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

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ORION Energy

Anna Paula Lougon – LAN Drilling and Geomechanics Business Owner
Schlumberger

Overview of Orion Energy

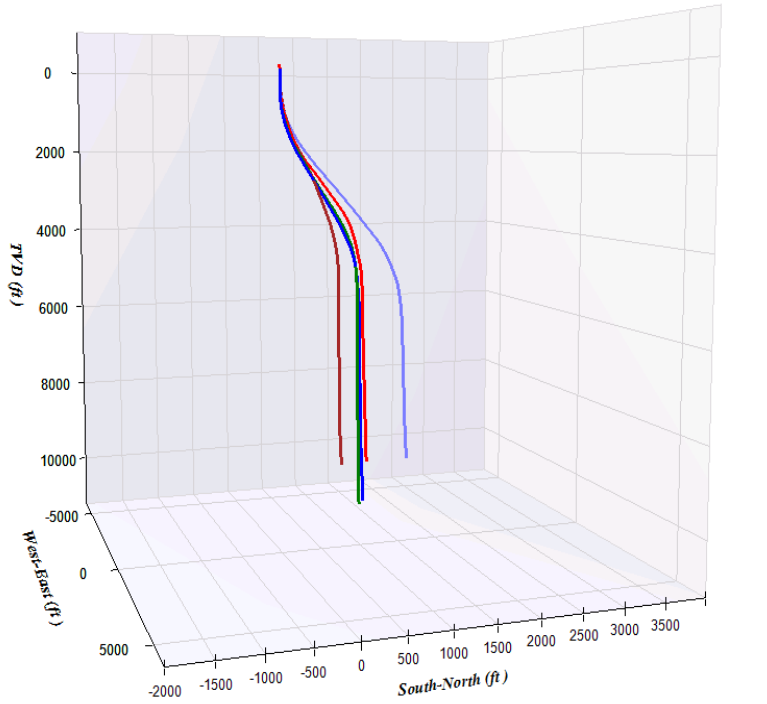
- Orion Energy is an Ecuadorian oil company operating blocks 52 and 54, both in Ecuador's Oriente Basin. Development activities in these blocks started in 2012.

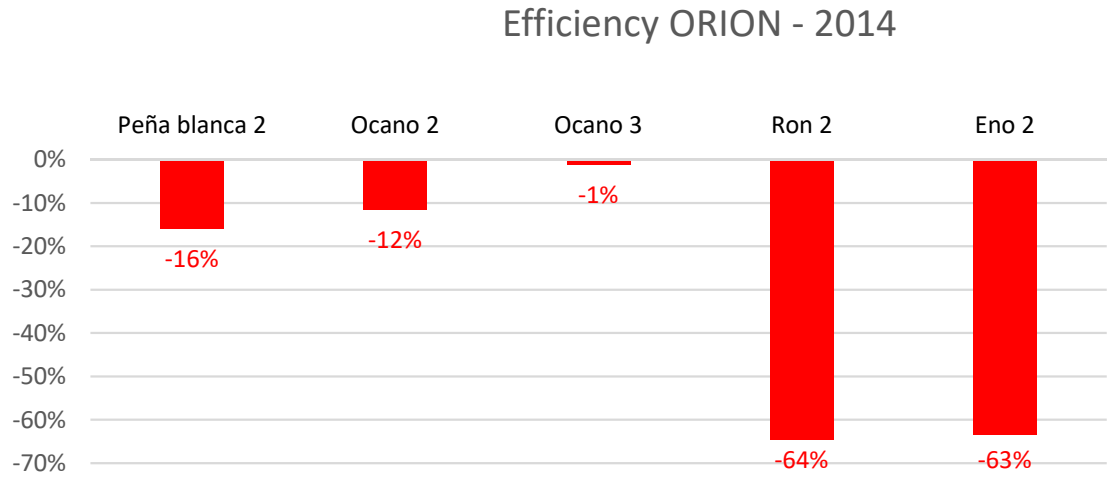
- As part of Orion's development strategy, the company relies on technological partners to develop strategic projects, seeking best-in-class solutions, risk transferring and alignment with strategic objectives of the company.

- **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





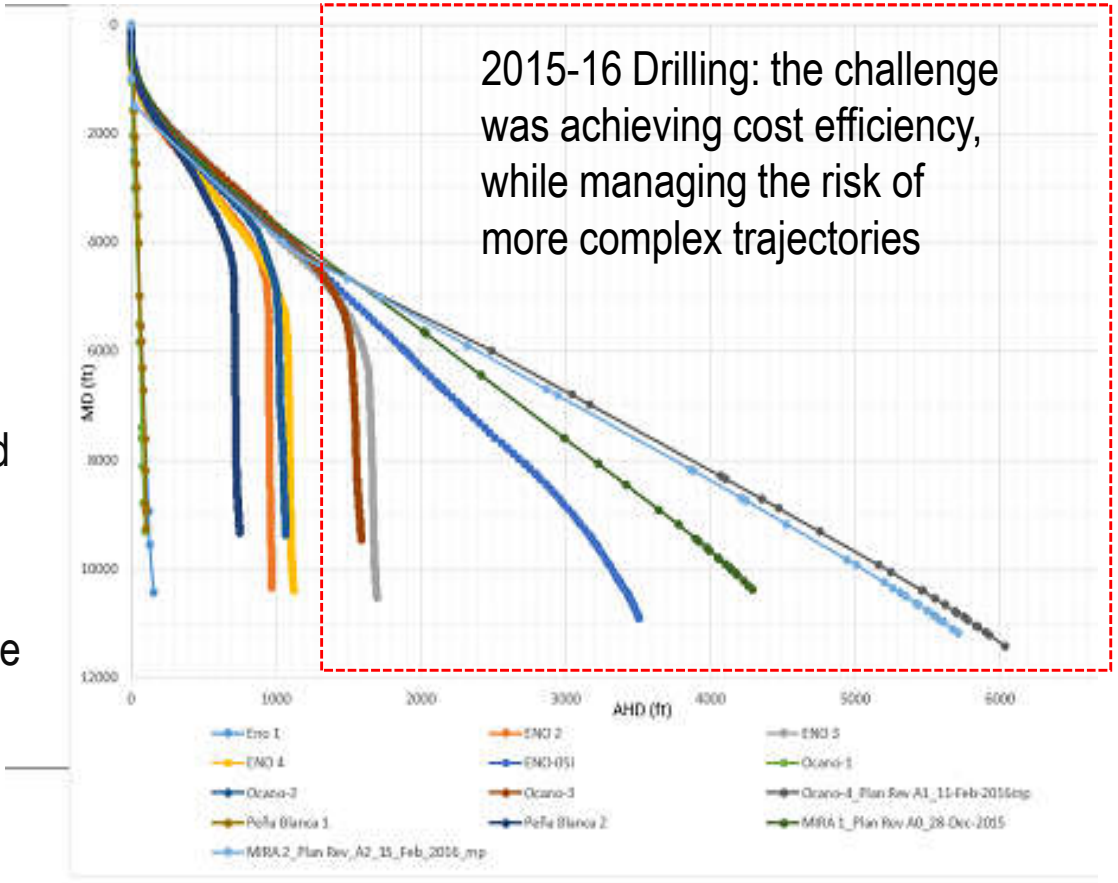
Learning curve? ➔ Something new needed to be done for future drilling

