Операции в режиме реального времени: Опыт в повышении эффективности бурения и заканчивания скважин

Real Time Operations: Experience in Improving Efficiencies for Drilling & Completions

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Digital Asset Solutions &
Formation Evaluation
Halliburton

the digital asset™
Model. Measure. Optimize.

Операционные центры реального времени – залог успеха на пути к Цифровым запасам

Real Time Centers are a key enabler of the Digital Asset™

Presentation Overview

- Value Drivers & Industry Challenges
  - Ценность и проблемы
- What is a D&C Real Time Center™? And some of the naming conventions
  - Что такое операционный центр реального времени
- Where are D&C RTOC's located and Global Presence
  - Расположение и присутствие в регионах мира
- Industry D&C Real Time Market Models
  - Модели отраслевого рынка
- Why should WE care? Internal / External
  - Зачем НАМ это?
- Real Examples of connectivity & delivering efficiencies to both the operator and service company
  - Примеры

Key Drivers for Change

Основные причины для перемен

Why is it important

- **Rig Time** (экономия времени)
- **Understanding Reservoir Extents**
  - Размеры пласта по горизонтали
- **Expensive drilling (>$600k/day GOM)**
- **Reduction of NPT**
  - Сокращение простоев
- **Reaction time for well intervention**
  - Время для принятия решения

Industry Challenges

- **Harder to Access Reserves** – Трудноизвлекаемые запасы
- **Smaller Accumulations** – Небольшие залежи
- **Rising Costs** – Увеличение издержек
- **More Challenging Production Targets** – Увеличение объемов добычи
- **Less Experienced Talent –** Снижение уровня квалификации полевых работников

What is a Real Time Center?

Workflows, Processes & Technology that drive:

Collaboration across Disciplines, Companies, Organizations and Geographical boundaries;

Enabling Faster and Better…

Decision-Making: Organizations, Groups & Disciplines…

etc

Speed

NPT

Real Time Centers are a key enabler of the Digital Asset™

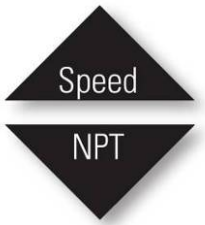
What is a Real Time Center?

Технологические процессы и технологии:

Взаимодействие между подразделениями, компаниями, организациями и географическими регионами;

Ускоренное и лучшее принятие решений

Операционные центры реального времени – залог успеха на пути к Цифровым запасам



Industry "Real Time Center" Go to Market Model's

- **Real Time Centers– Client Centers**
  - Where: Hubs, Satellites or centers **dictated** by client needs
  - Why: POB, NPT, Well Placement & Construction
  - ***What: Delivery of managed services w/in Client domain***

- **RTC – "Service Company" Client Hosting Centers**
  - Where: Calgary RTC, EORTC, NRGv2, Denver, OKC....
  - Why-Client: POB, NPT, Well Placement & Construction
  - Why-Service Co.: Service Quality, POB, ROP, RT Support
  - ***What: Delivery of Hosted Services for Client w/in Service Company domain***

- **ROC – Internal Service Company Centers**
  - Where: Hi-End Service Company Operations base's
  - Why-Service Co.: Service Quality, POB, ROP, RT Support
  - ***What: Delivery of focused service quality***
    - ***Can deliver services to client "JITS"***

Industry "Real Time Center" Go to Market Model's

- **Real Time Centers– Client Centers**
- **Центры реального времени – у заказчика**
  - Where: Hubs, Satellites or centers **dictated** by client needs
  - Why: POB, NPT, Well Placement & Construction
  - ***What: Delivery of managed services w/in Client domain***

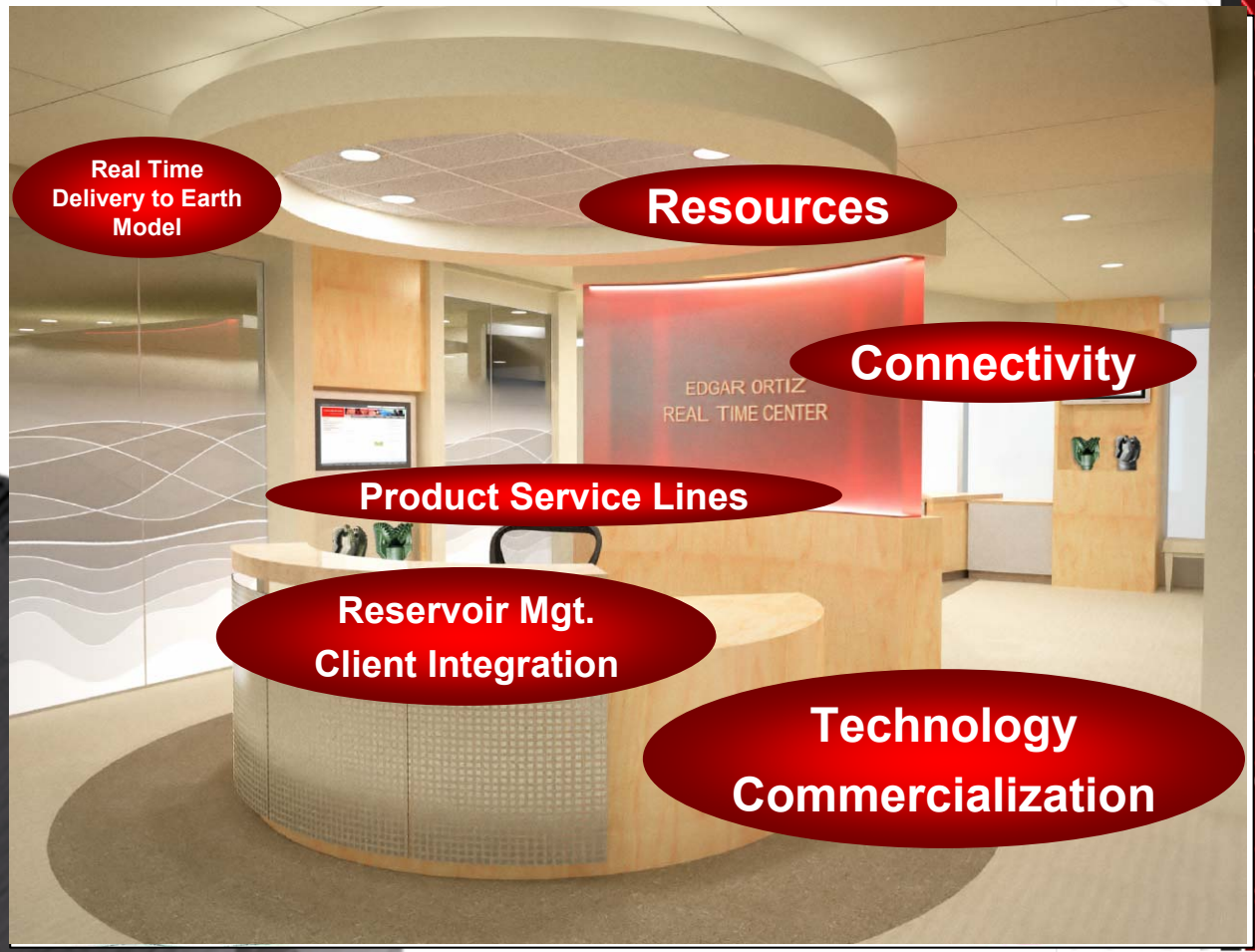
- **RTC – "Service Company" Client Hosting Centers**
- **Операционные центры RTC – у сервисного подрядчика для посещения заказчиками**
  - Where: Calgary RTC, EORTC, NRGv2, Denver, OKC....
  - Why-Client: POB, NPT, Well Placement & Construction
  - Why-Service Co.: Service Quality, POB, ROP, RT Support
  - ***What: Delivery of Hosted Services for Client w/in Service Company domain***

