RT Data Integration to Enable Enhanced Workflows for Better Drilling Performance and Events Avoidance

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What's Next?
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AGENDA

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- Objective
- Methodology
- CIP
- NPT Reduction
- Risk Analysis
- Drilling Optimization
- Value for PEMEX
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- Conclusions

Introduction

Located in Mexican limits of Gulf of México

PEMEX: Gerencia de Proyectos Aguas Someras
(Office for Shallow Water Projects)

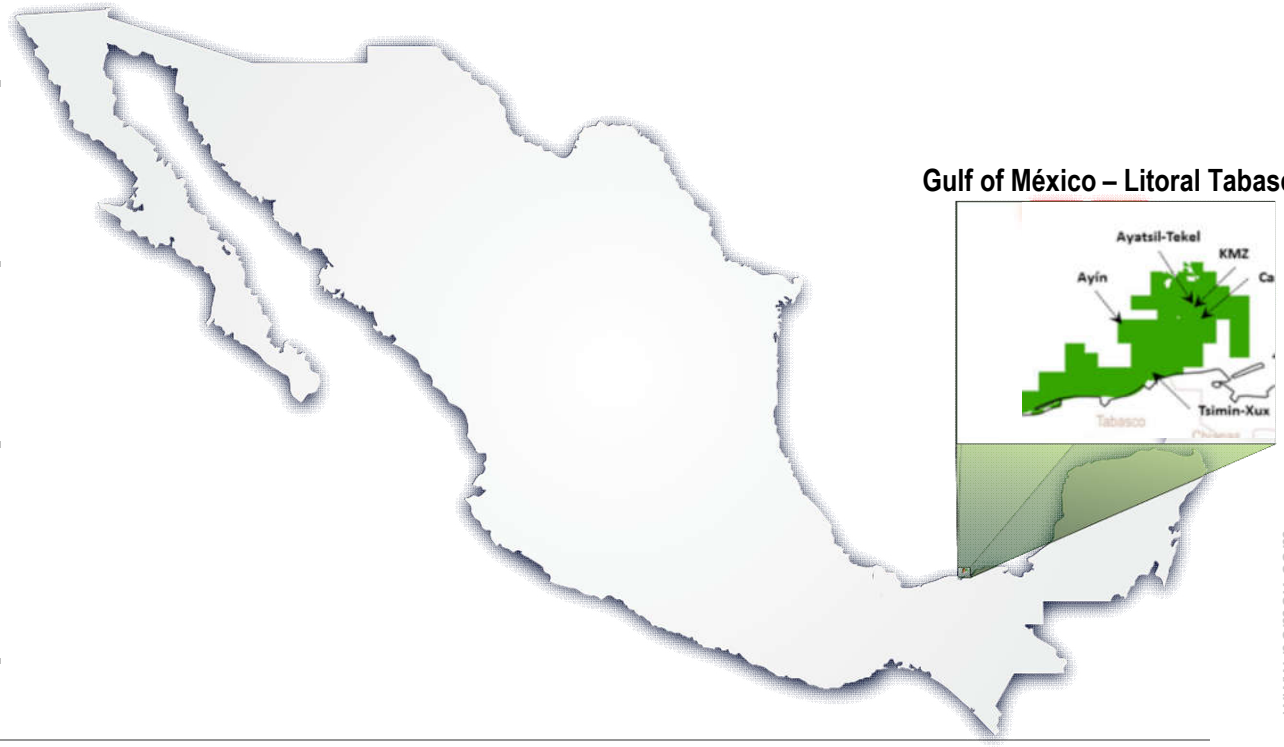
Asset: Tsimin-Xux (TX),
Ayatsil-Tekel Utsil (AT)

- TX Gas and condensate producer in carbonates Kimmeridgian (Upper Jurassic)

- AT producing Heavy Oil and Gas in BTPKS – (Breccia between Paleocene upper cretaceous)

Assets production: (est.) 150,000 bpd

LOCATION



source: *ebdi.pemex.com, ri.pemex.com, reformas.gob.mx*

Objective

The main objective of Gerencia de Proyecto de Aguas Someras is to develop recently discovered fields in record time to incorporate them to production by 2018 as per FDP. The critical phase of this FDP is related to **Drilling Operations**. Certain challenges in this kind of formations shoul be faced, otherwise may result in unacceptable delays:

