
AVEVAWORLD

Blowout Preventer Real-Time Monitoring

AVEVA PI System and Asset Intellect

industrial insight
Data Optimization Experts

SUBSEA SOLUTIONS
WELL-CONTROL & RIG EQUIPMENT CONSULTING

Larry Landis

- Worked offshore with Transocean for 17 years.
- Specialized in the inspection, maintenance, troubleshooting and testing of blowout preventers for 12 years.
- Proficient in electrical and hydraulic schematics
- Ability to provide a real-world approach to the Real-Time monitoring of BOPs
- With Subsea Solutions - September 2023 - Present

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Justin Crawford

- Graduated from Virginia Tech with a BS in Chemical Engineering in 2012.
- He worked as a process engineer before spending four years in China starting up a greenfield activated carbon plant.
- Expertise in the PI System and automation data historization.
- Specializes in delivering actionable data insights with tools like PI, IOTA, Asset Intellect, Power BI, PARCview, Excel, Python, dotnet, and MQTT.
- With Industrial Insight - April 2024 - present
- Fun facts:
  - Avid cyclist 🚵
  - Woodworker 🪵
  - Beekeeper 🐝
  - Wannabe diesel mechanic for our farm equipment 🤣

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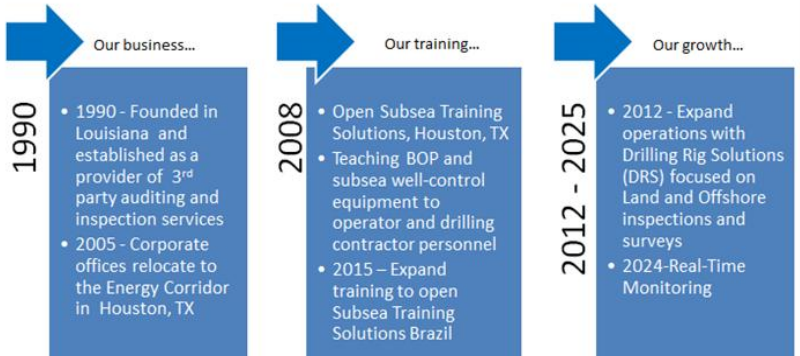
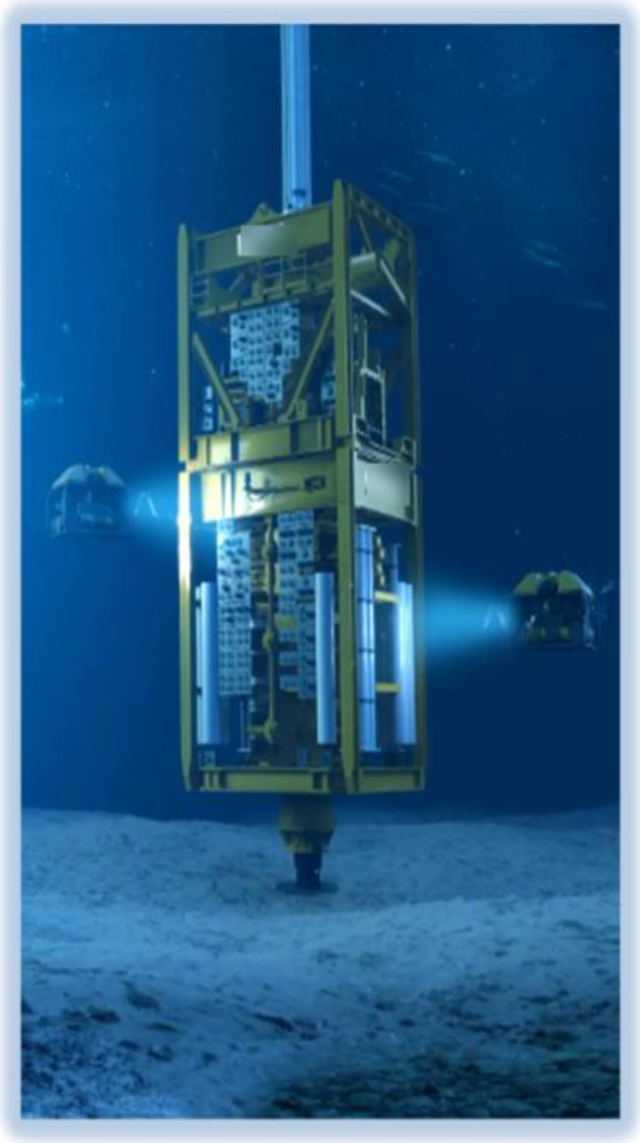
Subsea Solutions