- **ROC – Internal Service Company Centers**
- **Операционные центры реального времени ROC – для нужд подрядчика**
  - Where: Hi-End Service Company Operations base's
  - Why-Service Co.: Service Quality, POB, ROP, RT Support
  - ***What: Delivery of focused service quality***
    - ***Can deliver services to client "JITS"***

Real Time centers are part of a larger context…

Its really about integrating Operations across organizations and companies…

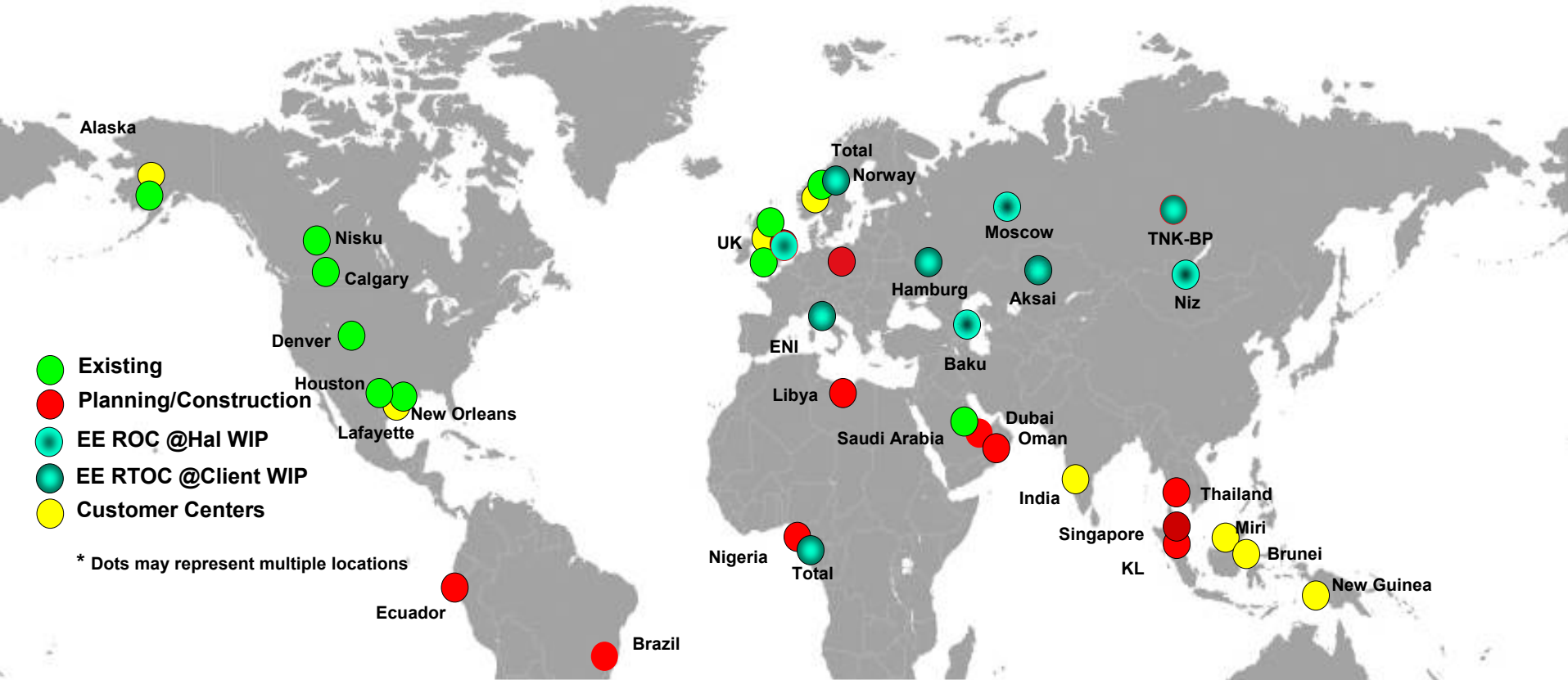
EDGAR ORTIZ



Real Time centers – часть большой картины…

Это – интеграция операций между организациями и компаниями…

Отрасль широко использует эту технологию по всему миру!

