

Multidisciplinary Integrate Drilling Engineering and Systems at Ecuador delivering solutions and high performance.

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Schlumberger



What's Next?

SIS Global Forum 2017

September 13-15

Le Palais des Congrès de Paris

Schlumberger



Overview of Orion Energy

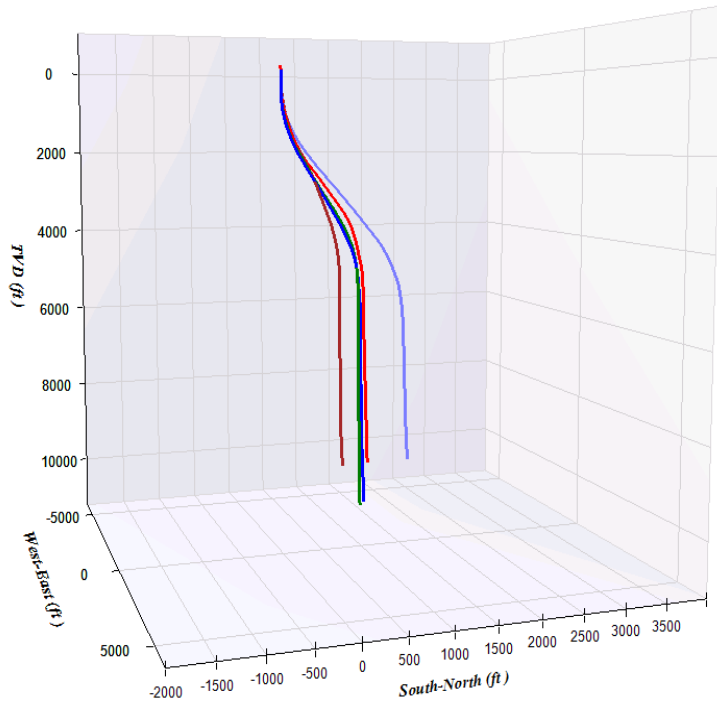
- Orion Energy is an Ecuadorian oil company operating blocks 52 and 54, both in Ecuador's Oriente Basin. Development activities in these blocks started in 2012.
- As part of Orion's development strategy, the company relies on technological partners to develop strategic projects, seeking best-in-class solutions, risk transferring and alignment with strategic objectives of the company.
- **Schlumberger** has provided Engineering and Integrated Services (IDS, D&M/GSS, BDT, M-I Swaco, Well Services, Wireline, and SIS as an integrator) on a rig contracted by Orion during the 2014 5-well campaign, as well as for the 2015/2106 Drilling 6-well campaign. All of these wells were drilled in 4 marginal fields: Ocano, Peña Blanca, Eno and Ron.

2014 Drilling Campaign

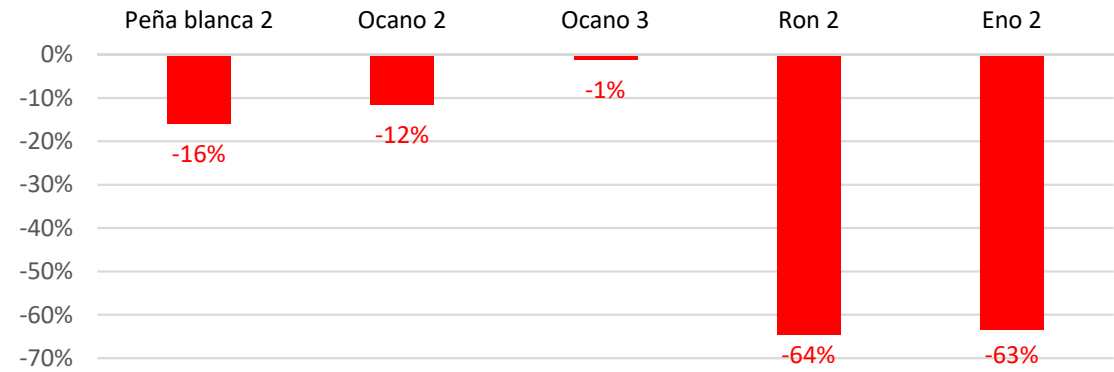


First wells drilled at the field.

S type wells
Integrated IPM services with all the SLB segments
4 different fields on the block 52 and 54