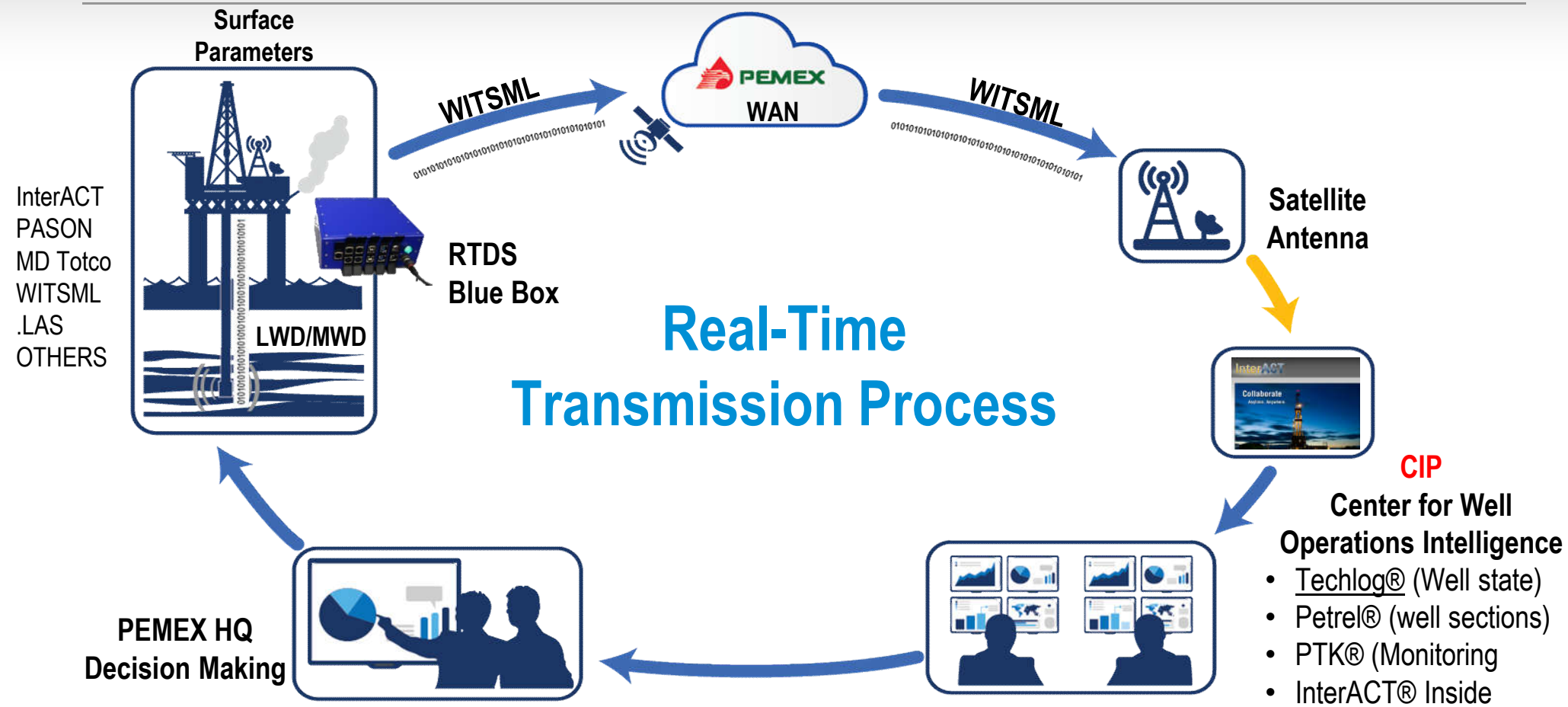
Challenges

- Uncertainty mapping mudstone interbedding in Lower Oligocen causing:
  - Formation fluids influx
  - Wellbore instability
  - Stuck pipe events
  - Sidetracks, windows…
- Problems properly detecting casing setting depth
- Loss circulation problems
- Poor or under expectation drilling performance

Objectives

- Reduction of Non Productive Time (NPT)
- Drilling Performance Optimization
- Compilation/Distribution of Best Practices among Well Design Teams
- Optimize time for well production incorporation
- Reduction in operational costs

