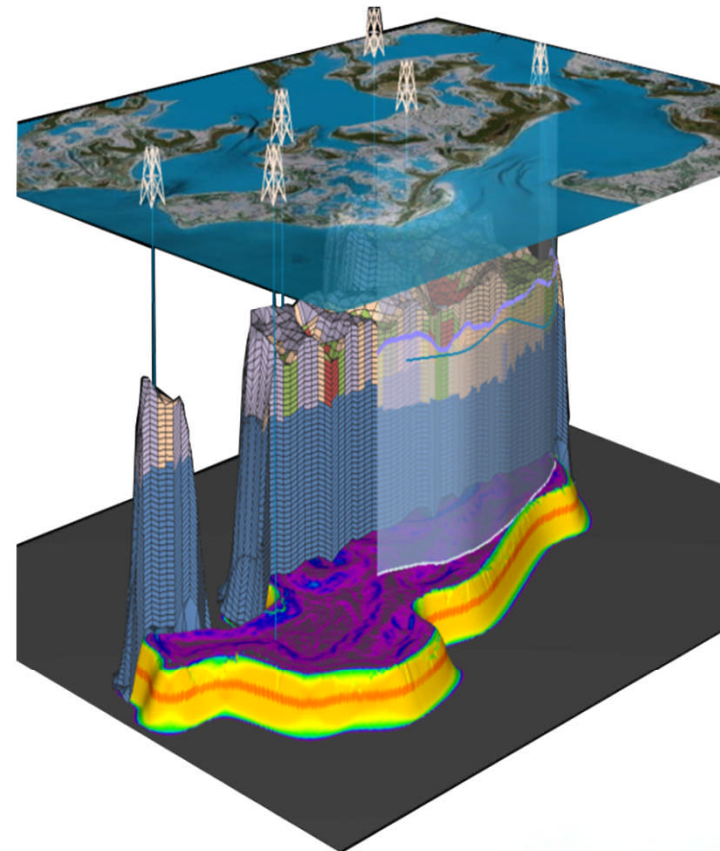
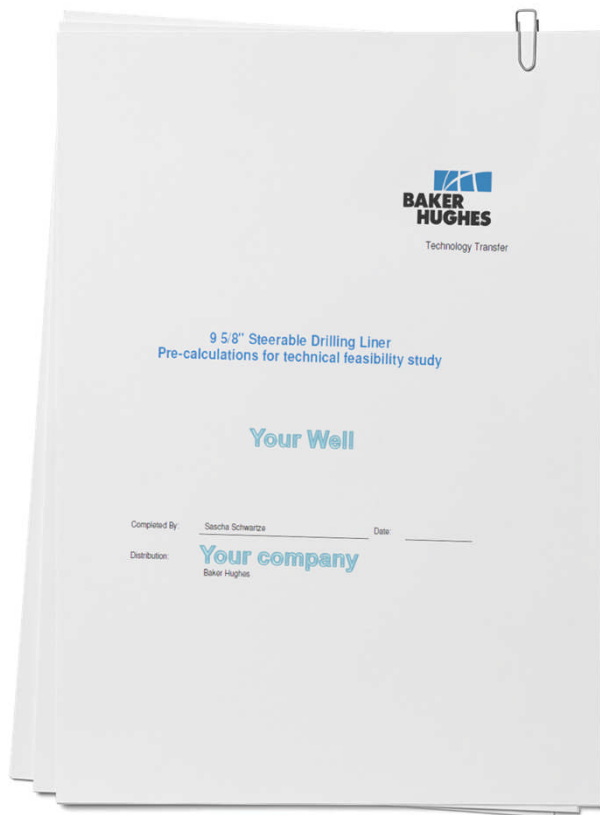
Test	Liner Length [m]	Depth In [ m MD ]	Depth Out [ m MD ]	Circ.Hrs [ hrs ]	Bit Hrs [ hrs ]	Average ROP [ m/h ]	Drilled Distance [ m ]
9 5/8"	430	449	573	44.3	27.7	4.5	124
7"	378	447	771	41.4	30.5	11.1	324
9 5/8"	1228	3,873	4,053	74	31.5	5.7	180
7"	280	3,005	3,181	38	15.8	11.1	176
7"	231	2,770	3,020	21	16	19.0	250
7"	308	3,289	3,492	48	40	5.0	203
7"	1214	5,094	5,105	13	0.7	16.5	11
7"	630	3,606	4,111	176	131	4.0	505
7"	260	3569	3667	na	na	na	98
7"	880	3,875	4,215	67	45	10	340
TOTALS				462	298		2,113



