Leveraging PI Asset Framework and PI Event Frames to Achieve Operational Excellence in Offshore Drilling

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Agenda

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- PI System Overview
- Benefits of using Event Frames
- Use Cases
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  - Equipment Test
  - Anomaly Detection
- Best Practices/Lessons Learned
- Summary
- Q&A

World’s largest offshore fleet

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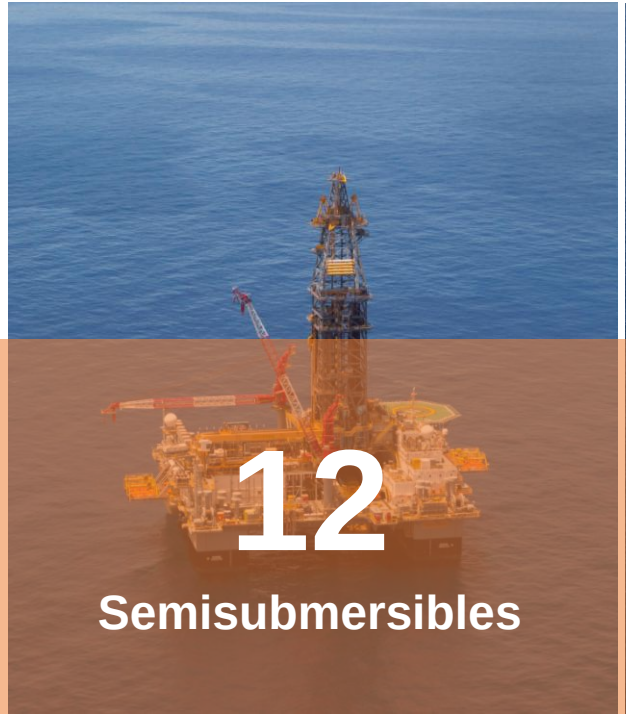


About Ensco

- Operations span six continents
- Drilling experience in virtually every major offshore basin
- Headquarters in London and corporate office in Houston
- More than 40 patent filings since 2015

The Ensco Predictive Intelligence Center

- Ensco's operation and condition monitoring tool.
- Ensco's business case is looking for bottom line results by:
  - Provide early warning of asset degradation
  - Determine the Remaining Useful Life of an asset
  - Reduce costs by optimizing asset selection and maintenance activities
  - Increase revenue capture by limiting unplanned downtime

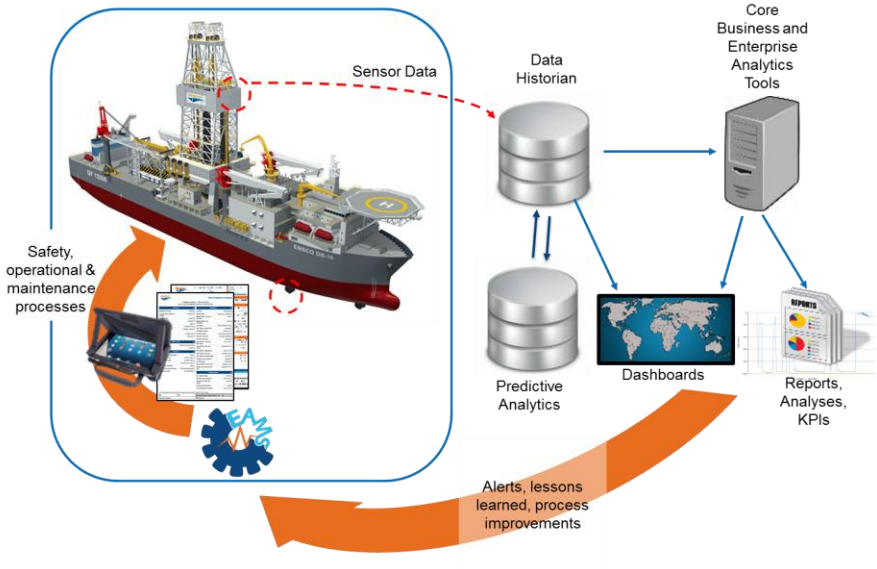
Doing the right work at the right time based on the health of our assets