2015-16 Drilling Campaign

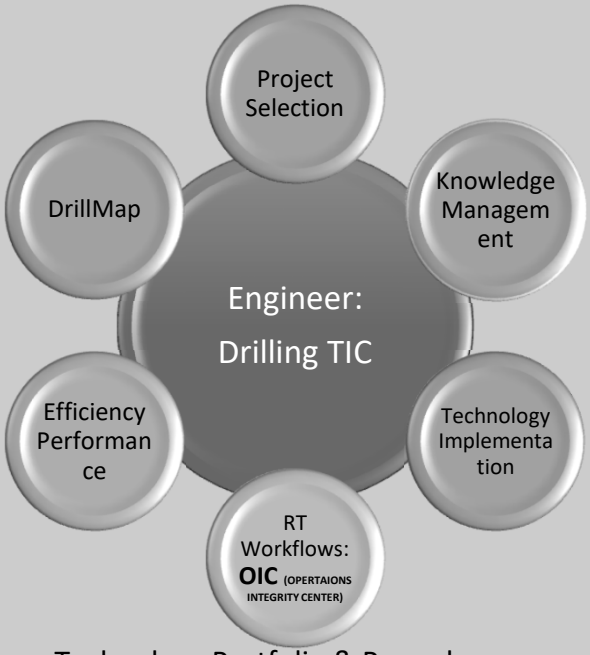
- The contractual model transferred risk to the technological partner (Schlumberger), which took control of all the operations, excluding the drilling rig

- Orion seeked 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…



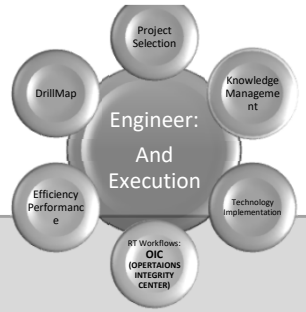
Technology Portfolio & Procedures

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

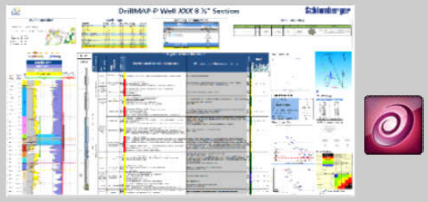
How **Software Integrated Solutions (SIS)** took part:

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



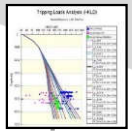
- DrillMap-P (Geomechanics and Risk analysis - Drilling + G&G)
  - Drilling
  - Tripping
  - Casing Run
  - Cementing
- Technology Anaylsis (fit for purpose)
- Rig sizing
- Casing Design

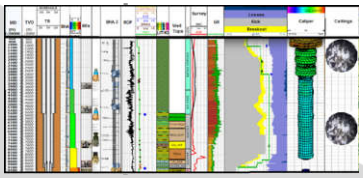
Execution

Rig Information - InterACT

Data Analysis

- Techlog
- Perform View
- Rig Hour

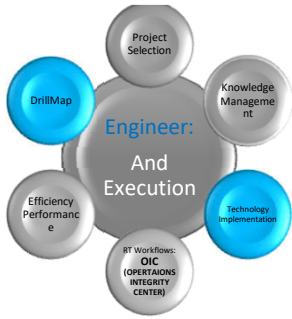




Deliver Value

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

Integrated DRILLMAP example



ORION

RiskMAP POZO *Ocano-04* Sección 8 1/2"

Schlumberger

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 (°)	Azim Grid (°)	TVD (ft)	TVDSS (ft)
Caliza M-2	10540.07	36.75	148.94	8906.78	7820.00
Zona Arenisca N-2	***10657.92***	***35.81***	***148.94***	***8991.78***	***7715.00***
Caliza A	10780.48	34.83	148.94	8701.78	7915.00
Arenisca U Superior	***10798.73***	***34.68***	***148.94***	***8716.78***	***7930.00***
EOC #2	10854.19	34.00	148.94	8757.33	7900.55
Arenisca U Inferior	***10934.18***	***34.00***	***148.94***	***8828.78***	***7942.00***
Caliza B	11039.93	33.37	148.94	8916.78	8020.00
T Superior (OS)	***11053.86***	***33.22***	***148.94***	***8936.78***	***8050.00***
Arenisca T Inferior	***11153.24***	***32.69***	***148.94***	***9011.78***	***8125.00***
Base T Inferior	11206.61	32.37	148.94	9056.78	8170.00
7" Liner - PT	**11418.25**	**31.10**	**148.94**	**9236.78**	**8350.00**