# **FIRST STEPS**

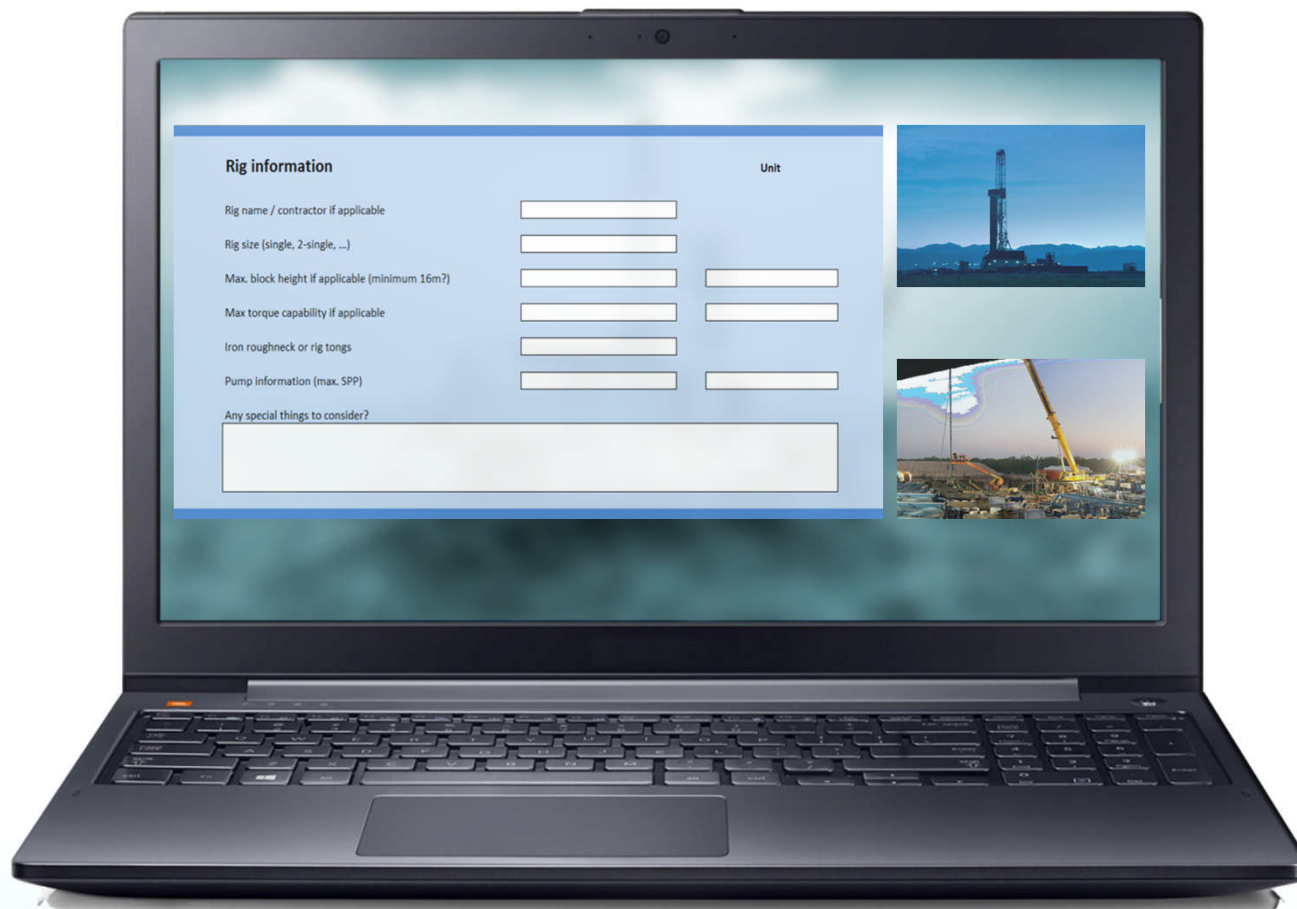
SURETRAK





SHORT FEASIBILITY STUDY UPFRONT





RIG SURVEY IF NECESSARY



P110?



CR13?

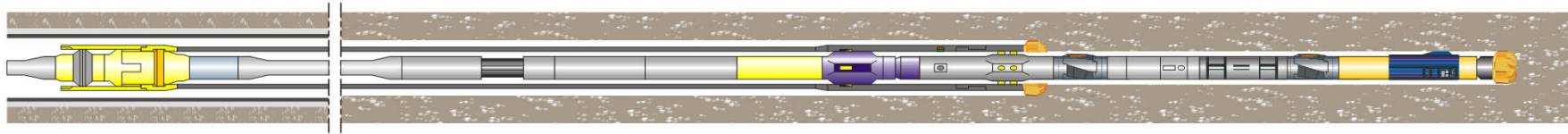
SPECIAL REQUIREMENTS?





# **DRILLING ENGINEERING**

SURETRAK



## CURRENT SureTrak SIZES

7"