thereby,

increasing operational uptime and decreasing lifecycle costs

The Ensco Predictive Intelligence Center

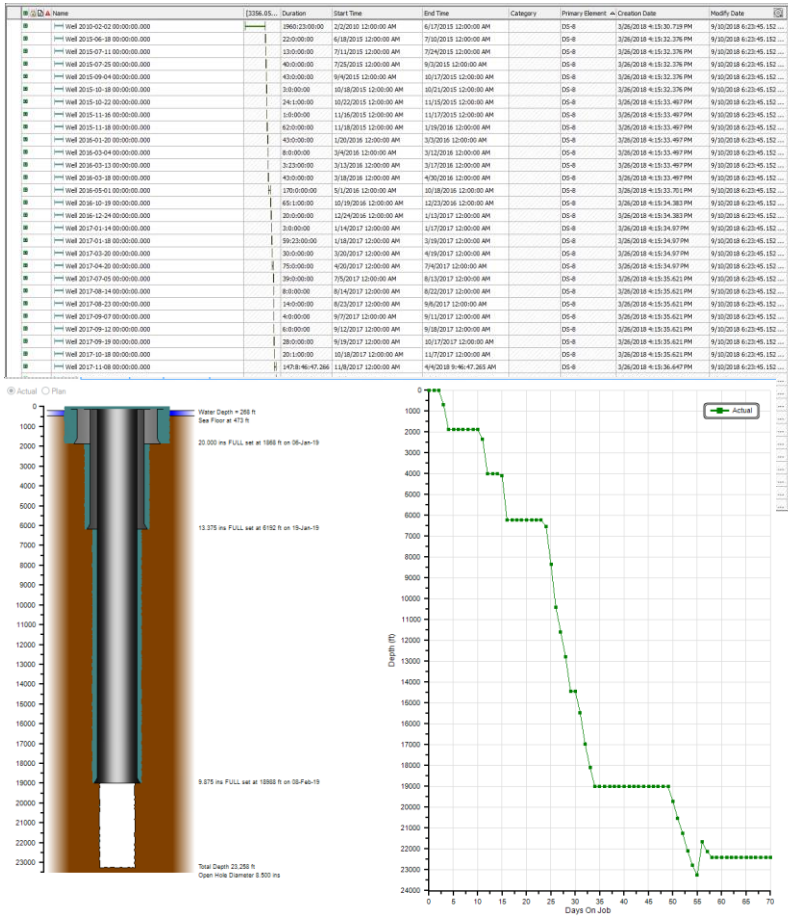
- PI System collects control system and sensor data on board our rigs and streams it back to shore in real time
- Static Data is also collected from corporate databases and reports, also stored on PI linked in PI AF using tables and RDBMS Interface
- Data is processed in Asset Framework, using Asset Analytics
- A Machine Learning Engine works on top of PI System consuming its data and writing back its results as additional tags
- PI System uses these outputs combined with sensor data and Asset Analytics calculations to generate Event Frames as well as Notifications



Ensco's PI System Overview

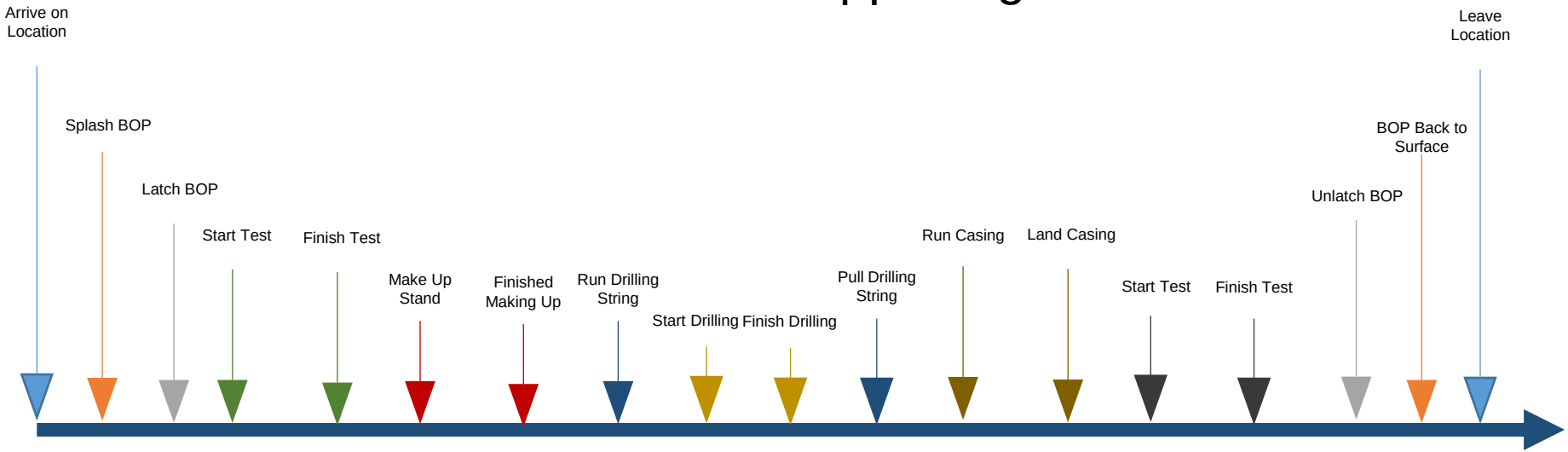
Why Event Frames?