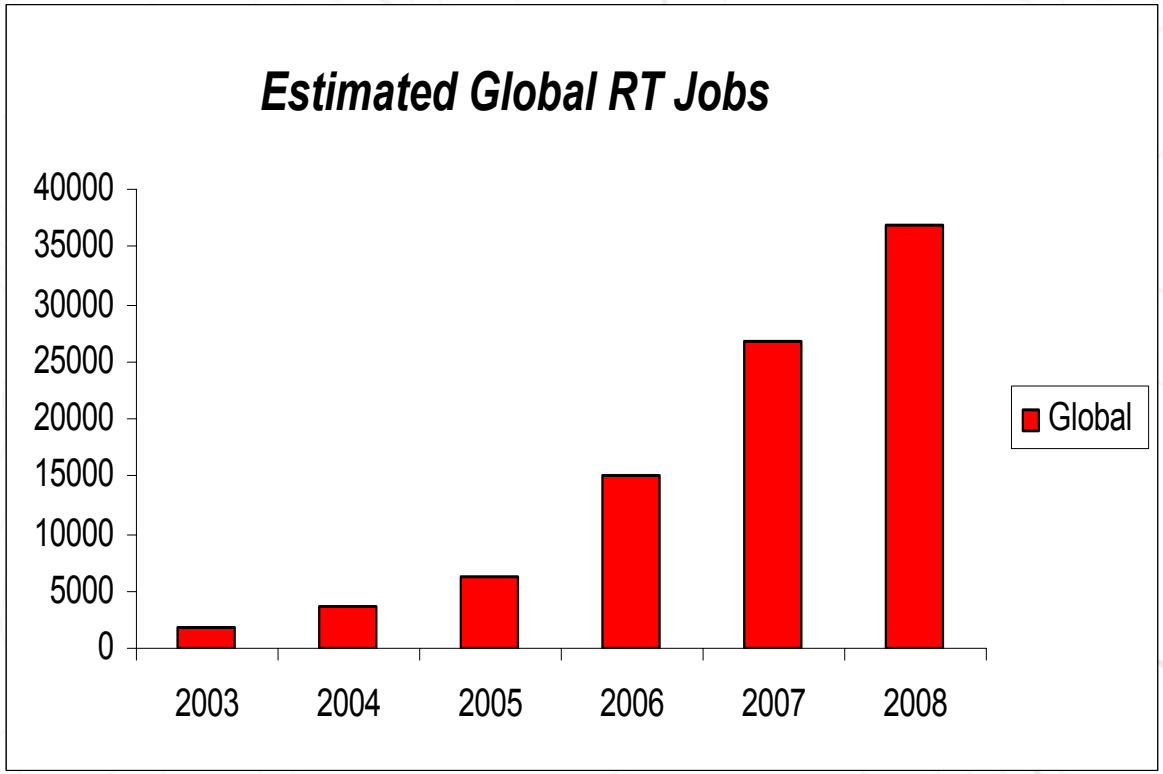


- 15 RTOC manned and operated for our clients with 3 in progress
- 14 Halliburton Remote Operating Centers with 5 in progress
- 4 Halliburton Client Hosting Centers
- *9 Centers under consideration in Europe Eurasia*
- Approximately 19,000 RT jobs in 2007 with 23,000 Jobs planned for 2008

Global Real Time Jobs

Real Time "Use Trends" suggest a change in the way are Constructing & Placing wells today…

Greater use drives better efficiencies



Industry names for Real Time Centers

- **OSC:** Onshore Support Center (SLB)
- **Beacon:** Baker Expert Advisory Centre/Operations Network
- **ACE:** **Advance Collaborative Environment (BP)**
- **ICE:** Integrated Collaborative Environment (BG)
- **iDoc:** **Reliance Industries**
- **DOMC:** Drilling Operations Monitoring Center (Petronas)
- **RTDC:** **Real Time Drilling Center (ARAMCO, KOC and others)**
- **WellDECC:** **Well, Design, Execution and Collaboration Center (Chevron)**
- **ODC:** **Onshore Drilling Center (ConocoPhillips)**

Halliburton Real Time Center Names

- **RTC™:** Real Time Center (HAL)
- **RTOC:** Real Time Operations Center (HAL and Shell)
- **ROC:** Remote Operations Center (HAL Sperry)
- **RLO:** Remote Logging Operations (HAL WPS)
- **RTDC:** Real Time Decision Centers (HAL Landmark)
- **Viz Center:** Visualization Center (LGC Constructed)

Components of a Real Time Operating Center

Drilling Optimization

Drilling Opt. Eng.

Drilling Opt. Eng.

Wellbore Placement

SME Wellbore Placement Eng.

Monitoring - Intervention

Drilling Ops Engineers

Stimulation Ops Engineers

Completions Engineers

SME Fluids Eng.

Well Planning

Well Planning Engineer

Collaboration

Applications Facilitators

Knowledge Management communities

OpCo Asset Team

Extended Advisor Network

Wellbore Stability Advisors

ERD Advisors

Visualization Specialist

Completions Advisors

Petrophyscial Advisors

G&G Advisors

Tubular Design Engineer

RT “Mud” Rheology

Cementing Advisors

Technical Limits Advisors

Stimulation Advisors

Pore Pressure

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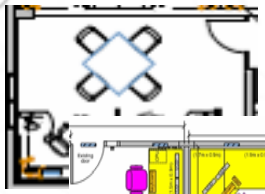
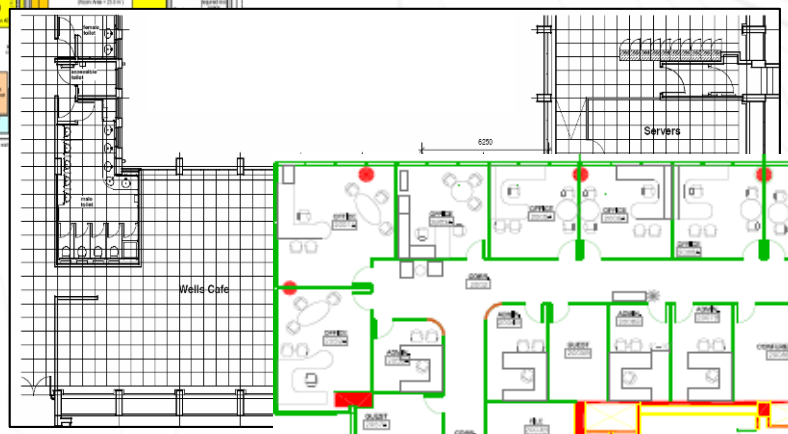
Real Time Centers are Scalable