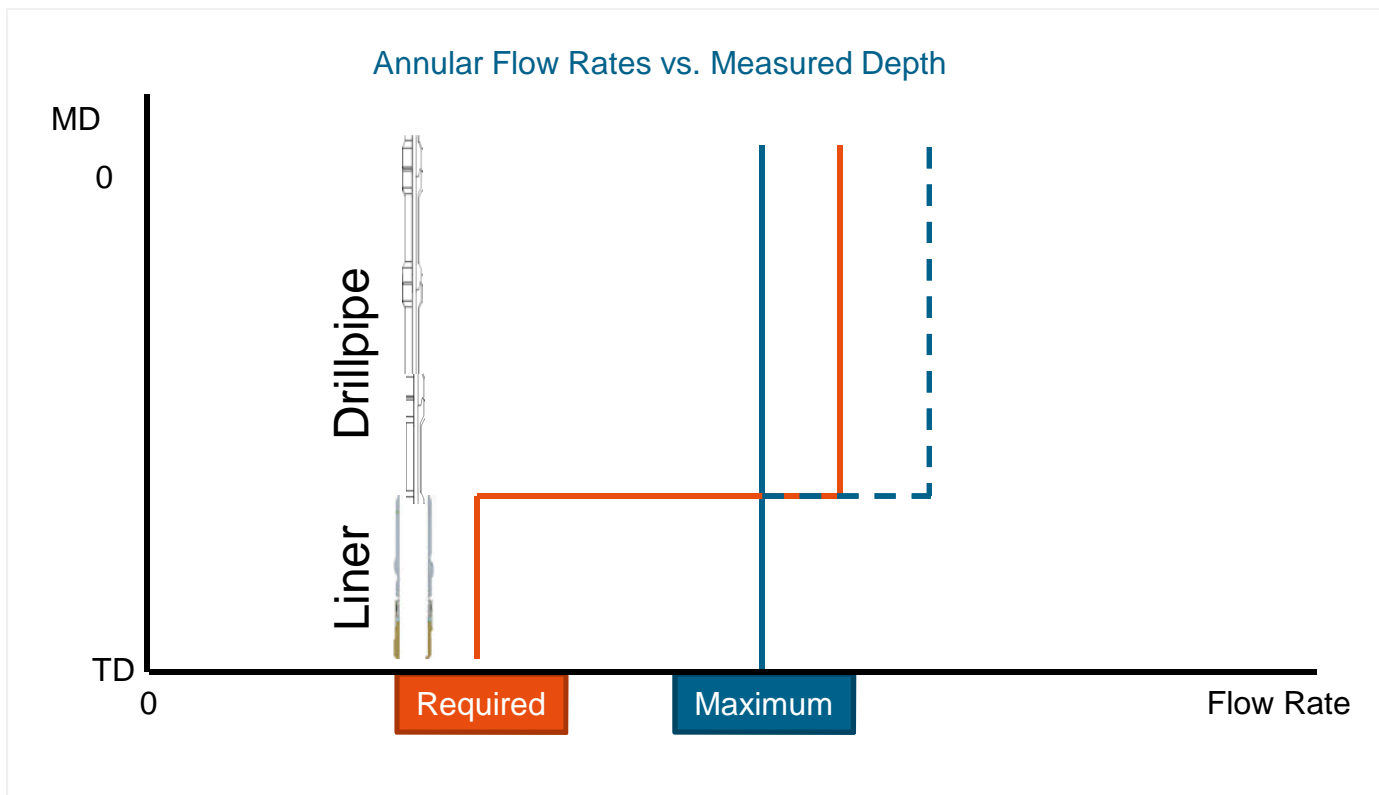
4.3/4" inner string to drill 8.1/2" hole

9.5/8"