SUBSEA SOLUTIONS
WELL-CONTROL & RIG EQUIPMENT CONSULTING

- Founded in 1990 by Stan Bugara offered technical expertise, auditing, consulting services for upstream Oil and Gas Industry
- Enhance Safety and Operational Excellence Safeguarding Environmental Impacts
- Provided over 4500 surveys in the past 35 years
- Industry Leading Training Centers
- Compliance with Regulatory Standards and Agencies
  - American Petroleum Institute (API)
  - American Society of Mechanical Engineers (ASME)
  - National Association of Corrosion Engineers (NACE)
  - Code of Federal Regulations (CFR)
  - Bureau of Safety and Environmental Enforcement (BSEE)
  - Bureau of Ocean Energy Management (BOEM)
- OEM-Cameron, NOV, GE





Industrial Insight

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- Founded by Jim Gavigan in 2016 after his experiences at former OSIsoft as an account manager and his work at a Systems Integrator
- Deep with PI System from architecture/installation through custom solutions with PI System tools
- We cover almost all major industries: pulp and paper, oil and gas, chemicals, power generation, food and bev, mining, pharma
- We are deep skill-wise

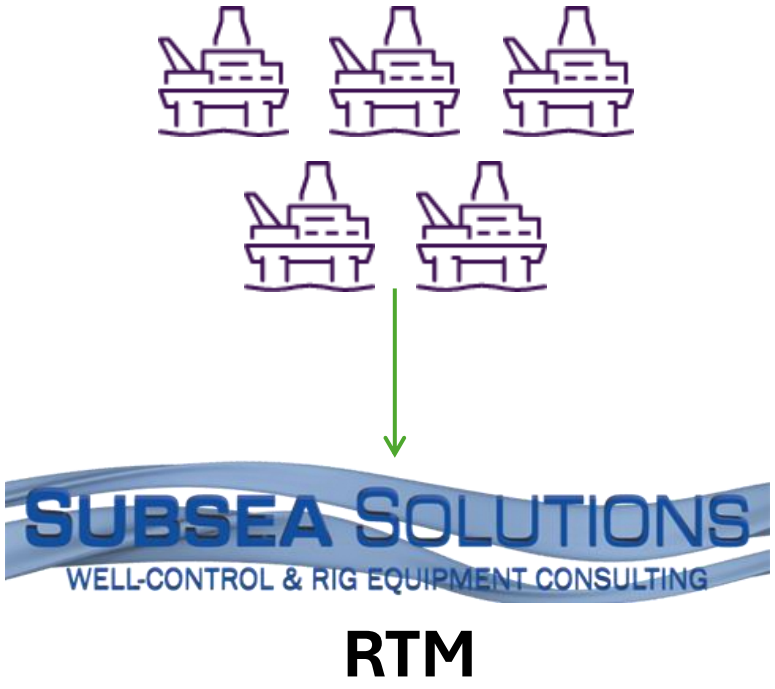
- All of us have some type of field experience in engineering and/or IT
- We come from diverse industrial backgrounds
- We work exclusively with time-series databases/data historians with 95% plus of our work centering around the PI System
- We also work with Business Intelligence tools like Power BI and Tableau
- We also are trained and versed with several advanced analytics/machine learning tools (Simca, Lityx, a little bit of Seeq)
- Several staff members are well-versed in writing custom code

Problem Statement

After the Deepwater Horizon oil spill in 2010, 30 CFR 250.724 & 737 regulations require an independent 3rd party to perform real-time monitoring of the blowout preventers on offshore drilling rigs in the Gulf of Mexico.