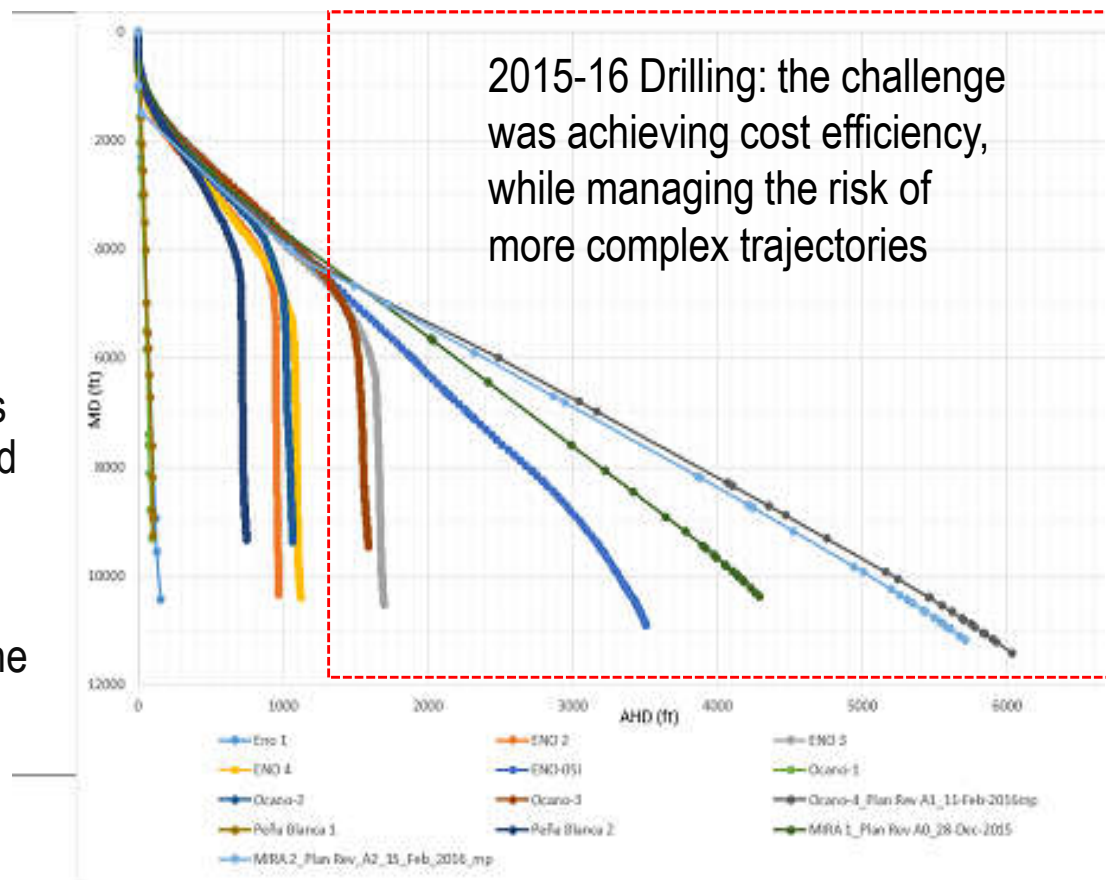
Efficiency ORION - 2014



Learning curve? → Something new needed to be done for future drilling

2015-16 Drilling Campaign

- The contractual model transferred risk to the technological partner (Schlumberger), which took control of all the operations, excluding the drilling rig
- Orion sought alignment through a lump sum model with a risk premium, where all benefits from efficiency and optimization would reward Schlumberger
- Through this alignment, Schlumberger has the incentives to deploy best-in-class execution, while Orion had peace of mind in cost and execution, achieving faster time-to-market of production.



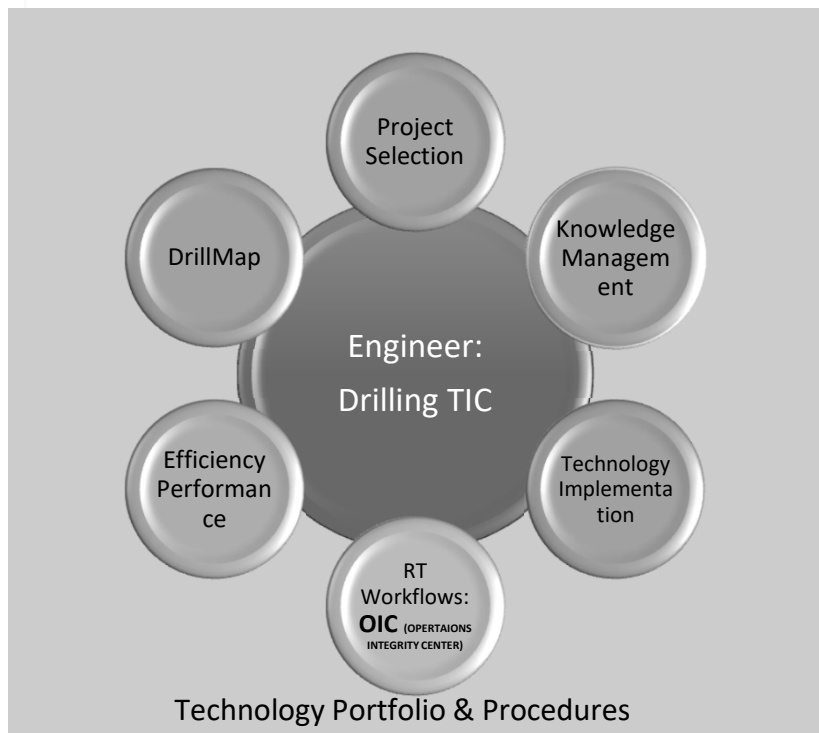
What NEXT meant for Orion...



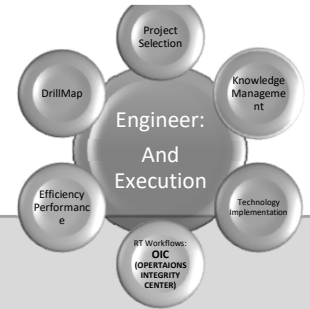
Mission: fit-for-purpose technical solutions for increased and consistent performance through efficiency, operational optimization, risk management and maximizing production

How **Software Integrated Solutions (SIS)** took part:

1. TECHLOG as the unique Platform: integrate all product lines information during planning, execution and lessons learned
2. Stablish process and workflows and also established the integrated tasks and regular meetings.
3. Added Drilling-Geomechanics fit for purpose support.
4. Execution Monitoring (InterACT, Techlog RT and DPA module)
5. KPI to well performance to monitor NPT (no productive time) and ILT (Invisible Lost Time)
6. Use Rig Hour to avoid ILT and accelerate the learn curve.



Main Workflows



Planning



- DrillMap-P (Geomechanics and Risk analysis - Drilling + G&G)
 - Drilling
 - Tripping
 - Casing Run
 - Cementing

- Technology Analysis (fit for purpose)
- Rig sizing
- Casing Design

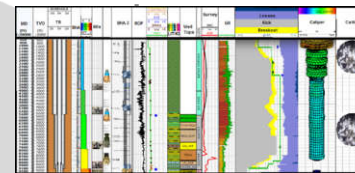
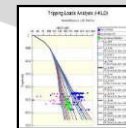
Execution

Rig Information - InterACT



Data Analysis

- Techlog
- Perform View
- Rig Hour

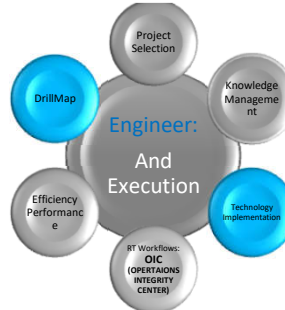


Deliver Value

- Look-Ahead
- Procedural Adherence
- KPIs - Rig Hour
- Lessons Learned (Techlog)
- DrillMap Updated



Integrated DRILLMAP example



RiskMAP POZO Ocano-04 Sección 8 1/2"

Localización

OCANO-04 Coordenadas
 PSAD56 * DMA-Ecu / UTM zone 18S
 LAT: N 0° 9' 4.02143"
 LONG: W 76° 29' 11.84577"
 Y NORTH: 10,016,708,82 m
 X EAST= 334,551,360 m

