

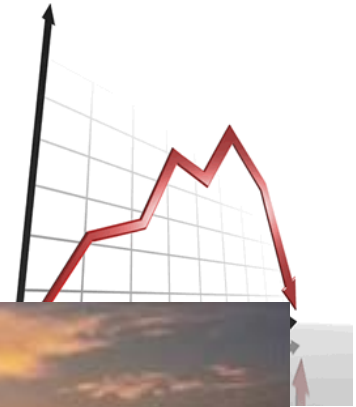
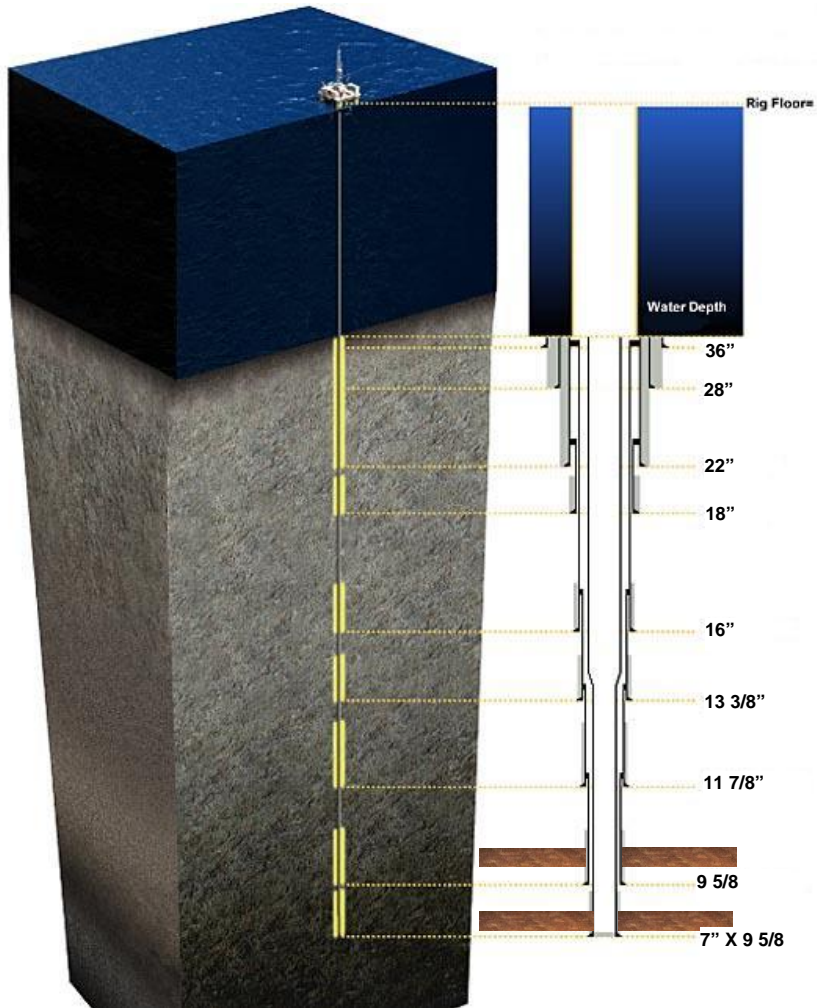


Reaching additional reserves behind multiple string of casing.