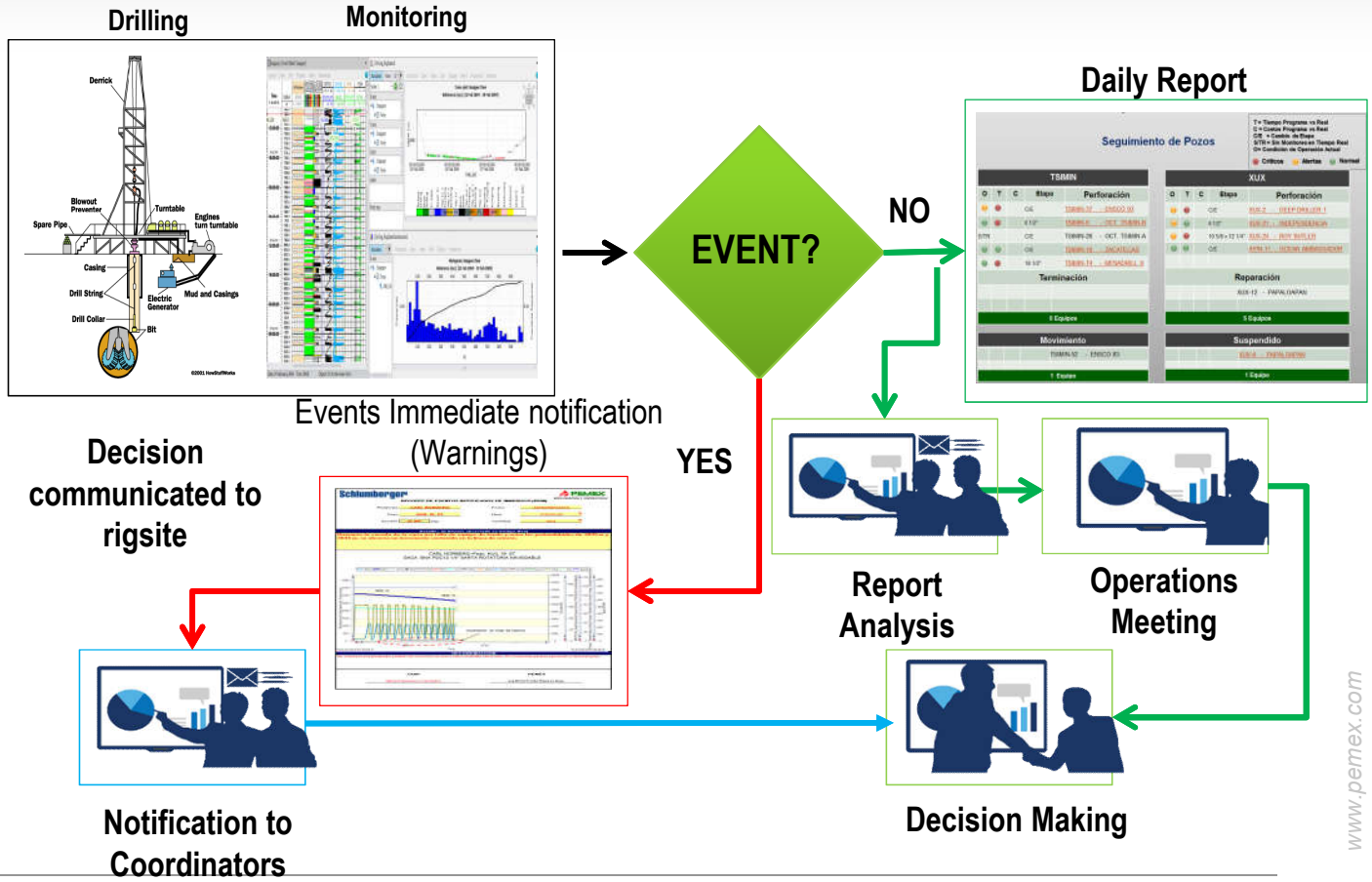
Methodology



CIP

Center for Well Information is a monitoring center for drilling operations that involves:

- Advance communications infrastructure for data transmisión and drilling data analysis.
- Surface Data analysis Service, proactive and preventive alerts, statistics.
- Surface parameters monitoring, daily report and emission of warnings and recommendations in 24/7 basis.



NPT Reduction

The main benefits of this workflow are:

- Recommendations prior starting drilling new sections.
- Recommendations for pipe tripping (in/out)
- Advice on drilling Parameters
- Proposed drilling equipment analysis
- Determine best drilling conditions to reduce torque and drag
- Planning in advance for drilling out cement and accesories.
- Guidance on type of drilling bit according the characteristics of the formation.