Prognosis Geológica

Comments	MD (ft)	Incl (°)	Asen Grad (°)	TVD (ft)	YVD98 (ft)
Corte 21	10540.07	33.72	148.94	781	7920.00
Zona Arenisca M-2	10567.92	35.81	148.94	860.78	7716.00
Corte 22	10701.48	34.43	148.94	1007.78	7511.00
Arenisca Superior	10796.72	34.64	148.94	878.78	7635.00
Corte 23	10854.18	34.00	148.94	878.78	7635.00
Arenisca inferior	10936.18	34.00	148.94	878.78	7635.00
Corte 24	11039.92	33.37	148.94	891.78	8020.00
T Superior (C-1)	11063.84	33.22	148.94	896.78	8065.00
Arenisca inferior	11183.34	33.65	148.94	901.78	8128.00
Corte 1 inferior	11200.01	32.99	148.94	911.78	8173.00
T Inferior - PT	11418.35	31.10	148.94	936.78	8550.00

Parámetros de Perforación

BROCAS FORMACIÓN	MSI616MUBPXX NAPO / HOLLIN
INTERVALO (ft)	10460 - 11418
GALONAJE (gpm)	380 (420 Hollin)
RPM	60-80
WOB (kibs)	0-20
Presión diferencial rotando (psi)	300
Presión diferencial deslizando (psi)	100 - 200
TFA	0.663 (6x12)

Esquema de Brocas

DIAM	BROCA	ADC	JETS - TFA	INTERVALO (MD)	FORMACION	LITOLOGIA	ESTRUT. DE CORTE
8 1/2"	MSI616MUBPXX	M233	0.663 in2 (6X12)	958' (10,460' - 11,418')	NAPO ARENISCA-T	Lutita, Caliza, Arenisca,	

BHA's

BHA #8 Intervalo: 10460'-11,418'

Drilling TIC Ocano-04 RiskMAP

Intervalo (ft)	Descripción de los Riesgos	FORMAS PROBABLES CONSECUENCIAS	Nivel de Peligro	Medidas Preventivas	Medidas de Mitigación	RACI
10460 - 10540	Traslapo de brocas	Traslapo de brocas	Alto	Verificar el estado de las brocas antes de bajar a fondo de pozo.	Controlar el tiempo de rotación de las brocas y verificar el estado de las brocas antes de bajar a fondo de pozo.	Operario
10540 - 10700	Rotación de la broca	Rotación de la broca	Alto	Verificar el estado de la broca antes de bajar a fondo de pozo.	Controlar el tiempo de rotación de la broca y verificar el estado de la broca antes de bajar a fondo de pozo.	Operario
10700 - 10850	Rotación de la broca	Rotación de la broca	Alto	Verificar el estado de la broca antes de bajar a fondo de pozo.	Controlar el tiempo de rotación de la broca y verificar el estado de la broca antes de bajar a fondo de pozo.	Operario
10850 - 11000	Rotación de la broca	Rotación de la broca	Alto	Verificar el estado de la broca antes de bajar a fondo de pozo.	Controlar el tiempo de rotación de la broca y verificar el estado de la broca antes de bajar a fondo de pozo.	Operario
11000 - 11180	Rotación de la broca	Rotación de la broca	Alto	Verificar el estado de la broca antes de bajar a fondo de pozo.	Controlar el tiempo de rotación de la broca y verificar el estado de la broca antes de bajar a fondo de pozo.	Operario
11180 - 11200	Rotación de la broca	Rotación de la broca	Alto	Verificar el estado de la broca antes de bajar a fondo de pozo.	Controlar el tiempo de rotación de la broca y verificar el estado de la broca antes de bajar a fondo de pozo.	Operario
11200 - 11418	Rotación de la broca	Rotación de la broca	Alto	Verificar el estado de la broca antes de bajar a fondo de pozo.	Controlar el tiempo de rotación de la broca y verificar el estado de la broca antes de bajar a fondo de pozo.	Operario

Ubicación del Pozo

Propiedades de Fluidos

Recomendadas

Densidad (lbg)	10.0-10.1 (10.2)
Sólidos (% by Vol)	< 10.0
PV (cP)	24 - 30
YP (lbg/100 pie3)	30 - 36
Filtrado API (cm3/30min)	< 4.8
Ca+1 (mg/L)	100 máx.
MBT (lbg/bbl equiv.)	< 7.5
Viscosidad de Embudo	50-60

Densidad de Fluido

MD (ft)	MW (ppg)
10,460	10
10,798	10
10,934	10.1
11,418	10.1

Vista del Perfil Direccional

Matriz de Riesgo

Flujo de Decisión para Concentraciones de LCM*

*ACARP As low as reasonably practicable
 R. Responsable de Riesgo
 E. Responsable de Evitar Lucha
 C. Consultado (depende)
 I. Informado

Fig. "Toma de decisiones para concentraciones de LCM"

Look Ahead example (drilling and tripping)

- Customizable
- Picture of the day (technology fit for purpose)



- Progress
- Current Drilling Parameters
- Directional Follow Up
- Fluids properties

Figure of the day
Depends on the current/next activity

- Current/plan information
- Next 24 hours

Schlumberger Drilling TIC - Operational follow up Well-XX

Date: 4/20/16 Report # 10 Section: 0.5 Activity: Viaje

Operational Summary (24h)

Progress	BHA #	Total depth (ft)	Current MD (ft)	Drilling Hours	Tripping Hours	Casing Run Hours
Last 24 hours	0.10	0.04	3R			

Drilling Parameters PLAN

Parameter	Min	Max
V/OB (Kb)	2	25
Torque (Kb-ft)		24
RPM (rpm)	50	80
GPM (gpm)	350	420
ROP Prom (ft/hr)	30	
ROP Hets (ft/hr)	40	
Precision (p-3)		1800
Densidad (ppg)	10.2	10.5
ECD (ppg)	10	14
HSI (hhp/in ²)	0.33	1.1
YP	30	36
VP (cP)	26	32
FH (lb/100ft)	50	65
BG gas (%)		1.2
Filtrado (cc/300 min)		4.8
MBT (lbbl equiv)		7.5
Cs+ (ppg)		100

Last Survey

MD	TVD	Inc	Az	DLS	Ce-Ce	VD	ARVAB	FF	S&S
10335	9255.44	24	43.5	0.25	4.01	3.951	0.66 AB		

Data transmission

p	ECD	YP	VP	FH	MBT	Filtrado	Cs+
100%	10.3	10.7	32	26	61	2.5	4.8

Current Operation

-POOH BHA # 3R at 740ft

Comments of today

- Spotted 70 Ebls pill (3% lubricant)
- POOH BHA #3R without problems

Next Operations (24 hours)

-RH 7in Liner

24 hr Activity breakdown

Activity	Time (h)
Pre-JOB Safety Meeting Run 7" Liner	0.5
Rig up tools for 7" Liner	2
RIU and run 7" Liner	8
RIU Liner Hanger Assembly	3
Circ Liner volume, RD Cog tools	1
RH Liner with DP	15

Risk 24 hours

- Restrictions found while running liner
- Partial or total losses while running liner

Prevention Measurements

- Monitor the tight holes identified in previous trips and while logging (GSS)
- Identify the potential restriction using the 4 arm caliper
- RH with continuous circulation
- Monitor shakers and mud volume

Mitigation Measurements

- Reciprocate circulate to pass a restriction
- Before taking any decision, please communicate with the office team to coordinate with the team evaluation (MOC)
- In case of a strong restriction, evaluate with the DrillingTIC the possibility of POOH the Liner and perform a wiper trip.