1 Rig Deep H20, GOM, RTOC @Client - Глубоководное бурение

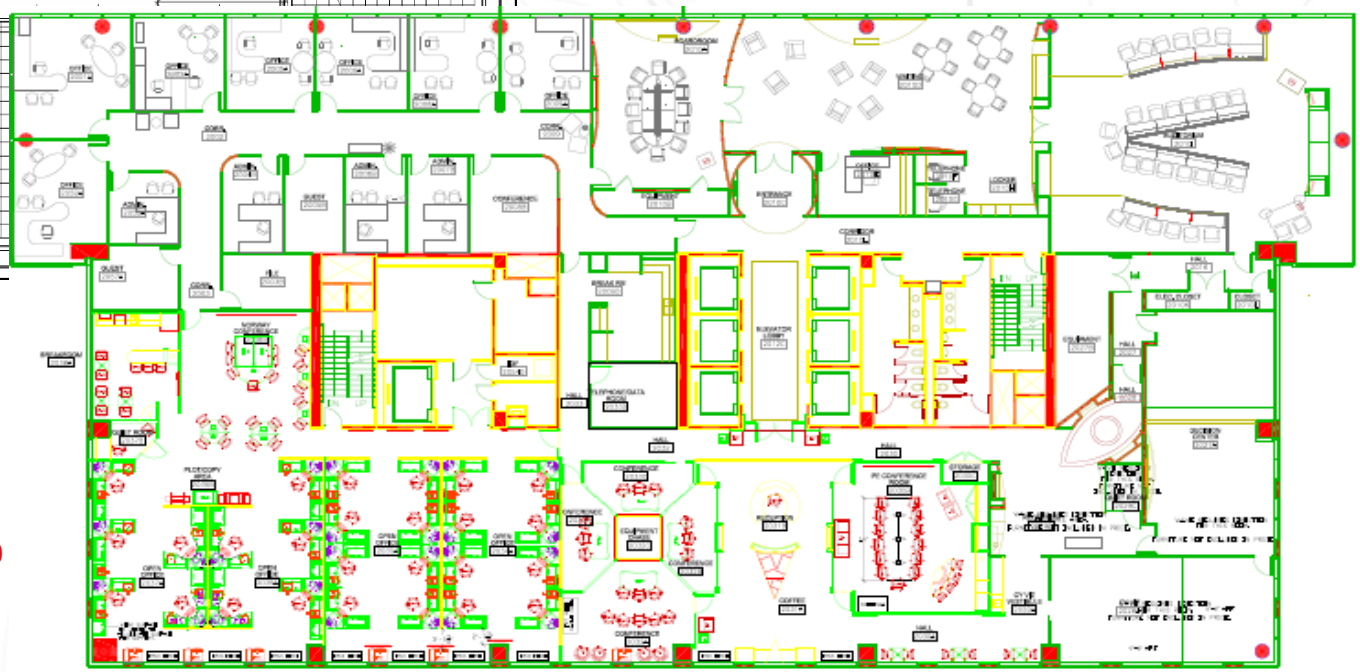
3-4 Rig, RTOC @Client, W. Africa or ROC @Service Company

Западная Африка – центр реального времени у заказчика



12-18 Rig RTOC @client OS/Land, ABZ

– Центр у заказчика в Абердине



14,000 работ в год

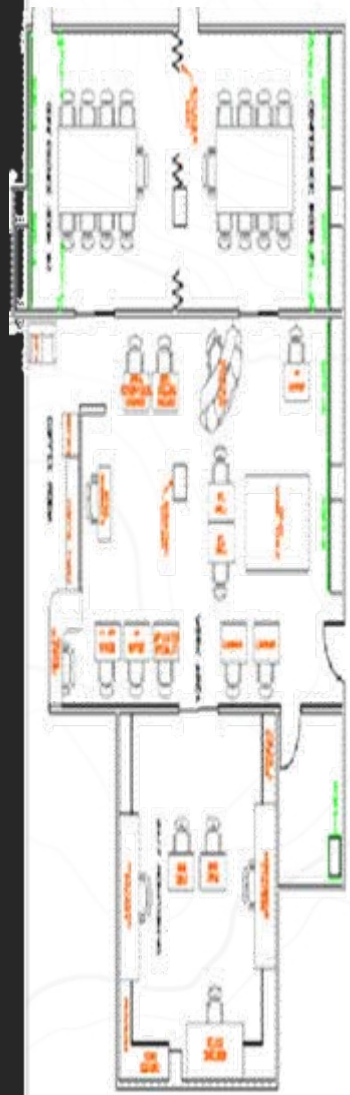
RTOC @Service Company

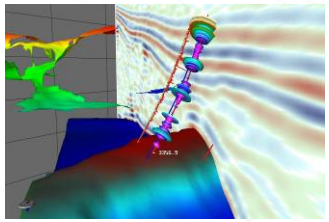
Центр у сервисного подрядчика

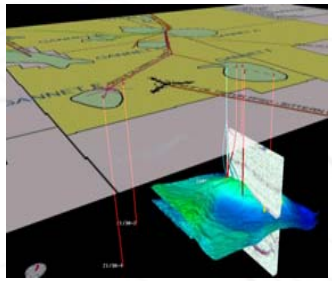
Every center is unique & dependent on the required work flow need!