- Offshore Drilling is an event based business.
- Storing data in events helps to compare and find patterns
- Asset Cycles are better understood when stored in events
- Event Frames to store data of Critical Asset testing can be a powerful tool
- Event Frames enable the use of PI Notifications



Why Event Frames?

Because Offshore Well construction is a combination of several event frames happening over time



Benefits of Event Frames

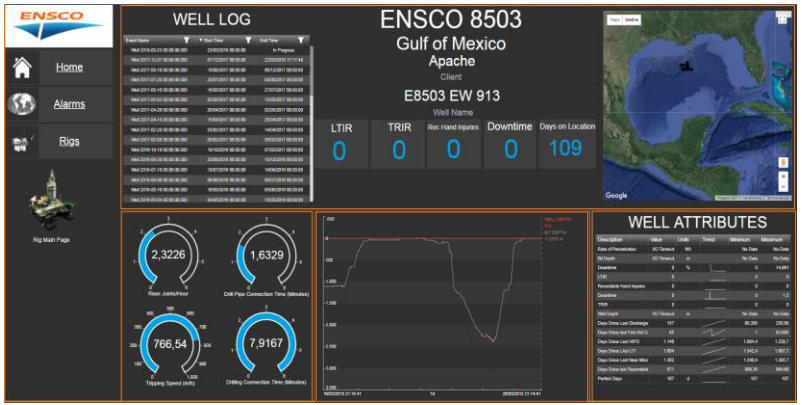
What was my Rig's…

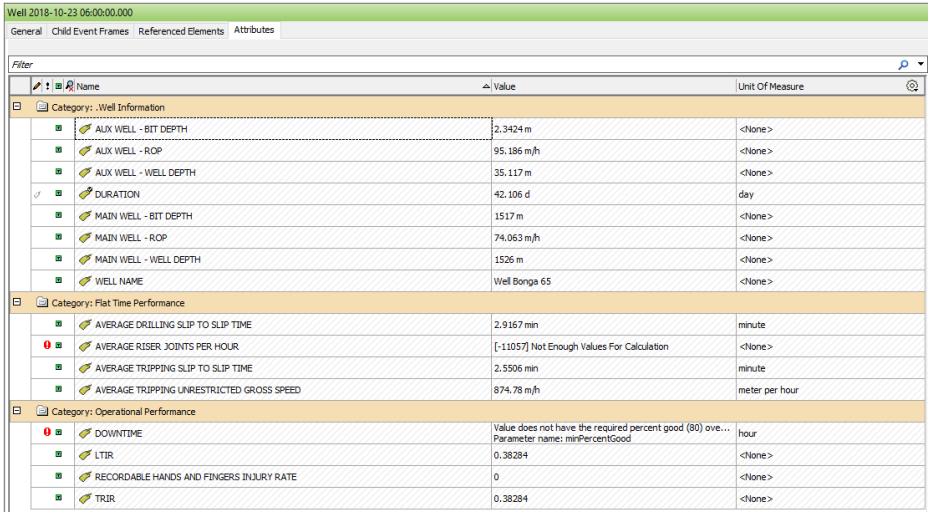
Drilling Performance in the previous Well?

Safety Record in the previous well?

Downtime Hours in the previous well?

