

# (Example of Improve drilling operational efficiency and reducing well costs in the Sirte basin (Libya))

Biltayib. M. Biltayib  
Lecturer  
Australian College of Kuwait (ACK)  
Kuwait

Saad A.Balhasan., Mohamed. A.Omar  
Lecturer & assistant Professor  
Australian College of Kuwait (ACK)  
Kuwait, Kuwait

**Abstract:** Libyan oil companies spend millions of Dollars per year to produce oil and gas, where some of these money spent to recover many problems faced during drilling, which result in drilling cost increase(2). Moreover, National Oil Operators are always continuing, to improve drilling operational efficiencies and reduce drilling oil and gas wells by maximize effectiveness of operating and reduce unnecessary maintenance and operations time in the oil field. As a rule of thumb, improve drilling efficiencies and cost reduction does not depend on the quantity of drilling rigs or un expensive technologies respectively.

In order to manage the well costs, the companies should right technology in term of equipment's and drilling fluids through better planning and execution. The cost of drilling is largely influenced by the impact of operating days number, technologies used, and problems may substantially delay the progress. So, preparing appropriate plan, applying right technology and execution will improve drilling performance.

This paper discussed the use of advanced technology (Rotary steering system (RSS) ) rather than conventional rotary drilling and Ultra drilling fluid for shale instability rather than conventional mud use in pervious well, also the increase efficiency of drilling operation and reduced cost, even the start cost of advanced technology is higher than conventional as you known.

**Key words:** performance, section, rate of penetration, drilling, cost

## I. INTRODUCTION

Drilling operation efficiencies in the complicities and simplicities oil and gas wells are still significant challenges in the term of achievements and cost reduction. This success is based, on the one hand, on the important details derived from geological drilled formations and, on the other hand, on the good drill-in reservoir conditions. Thus, the paramount drilling objectives are to reach the target safely in the shortest possible time and at the lowest possible cost.

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Thus, the paramount drilling objectives are to reach the target safely in the shortest possible time and at the lowest possible cost. Technology is playing the main role to improve drilling operations performance that makes well construction safer, reduce nonproductive time and enhance reservoir deliverability.

Using Rotary-steerable system technology instead of conventional one (mud motor) which is increased drilling operation efficiencies that effect hydrocarbon wells in the different reservoir in sirte basin. Also Drilling fluids went through major technological that improve fluid rheological properties and filtration capability, allowing penetrating heterogeneous geological formations under the best conditions.

Ultra mud weight is use in Sirte basin help for well stability that can reach bottom hole with perfect time, as our paper will focus on above mention technologies that applied in Sirte basin with different Nation Oil operator companies. More over in last days of the revolution technologies in oil industries many technologies have applied to speed up drilling operations as example, drilling-with-casing system to simultaneously drill and case your well.

Evaluation of drilling performance commands a high degree of visibility across oil and gas companies, and over the past few decades, various methods have been proposed to evaluate drilling cost and complexity. Understanding drilling process requires isolating the factors of drilling and quantifying their interactions [1.3.4].

The objectives of this study are study the reason behind the improving drilling efficiency , and techniques used in the fields which is reduce the cost of the well in Sirte basin . as maximize effectiveness of operating and reduce unnecessary maintenance and operation time in the field.

## 2. Background

Drilling for Oil and gas can be one of the most expensive processes in the exploration and production. Hence, drilling industry has been striving since its inception for developing drilling techniques which allow for fast drilling rates but ensuring the safety of the well and of the workers

Parameters affecting the drilling process can be cast in two major categories, rig and bit related parameters and formation parameters. The first category includes weight on bit, torque, rotational speed, and hydraulic parameters like flow rate, density and rheology of the drilling fluid. The second category includes local stresses, rock compaction, mineralogy, abrasively of formation, formation fluids.

In our field as achieved faster drilling rates, as we used a advanced technologies(RSS) in Horizontal section rather than conventional which is increase ROP and decrease time of drilling even in started cost was big different, and Drilling fluid technologies used. the main tendency is currently developed in search for new additives increasing the performances of water-based muds (WBM). Borehole stability remains the main problem during drilling and the selection of drilling fluid type and composition was at the origin of successful drilling. Numerous studies have analyzed shale problems and several methods have been proposed to improve fluid performances for clay swelling inhibition. In this paper we review the result of unprecedented job achievements Horizontal drilling section in term of drilling technologies in drilling fluid and operation and address the issues so that one can design future wells using information provided from an existing well.

### 3. Cases study

Drilling may be the most expensive process during the exploration campaign and the ability to predict penetration rates under given subsurface conditions with the various drilling rigs is very essential for the safe design and the accurate cost prediction before the start of the drilling campaign [2]. This paper is discussed result of two cases in term of technologies used in drilling operations mentioned above in drilled oil wells by different two oil companies with regard to improving drilling efficiencies. The aim of this to understand the factors that could improve drilling performance that will lead to reduce cost.