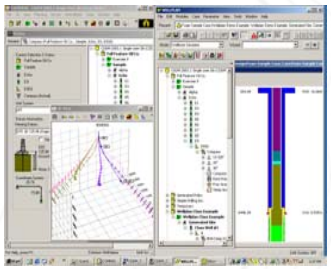
Каждый центр уникален и конфигурируется под требуемый объем работ

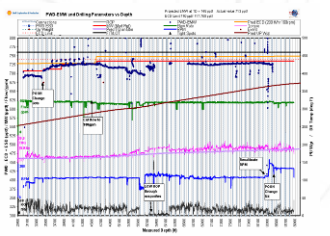
Real Time Center "Core Services Model"











Планирование скважин и визуализация

- Multi Discipline Collaboration
- Drilling G&G Peer reviews
- Field & Facilities planning
- Decision Gate reviews
- Reduction in Well Planning Cycle Time

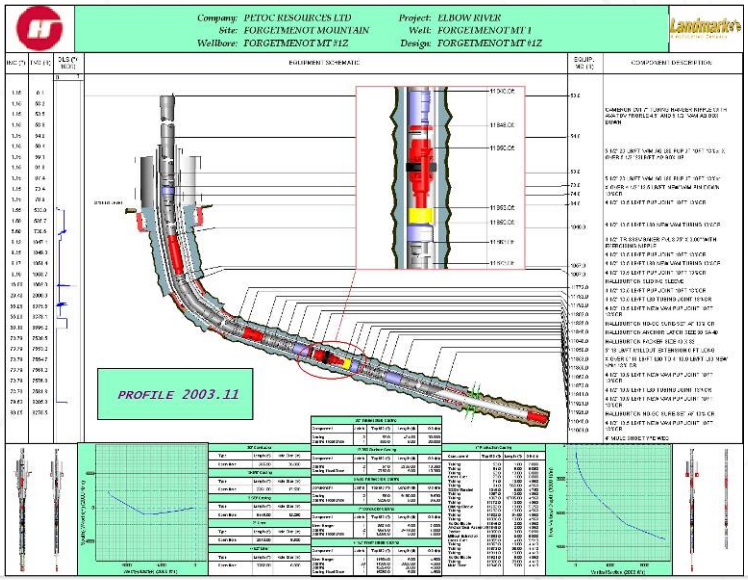
Оптимизация проектирования и анализ тенденций *(Прогнозное моделирование)*

- Detailed Trend Analysis
- Well Engineering
- Hydraulics, Vibration, Torque Drag, ECD, Pore pressure
- Csg. Plan & design

Мониторинг и вмешательство в реальном времени

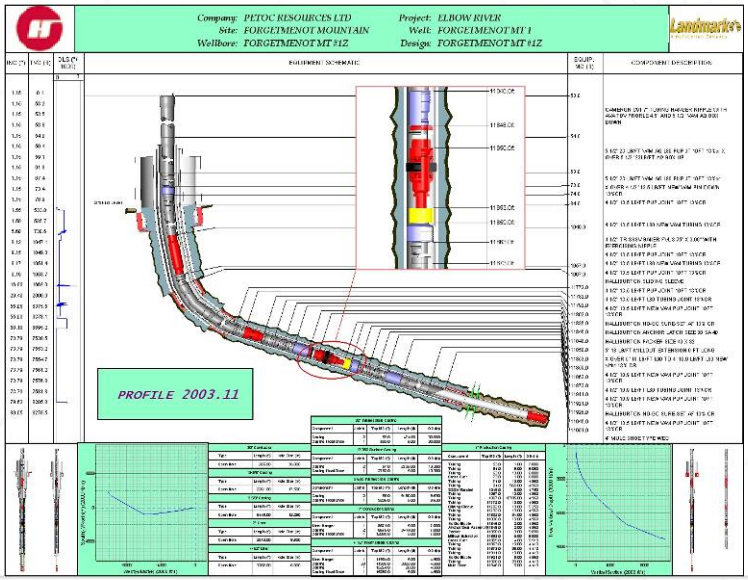
- Aggregate all Drilling Information
- Monitor Predictive Models against RT drilling Actuals
- Rig-to-Office vital offshore information on-going links
- Traffic-Light problem identification & resolution;

Collaborative Well Planning & Visualization



- Previously;
  - long iterative process among geologists, geophysicists and engineers
- ***Today all SME collaborate in the RTC decision-making process in parallel***
- Critical technologies
  - Common 3-D visualization environment
  - SW products to design rigorous well trajectories
  - Open Data feeds real-time data to any data base
  - Secure & tested data repositories

Collaborative Well Planning & Visualization



- Previously;
  - long iterative process among geologists, geophysicists and engineers
- ***Сегодня все ключевые специалисты взаимодействуют в центре реального времени параллельно и принимают решение вместе***
- Critical technologies
  - Common 3-D visualization environment
  - SW products to design rigorous well trajectories
  - Open Data feeds real-time data to any data base
  - Secure & tested data repositories

