FAILURE OF MEASUREMENT WHILE DRILLING (MWD) TOOL IN DIRECTIONAL DRILLING IN PETROLEUM INDUSTRIES

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Abstract

This project presents learning about basic of Directional drilling and failure of measurement while drilling (MWD) tool . This project detail about the MWD tool basic and problems caused in the petroleum industry and its uses. How the directional impact in ONGC . Ongc working on the some number of development wells and gain 99 % will under production .

MWD tool has gives the direction of coordinate that EASTING , NORTHING , AZIMUTHAL , INCLINATION , TRUE DEPTH , MEASURED DEPTH . This working under the well details that travelling in signal carry to surface through the mud pulse by binary coding that decoding by computer unit and some of the MWD software that survey the measured of depth of drilling .

MWD tool have some of part that install to make to Telemetry Channel ,Transmission System , Power Source ,MWD Sensors , Surface Systems . In this main important is Battery , directional sensor , gamma sensor , magnetometer , accelerometers .these makes the depth measured and avoiding of the another well and magnetic components .

Directional drilling make the drilling process is more easy that reach the target which are unreachable . Drilling has makes that kick off point that soil has specific viscosity that which turn the direction of drilling in all direction .

This project detail about failure about the MWD tool in ONGC that makes the target quite expenditures and time taken projects . The ONGC has solved that problems easily by MWD engineer that effect staff . Some of the problems like CHOKE problem , electrical connected problem , no signal problem . Thus the result on cases study on end of project.

1)INTRODUCTION

In early days the drilling was done throughout the vertical process they done about the deviation of hole that should maintain the some of problem of fish and jusk left in hole that gives some problems . Today itself that advanced to the reservoir modelling that used to drill through the multiple well from single surface location . Its exists to lean boundaries other wells . The term which directional drilling can be given through the development of the skill to direct to the science of directional drilling which trajectory to the designed sub surface target to the designed sub surface target the drilling process which directional and deviation controlled from surface area.

Directional Drilling terminology

The term which are given below that may be defined that working potential present to understanding of the field work that may be defined through terms of directional drilling :

- **BUILD UP RATE (BUR)**
- **DROP OFF RATE (DOR)**
- **AZIMUTH**
- **COURSE LENGTH**
- **CLOSURE**
- **CROOKED HOLE**
- **COURSE DEVIATION**
- **GO-DEVIL**

There so many terminology which explained more in directional-drilling these are small examples

APPLICATION OF DIRECTIONAL DRILLING

The application of directional drilling in which the probably of giving the detail about the process and there are some of applicants given below

1. Inaccessible location
2. multiple well from single locations
3. geological problems
   fault drilling
   salt dome drilling
4. side tracking
5. horizontal well

6. relief well drilling
7. controlling straight holes
8. ERD (EXTENDED REACH DRILLING)
9. multilateral drilling

Measurement while drilling(MWD)

The terms measurement while drilling (MWD), and logging while drilling (LWD) are not used consistently throughout the industry and its these terms are related, the term MWD refers to directional-drilling measurements, for decision support for the smooth operation of the drilling, while LWD refers to measurements concerning the geological formation made while drilling .A penetrating rig is used to make a borehole or well (likewise called a wellbore) in the world's sub-surface, for instance so as to extricate normal assets, for example, gas or oil. During such boring, information is obtained from the boring apparatus sensors for a scope of purposes, for example, choice help to screen and deal with the smooth task of boring; to make point by point records (or well log) of the geologic developments infiltrated by a borehole; to produce activities measurements and execution benchmarks to such an extent that upgrades can be distinguished, and to give well organizers precise chronicled tasks execution information with which to perform factual hazard investigation for future well tasks

2 LITERATURE REVIEW

Mud-Pulse High-Temperature Measurement-While-Drilling (MWD) System

The overall software goal is to broaden a mud-pulse measurement-whilst drilling (MWD) device for oil and fuel drilling operations that may be used in which downhole temperatures are as excessive as 195ºC (383ºF). The work become planned to be completed in phases: section I and an non-obligatory phase II. The targets of segment I were first to perceive essential components of present MWD structures that can or can not perform at 195ºC. For components no longer able to meet the better standard, one in all several strategies changed into pursued:

1) find excessive-temperature replacement components,

2) broaden new designs that take away the unavailable components, or

three) use cooling to keep components at suited operatingtemperatures (below 195ºC). New designs and additives had been then examined below high temperatures in the laboratory. The final intention of section i was to gather two high-temperature MWD prototype equipment and take a look at each in at the least one low-temperature

2.1 Research Gap

In ONGC ,directional drilling started from early seventies when some wells were required to be drilled directionally in eastern regions of Assam , due to inaccessible locations and non availability of sites . Job was accomplished by old methods using shondina kulgina apparatus .Very few directional wells were drilled till mid

seventies when then Bombay high field established and a number wells required to drilled to develop the field . Directional drilling techniques was empoled and four directional wells were tied back to platforms . Since 1980 several six wells platforms were constructed and wells were being drilled with horizontal displacement of approximate 1.5 km . Technology further develop and nine wells from one platform came into existence . Some with vertical and some with curved conductors .Wells were scattered in all direction and a circle 1.5 Km radius was covered with these wells from a single platforms . For the development of technology few wells were drilled initially by the foreign contractors was done away gradually . In 1984 , technology was completely indigenised and no foreign experts has been called for his job .

3) Objectives:

- To study about the failure of measurement while drilling MWD tool in Directional drilling
- some MWD TOOL surveys tables

4) Data and Methodology:

4-1) signal problem and no pulse of mwd tool :

a) signal generation with mud siren :

- no signal and no pump noise
- Dead sensor
- Bad connection
- Bad wiring
- Bad PSAM
- Bad USP board (check with loop back connector)

b) pump motor noise reading but no signal by spectrum yellow band with is pump noise but no signal of mwd tool with blue bandwith which means no readings

- tool dead
- power pulse tool start with BPSK 1 hz/0.5bps
- at low temperature
- and jamming at pump start
- Bring the pump down and restart.

c) tool operating in a different mode

- Bad configuration
- accidental down link

4-1-1 Binary Phase Shift Keying (BPSK)

• BPSK modulation uses two discrete phase changes.

• Each symbol represents one binary digit

• 0 = no phase change, 1 = 180º phase change.

The modulator spins at the carrier frequency. To transmit a "1", the modulator slows down then returns to normal speed, resulting in a phase change of 180 degrees in the wave phase. The surface computer

tries to identify this change. To transmit a "0", the modulator does not change phase from one period symbol to another. The **receiver** on the surface determines what data was sent by comparing the phase of the wave during the current symbol with the phase of the previous symbol

4-1-2 Quadrature Phase Shift Keying (QPSK)

• QPSK modulation uses four discrete phase changes.

• Each symbol represents two binary digits.

• 00 = no phase change, 01 = +90º phase change,

• 10 = -90º phase change, 11 = 180º phase change.

When the Symbol Rate is doubled then the band width is also doubled. The **receiver** on the surface determines what data was sent by comparing the phase of the wave during the current symbol with the phase of the previous symbol

4-1-3 Minimum Shift Keying (MSK) :

•MSK is a type of binary frequency shift keying.

•One of two frequencies is used to send a binary digit.

•A binary 0 is sent using the frequency fc-fb/4

•A binary 1 is sent using the frequency fc+fb/4, –where fc is the carrier frequency and fb is the bit rate.

•For binary modulation the symbol rate is the same as the bit rate. (Difference between f1 and f0 = 1/2 symbol rate)

4-1-4 Bayesian Receiver

This receiver operates on data in batches. The receiver waits until enough new data samples are received from the acquisition ("a new batch worth"), and then processes the data as a batch. Each time a new batch of data is processed, the following processing is done (in the

given order).

- The new batch of telemetry data is read from the hardware, and saved in buffers in the receiver.

- Bayesian technique is applied to new batch of data to determine bit decisions and confidences.

- Results from the new batch are presented to the Receiver, Frame Decoder, etc.