Comments/General recommendations

- Attached you can find the caliper 3D with all events faced during this section trips (overpull, backreaming, stuck-pipe)
- Special attention to the interval from 3850ft to 3930ft MD (Fig)
- Please consider all the recommendations listed in the Liner Run Program previously send by the Drilling-TIC.

Plan Drilling Parameters

Current operation Comments of the day Next 24hr

24 hr Activity breakdown

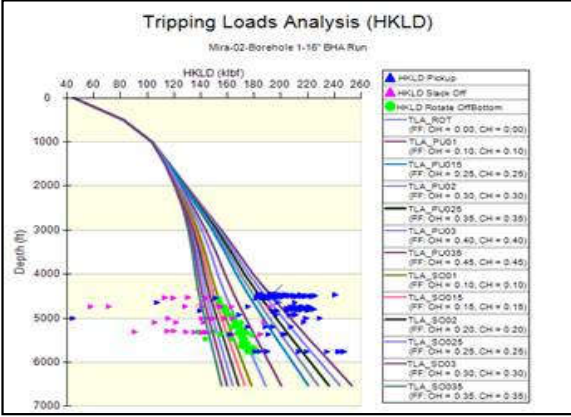
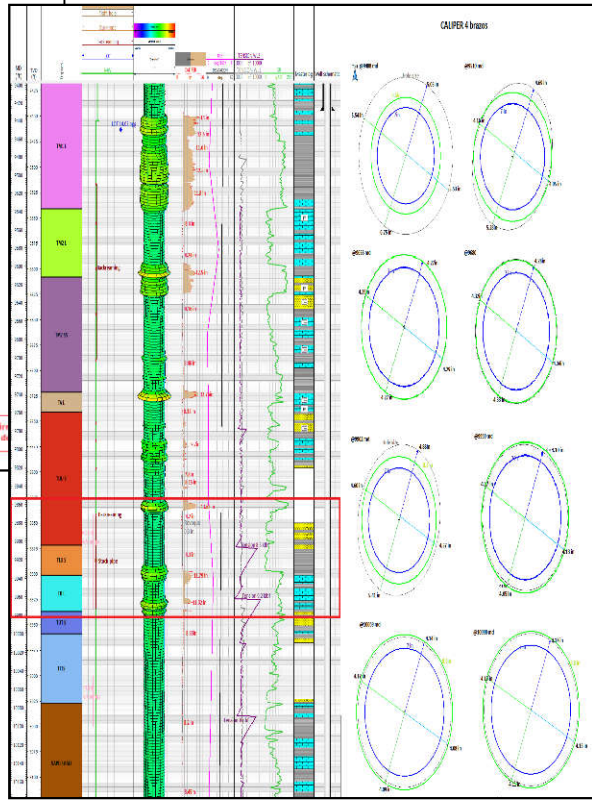
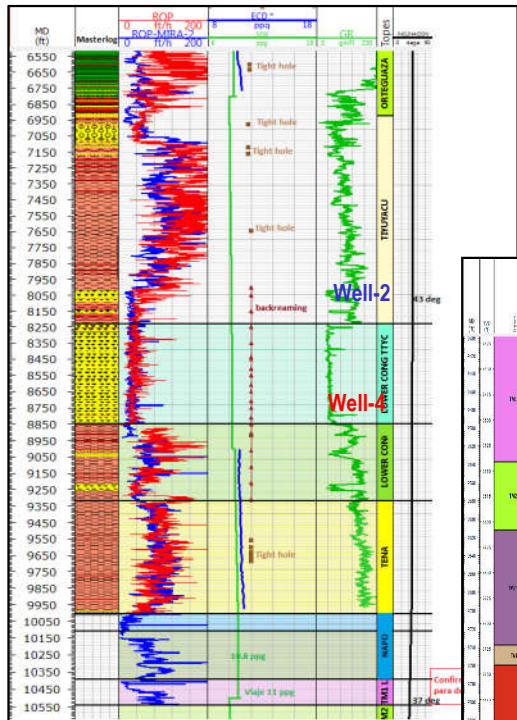
Risk, Prevention and Mitigation measurements and Comments

Data Monitoring (follow-up)

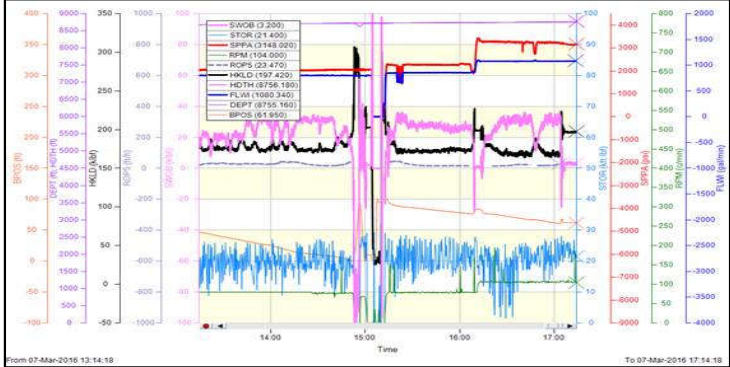
ROP performance (comparison in real time or post-drilled)



Borehole Shape Analysis (LWD)