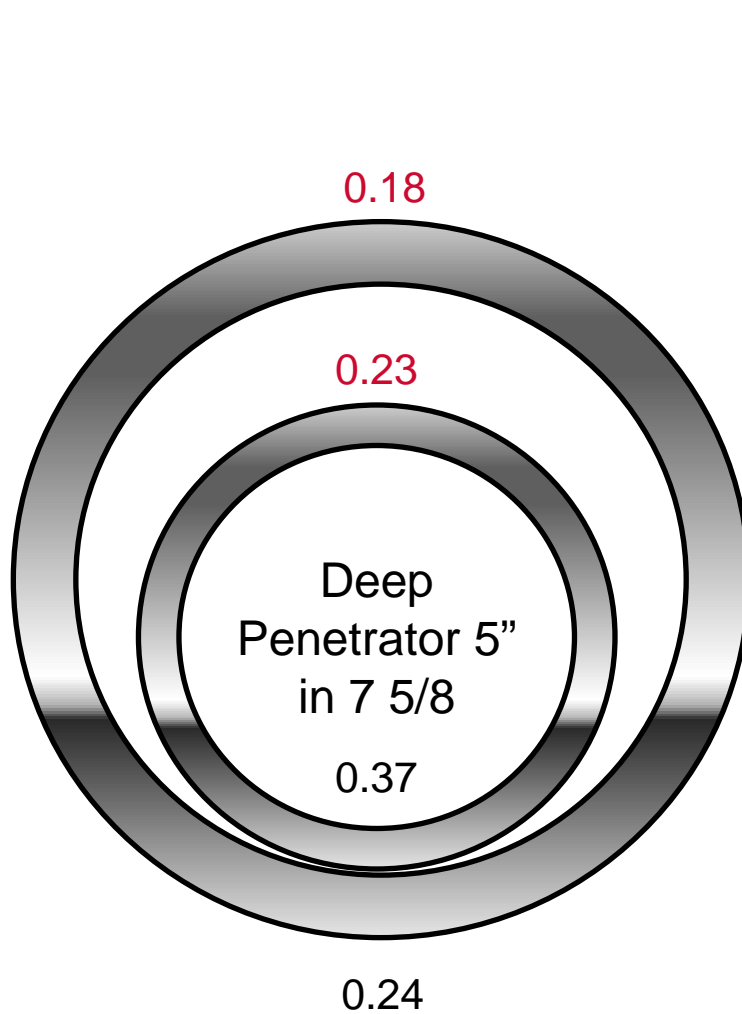
Bjørnar Kalsvik
Technical Advisor

HALLIBURTON

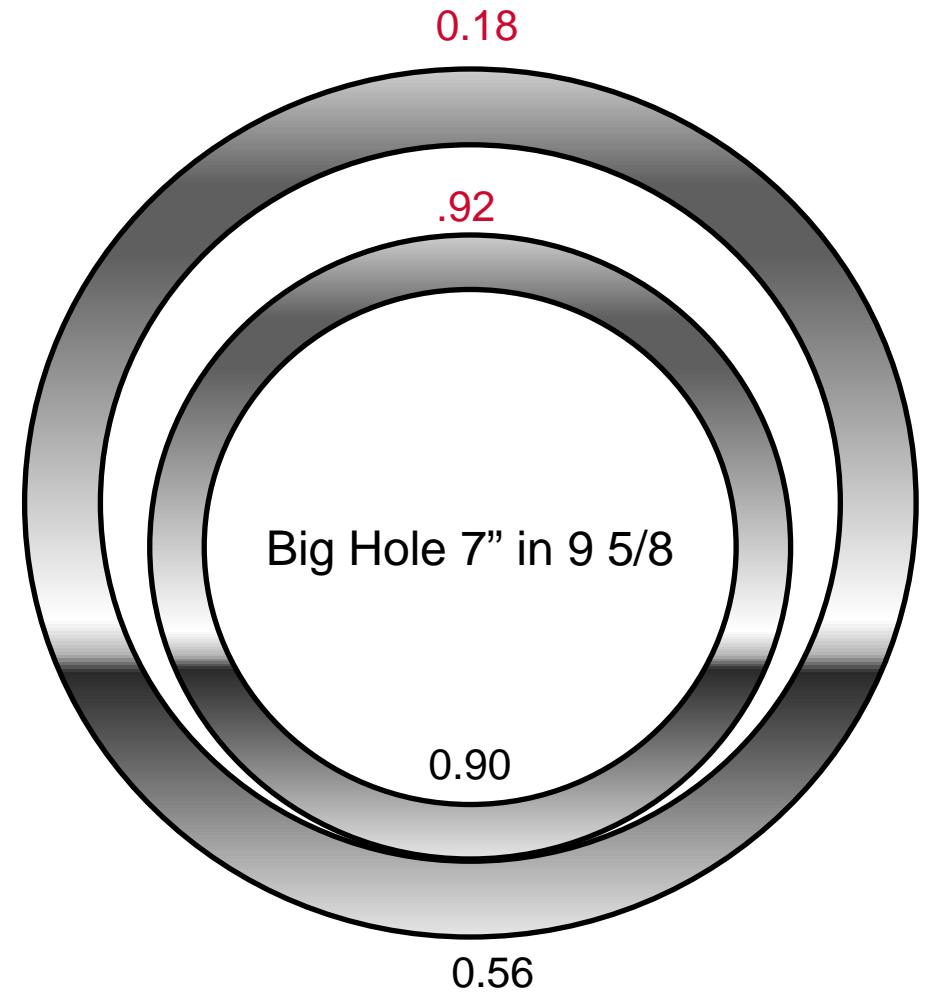
Dual String Genesis



Dual Casing Challenges



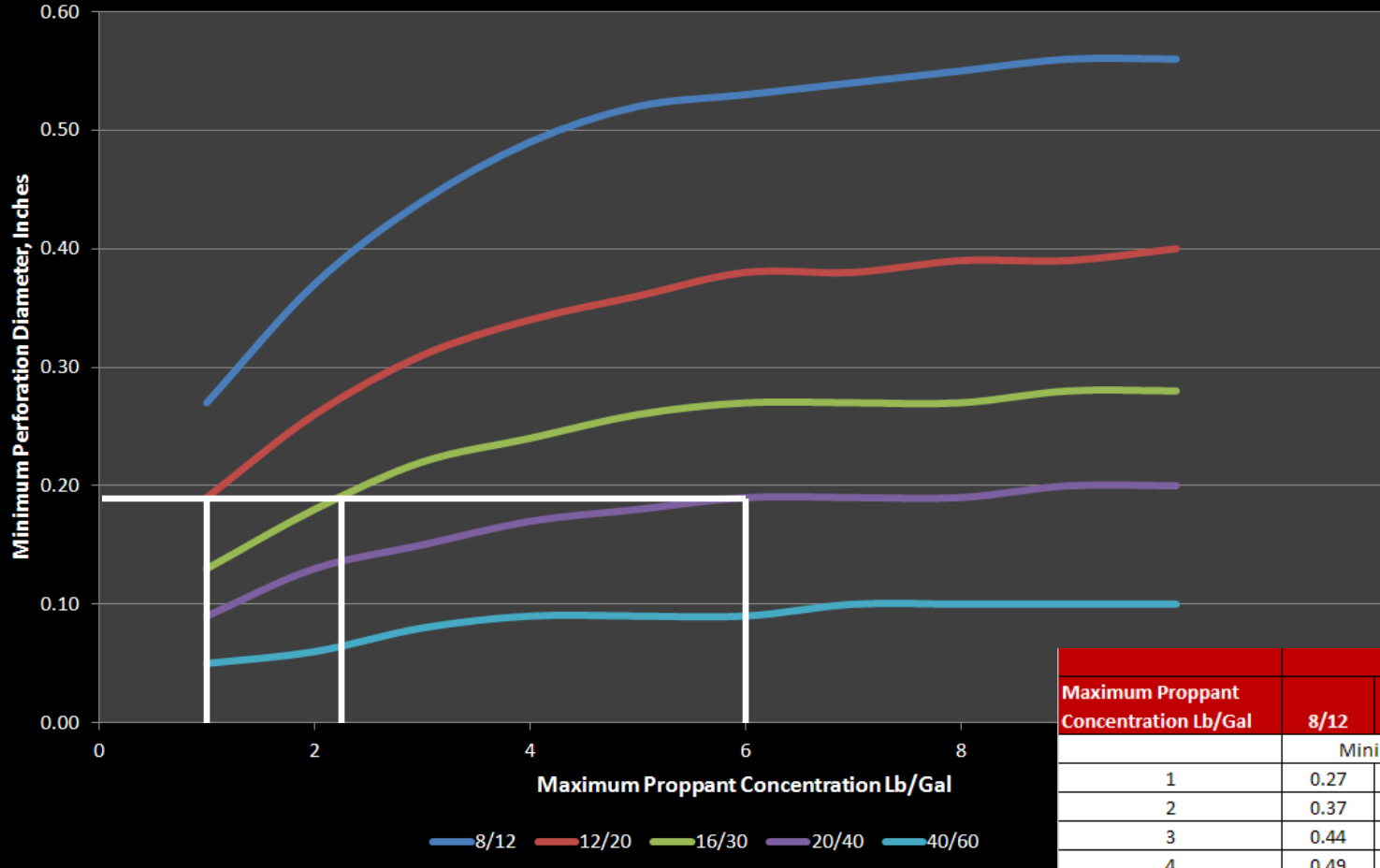
Penetration Reduction 31%



Penetration Reduction 90%

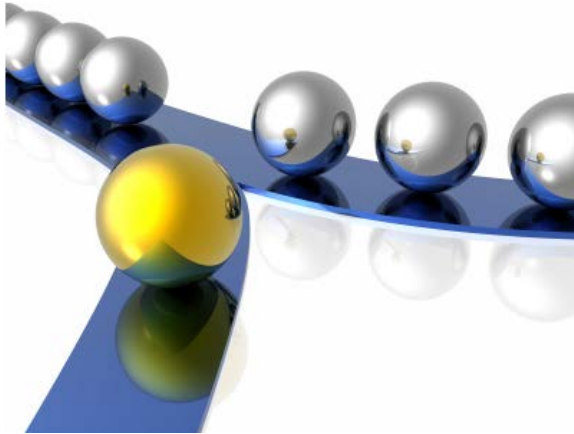
Dual String Complexity with Fracturing

Minimum Perforation Diameter to Prevent Bridging



Maximum Proppant Concentration Lb/Gal	Proppant Mesh Size				
	8/12	12/20	16/30	20/40	40/60
	Minimum Perforation Diameter, Inches				
1	0.27	0.19	0.13	0.09	0.05
2	0.37	0.26	0.18	0.13	0.06
3	0.44	0.31	0.22	0.15	0.08
4	0.49	0.34	0.24	0.17	0.09
5	0.52	0.36	0.26	0.18	0.09
6	0.53	0.38	0.27	0.19	0.09
7	0.54	0.38	0.27	0.19	0.10
8	0.55	0.39	0.27	0.19	0.10
9	0.56	0.39	0.28	0.20	0.10
10+	0.56	0.40	0.28	0.20	0.10