4-2-1 Electrical Noise

.All unshielded sensor links and electrical power links can act like radio wires for getting electrical commotion on the apparatus. All electrical hardware produces electrical commotion somewhat. This is especially

genuine if the gear has circuits that switch flows, for example rectifiers, thyristor switches and so forth. This commotion is either emanated through the air or directed along links or any leading way, for example the metal structure of the apparatus. Free electrical associations can likewise cause a kind of electrical clamor

Electrical Interference: Sources

- It has the in the Loose electrical connections
- noise of Faulty SPTs
- general ability of Moisture creeping into UCS connections
- Cable insulation that is worn out

- Improper grounding or broken ground wires
- vary of effects Sensor shield problem – the shield should be grounded at the logging
- unit end only
- Sensor cables that are too close to electrical noise from power cables
- Cross coupling of electrical signals from other equipment onto the
- telemetry cables.

4-3 CHOKE PROBLEM IN MWD TOOL

Choke line is used to control the drilling fluid or mud density ,viscosity , flow rate and mud weight and specific density of mud. Pressure increase at the bottom hole than flow rate of mud change then pulse generator of mud tool does not reading the directional stability of the well. To maintain the well stability pressure the choke control check the readings.

MWD tool does not reading the pulse and signal of tool by the maintains of well by choke vaules does not maintain the mud specific density of well.

To solve the problem the mud specific density by mixing chemicals then maintaining to run mud viscosity of well

1) weighing chemicals
   - lime
   - baryte

2) viscosity control
   - Bentonite
   - Xc- polymer

3) water loss
   - CARBON METHYL CELLULOSE (CMC)
   - POLY ANIONIC CELLULOSE (PAC)
   - RESIGNATED LIGNITE (RL)

4)SULPHONATED ASPHALT

5) CHROME FREE DEFLUCCULENT

6) POLYAMINE

7) KCL

8) HYDROXY POLY ACRANILIDE

9) PARTICALLY HYDROLYSISES (PHPA)

Case study of MWD TOOL :

Directional drilling is the main process in petroleum industry ,now a day the process that make easy to reach the unreachable target . We cant drill the well in city , mountains , and other unreachable area it can drilled in directional process.

Directional drilling process has maintain the developed wells that have been achieved target . In ongc the process make more impact on drilling in india . ONGC has reached many target by this process . In directional drilling some tools are used but in that one of important tool is MWD tool . This tool can analysed the directional report of the well . By doing the project in ONGC i study about the failure of MWD in directional drilling in ONGC .

The process make study on the MWD tool and its failure in directional drilling in ONGC , in above chapter analysed about the failure causes and solution on that failure .

In studies above cases of failure of MWD tool that make problem commonly in mud pulse process and sensor . The direction measurements of well can be measure d through MWD tool . The some of given cases studies are given below

Target Set

Comment :

Target Name: NKQF Target	**Position (Relative to Site centre)**		
	+N / -S : -263.18m	**Northing :** 2594791.63m	**Latitude :** 23°26'23.78"
	+E / -W : 41.78m	**Easting :** 225060.42 m	**Longitude :** 72°18'32.61"
Shape: Cylinder	**TVD(Drill Floor):** 1273.00 m		
	Orientation	**Azimuth :** 358.93°	**Inclination :** 0.00°
	Dimensions	**Radius :** 5.00 m	**Length :**0.00 m

Casing Points (Relative to Site centre, TVD relative to Drill Floor)

Name	MD (m)	Inc (°)	Az (°)	TVD (m)	N.Offset (m)	E.Offset (m)
Csg 9 5/8 in	350.00	0.00	0.00	350.00	0.00	-0.00

Well path created using minimum curvature

Salient Points (Relative to Site centre, TVD relative to Drill Floor)

Comment	MD (m)	Inc (°)	Az (°)	TVD (m)	N.Offset (m)	E.Offset (m)	Northing (m)	Easting (m)	DLS (°/30 m)	T.Face (°)	VS (m)	Clos.Az (°)
	0.00	0.00	0.00	0.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	-0.00	325.09
9 5/8 in Csg	350.00	0.00	0.00	350.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	-0.00	325.09
KOP	380.00	0.00	0.00	380.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	-0.00	325.09
	810.87	21.54	170.98	800.79	-79.06	12.55	2594976.26	225034.64	1.50	170.98	80.05	170.98
PAYTOP	1318.55	21.54	170.98	1273.00	-263.18	41.78	2594791.63	225060.42	0.00	0.00	266.48	170.98
	1436.81	21.54	170.98	1383.00	-306.07	48.58	2594748.62	225066.42	0.00	0.00	309.90	170.98