Benefits of Event Frames





Use Cases

- Blowout Preventer Run

Background

- Running a Blowout Preventer on an offshore drilling Rig is a very important operation that involves several risks
- Rig Personnel, Office and Client need to be informed during the operation

Solution

- Create physics based model that detects when the BOP is splashed and initiate the event frame
- Using PI Notifications, alert relevant personnel that the BOP run has begun
- Create physics based model that detects when the BOP lands and the event has finished

Results

- The recorded Event Frame stores the data of the BOP run
- Proven high performance can lead to revenue bonuses.
- The notification alleviates mangers from constantly calling the rig asking for statuses

Use Cases

- Asset Tests

Background

- Well Control equipment needs to be tested periodically
- For maintenance purposes cycles need to be counted and segregated between different categories
- Pressure curves, flow rates and times need to be recorded

Solution

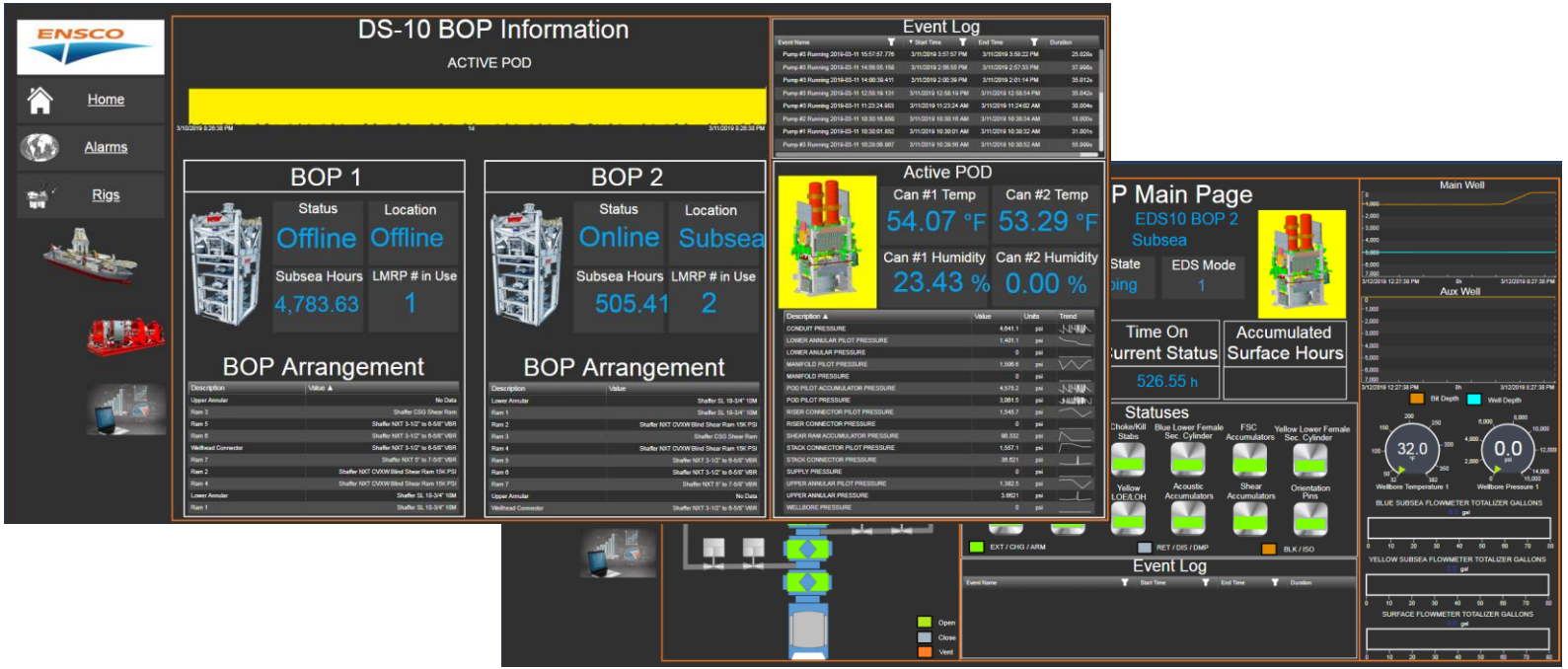
- Create physics based model that detects when the test starts and record the variables of interest
- Create physics based model that detect the test ends
- Created logic to segregate between cycle categories