Initiating the solution



Needs and Wants

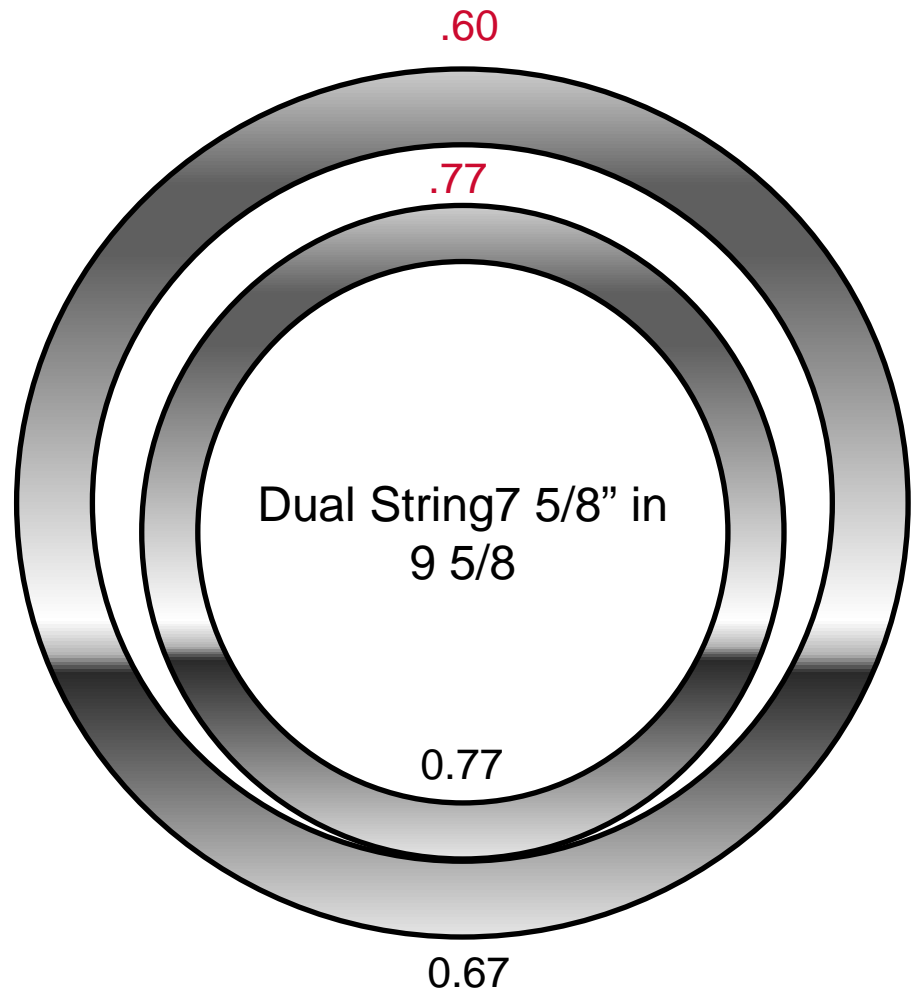
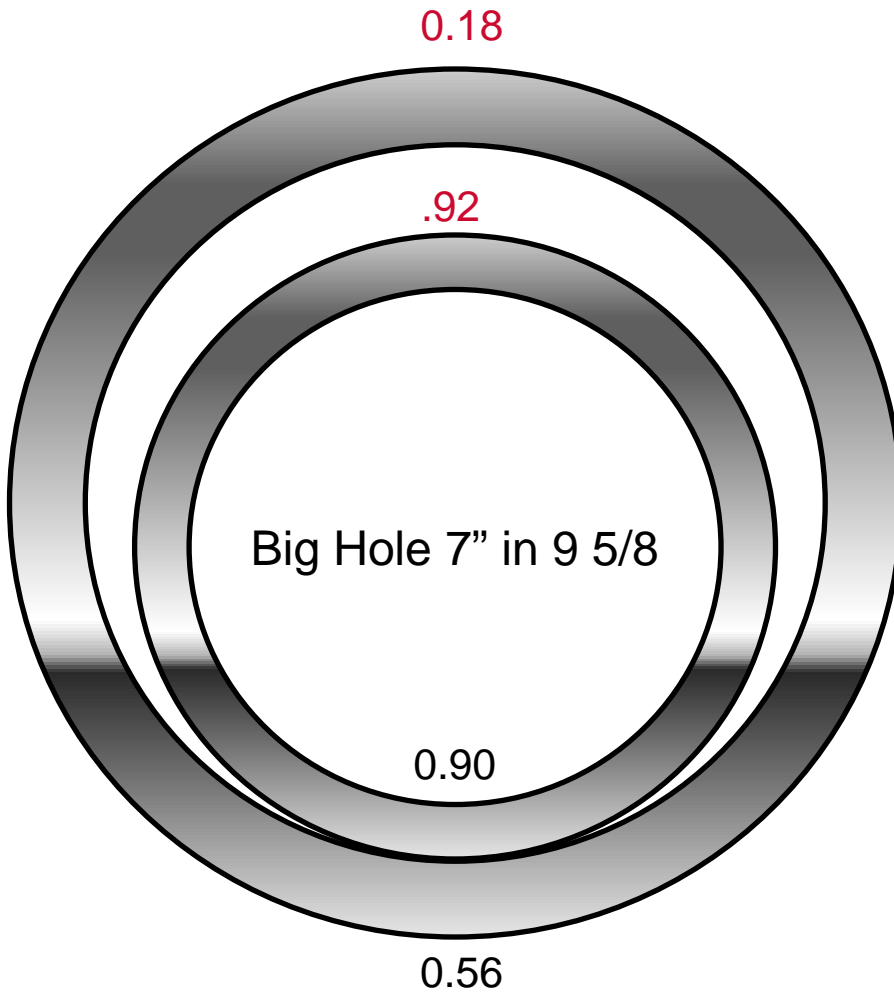
- Large Hole size in second string $>0.5\text{in}$
- Similar hole size in first string
- Consistency in hole size in decentralized casing
- Better Penetration than the Big Hole type charges
- Low Cost
- Shot density of 12 spf
- One run solution
- Sooner the better