We need to provide the following:

- Real-time monitoring of the BOP using existing data pipelines off the rig
- Easy Scalability for new rigs onboarded to the platform
- Visualization of the current status and overall health of the blowout preventer
- Alarm visualization and contextualization
- Visualization of function sequencing
- System to compile information from the rig ie:
  - Failure tracking
  - Observation tracking
  - Test history, etc.
- Custom analytics as market differentiators
- Ability for clients to view only their data in all solutions



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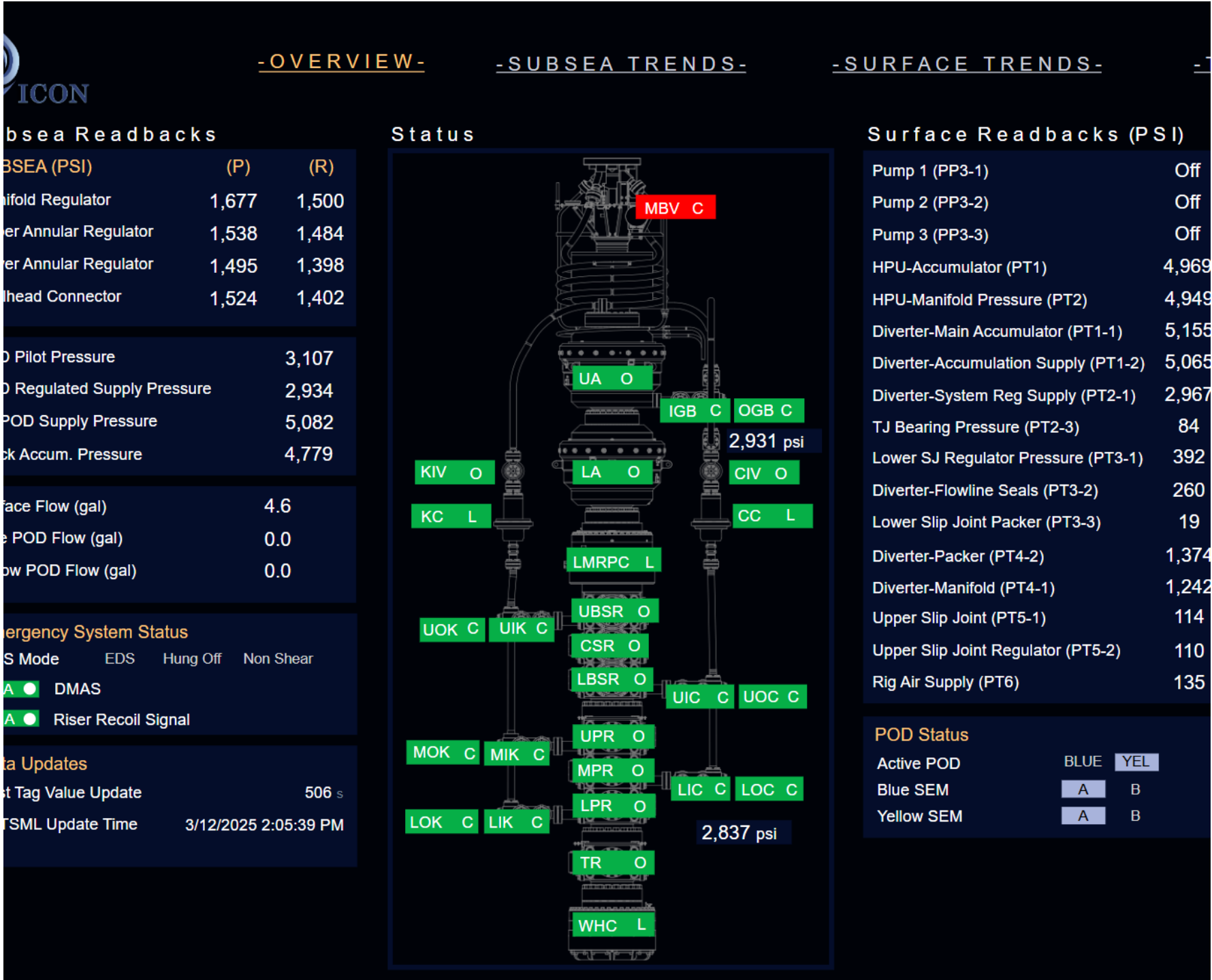
Overview Page