6.3/4" inner string to drill 12.1/4" hole

HOLE CLEANING





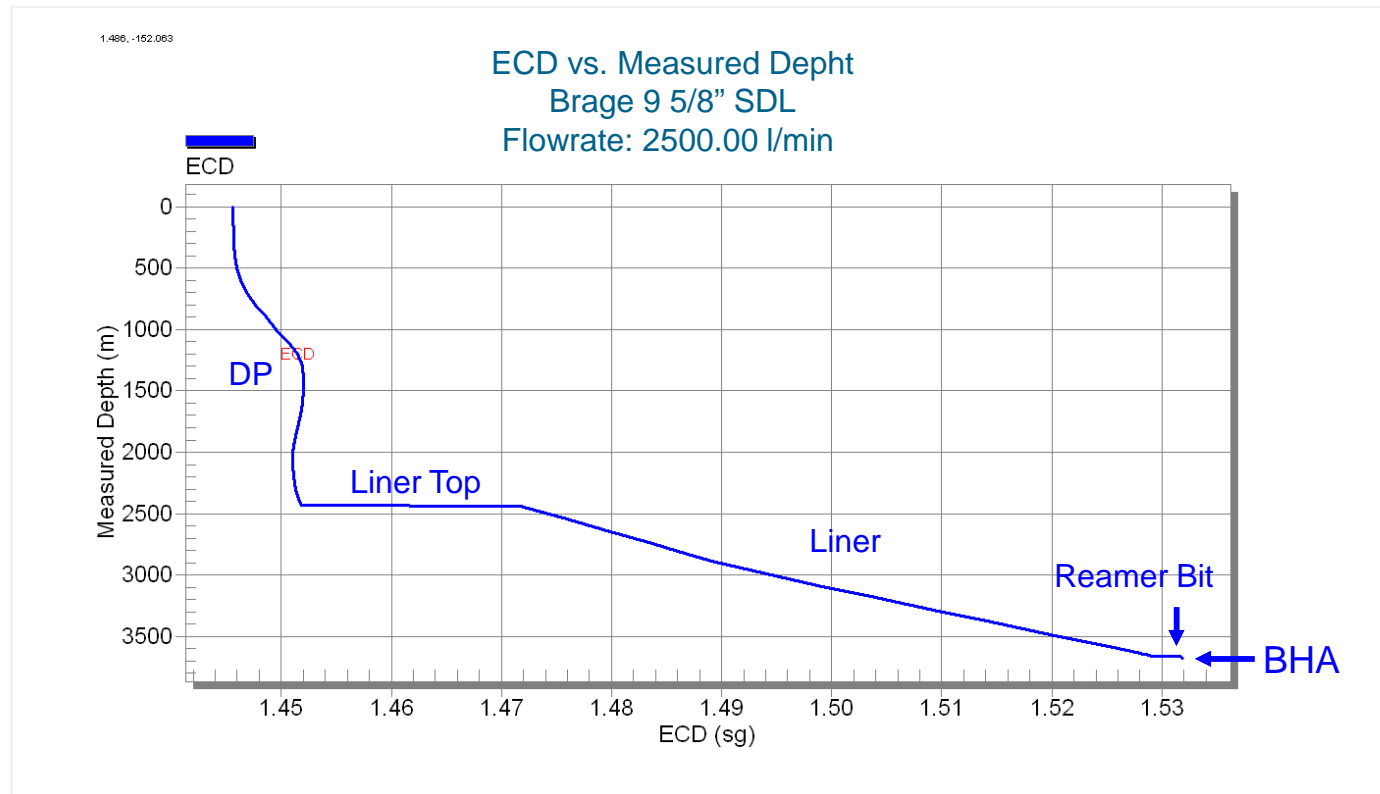
UNDERSIZED BHA WITH FLOW LIMITATIONS



## ADD UP TO 1,300 LPM

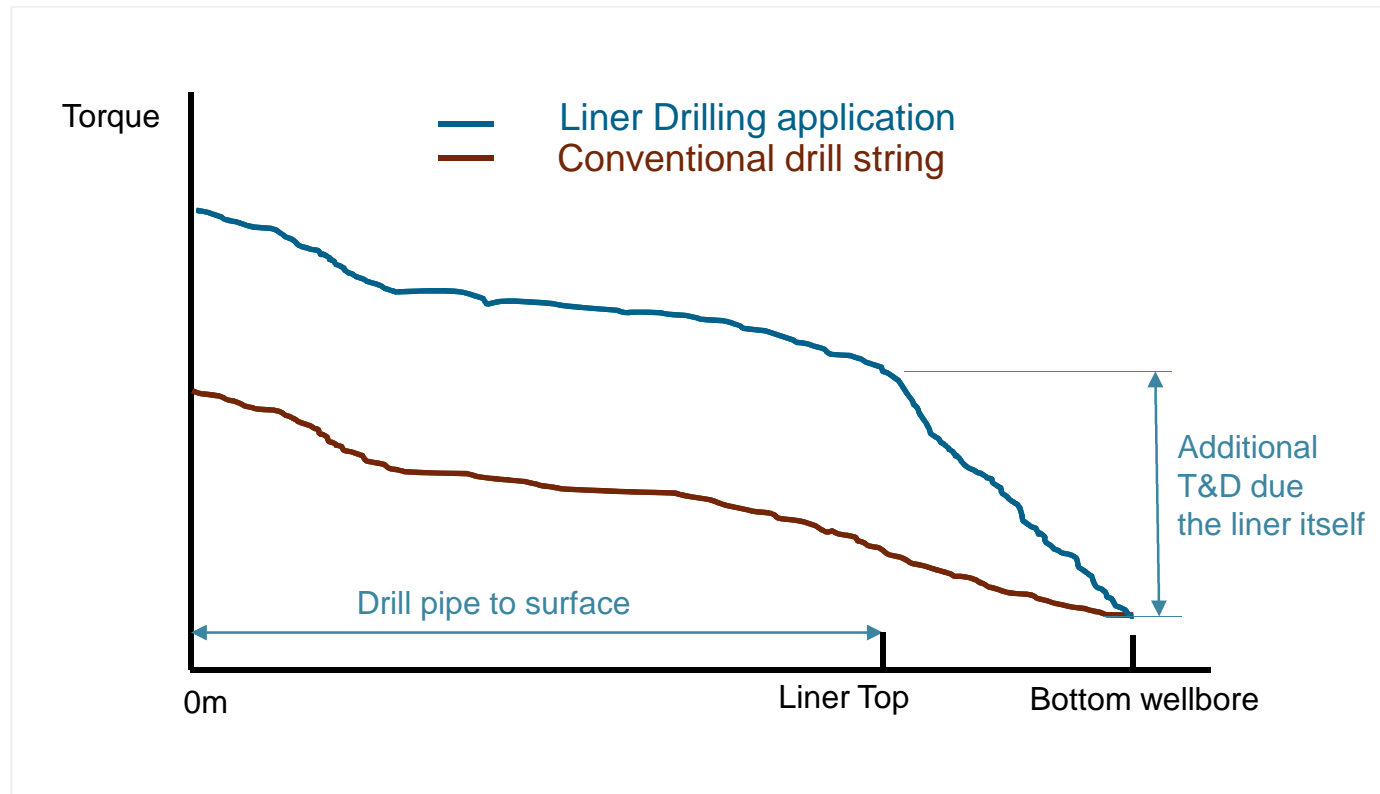
- Drill string component above the SureTrak
- Optional by-pass port to the annulus
- Activation by simple surface commands within time window
- Flow rate and string RPM
- Flow rate pattern

ON DEMAND - FLOW DIVERTER (PROTOTYPE)



MAIN ECD BOTTLENECKS: LINER TOP & LINER ITSELF





DRILL PIPE & TOP DRIVE LIMITS TO CONSIDER



# **RISK ASSESSMENT**

SURETRAK

RISK Matrix (general)									
		Unwanted event	Consequences regarding HS&E and cost impact	Risk reducing measures in place	Other measures needed	Action	Probability (depends on experience)	Consequence	Risk
Drilling									
1		Rig equipment failure	Reduced progress	Standard maintenance routines			n/a		
2		Handling to and from drillfloor. Basket length.	Reduced progress	Check length of basket	Check that the rig actually can handle basket lengths		n/a		
3		Problems regarding handling of Thruster on surface. (telescopic)	Safety Hazard	Special designed safety-clamp. (To be removed before R/H) .			n/a		
4		Damage to Reamer shoe during make up	Reduced progress and cost impact increase	Install protector.		Pick up Back Up	n/a		
5		Failure on inner-string/Pilot BHA	Pulling out inner-string. Liner left on bottom. Potential for stuck liner	Optimized used of centralizers. Correct MW and mud properties. Proper hole cleaning before pulling inner-string		special procedure required	n/a		
6		Worn out Reamer bit	No progress. Pulling of liner to change Reamer bit or early TD (extra section required?)	Conservative use of parameters. Short section to be drilled with SDL.	Pre-job simulations. Keep doglegs low as possible	Evaluate depth for start drilling with SDL vs minimum required liner setting depth.	n/a		
7		Mud pump failure	Reduced progress. Bad holecleaning and potential risk for stuck liner	Reciprocate liner.	Check and maintain mud pumps before start of section.		n/a		
		Magnetic interference. High mass of steel	Bad directional- and Anticollision-control.	Optimized Non Mag spacing(=longer pilot BHA), use of correction programs and wellbore	Thorough planning and execution	Use IFR. Calculate NonMag spacing required. Consider			