Developing the Solution

Internal Casing	Outer Casing	HoleSize in	Penetration in
7 5/8" 39 ppf	9 7/8" 65.1 ppf	0.67	8.11
7 5/8" 47 ppf	9 5/8" 47 ppf	0.67	5.98
7 3/4" 46.1 ppf	9 7/8" 62.8 ppf	0.63	7.99
9 5/8" 47 ppf	13 3/8" 73 ppf	0.67	8.70
9 7/8" 62.8 ppf	13 3/8" 73 ppf	0.63	6.89
10 1/8" 79.2 ppf	11 7/8" 72 ppf	0.67	6.50



Dual Casing Solution

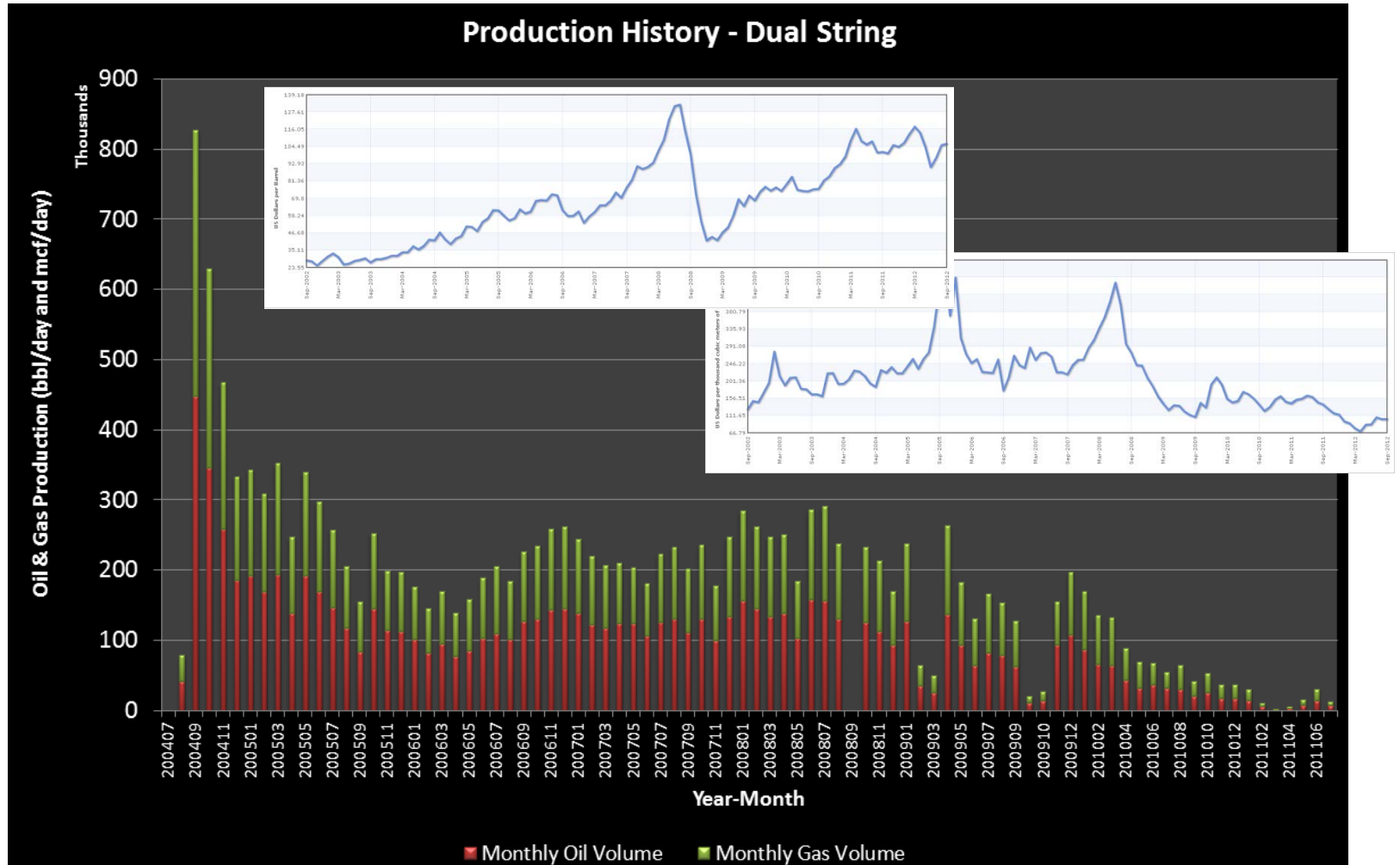


Penetration Increase 35-75%

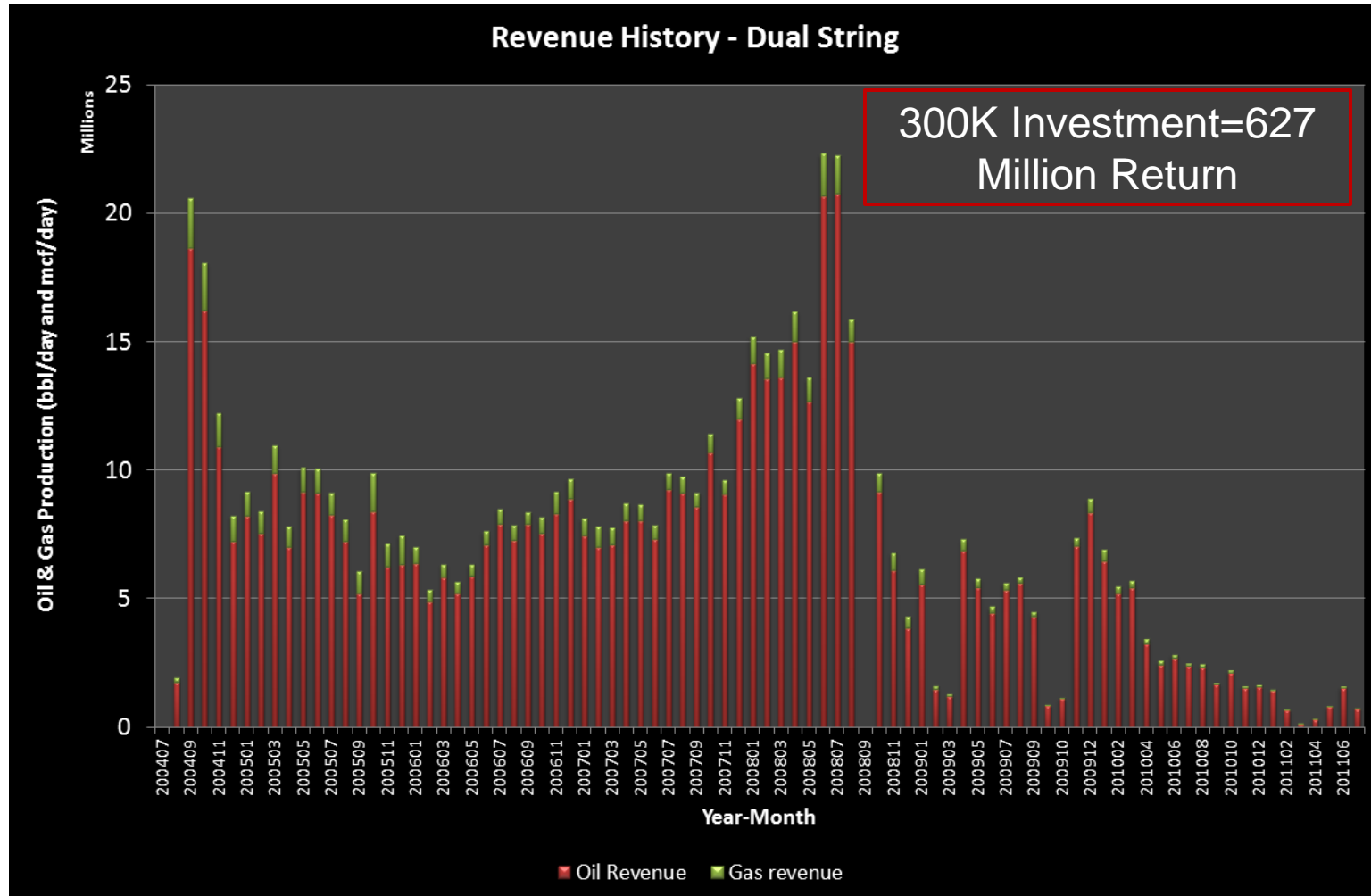
Needs and Wants

- ✓ Large Hole size in second string $>0.5\text{in}$
- ✓ Similar hole size in first string
- ✓ Consistency in hole size in decentralized casing
- ✓ Better Penetration
- ✓ Low Cost
 - Shot density of 12 spf
 - One run solution
 - Sooner the better