Results

- Event Frames can alert us on the degradation of the closing cycle and the potential root cause
- Data stored can assist with operational decisions as well as defining maintenance tasks required after the well is completed

Use Cases

- Asset Tests



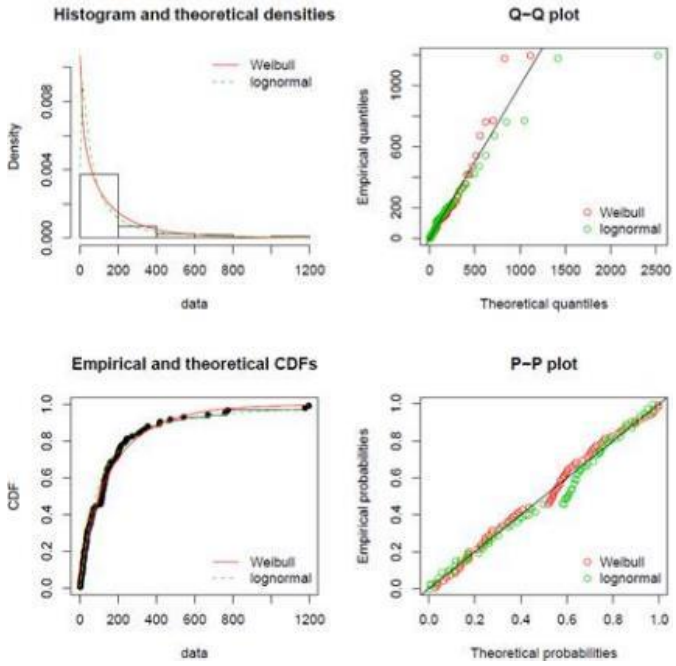
Use Cases

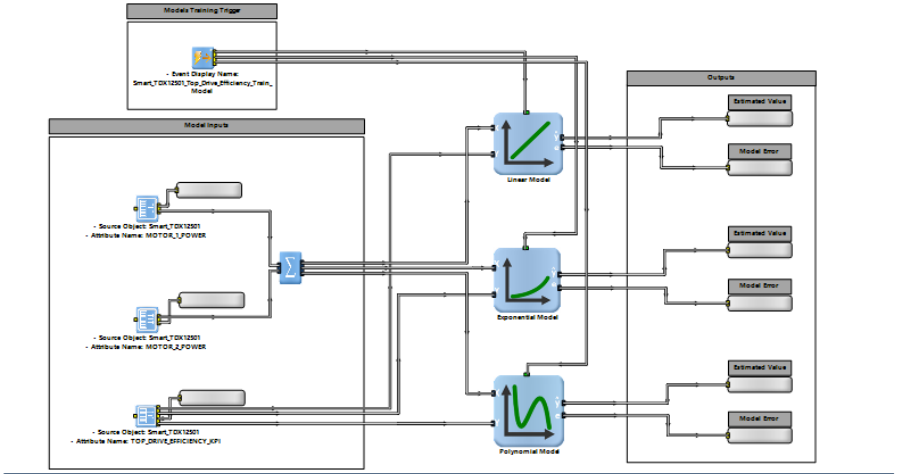
- Anomaly and Early Failure Detection

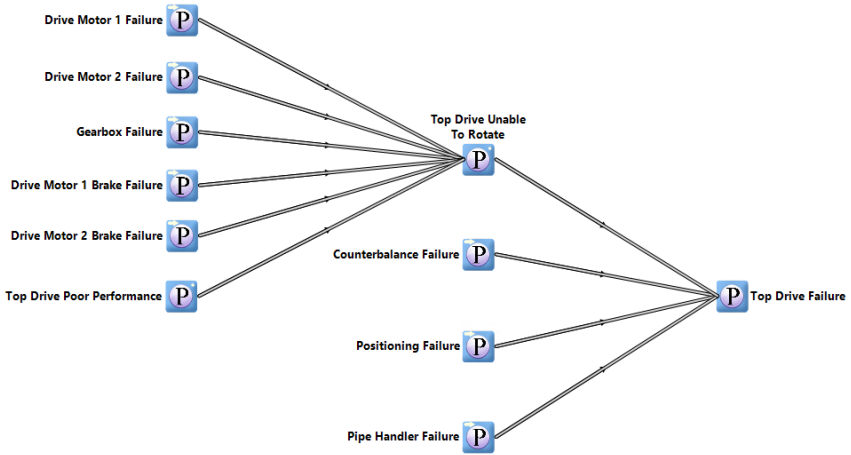
Background	Solution	Results
• Normal equipment alarms are triggered when equipment has already reached a functional failure and an action must be taken • Critical equipment that experiences these events can put us in a downtime situation (loss of revenue) • Crews may only band aid the issue in order to get off of downtime	• Create machine learning models with digital twins and run in parallel with the asset real time • Trigger an Event Frame when the asset starts to deviate from its twin, but before alarms are triggered. • Event Frame triggers a service request in the maintenance system	• Early identification of problems allows for proper planning and scheduling of work • This results in reduced mean time to repair and avoidance of operational downtime

