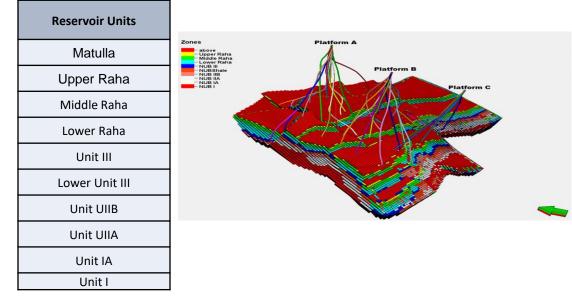
Improving Existing Perforations Efficiency with P3 Dynamic Underbalance Technique Enhances Productivity

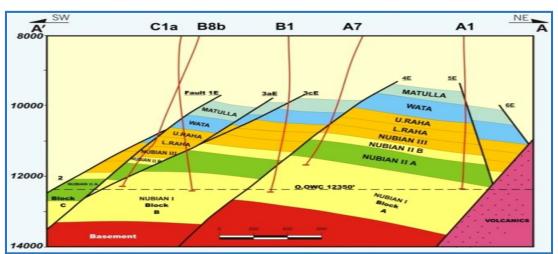
Case Study in Ras Budran Field; SUCO-GOS



Ras Budran Subsurface Overview





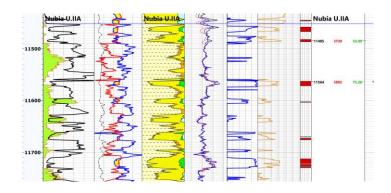


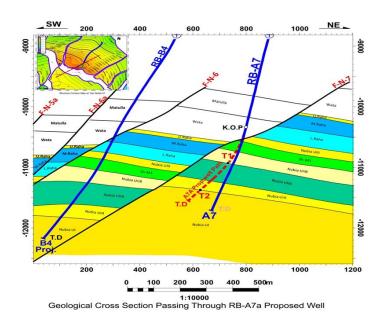
General Information	
Location: North Belayim offshore Area	
Discovery: 1978	
1 st production: February 1983	
Offshore Facilities: 3 Offshore Plattforms (A, B, C)	
STOIIP: 830 MMstb	
Cum. Production: 294 MMstb	
Recovery Factor: ~35%	
Reservoir Data	
Reservoir Formation: Nubia, Raha, Matulla.	
Formation Type: Sandstone, & Carbonate.	
Formation depth: ~9500 ft	
Reservoir thickness: ~ 2100 ft	
Permeability: 40 - 340mD	
Porosity: 9 - 15%	
Oil Gravity (API):19 – 26	



Development Oil Reserves in the Tight Sand of Nubian IIA

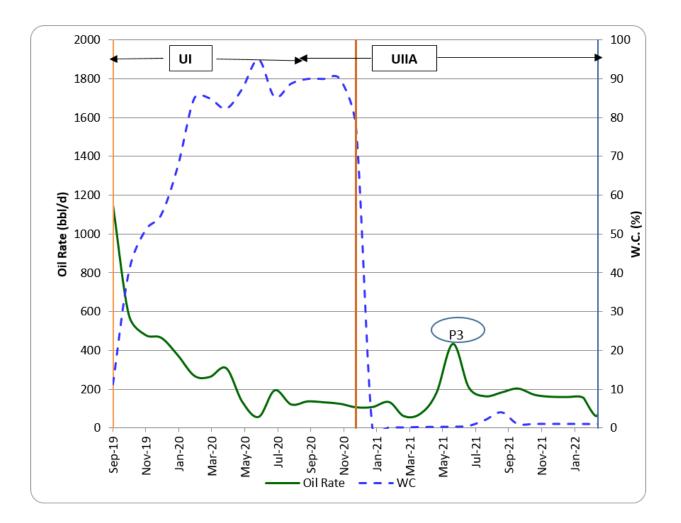
- As the challenges of Low Petro-Physical parameters (K ~ 40md, Phi ~11%, NTG~35%). UIIA wasn't considered a reservoir however it contain huge IOIP.
- UIIA was tested in wells C1a & B9 for short periods (17 and 3 days only) because of very low productivity.
- Well RB-C4a, which drilled in 2018, is consider the first well produced economically from UIIA (B-block)
- Encountered a challenged heavy crude in RB-C4a.
- Following the development plan to maximize oil recovery from the lower reservoir units (Nubia UIIA) and develop bypassed oil reserves in UI of block (A)
- Well RB-A7a was targeting Nubia IIA and Nubia I reservoirs in slightly higher position compared to the original well.







Ras Budran A7a



RB-A7a started production in September 2019 from deeper reservoir unit (unit I). Followed by additional perforation in January 2020 in unit IIA

The well showed steep decline reaching 50 bopd.