Production in Dual String



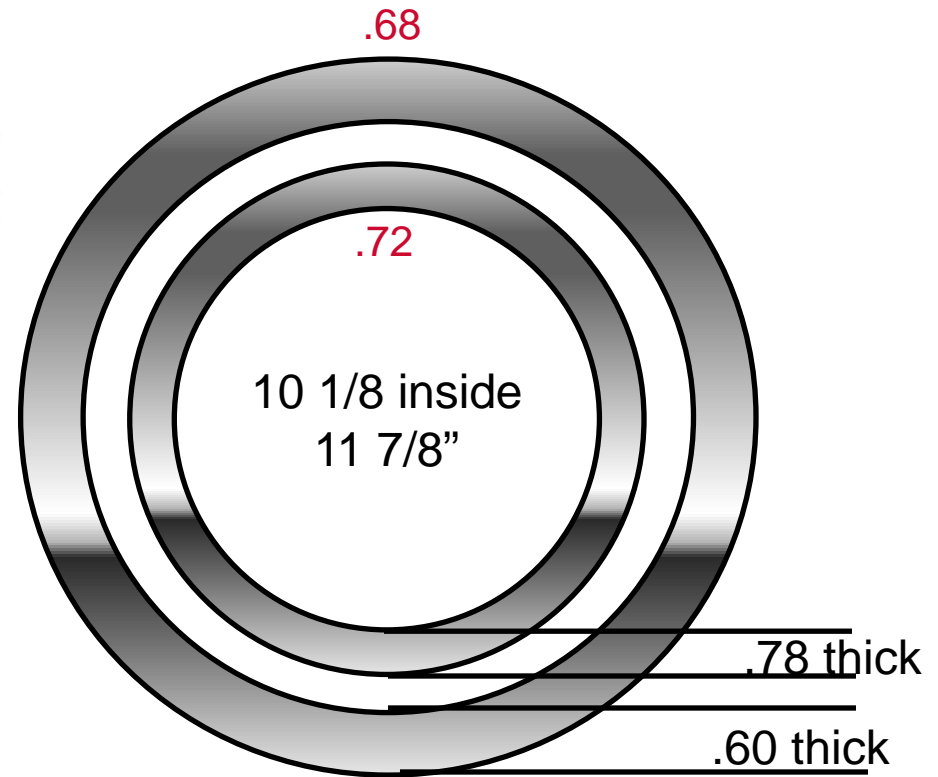
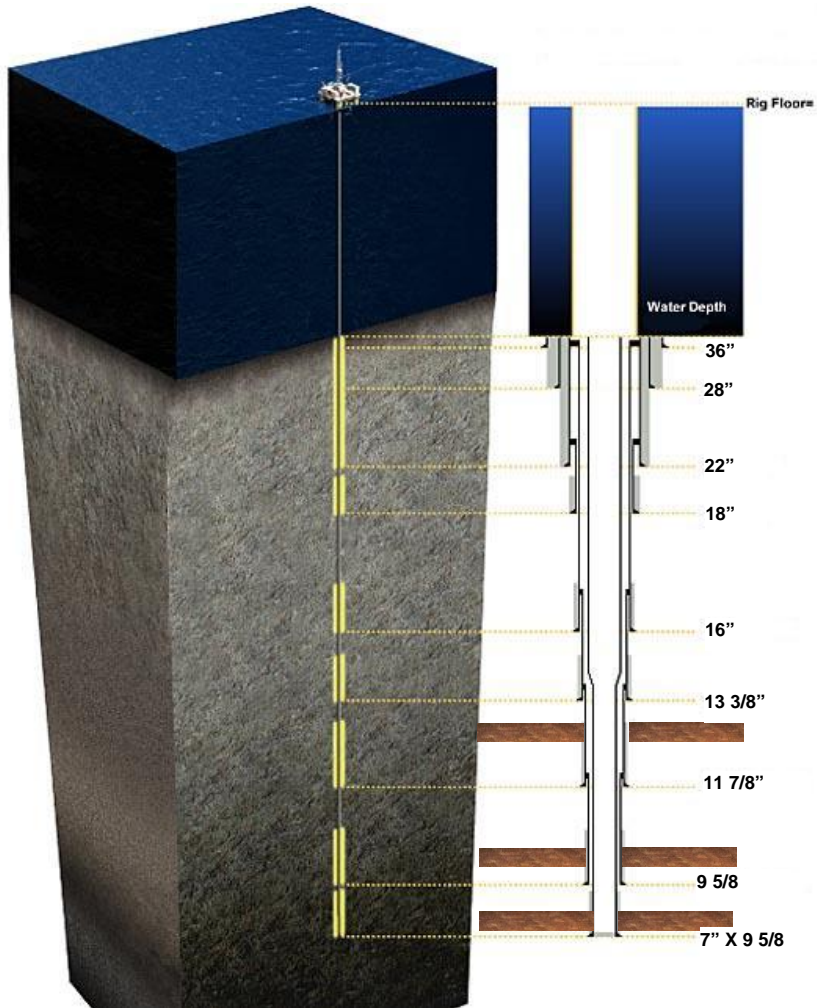
Return On Investment