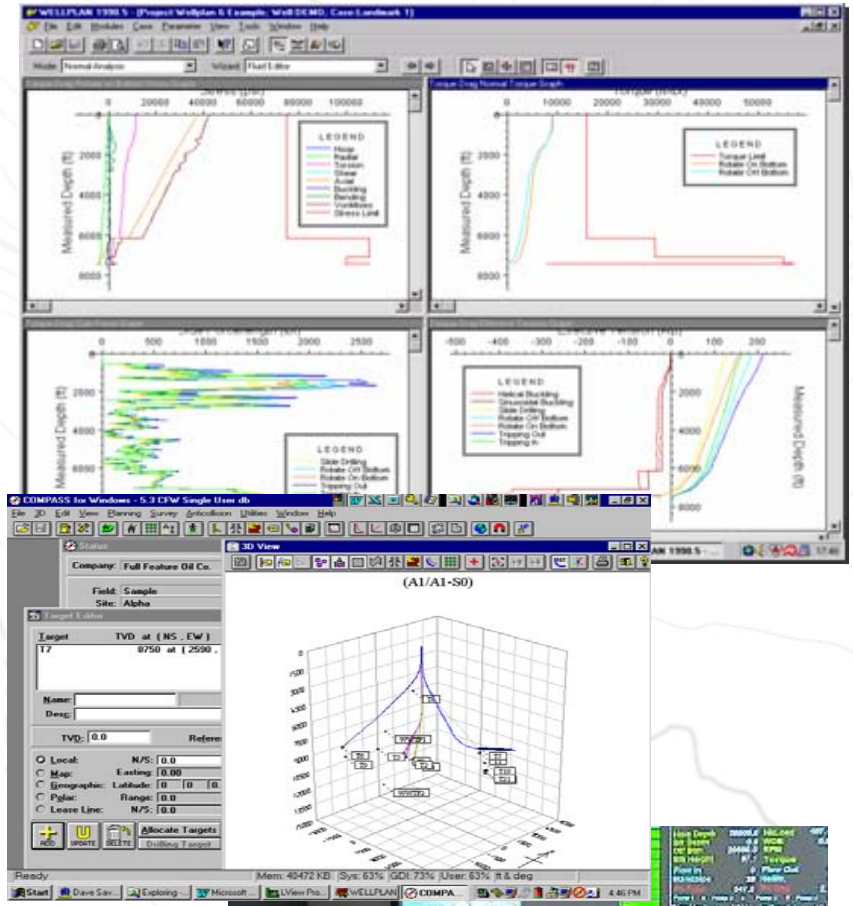
Engineering Optimization & Trend Analysis

Activities and Workflows;

Predictive Modeling;

- ***Drilling engineers create detailed engineering models. RTC team discusses modeling results and then support 24/7 monitoring & drilling teams w/ model updates as the wells are under construction***

- Swab, Surge & Hydraulics analysis
- Bore hole Stability, Torque & Drag and BHA Vibration simulations w/ analysis
- **Full data projection during morning calls with *"home work already done"***
- Learning's & best practices updated in operational reviews and DIMS data reviews

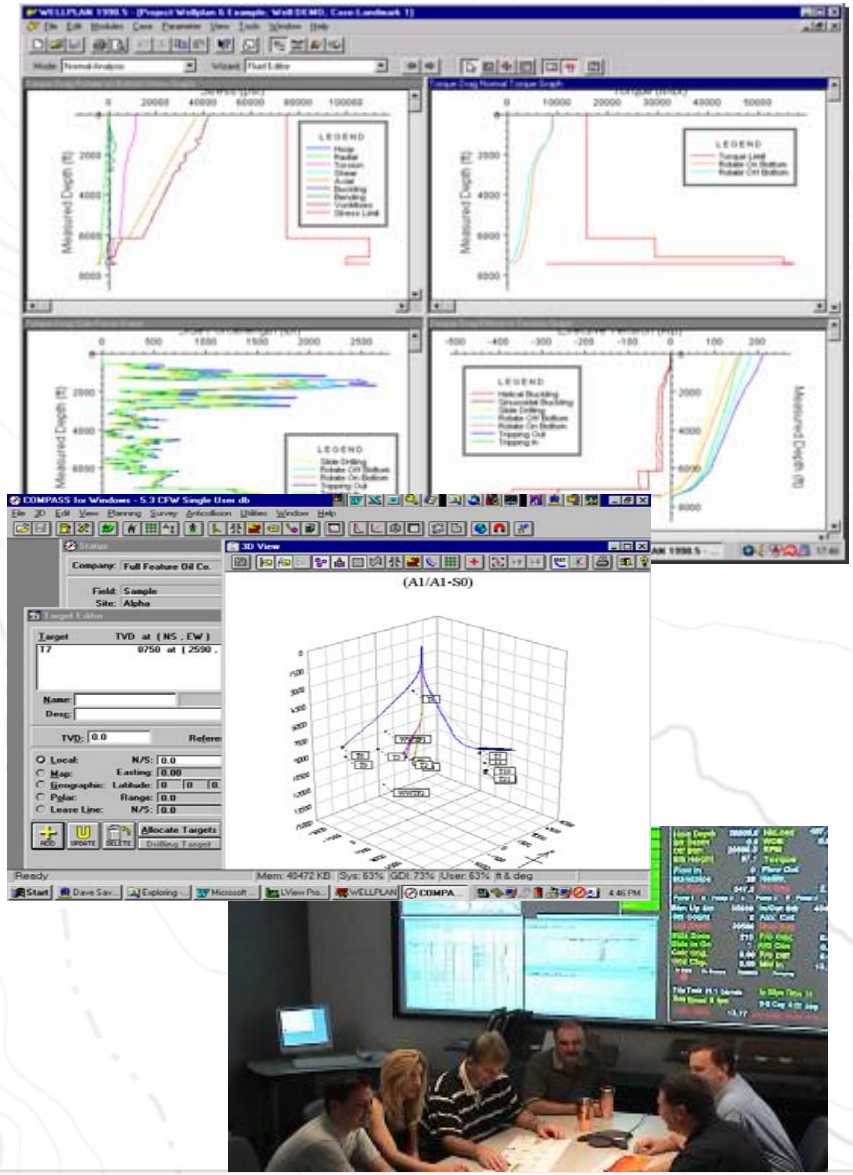


Engineering Optimization & Trend Analysis

Activities and Workflows;

Прогнозное моделирование;

- ***Инженеры по бурению создают детальные модели. Группа в центре реального времени обсуждает модель и затем при бурении скважины круглосуточно дает обновления по моделям специалистам по бурению***
- Swab, Surge & Hydraulics analysis
- Bore hole Stability, Torque & Drag and BHA Vibration simulations w/ analysis
- **Полная перспективная оценка данных в ходе ежедневных утренних совещаний, при этом *«домашняя работа уже выполнена»***
- Learning's & best practices updated in operational reviews and DIMS data reviews



24/7 Monitoring & Intervention

Emphasizing "Intervention" not control!