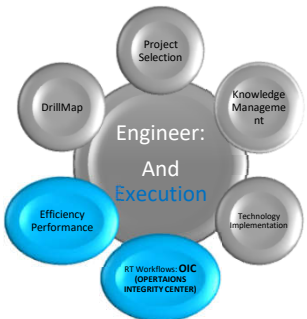


- Tripping
- Casing Run

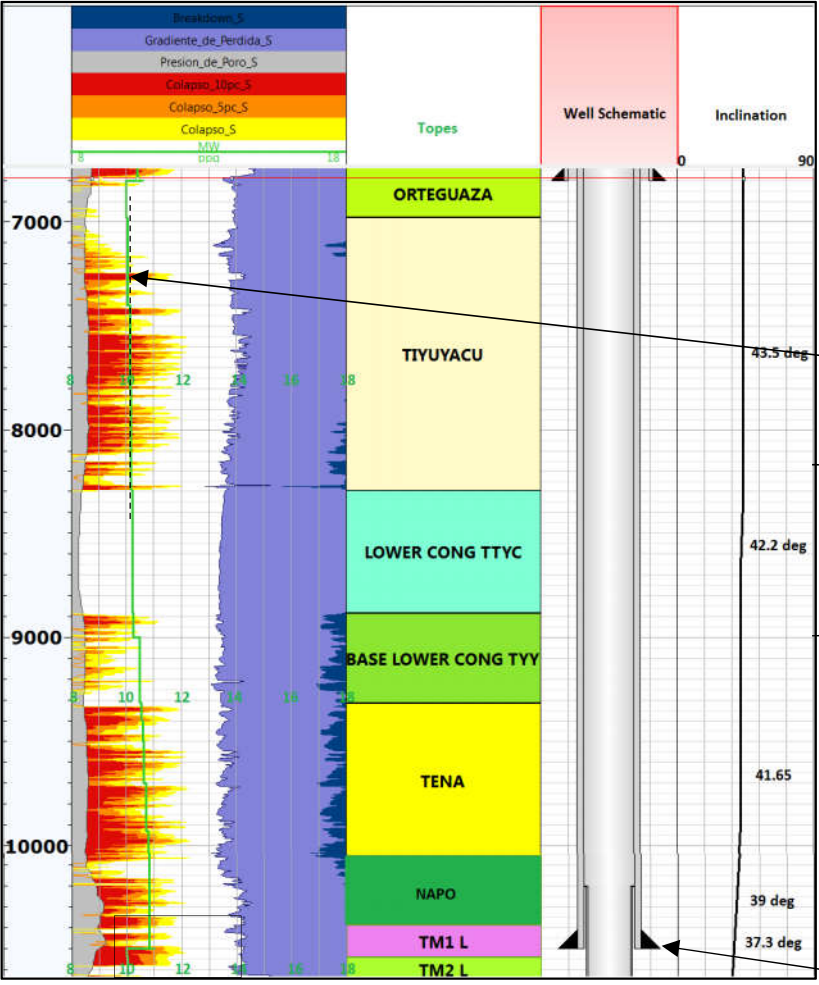


From 07-Mar-2016 13:14:18 To 07-Mar-2016 17:14:18

Geomechanics Integration for taking decisions (Follow-up)



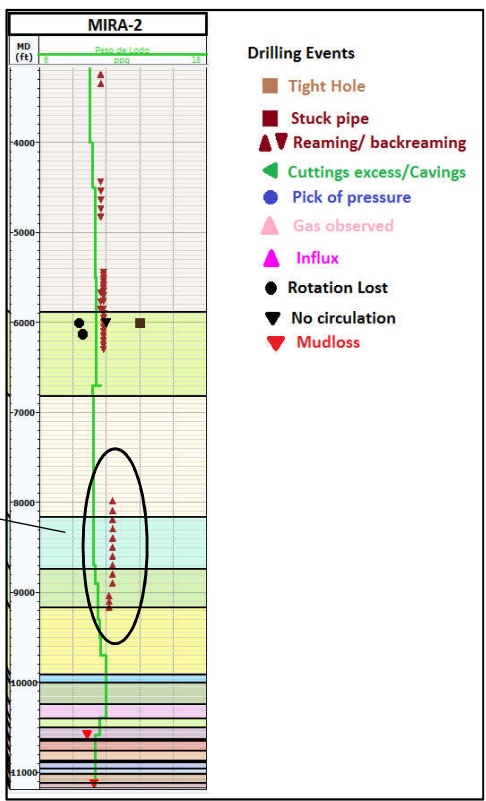
OCANO-4
12 1/4 in Section



10% DoD used for the MW design @ this section finishes with 10.8 ppg. No problems to correlate w/Mira-2 well ...

Engaged borehole expected

The lower the better

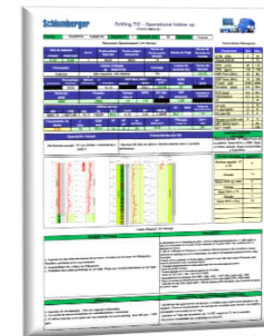
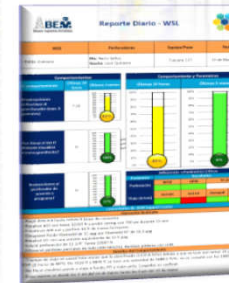
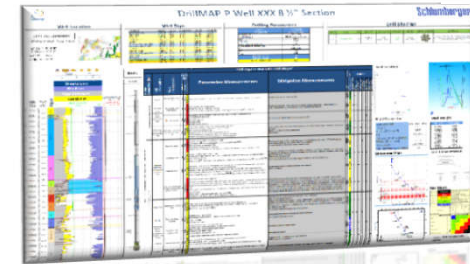
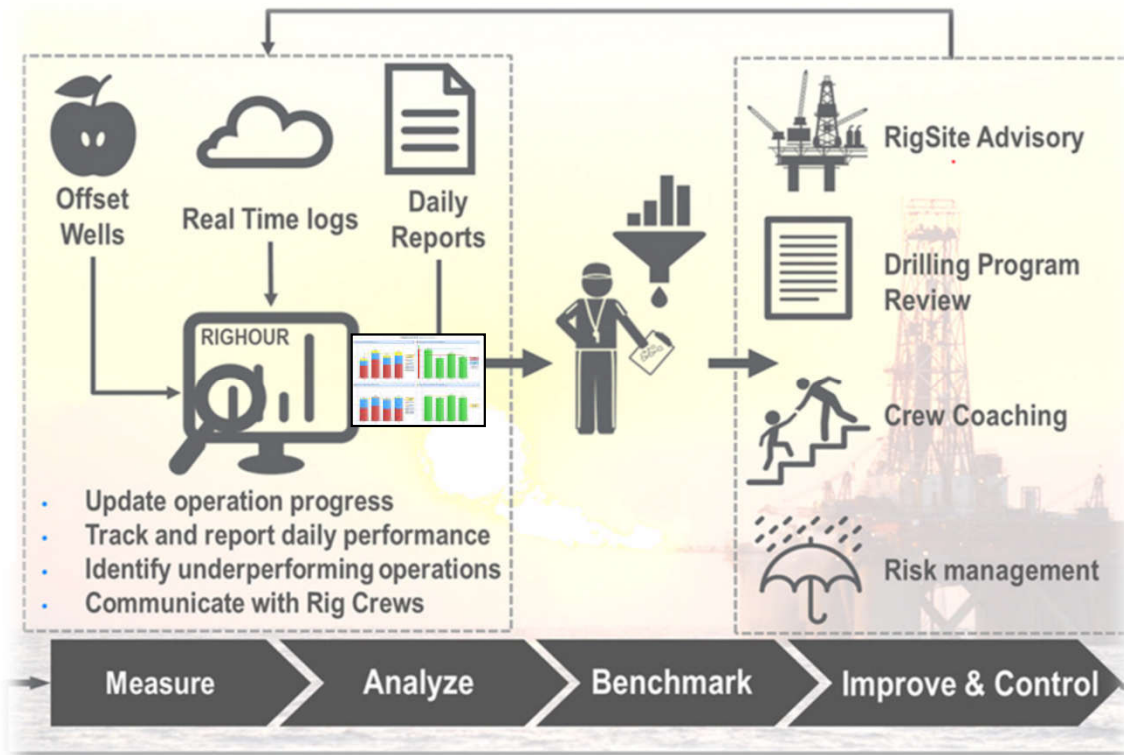