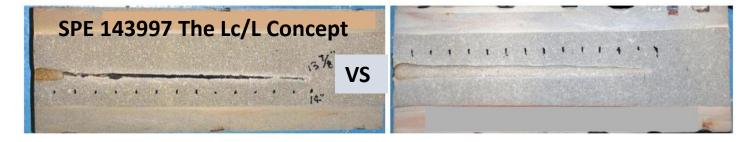
Re-Perforate the existing perforation without any improvement. Isolate the lower unit in December 2020. Perforate additional interval in Unit IIA.

Water cut dropped to nill with maximum production of 200 bopd.

Added additional perforation using P3 in May 2021, with a peak of production 400 bopd

Perforation Selection: The driving factors for the optimum result.

What type of
formation?What are the
bottom hole
conditions?Presence of Scale,
Fines migration,
organic deposits?

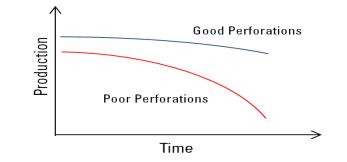


Completion Type? Minimum restriction? Rig less? Workover?

Is the formation damaged?

Fig 2. Photographs of perforated cores. (left) Zero DUB (or dynamic balanced - DB) core; (right) DUB core.

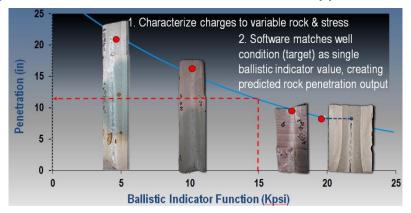
Reservoir Characteristics: Permeability, Porosity, UCS, Pressure?



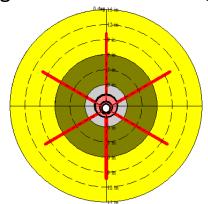
Producer/ Injector, Natural Producer or Artificially lifted?

RB-A7a perforating strategy selection criteria

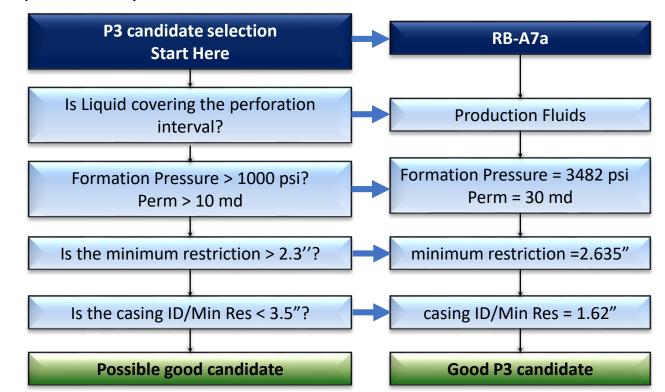
1. Need to select the deepest penetration gun/ charge for well conditions and reservoir characteristics: completion presence, rig less job, minimum restrictions, rock type, UCS



Simulate well utilizing SPAN rock software, API 19B Section 2



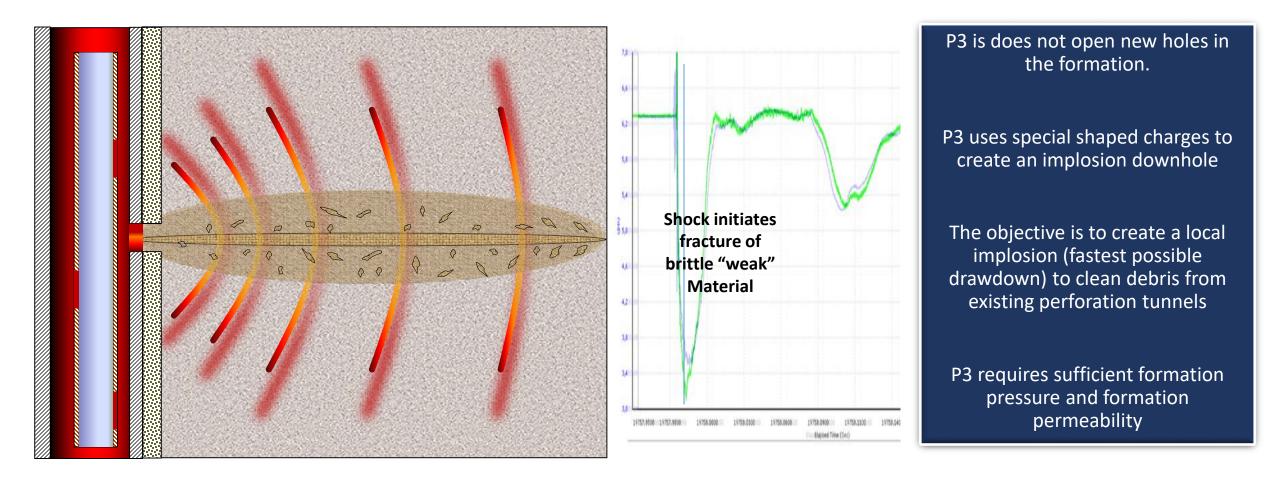
2. Perforation Tunnel needs to be cleaned for improved productivity: simulate effect of conventional perforation, static underbalance, dynamic underbalance, and dynamic underbalance implosion technique and compare productivity results.