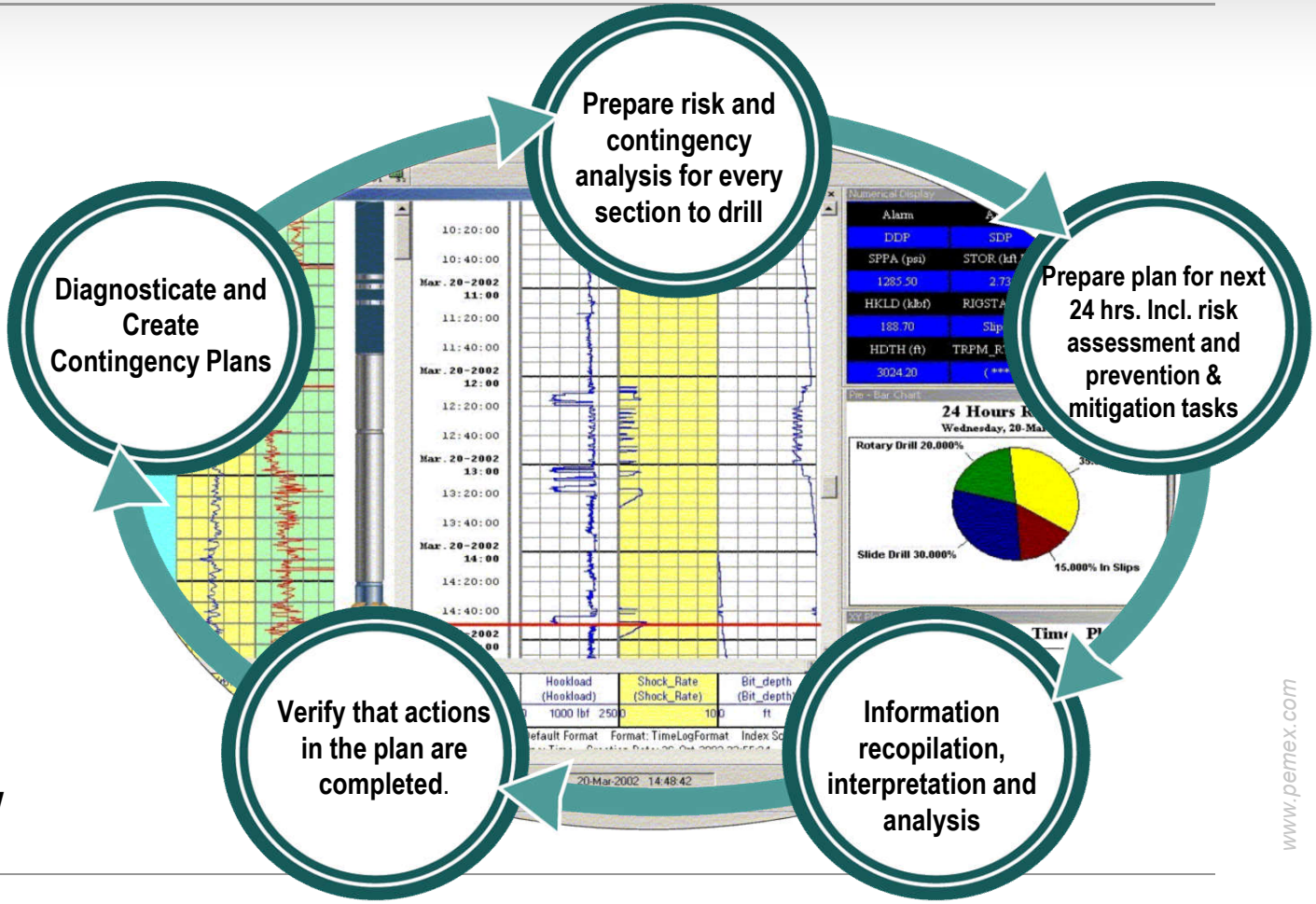
Image: slb.com

With this, communication is leveraged between multidisciplinary teams, achieving outstanding interaction and results.

Risk Analysis

- Correlation Wells
- Riks ID according formation
- Drillmap
- Prevention Plan
- Mitigation Plan