Benchmark and KPIs/ KPOs Monitoring

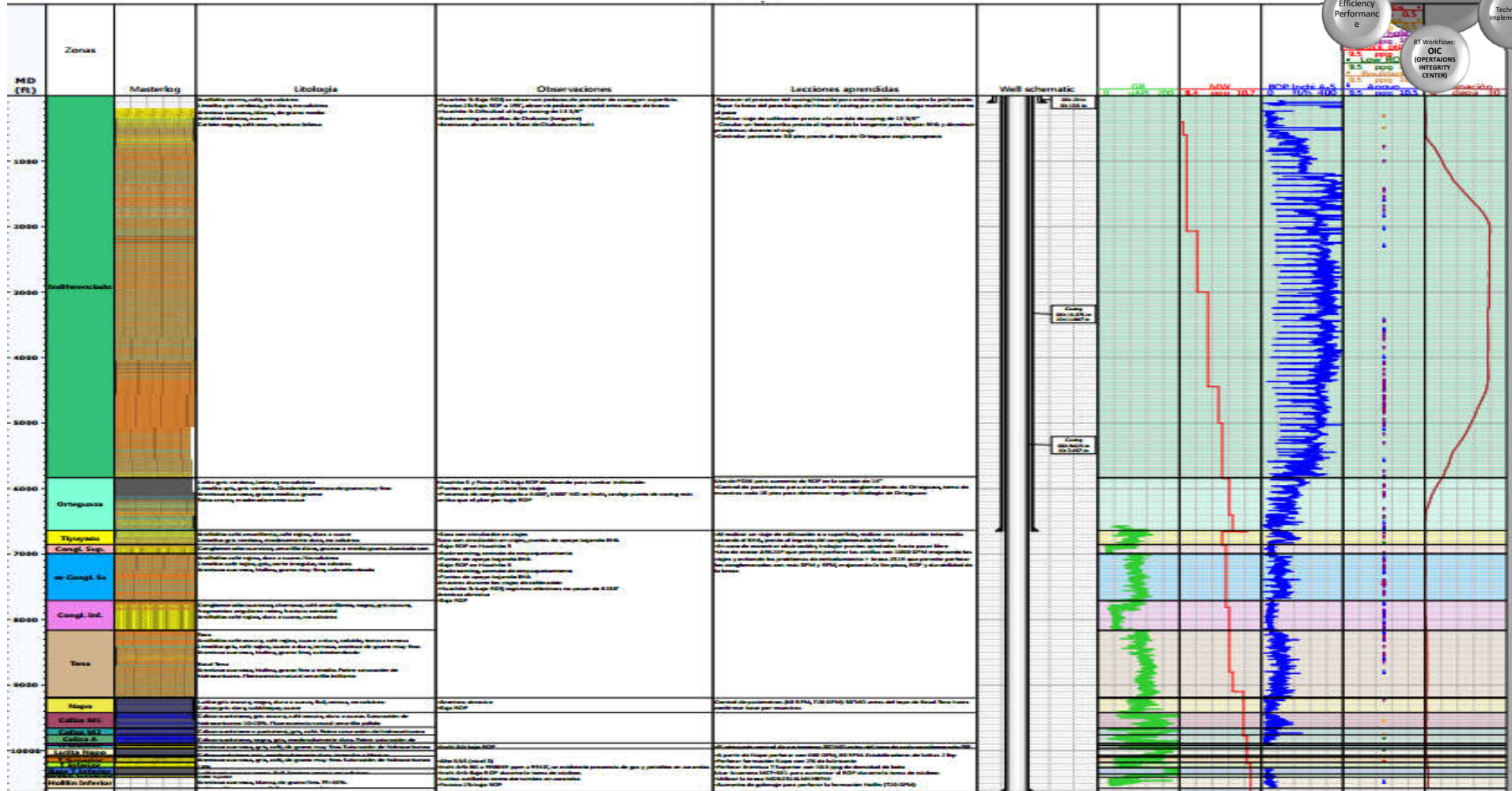
Tracking ORION - KPI's

	KPI's	Reference	Eno-3		Eno-4		Eno-5		Mira-1		Mira-2		Ocano-4	
			Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
	1. Execution													
All Segments	NPT SLB Hours per well = 0	Y= 10 N= 0 N/A	0	0%	0	0%	10	4%	0	0%	10	4%	5	2%
All Segments	HSE incidents per well = 0	Y= 10 N= 0 N/A	10	4%	10	4%	0	0%	10	4%	10	4%	10	4%
Direccional	DLS (degrees / 100 ft) in 3 consecutive readings. REAL DLS <= Planned DLS + 2.5 degrees / 100	Y= 10 N= 0 N/A	10	4%	10	4%	10	4%	10	4%	10	4%	10	4%
Direccional	Geological Target Tolerance = 60 ft diameter. Hit all targets within the tolerance	Y= 10 N= 0 N/A	10	4%	10	4%	10	4%	10	4%	10	4%	10	4%
Bits	Net ROP 16" (ft/hour) >= 100ft/hr (per section) ORION >= 100ft/fr	Y= 10 N= 0 N/A	0	0%	10	4%	10	4%	10	4%	10	4%	10	4%
Bits	Net ROP 12 1/4" Orteguaza (ft / hour) >= 70ft/ht (per formation), Net ROP 12 1/4" Tiyuyacu Claystone (ft / hour)>= 65ft/hr (per formation) and TENA (ft / hour) >= 55 ft/hr (per formation)	Y= 10 N= 0 N/A	0	0%	0	0%	10	4%	10	4%	10	4%	10	4%
Bits	Net ROP 8 1/2" (ft / hour) >= 50 ft/hour (per section)	Y= 10 N= 0 N/A	0	0%	5	2%	10	4%	0	0%	5	2%	5	2%
MI - Drilling Fluids	POOH Speed 16" (ft/hour) >= 600 ft/hr (per section)	Y= 10 N= 0 N/A	10	4%	5	2%	0	0%	10	4%	10	4%	0	0%
MI - Drilling Fluids	POOH Speed 12 /14" (ft/hour) >= 550 ft/hr (per section)	Y= 10 N= 0 N/A	0	0%	10	4%	10	4%	10	4%	10	4%	10	4%
MI - Drilling Fluids	POOH Speed 8 /12" (ft/hour) >= 420 ft/hr (per section)	Y= 10 N= 0 N/A	10	4%	10	4%	10	4%	10	4%	10	4%	10	4%