Parámetros de Perforación

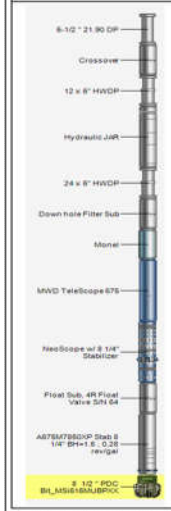
BROCAS	MSi616MUBPXX
FORMACION	NAPO / HOLLIN
INTERVALO (ft)	10460 - 11418
GALONAJE (gpm)	380 (420 Hollin)
RPM	60-80
WOB (klbs)	0-25
Presion diferencial rotando (psi)	300
Presion diferencial deslizando (psi)	100 - 200
TFA	0.663 (6x12)

Esquema de Brocas

DIAM	BROCA	IADC	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

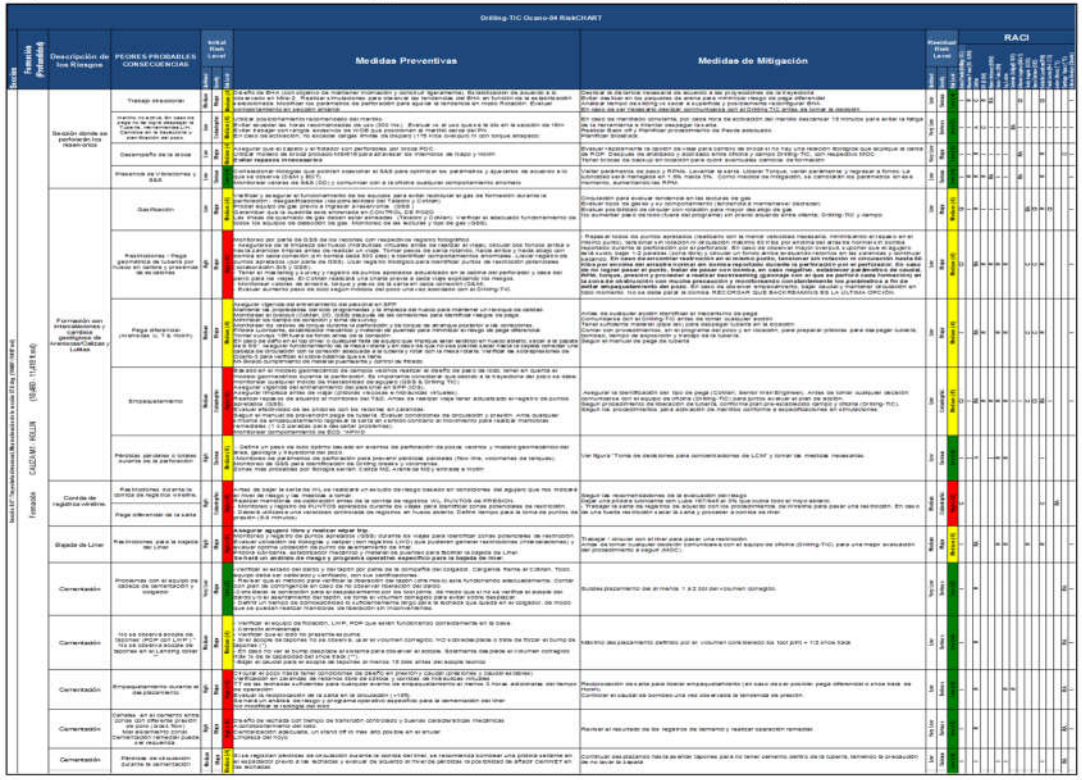
BHA #8 — Intervalo: 10460'-11,418'



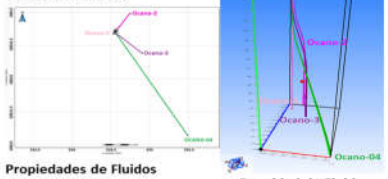
Matriz de Riesgo

*ALARP As low as reasonably possible

R- Responsable (ejecutal
A- Accountable (rinde cuentas)
C- Consultado (asesora)
I- Informado



Ubicación del Pozo



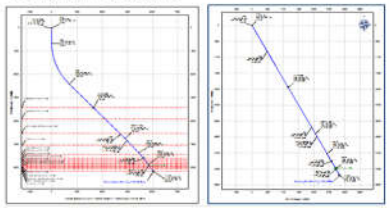
Propiedades de Fluidos Recomendadas

Densidad (lpg)	10.0-10.1 (10.2)
Sólidos (% by Vol)	< 10.0
PV (cP)	24 -30
YP (lbs/100 pie2)	30 - 36
Filtrado API (cm3/30min)	< 4.8
Ca++ (mg/L)	100 máx.
MBT (lbs/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



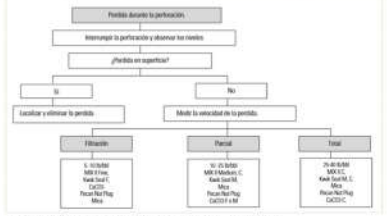
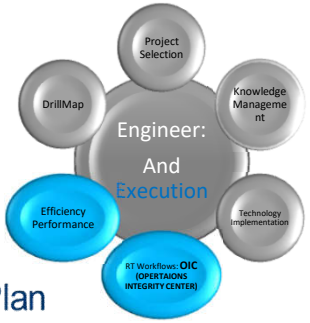


Fig. "Tomo de decisiones para concentraciones de LCM"

Look Ahead example (drilling and tripping)