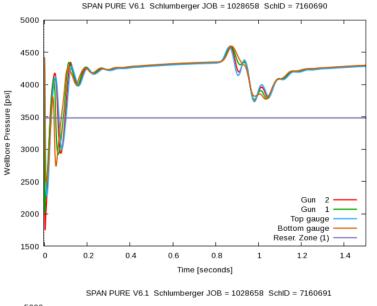
How does P3 works

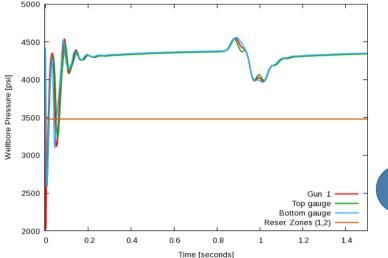


An implosion chamber is placed across the interval to be treated, the chamber is opened, and material removed from tunnel.



RB-A7a perforating strategy simulation and design





Add perforation across UIIA (11710 to 11730, and 11563 to 11575) ft-MDort.

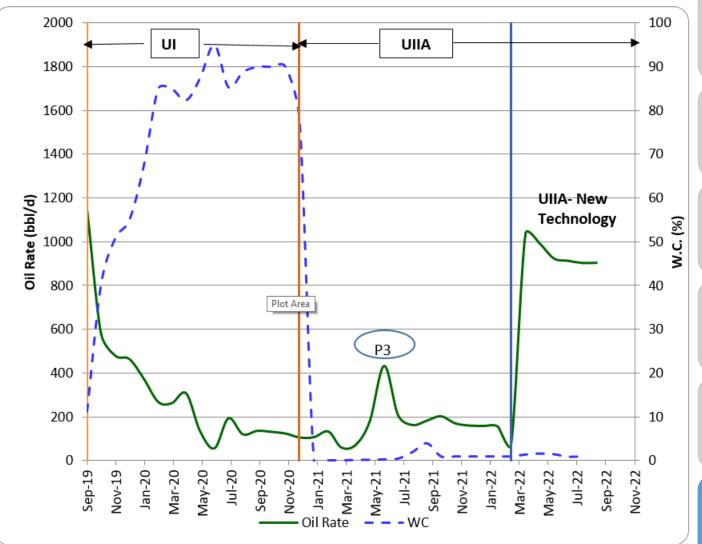
Add perforation across UIA (11877 to 11892) ft-MDort

Perform PURE P3 for the open perforation in UIA (11852 to 11902) ft-MD-ort.

			RB-A7	9				
Date: 29/3/2022								
					ort-thf	68	ft	
	ft-MD-thf	ft-M	ID-ort		ort-MSL	109	ft	
					MSL-SB		ft	
10368	X		10436	Top Of 5" Liner				
		H H						
				Top of unit III at 10	Top of unit III at 10972 ft-Md-ort			
				Top of unit IIB at 11234 ft-Md-ort			-	
				Top of unit IIA at 11446 ft-Md-ort				
11495			11563					
11507		12	11575				_	
11207	135							
11642			11710				_	
		20						
11662	75		11730	Top of unit IA at 1	1793 ft-Md-ort			
11737			11805					
11752		25	11830	Perforation using 2-1/8" PowerSpiral gun, HMX. SPF & 45o Phasing in Dec-20				
11762	22		11830					
11784			11852					
		25		Perforation using 2-1/8" PowerSpiral gun, HMX. SPF & 450 Phasing in Dec-2020, 2in P3 in May 21				
11809			11877				1	
		15						
11824			11892	Perforation using	2 1 /0° Duning	Contract an an	LINEY	
11834		10	11902		450 Phasing in I		. 1000.	
11905			11973 11990	TOC at 11973 ft-M Water Shut-off to			dee Plu	
				Top of unit I at 120				
11964			12032					
11904		30	12032	Perforation using		-		
11994	5		12062	HMX, 5 SPF, SDP 8	s 60° Phasing ir	1 Sept emt	ser 201	
11999		6	12067					
12005		0	12073	Perforation using	2" HSD gun, in J	lan 2020		
12006	1		12074	NEW PBTD (TOC in				
12104	46		12172	OLD PBTD (TOC in	September 201	9)	_	
12150	4		12218	5" Liner shoe	_			



Ras Budran A7a



RB-A7a started production in September 2019 from deeper reservoir unit (unit I). Followed by additional perforation in January 2020 in unit IIA

The well showed steep decline reaching 50 bopd.

Re-Perforate the existing perforation without any improvement. Isolate the lower unit in December 2020. Perforate additional interval in Unit IIA.

Water cut dropped to nill with maximum production of 200 bopd.

Added additional perforation using P3 in May 2021, with a peak of production 400 bopd

Additional perforation in unit IIA were added in April 2022 using new technology (Schlumberger P3 and Powerjet Omega 2" gun).



The Major Achievements:

- Initial target of commercial production from UIIA in Block A &B for the first time. (Produced till now <u>1.5</u> <u>MMBBL</u>).
- Add additional 60 MMstb to the field STOIIP and succeeded to double the remaining reserves for the field.