#### 3.1 First case

In general partially to complete losses circulation are expect in Paleocene formation, the best way to compact loss of circulation problem is an application of aerated drilling technique, which will eliminate waste of rig time and drilling problem such as stuck. Also minor seepage losses are expected in other porous sections of wells from surface to total depth. Potential gas zones in Fellaga and Ilatif are expected. Slough and caving are expecting through Tagrifet and Bahi formations, therefore applying invert oil base mud in 8 1/2 section to minimize slaving and caving The company drill several wells by Al-Mothouka Oilfield Services J.V in different fields that are Hamad , Bada, Latif and Nofooora fields used (RSS) and normal rotary drilling in 8 1/2” sections[6].

One of those fields is located in Gadams basin, which is Hamad field, and other three fields are locating in Sirte basin. Table (1) shows the use of Performance rotary technology saved 450,000\$ comparing normal rotary. Regarding to the company experience, those fields” lithology, improving of drilling performance” depends on selection of right technology for right section of drilling [6].

#### 3.2. Second case

Borehole stability remains the main problem during drilling and the selection of drilling fluid type and composition was at the origin of successful drilling. Numerous studies have analyzed shale problems and several methods have been proposed to improve fluid performances for clay swelling inhibition the case is C318H-6 well in sirte basin south east of Al-Bragah. Mud used is ultra-drill mud system. Water base system W/ triple- inhibition approach: superior clay inhibition, and cutting encapsulation and protect metal services. By drilling with ultra-mud, we did not see problems of shale sloughing or bit balling and trip in and any tight spot or fill in bottom . See pictures below. Pictures below that shows clean bit and stabilizer.

#### 4. Results and Discussions

Address the technologies issues, that impact on the ROP improve, distinct between Performance drilling and normally rotary drilling, and contribute of using different technologies on the cost and drilling efficiency. Field and operational data of different hole sections are presented in tables 1.

Table (1) shows the use of Performance rotary technology .vs. normal rotary drilling in different reservoir section.

Field	Well	Section	Rotary	RSS	Improvement %	Interval ft
Nafoora	G301-51	8.5”	10	22.7	127.0	1,293
Latif	D2-NC59	8.5”	7	23.4	234.3	1118
Hamada	B1-NC4	8.5”	8	26.8	235.0	1,146
Nafoora	G302-51	8.5”	10	28	180.0	1049
Nafoora	G-303-51	8.5”	12	37	208.3	2,679
Beda	B8A-47	8.5”	22	37	68.2	285
Average 8 1/2” section			<b>12</b>	<b>29</b>	<b>175</b>	<b>7570</b>
Cost With Normal Rotary Drilling					\$780,000	
Cost With RSS Performance Drilling Services					\$330,000	
Total save					\$450,000	

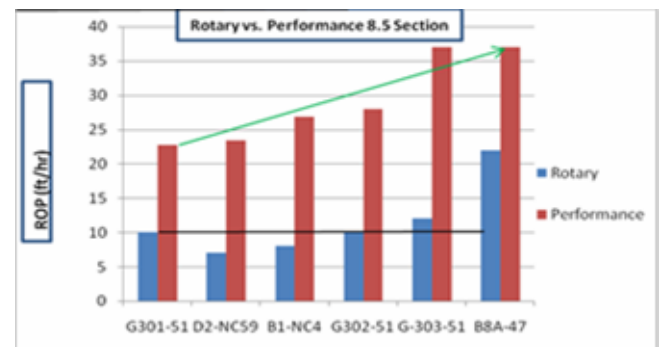
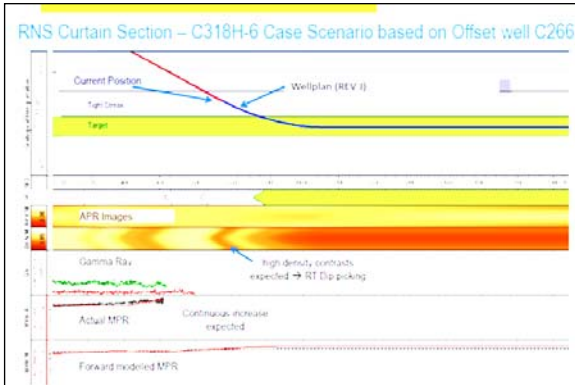


Figure1: normal rotary vs. performance using 8 1/2 hole section

- The section case:

The entire 8.5’’ build up section (1647’) was drilled successfully with full returns @ 8°/100ft DLS using KCL mud system and 7’’ csg was landed @ tight streak (6497’ MD/5661’ TVD) even though formation tops came in 45-50’ low to prognosis & anticipated high in target area did not appear figure(2) .