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



Progress

Current Drilling Parameters

Directional Follow Up

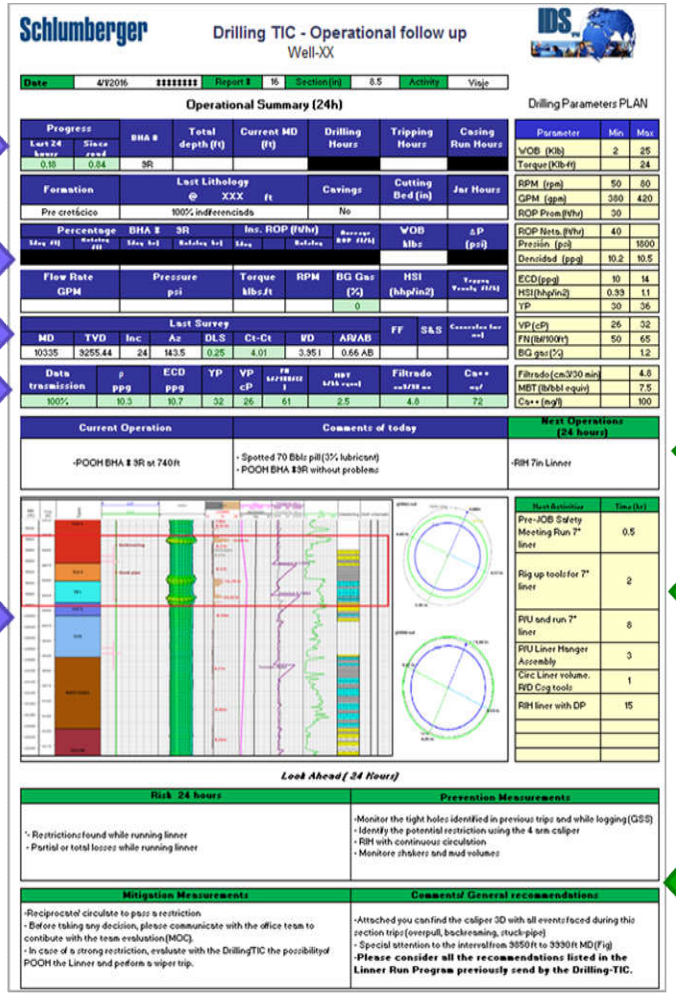
Fluids properties

Figure of the day

Depends on the current/next activity

Current/plan information

Next 24 hours



Plan Drilling Parameters

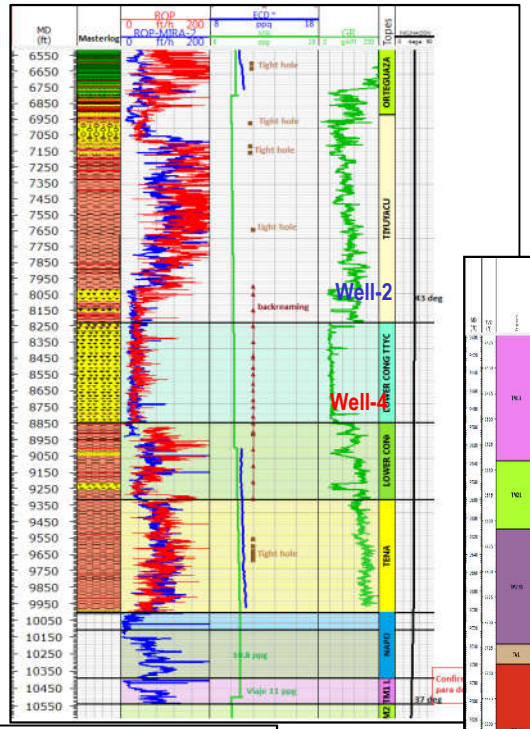
Current operation
Comments of the day
Next 24hr

24 hr Activity breakdown

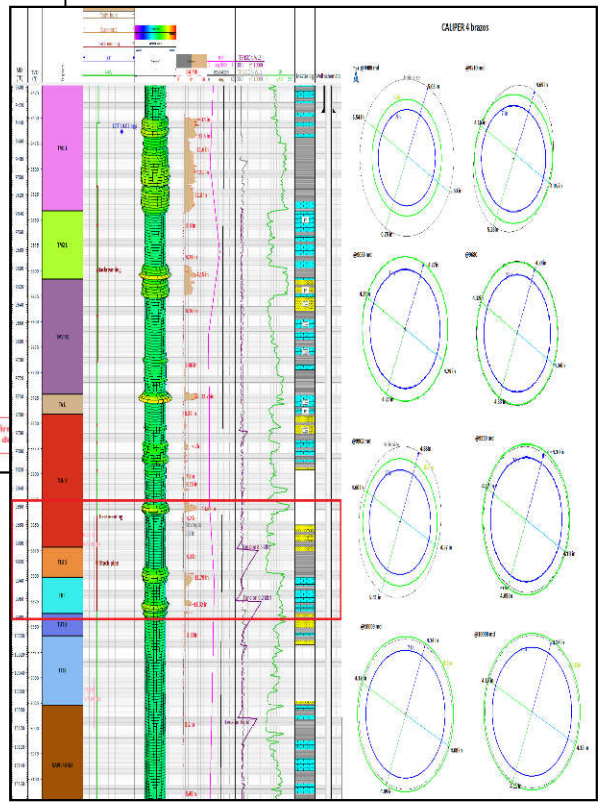
Risk, Prevention and Mitigation measurements and Comments

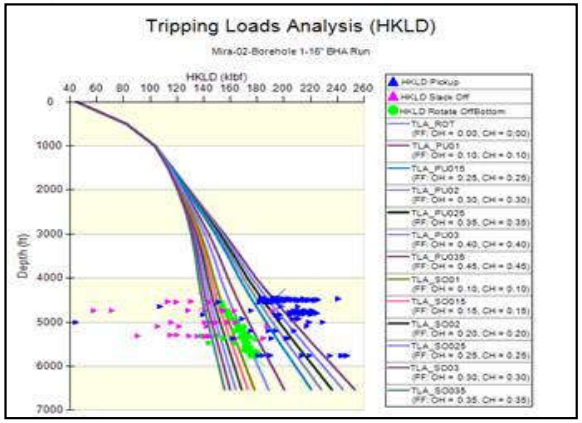
Data Monitoring (follow-up)