Cementing of 9 5/8" liner									
19		Problems to establish circulation	Time loss. Reduced progress	Circulate hole clean before releasing and pulling out inner-string			n/a		
20		Leakage when performing low pressure test	Failed cement job			Pressure test annulus before pulling drilling assembly (if failing test - plan for 2-trip cement solution)	n/a		
21		Failed cement job	Not holding pressure	50 m. shoetrack	RTTS packer available for casings		n/a		
		Cement scale in DP or plugging of string	Have to lay down string	Pump sponge-balls behind cement	Check that sponge-balls are not plugging circ-sub.	To be verified by BOT	n/a		
22		Cement job failure	Cemented string stuck		Test annulus flappers in retainer(ref Baker Hughes).		n/a		
23		Problems entering packer	Stuck, or can not install.	Consider clean-up. Cuttings control.	Clarified criteria for cleanout run.		n/a		
Well Control									
24		Well Control situation when running liner. Open liner(no float) through BOP	Loss of well control. Backflow in liner	Follow procedures special made for SDL. Quick connect kick-stand ready made up. Pump slug			n/a		

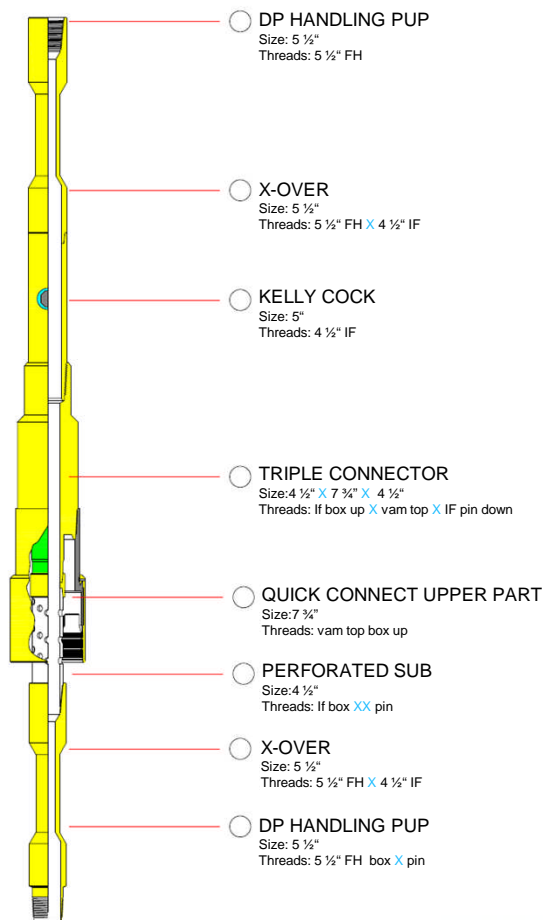
POW-WOW OF ALL INVOLVED PARTIES





# **WELL CONTROL**

SURETRAK



## RUNNING INNER STRING / WELL BECOMING UNSTABLE

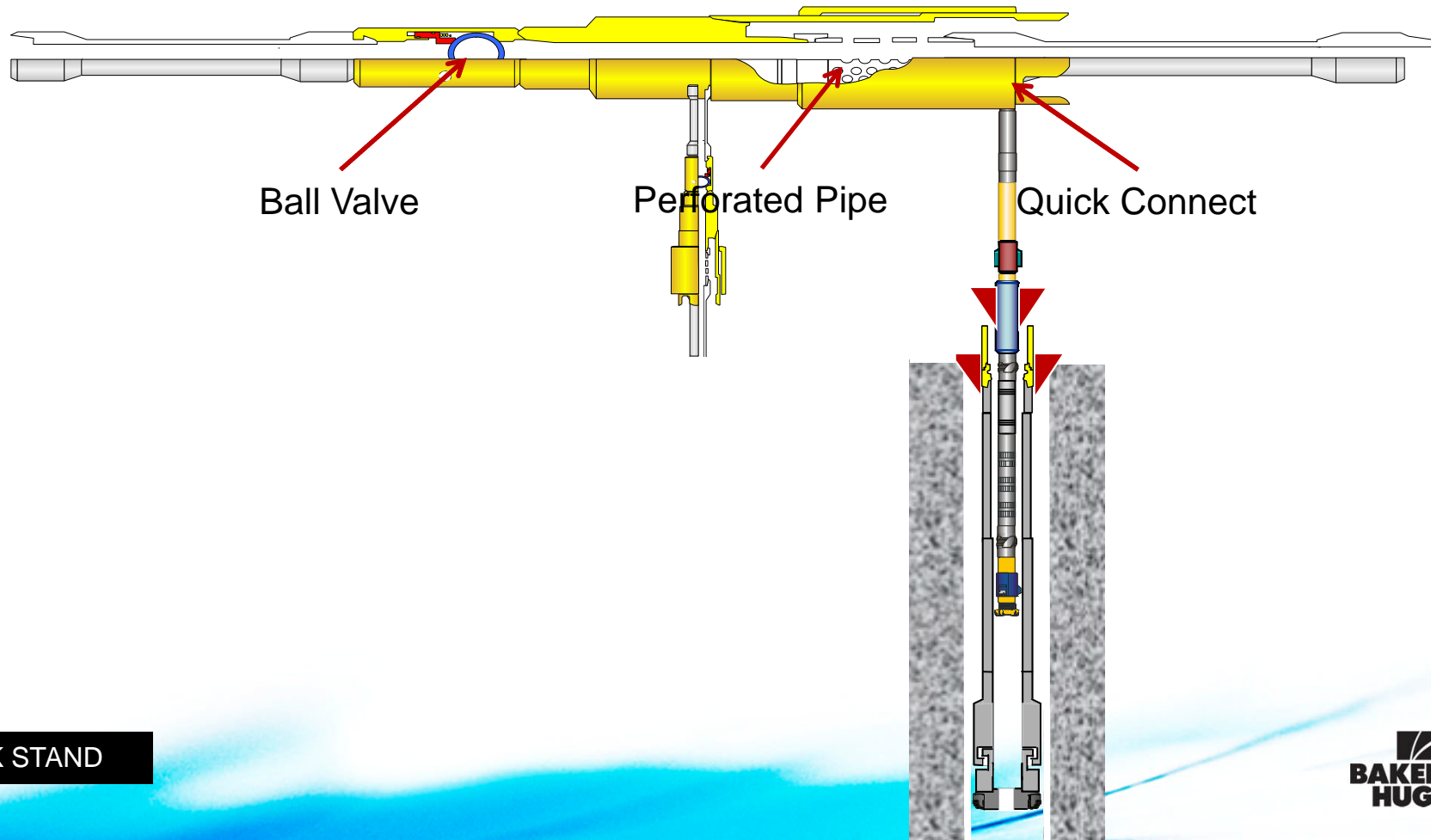
- Liner in slips in rotary with quick connect installed
- Liner through BOP
- False Rotary mounted for DP running
- Started but not finished running DP