BOP status, surface & subsea pressures, HPHT, EDS, DMAS and HPU pressure and consumption on PI Vision



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Subsea and Surface Trends

- Pilot and readback pressures each of the subsea circuits.
- All trends can be overlaid for drill down investigation

ICON

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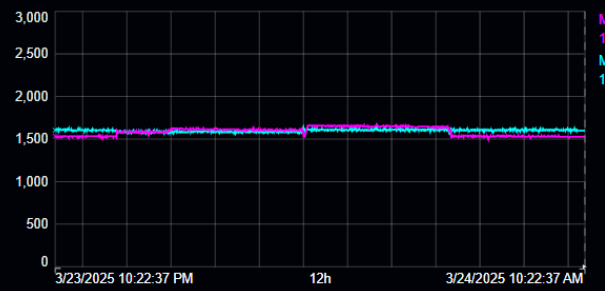
3,000
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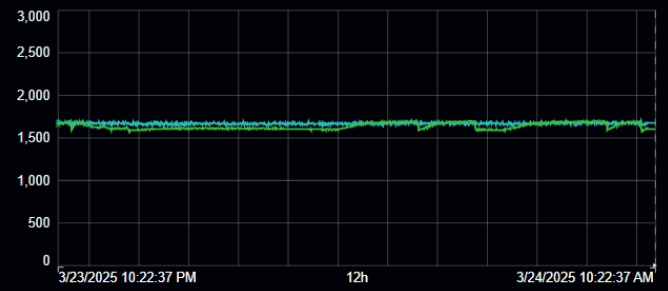
3/23/2025 10:22:37 PM
12h
3/24/2025 10:22:37 AM
Manifold Regulator - R
1,527.6 psi
Manifold Regulator - P
1,598.34 psi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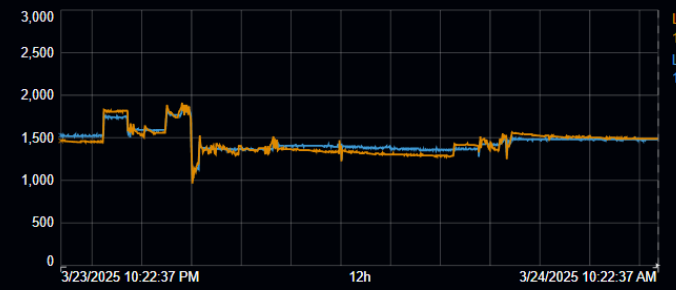
3/24/2025 10:22:37 AM
Upper Annular - R
1,603.66 psi
Upper Annular - P
1,677.27 psi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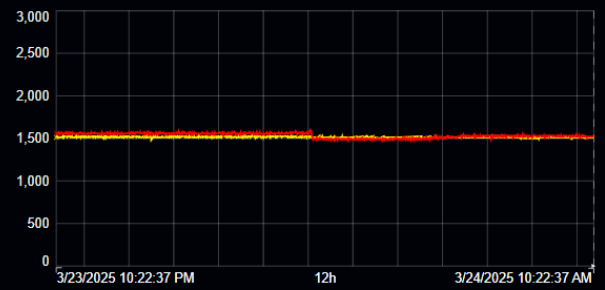