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

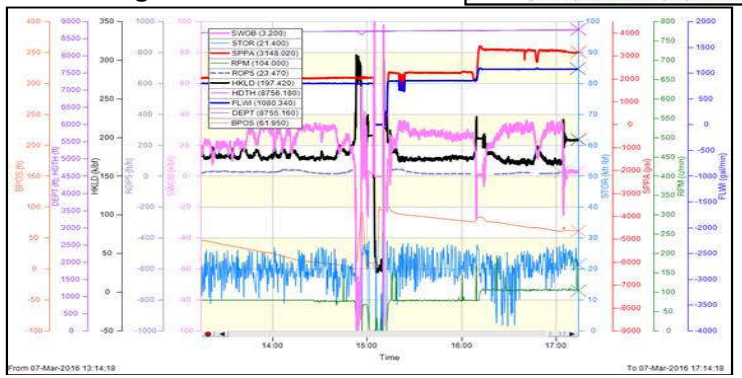


Borehole Shape Analysis (LWD

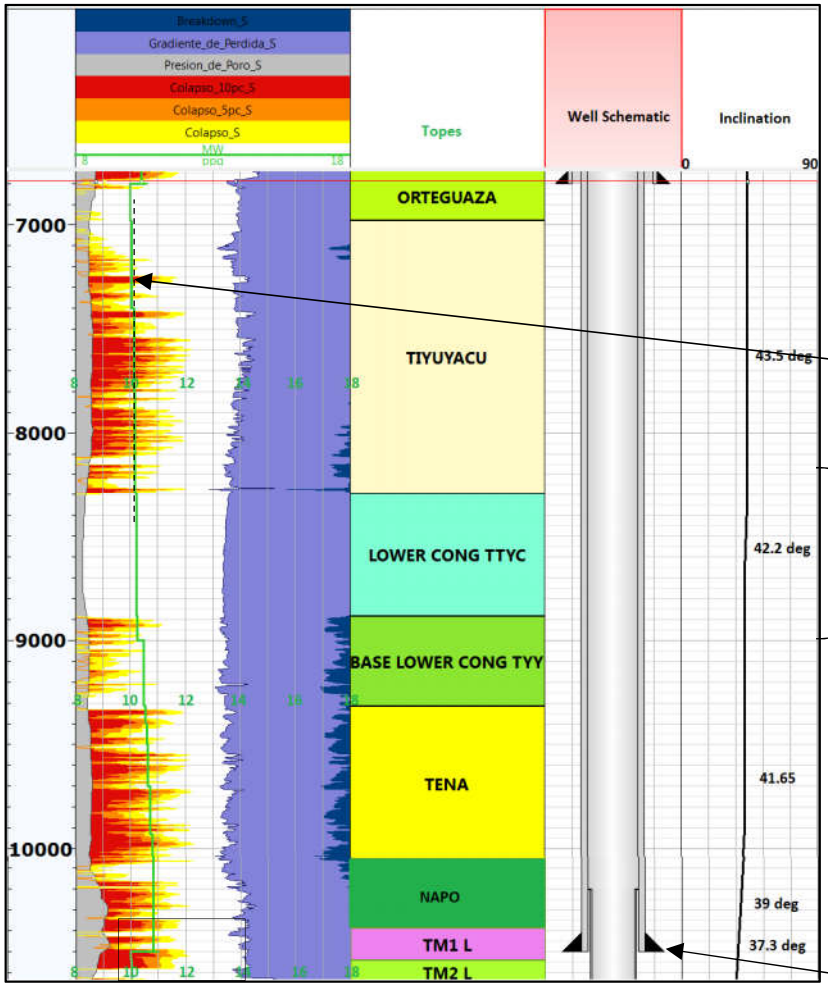




- Tripping
- Casing Run



Geomechanics Integration for taking decisions (Follow-up)