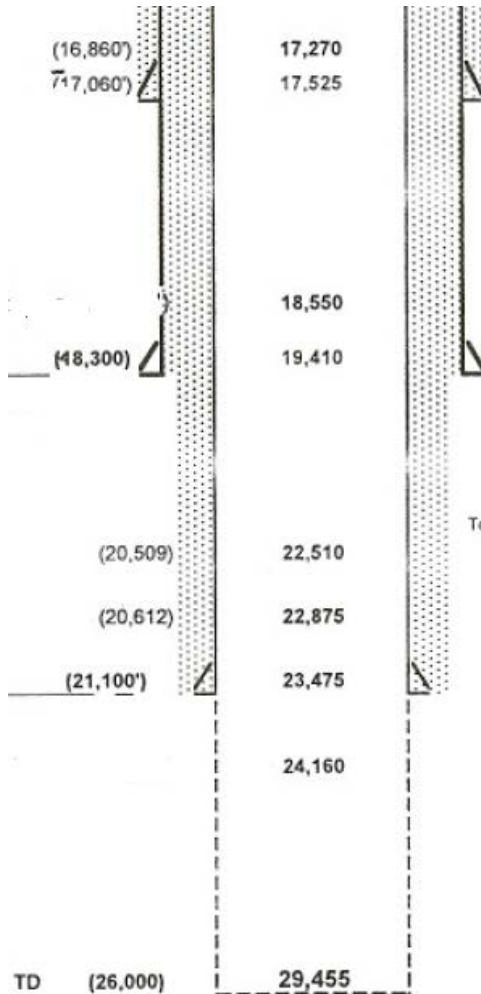
Additional Capability

Cement Placement

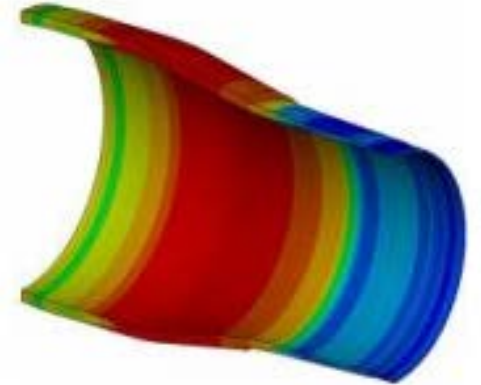


Higher success rate with >0.5in hole

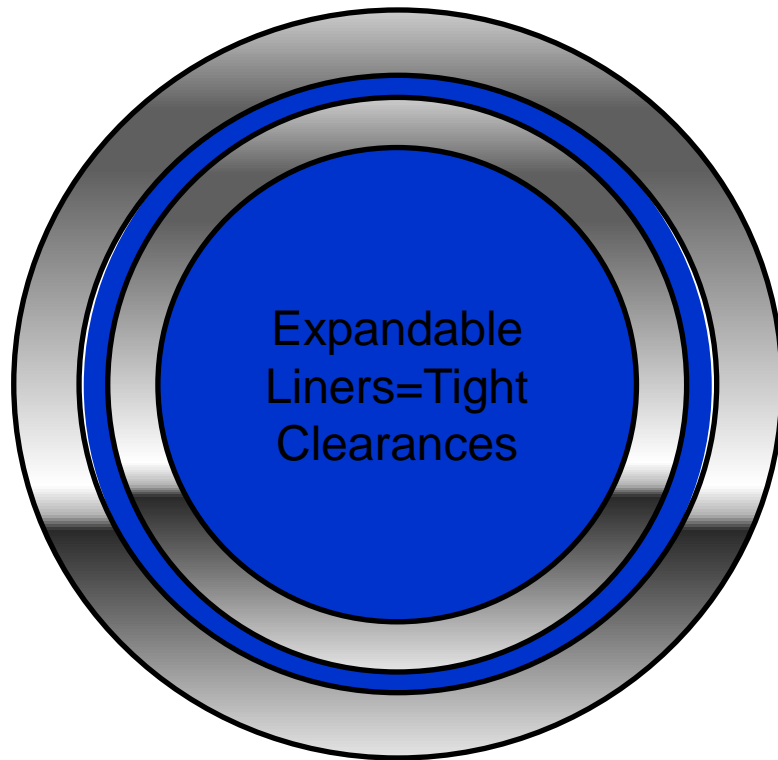
Getting to TD



11 3/4" 65#/ft. P-110 Hydril 512 (Drift 10.625")	(15.8 ppg FIT)
10 5/8" Pilot bit 11 1/4" Reamer	13.9 - 14.9 ppg Synthetic Mud
10.3" Expansion Cone 9 5/8" x 11 3/4" 36# SET EX-80, G3 (Drift 10.25", OD = 11.1")	(16.2 ppg FIT)
9 3/4" Pilot Bit 11 1/4" Reamer	14.5 - 15.5 ppg Synthetic Mud
Top Foam Cement	ECD < 16.0 ppg
7 5/8" 47.1 #/ft. Q-125 VARST1 2000-STS SC (8.25")	(16.5 ppg FIT, 16.0 ppg min)
6 1/8" Pilot Bit 7" Reamer	15.3 - 15.5 ppg Synthetic Mud
	ECD < 16.3 ppg



Completion in Expandable Liners

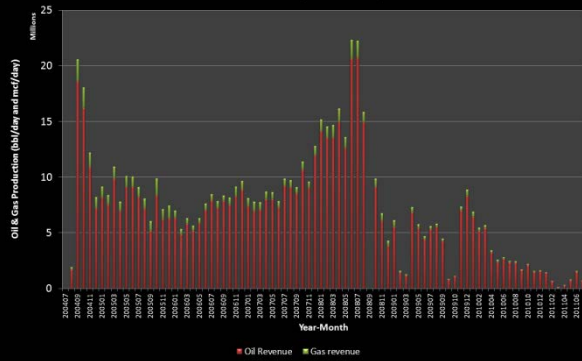


Internal Casing	Outer Casing	Fluid / Cement	HoleSize in	HoleSize in	Penetration in
7" 37 ppf	9 3/8" Expandable	Cement	0.79	0.67	8.19
		Fluid	0.79	0.59	7.80
6" Expandable	8 5/8" 57.4 ppf	Cement	0.83	0.83	7.95





Revenue History - Dual String



Summary

What questions can Dual String Technology answer for you?

Bjørnar Kalsvik