Figure(2).C318H-6 case Scenario

- 6’’ Horizontal hole section:

A good match was obtained between actual and modelled data to maneuver properly the RNS Reservoir Navigation tool figure (3).

- The horizontal section @ 890 ft was drilled to TD with full return using non damaging mud system in one run by utilizing Auto track Rotary Closed loop Steerable System.
- The 6’’ hole section was arrested through the top of 4ft thickness of the layer ‘4’ by using Azi track & Litho track System.
- Well was flow tested using test separator and it made around 900BOPD with 50% WC @ 500psi Whp on 1/2’’ choke.

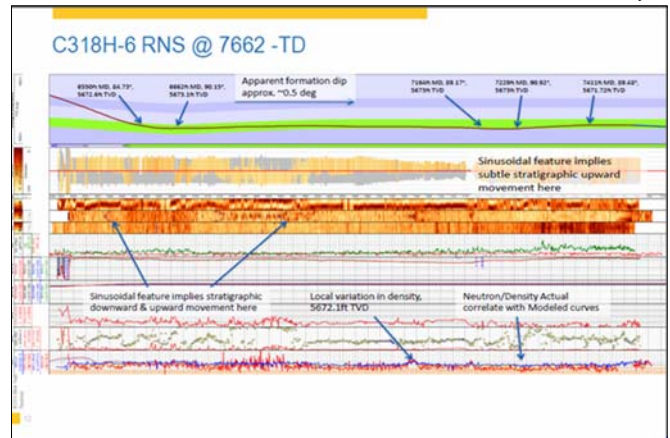


Figure (3) the horizontal section

#### 4. Conclusion:

Prediction of rate of penetration is among the most sought after parameters in a drilling campaign for oil and gas exploration as it allows for optimization of drilling parameters to decrease drilling costs and enhance drilling process safety. Difference in rate of penetration applying normal rotary drilling and RSS performance in 8 1/2 hole section for four wells. Cost with normal rotary drilling is 780,000\$ for 8 1/2 hole sections, while the cost with RSS performance drilling services and 330,000\$ for 8 1/2 hole section. Total saving cost 450,000\$ for 8 1/2 hole section. The WBM are mainly composed of aqueous solutions of polymers and clays in water or brines, with different types of additives incorporated to the aqueous solution. Moreover, Recent advances made available simulators which could be used onsite having been adjusted with real time drilling data so that they can be used in future campaigns in similar fields. In order for this to be successful, real time drilling monitoring is essential with the main parameters at hand such as weight on bit, torque, rotary speed, flow rate.

#### REFERENCES

- [1] Paco Vieira, Hani Qutob and Maurizio Arnone, Weatherford International; and Mohamed Ben Shatwan, Arabian Gulf Oil Co.(Libya); and Biltayib. M., National Oil Corporation (Libya) (SPE/IADC 130562)(2010) First Underbalanced Drilling Experience in AGOCO Sarir C- Main Field - LIBYA: Conference & Exhibition, 24-25 February 2010, Kuala Lumpur, Malaysia.
- [2]. Annually drilling report (2008)., Drilling performance from 2005 to 2010 internally published by Production department National Oil Corporation.pp50
- [3]. Yu Zhucheng, Wang weig.,(2010). Comprehensive technology of drilling and completion for jida 4 well in Fergana Basin, Uzbekistan.

[4]. Assoc. Prof. V.C. Kelessidis<sup>1</sup>, P. Dalamarinis<sup>1</sup>, Monitoring Drilling Bit Parameters Allow optimization of Drilling Rate. Mineral Resources Engineering Dept. Technical University of Crete, Greece

[5]. DC Mannon, Reducing well cost by increasing drilling efficiency, paper AADE-01-NC-HO-35 presented at the AADE 2001 National Drilling Conference, Houston, Texas, March 27 - 29, 2001.

[6]. Biltayib. Misbah, National Oil. Corporation (Libya); Khulud. Rahuma, Al-Fateh University, (2014); Impact of Various Techniques performance on well cost of different reservoir types. Mediterranean Petroleum Conference and Exhibition 2014, Istanbul-Turkey".



Inhibition action #2: Cuttings encapsulation



Inhibition action #1: Superior clay inhibition

## **The Authors**

Dr. Biltayib. Misbah is Lecturer at Australian College of Kuwait (ACK). I received My PhD degree in Drilling Engineer and Fluid mining from TU-Freiberg in Germany. I worked with National Oil Corporation (NOC) of Libya from 2007 to Jan 2015.as Drilling Superintendent



Dr. Saad A.Balhasan  
Lecturer at Australian College of Kuwait (ACK).  
I received my Phd from University of Wyoming



Mohamed. A.Omar Elhemry  
assistant Professor  
Australian College of Kuwait (ACK)  
Kuwait.