Use Cases

- Anomaly and Early Failure Detection

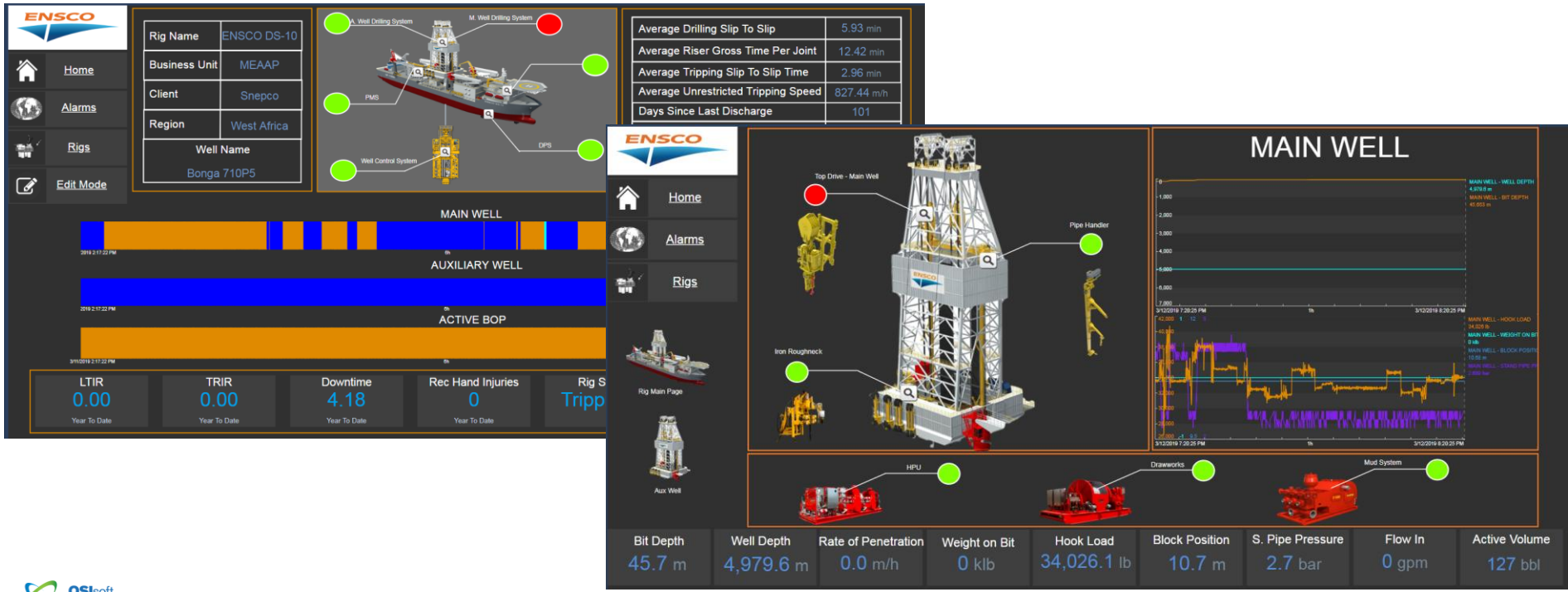






Use Cases

- Anomaly and Early Failure Detection

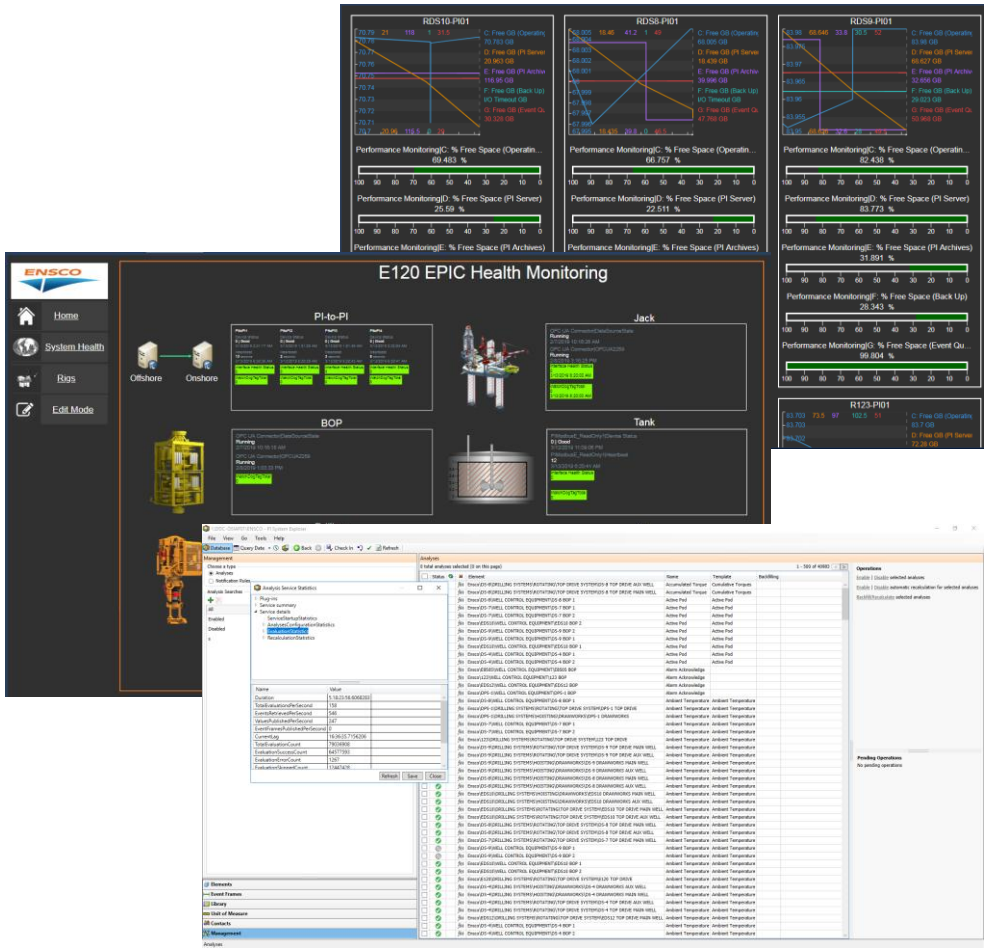


Use Cases

- Anomaly and Early Failure Detection

Lessons Learned

- Define standards first.
  - Data quality
  - AF hierarchy
  - Asset Analytics
- Keep Calculations Efficient
  - Watch your Analysis service
  - Watch your lagging and skipping
  - Computing resources



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CHALLENGE

How can Ensco reduce maintenance and overhaul cost and also reduce unplanned downtime

- Early identification of needed repairs
- Scheduling maintenance work around operational requirements

SOLUTION

Implement the EPIC system which included use of the PI System

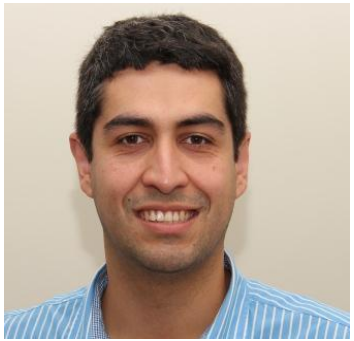
- Integrated PI System to predictive analytics system and the Maintenance System
- Capture important data using PI Event Frames
- Trigger notifications when warranted

RESULTS

Efficiencies created within daily operations

- Removal of manual tasks
- Data helps to identify and repair true root cause problems
- Reduction of mean time to repair

Speaker Information



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Questions?

Please wait for the **microphone**

State your **name & company**

Please remember