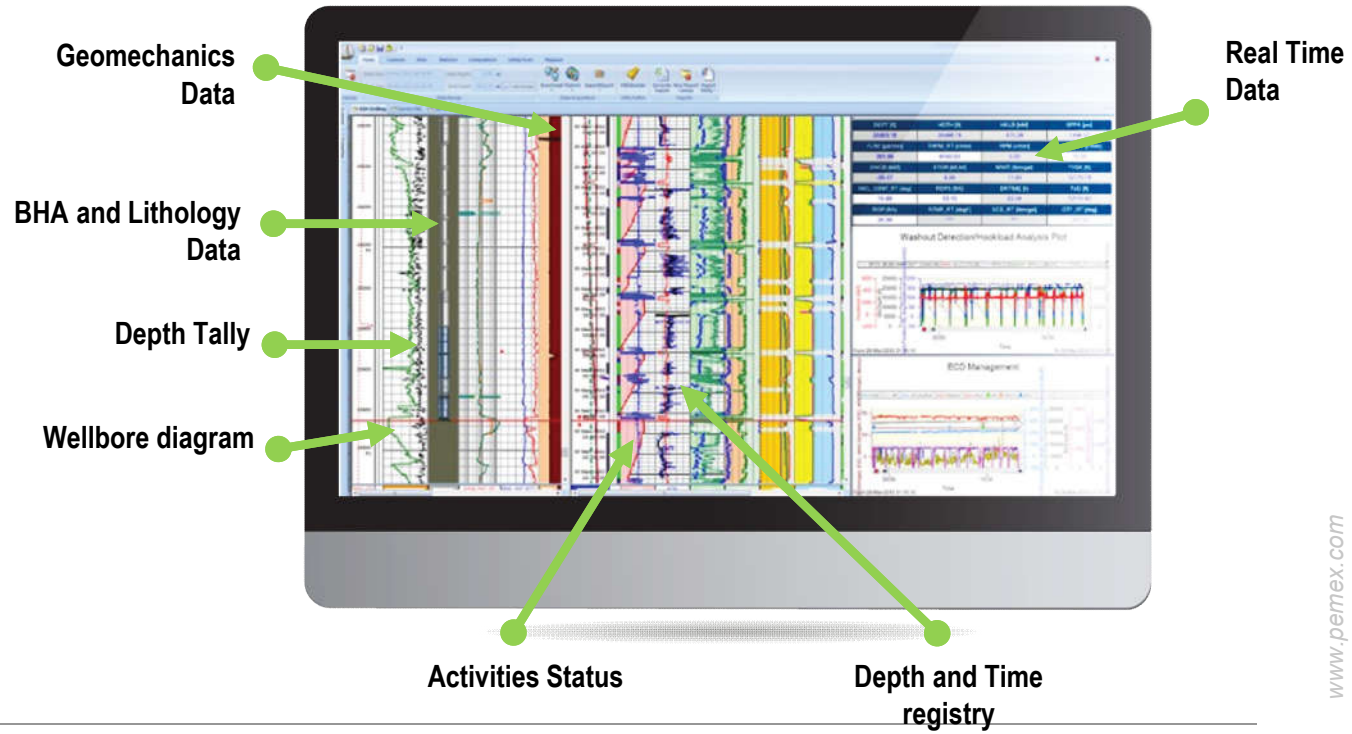
Continous imrpovement workflow



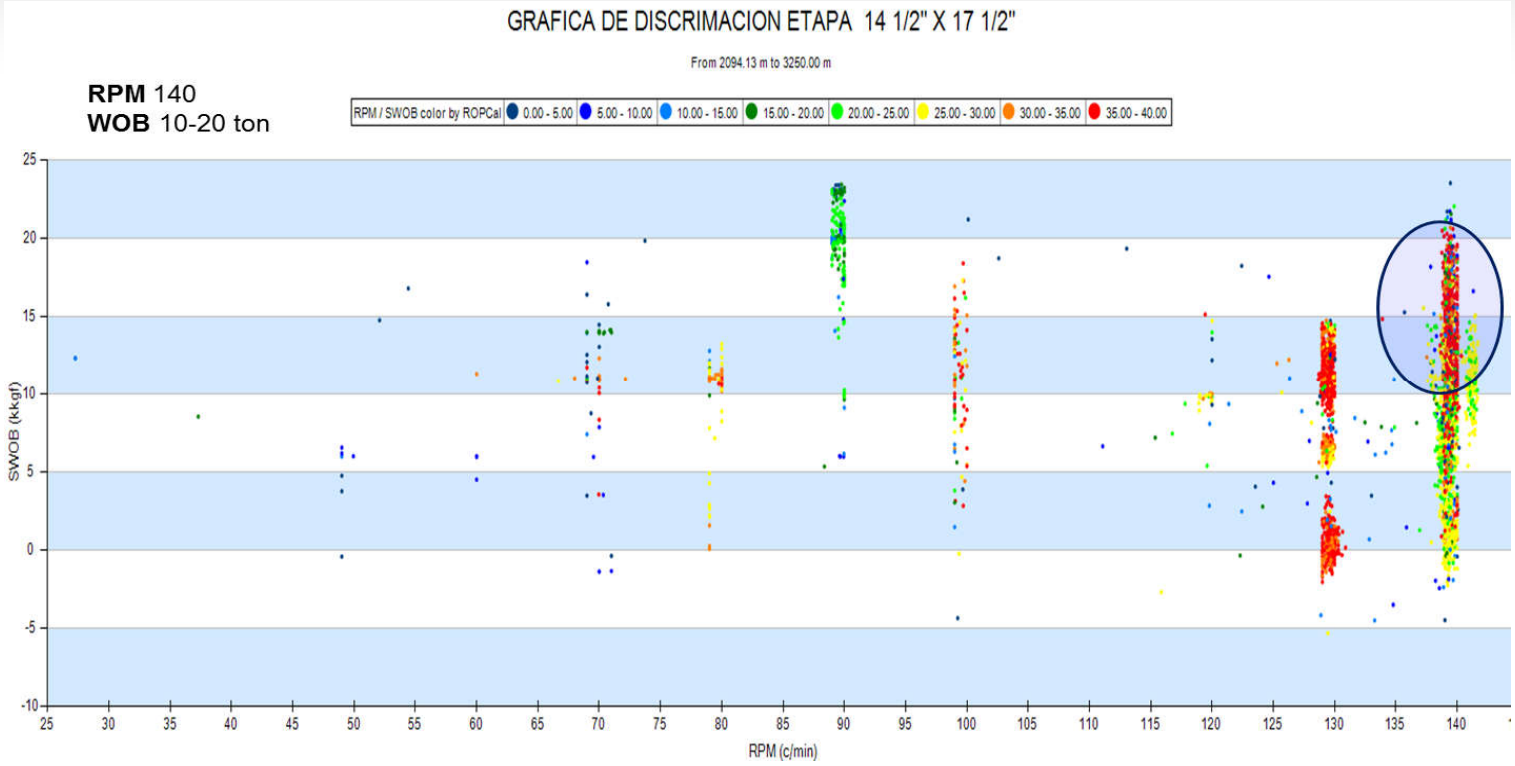
Drilling Optimization

Technology and Experience combined to:

- Evaluate, anticipate or mitigate any risk.
- Define optimum drilling parameters (Weight on bit, RPM, , etc.…)
- Provide operational recommendations to optimize ROP, within the technical limits.