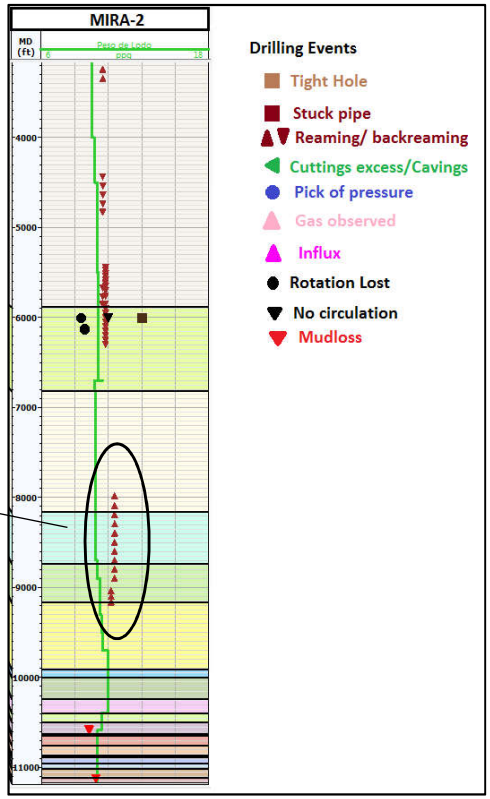


OCANO-4
12 1/4 in Section

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

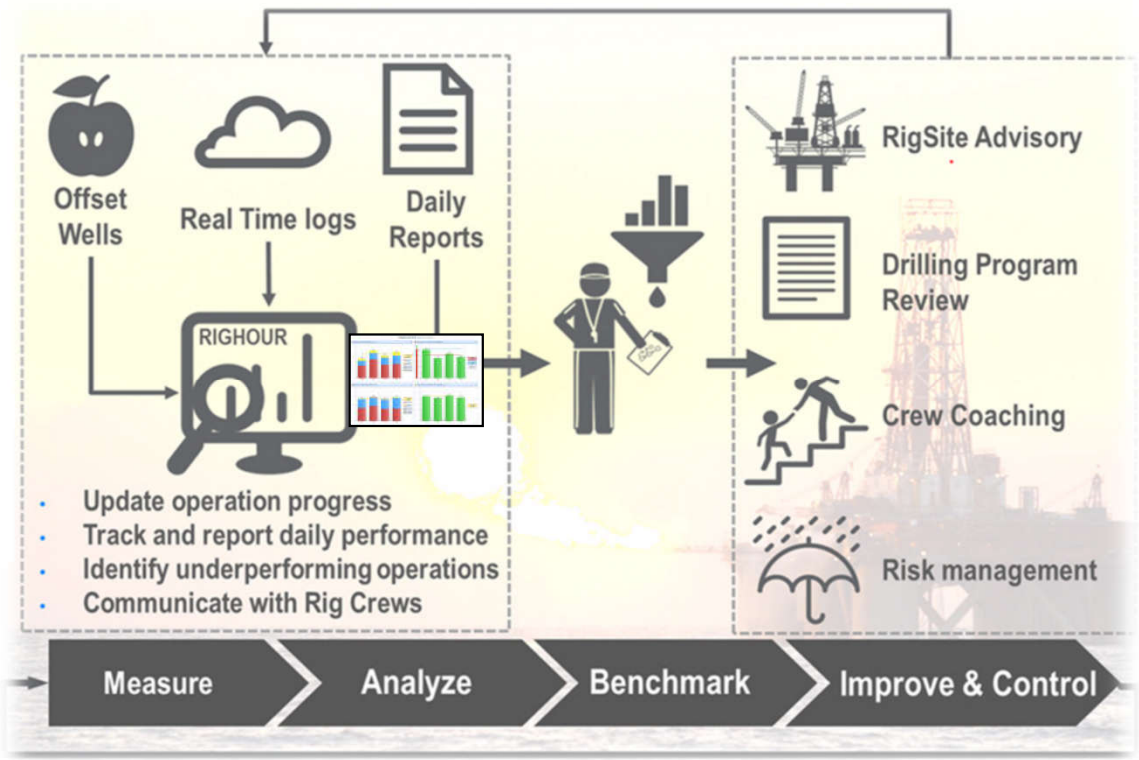


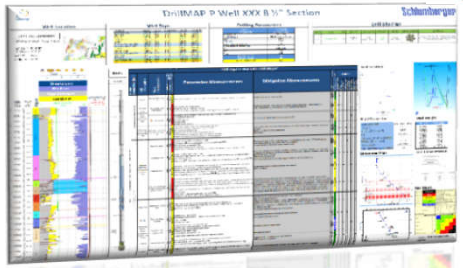
Benchmark and KPIs/ KPOs Monitoring

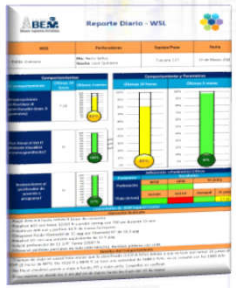
Tracking ORION - KPI's

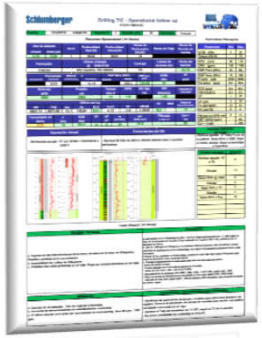
	KPI`s	Reference	Eno-3		Eno-4		Eno-5		Mira-1		Mira-2		Ocano-4	
	1. Execution		Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
All Segments	**NPT SLB Hours per well = 0**	Y= 10 N= 0 N/A	0	0%	0	0%	10	4%	0	0%	10	4%	5	2%
All Segments	**HSE incidents per well = 0**	Y= 10 N= 0 N/A	10	4%	10	4%	0	0%	10	4%	10	4%	10	4%
Direcional	DLS (degrees / 100 ft) in 3 consecutive readings. REAL DLS <= Planned DLS + 2.5 degrees / 10	Y= 10 N= 0 N/A	10	4%	10	4%	10	4%	10	4%	10	4%	10	4%
Direcional	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 Solic	% humidity in cuttings <= 45%	Y= 10 N= 0 N/A	10	4%	10	4%	10	4%	10	4%	10	4%	10	4%
MI - Enviromental Sc	Tabla 7 RAOHE - Mesaured Parameters - 100% complience	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	Equipament 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