MI - Control de Sólidos	% humidity in cuttings <= 45%	Y= 10 N= 0 N/A	10	4%	10	4%	10	4%	10	4%	10	4%	10	4%
MI - Environmental Services	Tabla 7 RAOHE - Mesasured Parameters - 100% compliance	Y= 10 N= 0 N/A	0	0%	10	4%	0	0%	10	4%	10	4%	10	4%
Geoservices	Hours with No Data Transmission para equipo de Trabajo en Quito	Y= 10 N= 0 N/A	0	0%	10	4%	10	4%	10	4%	10	4%	10	4%
Geoservices	Hours with No Data Transmission para equipo de Trabajo en campo	Y= 10 N= 0 N/A	10	4%	10	4%	10	4%	10	4%	10	4%	10	4%
DT&R	Equipment Failure SQ Events = 0	Y= 10 N= 0 N/A	10	4%	10	4%	10	4%	10	4%	10	4%	5	2%
Cementing	Faliure at the Cementing Equipments = 0	Y= 10 N= 0 N/A	10	4%	10	4%	0	0%	10	4%	10	4%	10	4%
Cementing	Cementing Evaluation on the producing Zones = NO SQUEEZE Required	Y= 10 N= 0 N/A	10	4%	0	0%	10	4%	10	4%	10	4%	10	4%
Cementing	Cementing Executed by the program . Vol. Real = Vol. Program	Y= 10 N= 0 N/A	10	4%	10	4%	10	4%	10	4%	10	4%	10	4%
	TOTAL EXECUTION	64%	110	39%	140	50%	140	50%	160	57%	175	63%	155	55%
	2. Well time													
D-TICv	Actual vs plan as per approved time vs depth curve (if ahead of plan - yes =50)	Y= 50 N= 0	0	0%	0	0%	50	18%	50	18%	50	18%	50	18%
IDS - D-TIC	DDI x pie/dia >= 2200	Y= 50 N= 0	0	0%	0	0%	50	18%	50	18%	50	18%	50	18%
	TOTAL WELL TIME	36%	0	0%	0	0%	100	36%	100	36%	100	36%	100	36%
	Percentage													
	TOTAL		110	39%	140	50%	240	86%	260	93%	275	98%	255	91%

Flat Time Monitoring –Rig Hour

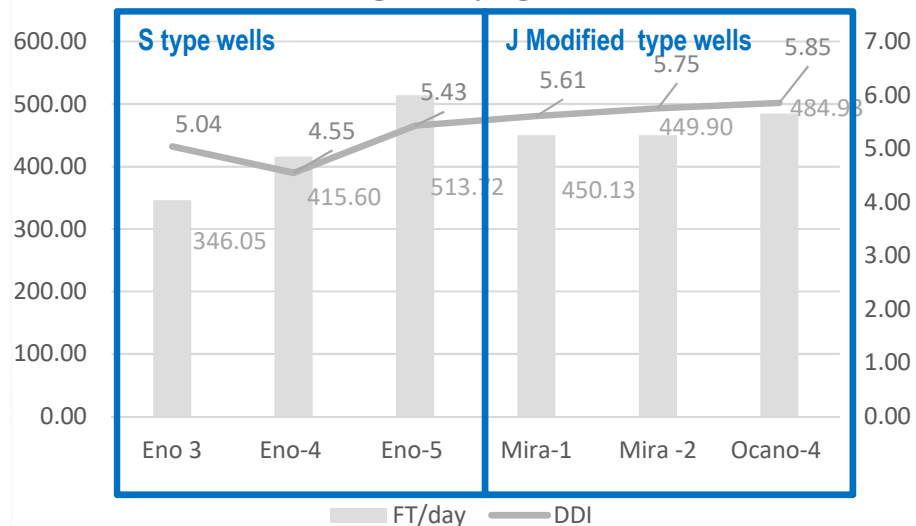


Lessons Learned → TECHLOG (data base /data management)