Drilling Optimization

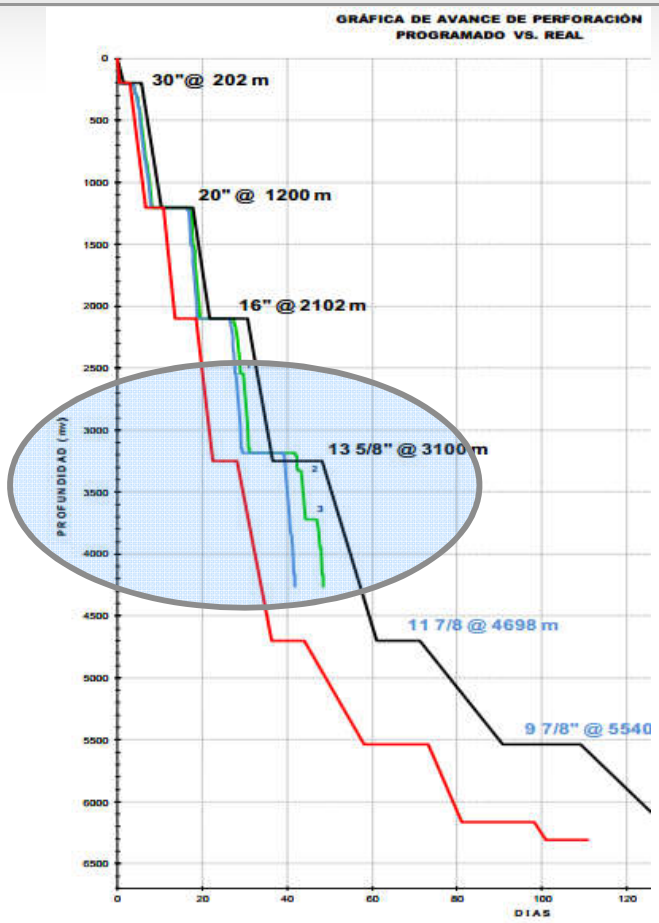


Documenting lessons learnt and best parctices helped us to gather key data for statistical analysis. E.g. considering WOB and RPM for an specific ROP, provides optimal values that can be applied for certain fields.

Value for PEMEX

Reduction of unexpected drilling events:

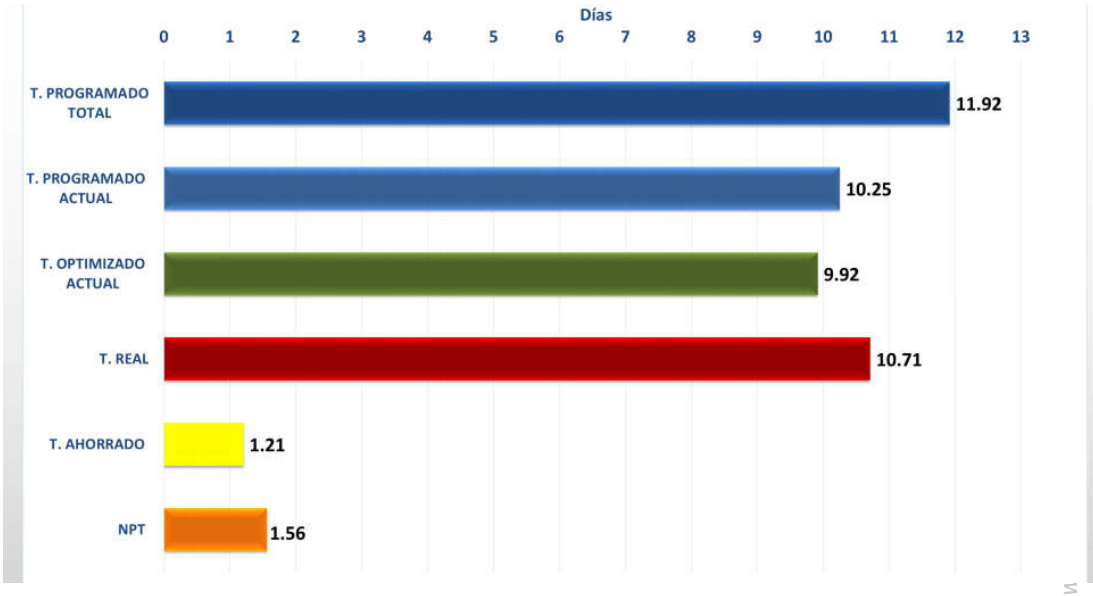
- Dilling performance optimization with parameters adjustment and improvement proposals.
- Minimize time for data and information availability.
- Effective decisión making in timely manner.
- Reduce unexpected drilling events through RT monitoring of parameters.
- Early detection of trends and initial stages of problems to minimize Non Productive Time



Value for PEMEX

- Effective casing setting depth using RT parameters
- Operation monitoring from beginning to end of well
- Effective tool for root-cause analysis
- Lesson learnt and repository of best practices.