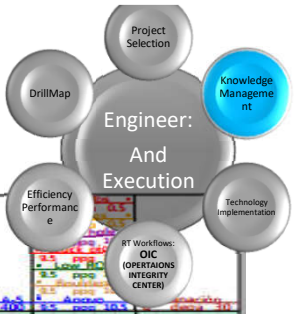


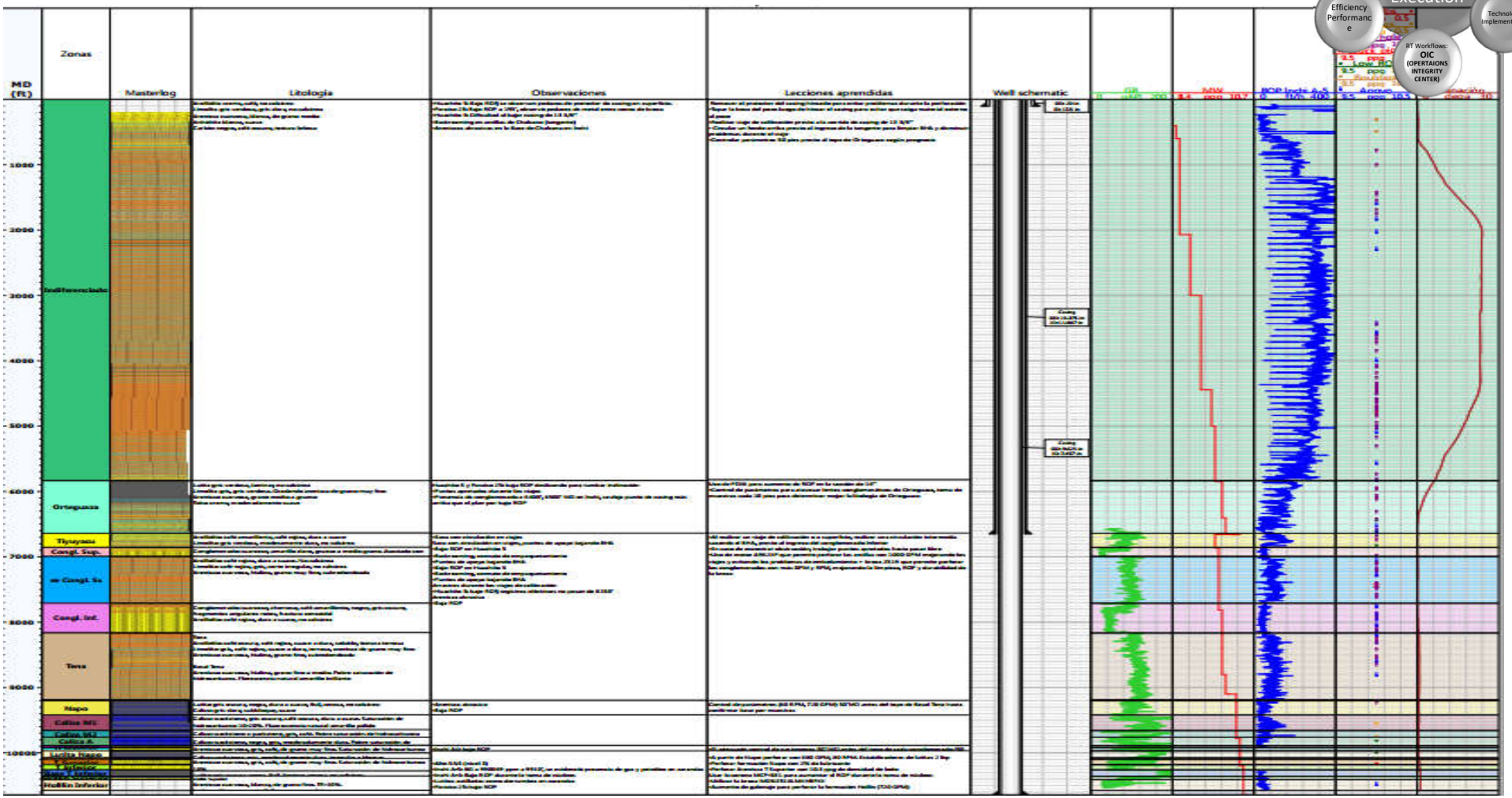




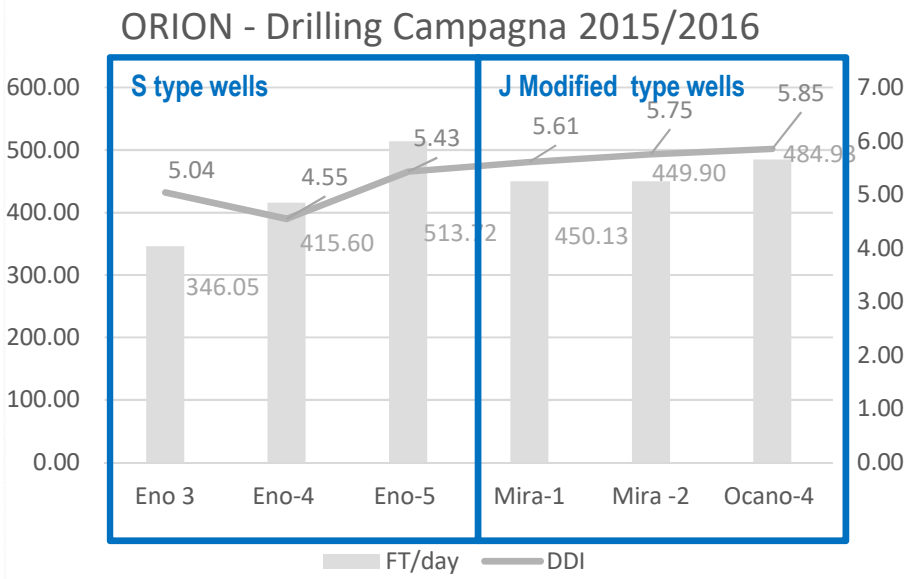


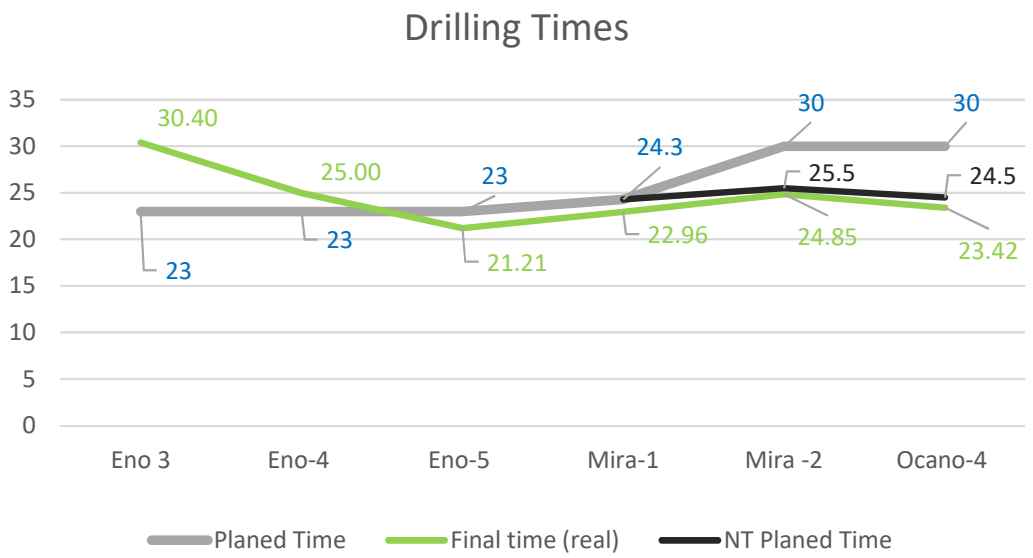
Lessons Learned ➔ TECHLOG (data base /data management)