### ACTIVITIES / OPERATION

OPERATIONAL DESCRIPTION	REMARKS
Set slips on DP in false rotary	If not done
Pick up Baker kick joint from cat walk	Ready on tugger
Install Baker Kick joint to DP with Kelly Cock in open position	
Connect top drive to Baker Kick joint	
Lift inner string out if slips	
Remove false rotary	
Lower Baker kick stand and connect to liner quick connect	Hand tight and lock set screws
Close Annular	
Evaluate situation in cooperation with management onshore	

Mark out activity / operations sequence completed on Drillers DOP  
Deliver copy to rig operations leader and drilling supervisor

SAME SCENARIO AS RUNNING SCREENS AND WASH PIPE



Ball Valve

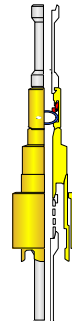
Perforated Pipe

Quick Connect

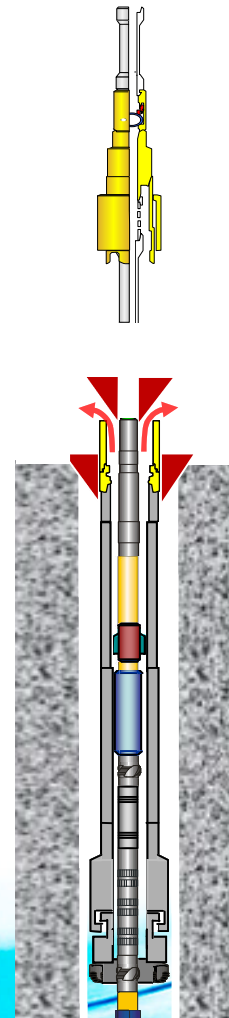
KICK STAND



Install Kick Stand Assembly



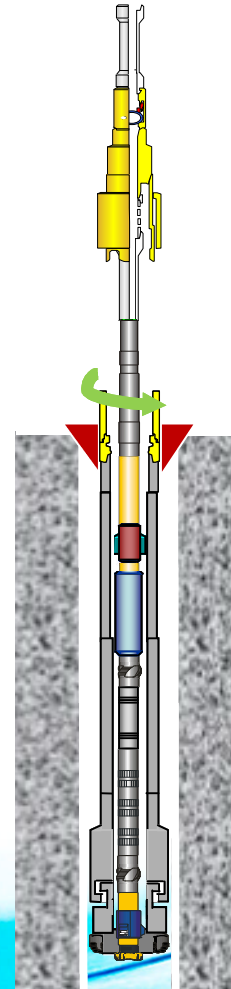
Well unstable



KICK STAND

**BAKER  
HUGHES**

Make up Liner



KICK STAND

**BAKER  
HUGHES**

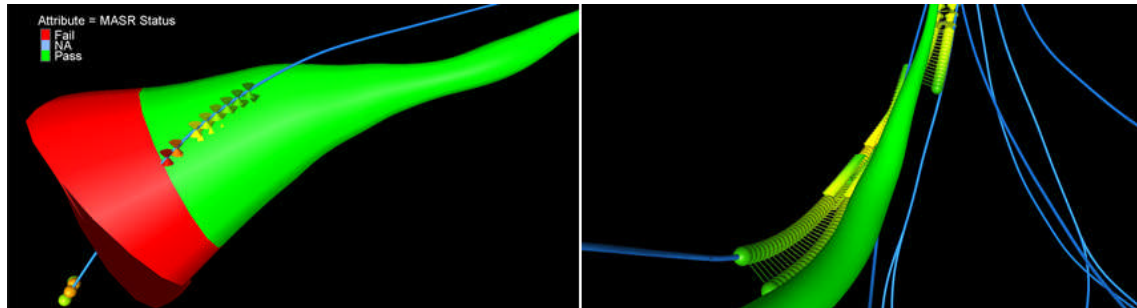
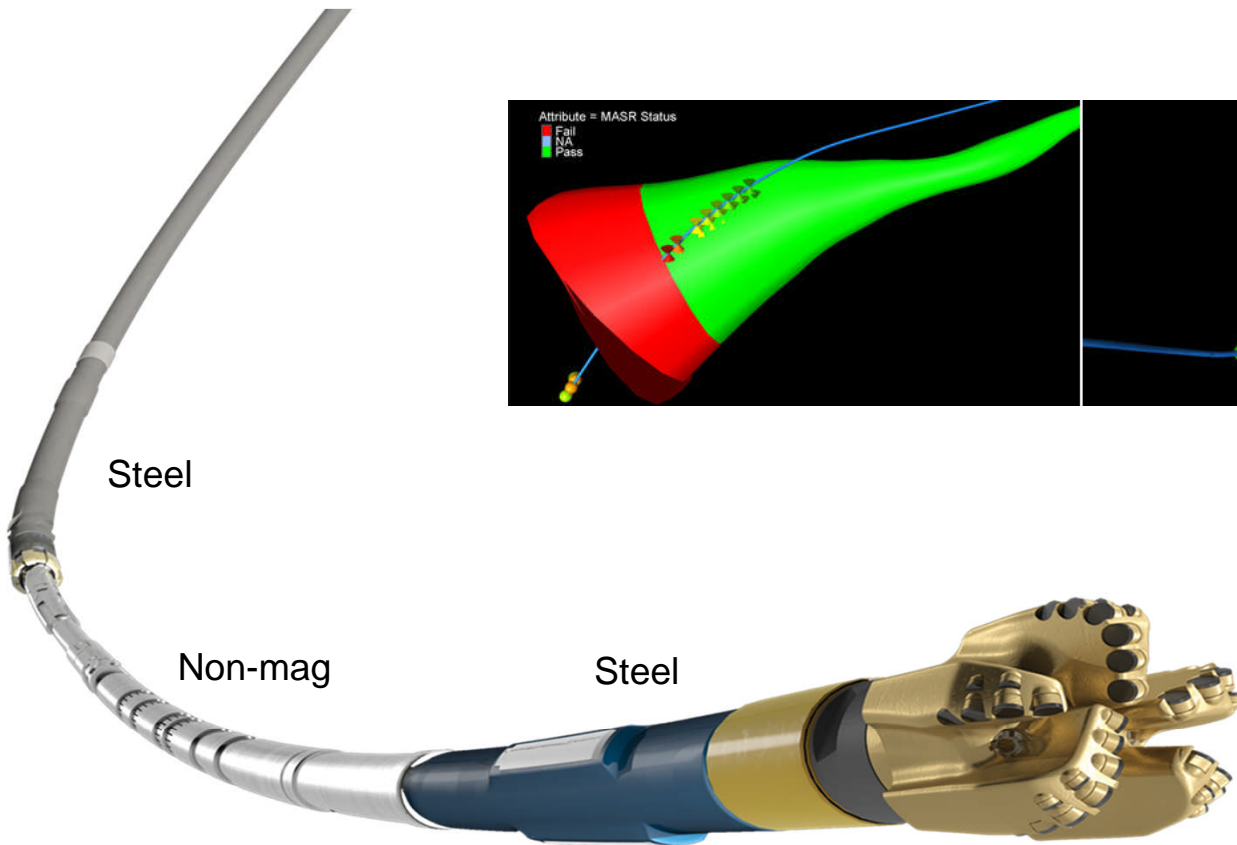




# **BITS AND PIECES**

SURETRAK





WELLBORE POSITIONING – SHORT MAGNETIC SPACING & MAGNETIC CORRECTION

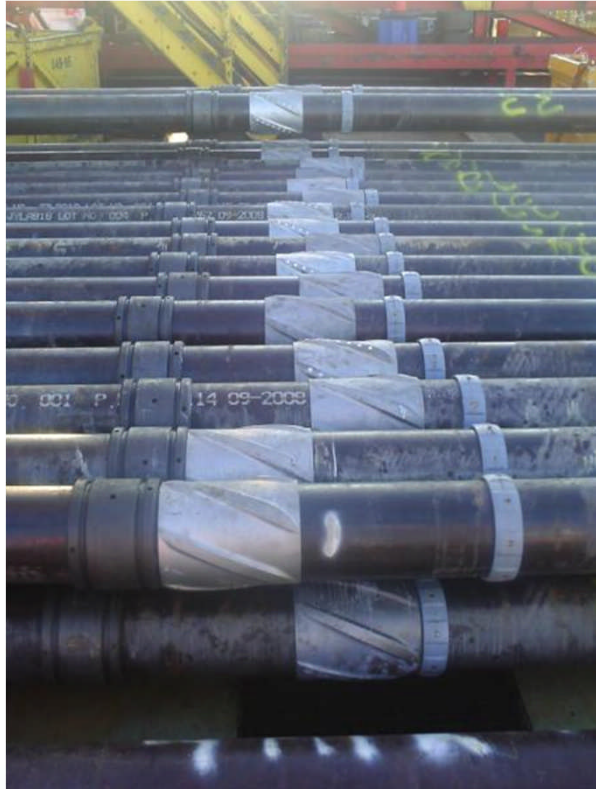
8 1/2"