- What do we look for
  - Geologic Surprises
  - *Missed Targets / Well Collisions*
  - Borehole Stability
  - Casing Shoe Selection
  - *Lost Circulation events*
  - *Well Control*
  - Casing / Cementing Failure
  - *Stuck Pipe*
  - Drill String Failures
  - Tubing & Wellhead Movement
  - *Poor ROP*
  - Waiting on Data / Orders
  - Logistics Problems
  - Cost Overruns

RISK MANAGEMENT GOAL (STAYING OUT OF TROUBLE):

$900MM/yr x 25% Trouble or NPT x 20% Reduction = $45 MM/YR.

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Круглосуточный мониторинг и вмешательство

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Operational Efficiencies Service Company Vs. Operator

Эффективность работ – сервисный подрядчик и оператор

Internal "Remote Operations Centers"

Внутренние центры реального времени

Real Time Operations and Knowledge Management are becoming fundamental parts of some Service Companies business

«Чрезвычайно важно для бизнеса сервисных компаний»

Service Company benefits from - Выгоды для подрядчика:

- Operational Excellence
  - Высокое качество
- Better Service Quality / Less Repair
  - Меньше ремонта оборудования
- Reduction of POB
  - Уменьшение состава полевых бригад
- Improved Knowledge Management
  - Лучшее управление опытом
- Do more with the same
  - Меньшие ресурсы для тех же объемов
- Less NPT – Меньше простоев

Operational Efficiencies Operator Vs. Service Company
Эффективность работ – оператор и сервисный подрядчик

Client External "Real Time Operating Centers"

Центры реального времени для заказчика - внешние

Real Time Operations drive collaboration with the Service Companies! … its a different engagement model…

Технологии реального времени ведут к тесному взаимодействию с сервисным подрадчиком

Client / Operators benefits – Выгоды для заказчика:

- Operational Excellence
  - Высокое качество
- Better Service Quality / Less Repair
  - Меньше ремонта оборудования
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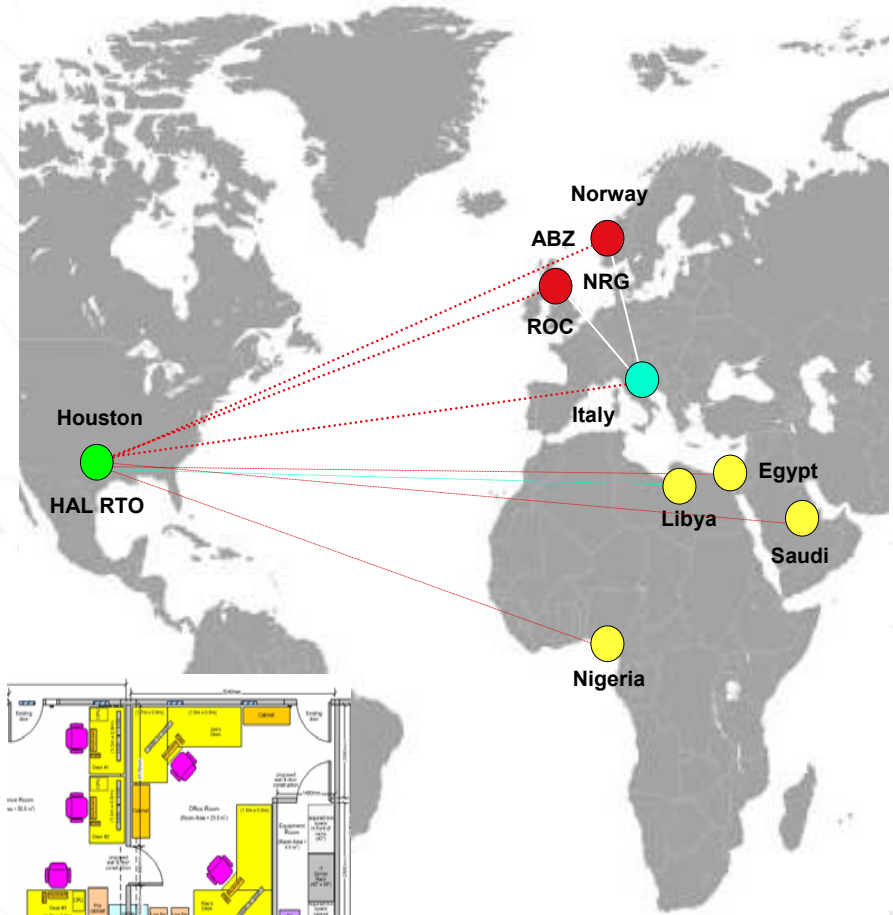
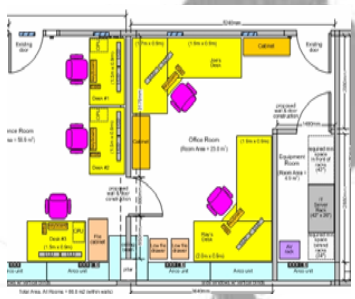
RTOC @Client; Typical use case…

- *Client require an RTOC in Europe staffed with:*
  - *Collaboration & Well Planning*
  - *Optimization & Visualization Engineering*
- *Aberdeen & Norway*
  - *Provide "Just in Time Services"*
    - *Petrophysics*
    - *Engineering Optimization*
    - *Well Planning etc.*
- ***Client Exploration Locations & Issues***
  - ***Egypt: HPHT***
  - ***Libya: Remote Operations***
  - ***Nigeria: Deep H2O***
  - ***Saudi Arabia: Empty Quarter***