Performance and Improvement

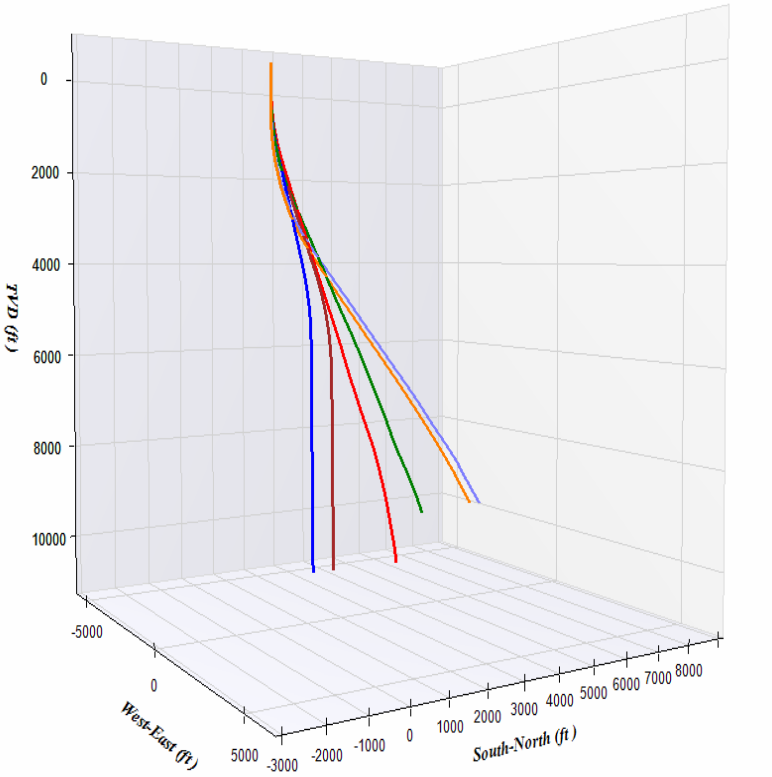


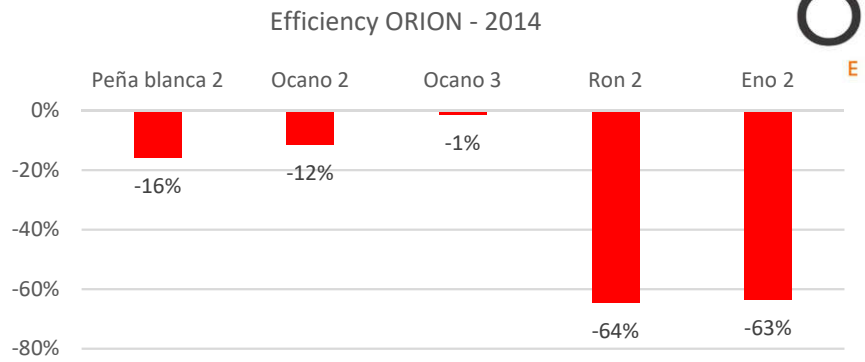


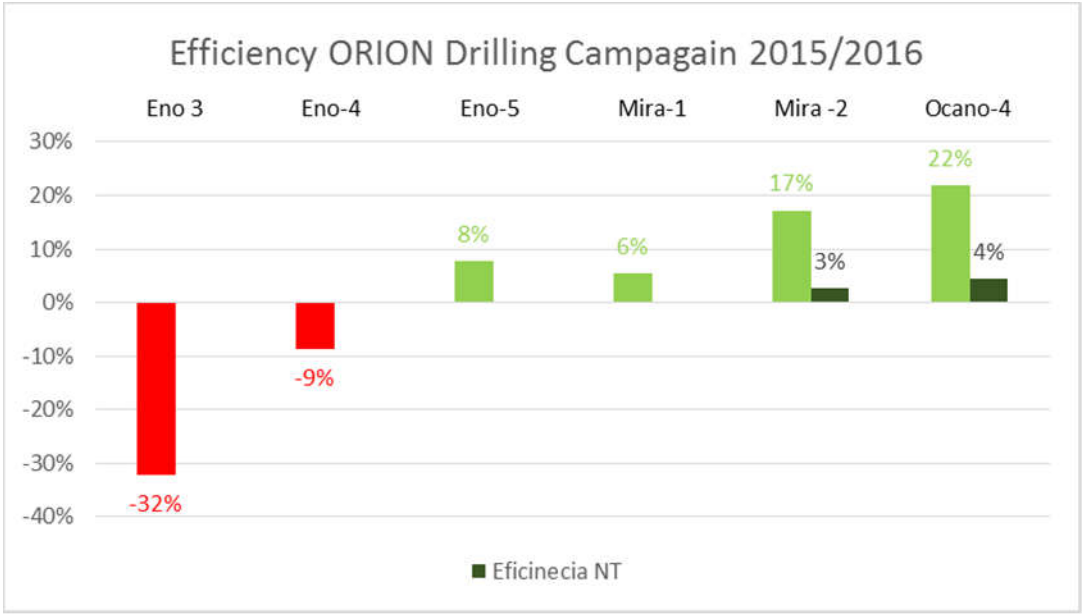
Increased the wells complexity (DDI) aside to be drilling at new part of the blocks and the performance increase as well

Drilling Performance Evolution

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







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?