Interpolated Points (Relative to Site centre, TVD relative to Drill Floor)

Comment	MD (m)	Inc (°)	Az (°)	TVD (m)	N.Offset (m)	E.Offset (m)	Northing (m)	Easting (m)	DLS (°/30 m)	T.Face (°)	B.Rate (°/30 m)	T.Rate (°/30 m)	VS (m)
	0.00	0.00	0.00	0.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	30.00	0.00	0.00	30.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00

Interpolated Points (Relative to Site centre, TVD relative to Drill Floor)

Comment	MD (m)	Inc (°)	Az (°)	TVD (m)	N.Offset (m)	E.Offset (m)	Northing (m)	Easting (m)	DLS (°/30 m)	T.Face (°)	B.Rate (°/30 m)	T.Rate (°/30 m)	VS (m)
	60.00	0.00	0.00	60.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	90.00	0.00	0.00	90.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	120.00	0.00	0.00	120.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	150.00	0.00	0.00	150.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	180.00	0.00	0.00	180.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	210.00	0.00	0.00	210.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	240.00	0.00	0.00	240.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	270.00	0.00	0.00	270.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	300.00	0.00	0.00	300.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	330.00	0.00	0.00	330.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	360.00	0.00	0.00	360.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
KOP	380.00	0.00	0.00	380.00	0.00	-0.00	2595055.55	225023.57	0.00	0.00	0.00	0.00	-0.00
	390.00	0.50	170.98	390.00	-0.04	0.00	2595055.51	225023.58	1.50	170.98	1.50	0.00	0.04
	420.00	2.00	170.98	419.99	-0.69	0.11	2595054.86	225023.67	1.50	0.00	1.50	-0.00	0.69
	450.00	3.50	170.98	449.96	-2.11	0.33	2595053.43	225023.87	1.50	0.00	1.50	-0.00	2.13
	480.00	5.00	170.98	479.87	-4.30	0.68	2595051.23	225024.17	1.50	0.00	1.50	0.00	4.36
	510.00	6.50	170.98	509.72	-7.27	1.15	2595048.25	225024.59	1.50	0.00	1.50	0.00	7.36
	540.00	8.00	170.98	539.48	-11.01	1.75	2595044.51	225025.11	1.50	0.00	1.50	0.00	11.15
	570.00	9.50	170.98	569.13	-15.52	2.46	2595039.99	225025.74	1.50	0.00	1.50	0.00	15.71

Interpolated Points (Relative to Site centre, TVD relative to Drill Floor)													
Comment	MD (m)	Inc (°)	Az (°)	TVD (m)	N.Offset (m)	E.Offset (m)	Northing (m)	Easting (m)	DLS (°/30 m)	T.Face (°)	B.Rate (°/30 m)	T.Rate (°/30 m)	VS (m)
	600.00	11.00	170.98	598.65	-20.79	3.30	2595034.70	225026.48	1.50	0.00	1.50	-0.00	21.05
	630.00	12.50	170.98	628.02	-26.82	4.26	2595028.65	225027.33	1.50	0.00	1.50	0.00	27.16
	660.00	14.00	170.98	657.22	-33.61	5.33	2595021.84	225028.28	1.50	0.00	1.50	-0.00	34.03
	690.00	15.50	170.98	686.23	-41.16	6.53	2595014.27	225029.33	1.50	0.00	1.50	0.00	41.67
	720.00	17.00	170.98	715.03	-49.45	7.85	2595005.96	225030.49	1.50	0.00	1.50	0.00	50.07
	750.00	18.50	170.98	743.60	-58.48	9.28	2594996.90	225031.76	1.50	0.00	1.50	-0.00	59.21
	780.00	20.00	170.98	771.93	-68.25	10.83	2594987.11	225033.13	1.50	0.00	1.50	0.00	69.10
	810.00	21.50	170.98	799.98	-78.75	12.50	2594976.58	225034.60	1.50	0.00	1.50	0.00	79.73
	810.87	21.54	170.98	800.79	-79.06	12.55	2594976.26	225034.64	1.50	0.00	1.50	-0.00	80.05
	840.00	21.54	170.98	827.88	-89.63	14.23	2594965.67	225036.12	0.00	0.00	0.00	0.00	90.75
	870.00	21.54	170.98	855.79	-100.51	15.95	2594954.76	225037.64	0.00	0.00	0.00	0.00	101.76
	900.00	21.54	170.98	883.69	-111.39	17.68	2594943.85	225039.17	0.00	0.00	0.00	0.00	112.78
	930.00	21.54	170.98	911.60	-122.27	19.41	2594932.94	225040.69	0.00	0.00	0.00	0.00	123.80
	960.00	21.54	170.98	939.50	-133.15	21.13	2594922.03	225042.21	0.00	0.00	0.00	0.00	134.81
	990.00	21.54	170.98	967.40	-144.03	22.86	2594911.12	225043.74	0.00	0.00	0.00	0.00	145.83
	1020.00	21.54	170.98	995.31	-154.91	24.59	2594900.21	225045.26	0.00	0.00	0.00	0.00	156.85
	1050.00	21.54	170.98	1023.21	-165.79	26.32	2594889.30	225046.78	0.00	0.00	0.00	0.00	167.86
	1080.00	21.54	170.98	1051.12	-176.67	28.04	2594878.39	225048.31	0.00	0.00	0.00	0.00	178.88
	1110.00	21.54	170.98	1079.02	-187.55	29.77	2594867.48	225049.83	0.00	0.00	0.00	0.00	189.89