1-2 Rig, RTOC@Client, Italy

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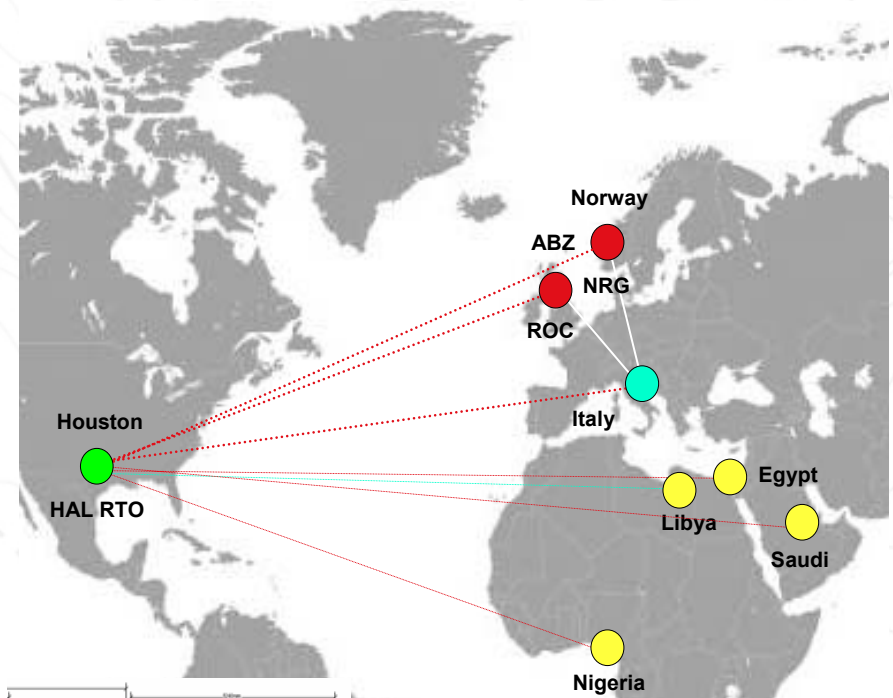
  - *Provide "Just in Time Services"*
    - *Petrophysics*
    - *Engineering Optimization*
    - *Well Planning etc.*
- ***Регионы проведения работ и проблемы***
  - ***Египет – скважины с высоким давлением/температурой***
  - ***Ливия – удаленные районы работ***
  - ***Нигерия – глубоководное бурение***
  - ***Саудовская Аравия – удаленный район в пустыне***



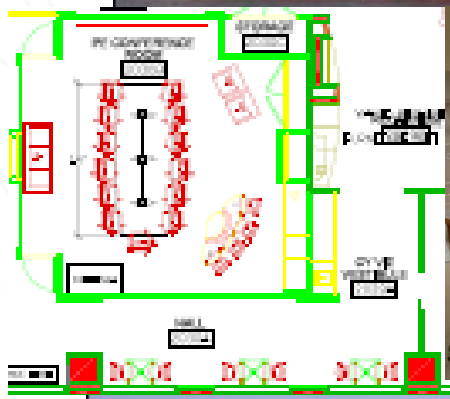
1-2 Rig, RTOC@Client, Italy

24/7 Monitoring and Intervention Stimulation GOM

Stimulation Decreasing NPT:

Example #1

- Majority of all FracPac jobs Mini-Fracs are pumped to analyze fracture geometry and model treatment design
- Conventionally the RIG is shut down 2-8 hours WOO: depending on person doing analysis
- Our experience using RTO consistently minimizes this time by time utilizing multiple analyst and allowing interaction between the Rig, Asset and Frac team simultaneously
- ***For PE RT is normal mode of operations…***

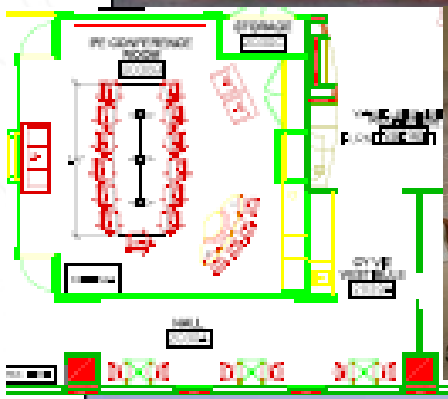


24/7 Monitoring and Intervention Stimulation GOM Круглосуточный мониторинг и вмешателство – ГРП, Мексиканский залив

ГРП с сокращением простоев

Пример 1

- Большинство ГРП (Мини-ГРП) выполняются для анализа геометрии трещин и моделирования процесса ГРП
- Обычно буровая останавливается на 2 – 8 часов для ожидания решения
- Наш опыт применения технологий реального времени значительно сокращает этот простой за счет работы нескольких специалистов и взаимодействия между буровой, геологической группой и бригадой ГРП
- ***Для ГРП это стало обычным режимом работы…***



Drilling & Completions Efficiencies *"Past vs. Present"*

Traditional Operations – Традиционные операции

- **Rotation of SME working on one rig at a time**
  Ротация специалистов на буровой
- ***Decisions made in isolation or with limited organizational input***
  Решения принимаются изолировано
- ***Trouble resolution in isolation or with limited assistance***
  Устранение проблем в изоляции или с минимальной помощью
- ***Limited G&G input in real time***
  Ограниченное участие геологической группы

Real Time Operations – Операции в реальном времени

- ***SME groups supporting multiple rigs*** **– Специалисты обслуживают несколько буровых одновременно**
- ***Broader organizational input for critical decisions*** **– Большее вовлечение ресурсов организации** ***Across multi discipline teams and assets*** **– Многодисциплинарные группы**
- ***Reduced trouble & cost due to greater collaboration*** **– Сокращение проблем и затрат за счет большего взаимодействия…** ***In place Issue escalation & resolution trees***
- ***Increased & Diverse teams*** **– Большие и многопрофильные группы специалистов**
  G&G, Petrophysics, Engineeing COMPLETE Asset Team!

Enabling
The DIGITAL
ASSET

Thank you! / Спасибо!

Please feel free to contact me w/ any RTO questions

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Thank You! Спасибо!

Jeff Grable