UPDATED FOLLOW UP IN SECTION CHANGE AND STATISTICS



Well 1

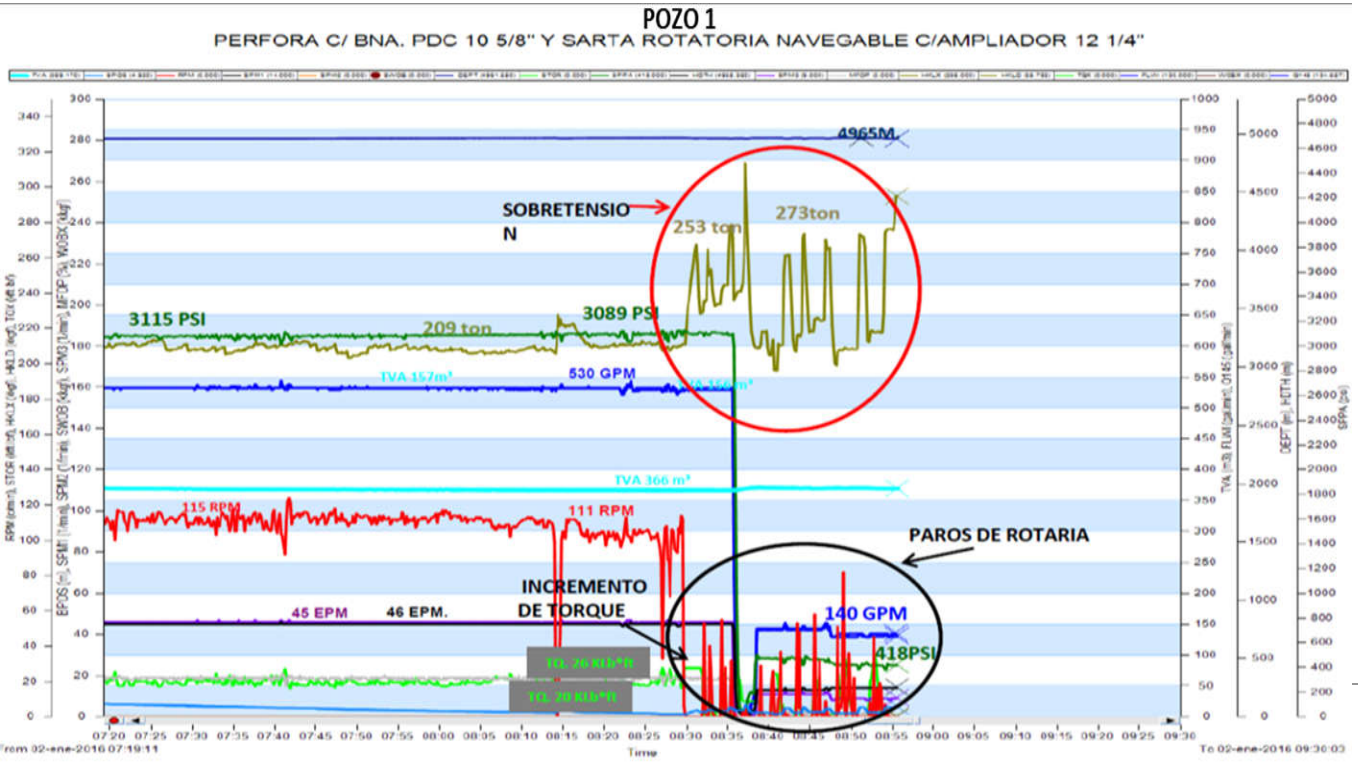
- **Description:** While drilling last section (12 ¼ “) increase of torque and drag was registered:

- **Action:** Recommended to pick up BHA, circulate, work the pipe up and down to make sure BHA is free using same circulation flow (TFLOW) to prevent well stuck or packed off BHA, at the same time this inhibit loss circulation, solids in the shale shakers should be verified. It is essential to keep following best practices for washing up and down and use WOB and RPM parameters to mitigate Stick & Slip, Shocks and Vibration that may affect the optimum performance of tools.

- **Results:** Pipe stuck event was prevented, traslating into a potential saving of 8-10 days in NPT.

Well 1

Events observed in RT: Drilling with 10 5/8" PDC bit and BHA with hole opener 12 ¼ " @4965m, fluid density 2.10 gr/cc a sudden stop in rotary was observed, tried to pick up BHA but torque increment of 20 KFT*LBF was observed, registering drag between 253-278 tons with overweight of 25 tons. Later, BHA was tripped in while pumping (140 GPM, 418 PSI) but no rotation was observed.



Recommendations: Circulation was recommended, pick up two stands and work the pipe to ensure free BHA, circulating with same TFLO to prevent stuck or packed off, inhibiting at the same time potential loss circulation.

It is important to verify the amount of solids in shale shakers, as well as morphology and size to define the well mechanics. It is also essential append to best practices to work up and down the BHA and use the recommended WOB and RPM parameters to mitigate effects of *stick & Slip*, shock and vibration that could pose a effect and/or risk in the tolos and drilling operations.