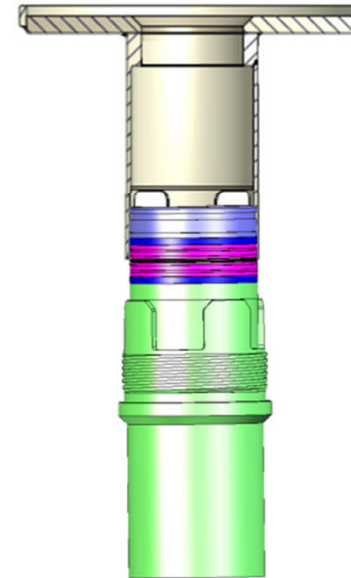
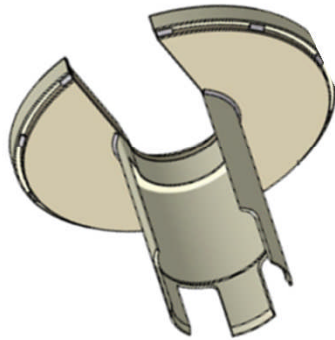
6"



WEIGHT AND TORQUE DISTRIBUTION TO CONSIDER



LOW-TORQUE, NON-ROTATABLE CENTRALIZER RECOMMENDED



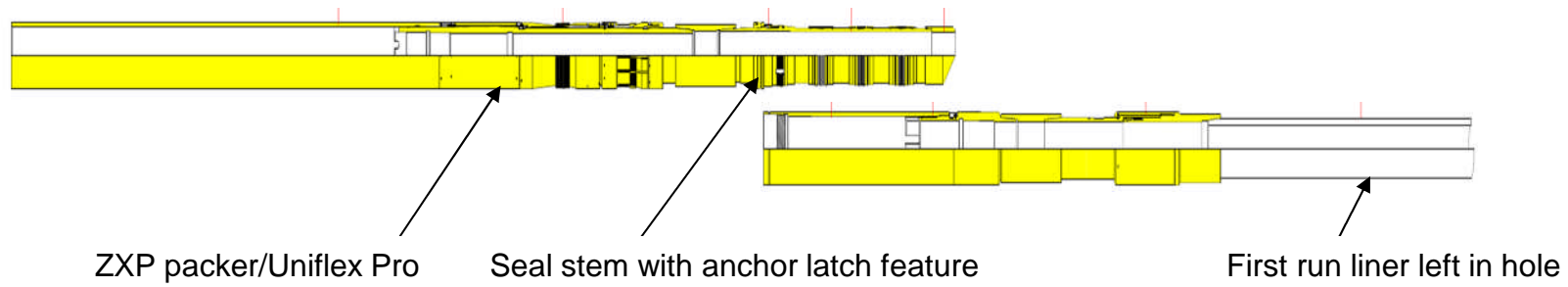
“FALSE ROTARY TABLE” C-PLATE FIT FOR PURPOSE





# **COMPLETION & CEMENTING**

SURETRAK



UNIFLEX PRO

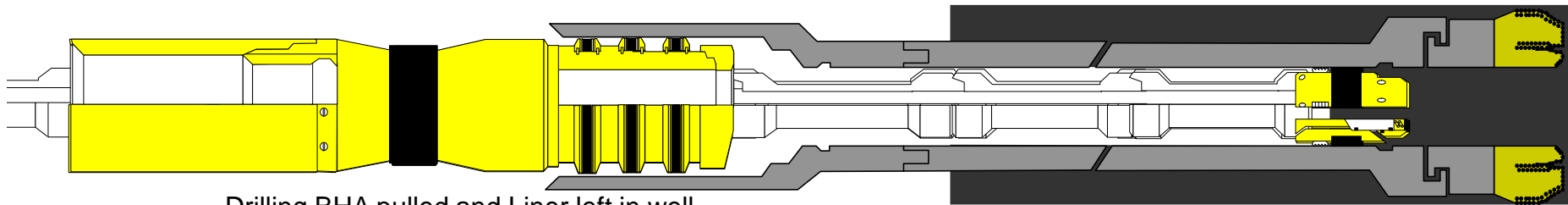




Install cement retainer with back flow valve along with liner top packer

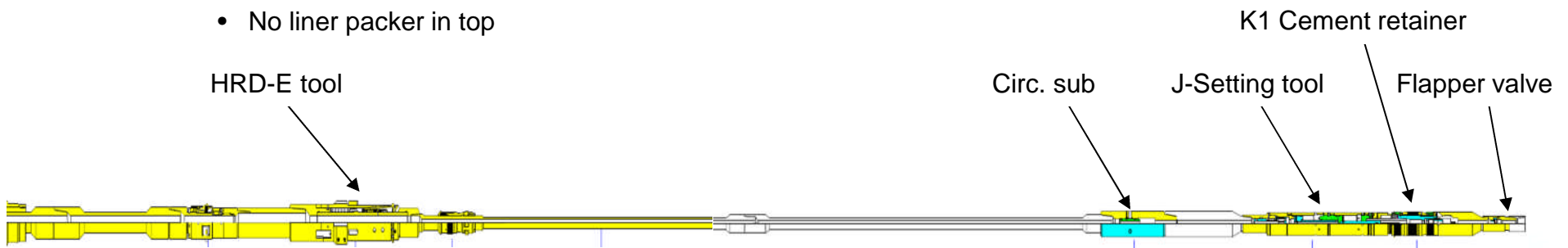
Perform cement operation

Activate liner top packer



Drilling BHA pulled and Liner left in well

- No back flow valve in liner shoe
- No liner packer in top



OPEN ENDED LINER LEFT IN THE HOLE

## WE CAN OFFER:

Lunch & Learn sessions

Customized training for:

- Drilling engineers
- Other staff  
(e.g. geologist, planners, etc.)
- Rig crew
- .....



# Thank You