Interpolated Points (Relative to Site centre, TVD relative to Drill Floor)													
Comment	MD (m)	Inc (°)	Az (°)	TVD (m)	N.Offset (m)	E.Offset (m)	Northing (m)	Easting (m)	DLS (°/30 m)	T.Face (°)	B.Rate (°/30 m)	T.Rate (°/30 m)	VS (m)
	1140.00	21.54	170.98	1106.93	-198.43	31.50	2594856.57	225051.35	0.00	0.00	0.00	0.00	200.91
	1170.00	21.54	170.98	1134.83	-209.31	33.22	2594845.65	225052.88	0.00	0.00	0.00	0.00	211.93
	1200.00	21.54	170.98	1162.73	-220.19	34.95	2594834.74	225054.40	0.00	0.00	0.00	0.00	222.94
	1230.00	21.54	170.98	1190.64	-231.07	36.68	2594823.83	225055.92	0.00	0.00	0.00	0.00	233.96
	1260.00	21.54	170.98	1218.54	-241.95	38.41	2594812.92	225057.45	0.00	0.00	0.00	0.00	244.98
	1290.00	21.54	170.98	1246.45	-252.83	40.13	2594802.01	225058.97	0.00	0.00	0.00	0.00	255.99
PAYTOP	1318.55	21.54	170.98	1273.00	-263.18	41.78	2594791.63	225060.42	0.00	0.00	0.00	0.00	266.48
	1320.00	21.54	170.98	1274.35	-263.71	41.86	2594791.10	225060.49	0.00	0.00	0.00	0.00	267.01
	1350.00	21.54	170.98	1302.25	-274.59	43.59	2594780.19	225062.02	0.00	0.00	0.00	0.00	278.02
	1380.00	21.54	170.98	1330.16	-285.47	45.31	2594769.28	225063.54	0.00	0.00	0.00	0.00	289.04
	1410.00	21.54	170.98	1358.06	-296.35	47.04	2594758.37	225065.06	0.00	0.00	0.00	0.00	300.06
	1436.81	21.54	170.98	1383.00	-306.07	48.58	2594748.62	225066.42	0.00	0.00	0.00	0.00	309.90

6) Conclusion:

The project has give the detail about the directional drilling and measurement while drilling (MWD) tool and failure that cause to the tool . In ONGC works goes in before successfully solved and done program make easy to access the development wells and production easily . MWD tool has vary on the well expenditure that make less costly or high costly . These problem of MWD tool cause in all drilling phase of petroleum industries . That problem are solve real time by the engineers . Thus the conclusions of project of failure of MWD tool in directional drilling

Reference

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Reference of ongc

[1] Schlumberger and weatherford MWD tool failures studies

Reference for Conclusion

[1] MWD tool future studies and which internet series

Reference for case studies

case studies reference from ONGC works rigs of MWD software of tools calcutions