Well 2

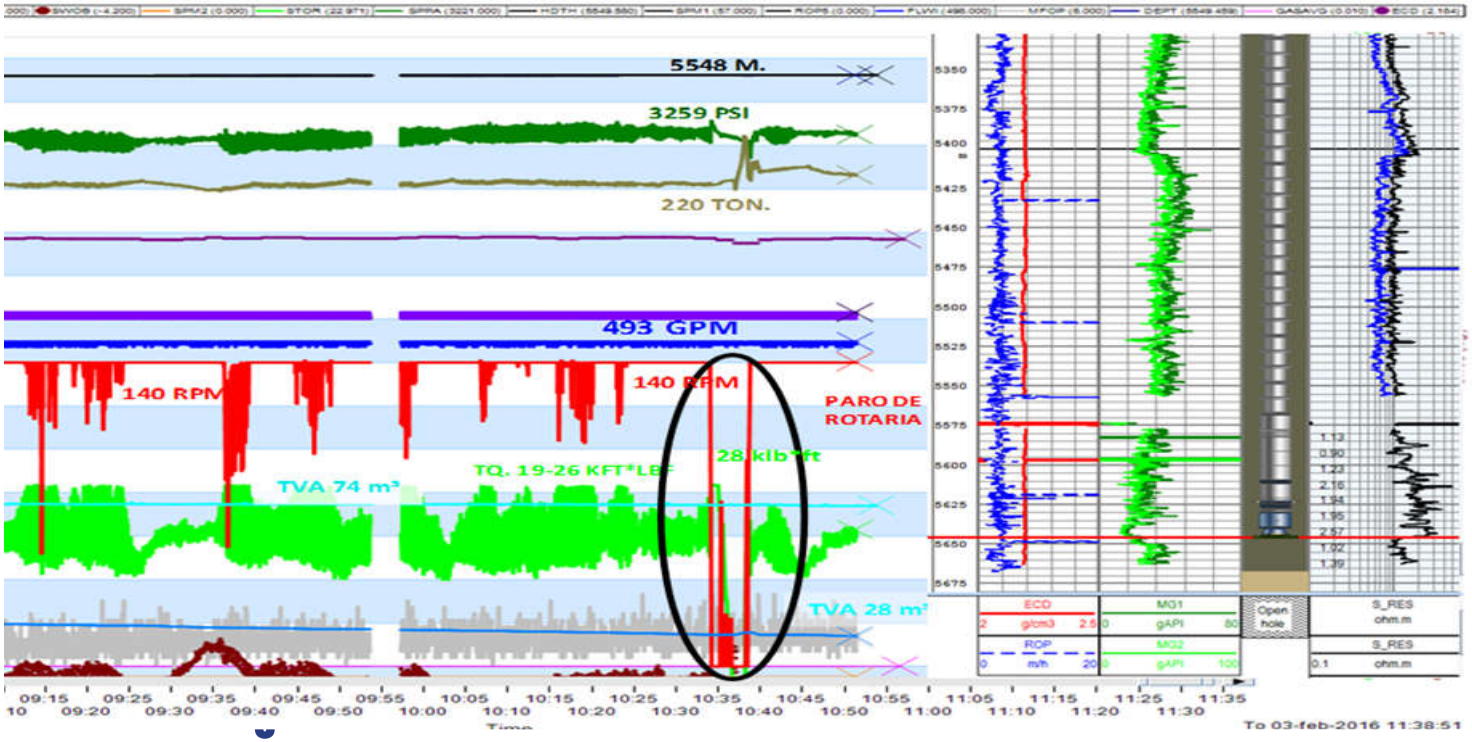
- **Description:** With the experienced gathered with correlation wells and the RT information, it was possible to identify the casing setting depth.

- **Action:** The top of the Paleocen was opportunely detected, with the aid of the surface and bottom parameters.

- **Results:** The well program was kept inside the plan properly identifying the casing setting depth, saving time and money

Well 1

Events observed in RT: Drilling with 10 5/8" PDC bit and BHA with hole opener 12 ¼ " @5548m, fluid density 2.12 gr/cc ECD 2.19 gr/cc, WOB 1 Ton, 140 RPM, 25 KLB*FT, 497 gpm, 3190 psi. Rotary stopped with torque surging to 28 KLB*FT, picked up BHA and continued drilling.



Recommendations: Work the pipe rotating and pumping, additionally it is important to use WOB and RPM recommended parameters to mitigate stick and slip effects.

Keep circulating with same flow. Verify size, amount and morphology of cuttings, for possible changes in formation and lithology, founding to be near from Paleocen.

Conclusion

- RT data management from drilling site to surface acquisition systems for processing, visualization and analysis is crucial for drilling performance optimization (NPT & Cost Reduction).
- Effective 24/7 colaborative communication between CIP, well design and operations engineers is the cornerstone of this methodology, helping to anticipate and minimize non desired events, saving time and money.
- Documenting operations has built an important repository of best practices and data base of knowledge, from which we can identify the Technical Limit of each drilling location, defining a **benchmark** that help us to evaluate contractors.
- Thanks to teamwork, complemented with applied workflows we were able to fulfill and exceed FDP expectations, incorporating production before planned.

QUESTIONS

Source: PEMEX youtube channel

PEMEX Offshore Support Vessel "REFORMA"