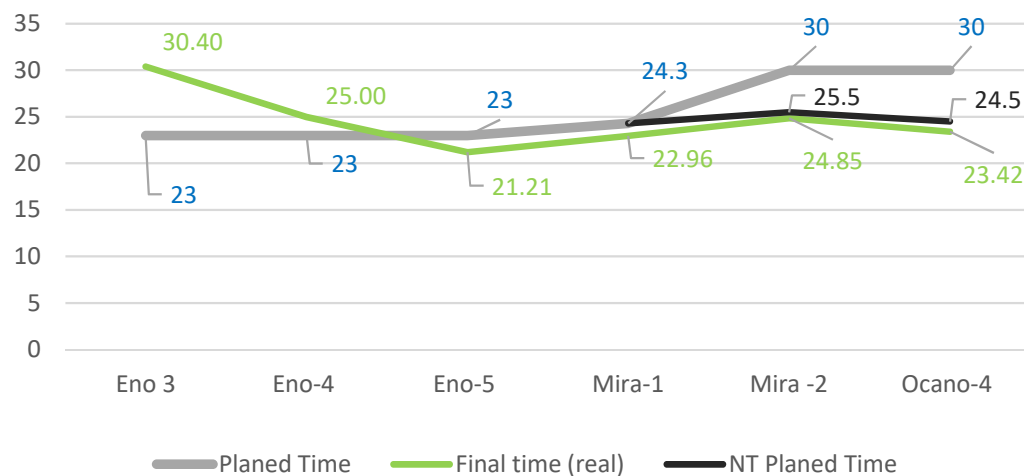


Performance and Improvement

ORION - Drilling Campagna 2015/2016



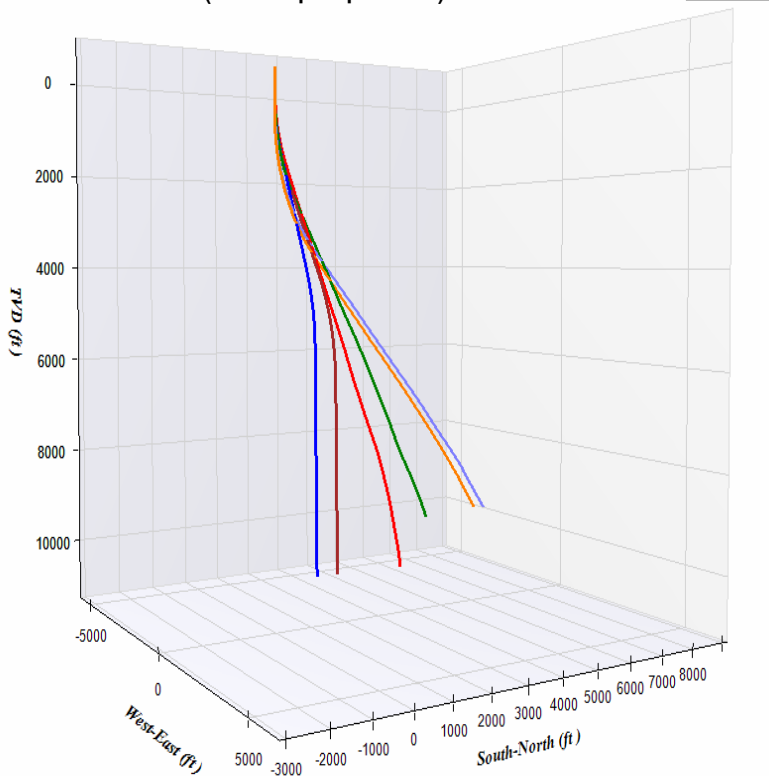
Drilling Times



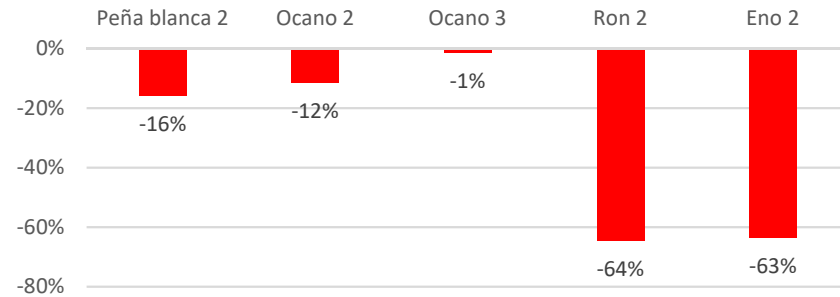
Increased the wells complexity (DDI) aside to be drilling at new part of the blocks and the performance increase as well

Drilling Performance Evolution

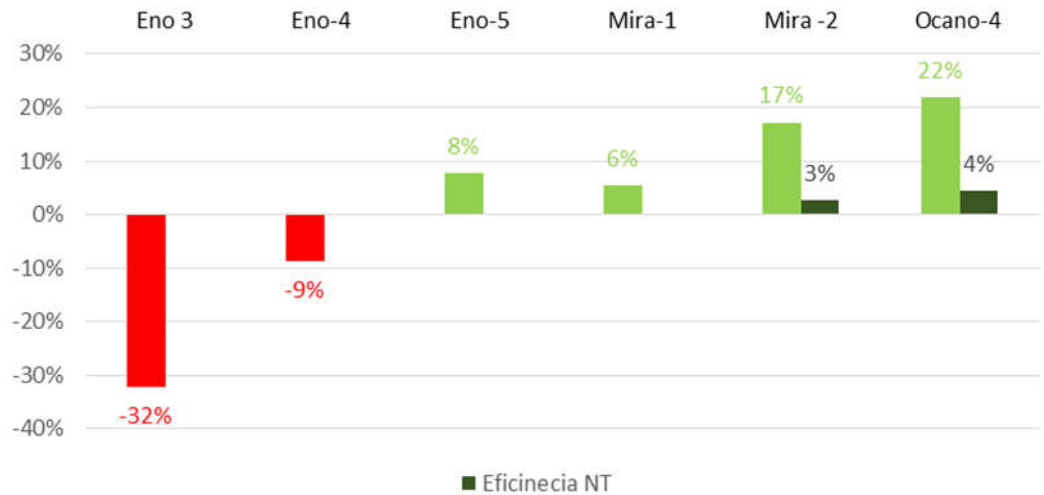
J modified well – high displacement.
Technology changed based on risk
assessment (fit for proposed): last 2 wells



Efficiency ORION - 2014



Efficiency ORION Drilling Campaign 2015/2016





Final Remarks

- Last well of the campaign: the most complex: J Modified, DDI= 5.85, Inc. of 43 degrees and displacement of 6040 ft.
- Excelled in performance: 484.93 ft. /day, 23.4 days.
- Campaign completed 5 days ahead of the plan
- After this project Techlog and Rig Hour have been implemented as part of the integrated solutions for internal and external clients in Ecuador and other Geomarkets
- Successful innovation becomes the navigational tool for “lower for longer” oil prices
- Best-in-class technological partners become essential to achieve efficiency and mitigate risks
- The technological challenge in oil field development will only become harder: basins more mature, deeper, further, tighter



So... WHAT'S NEXT?