Lower Annular - R
1,490.38 psi
Lower Annular - P
1,480.98 psi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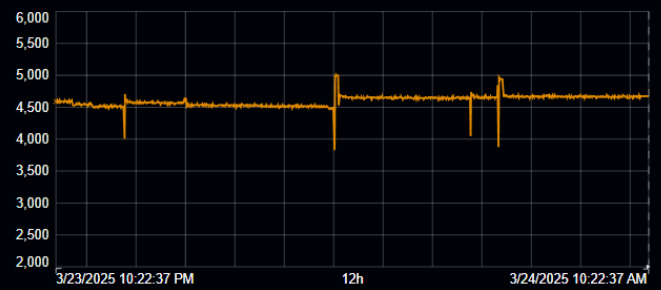
Wellhead Connector - R
1,521.39 psi
Wellhead Connector - P
1,512.14 psi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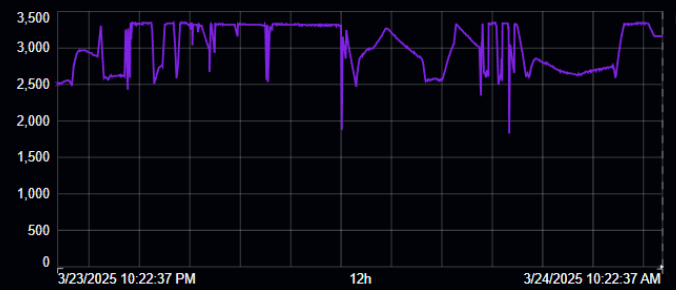
5K Pod Supply Pressure
4,674.47 psi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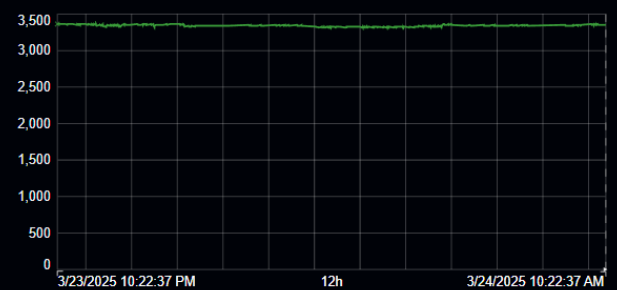
Pod Supply Pressure
3,161.76 psi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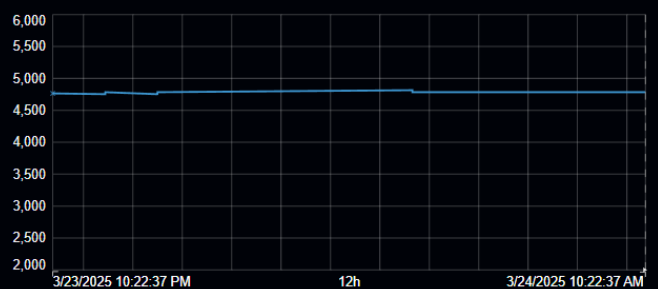
Pod Pilot Pressure
3,353.66 psi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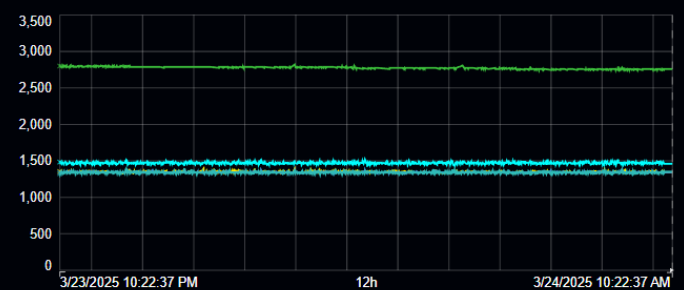
Stack Accumulator Pressu
4,785 psi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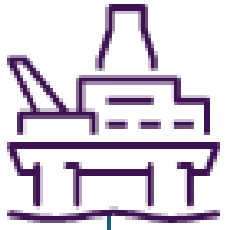
3/23/2025 10:22:37 PM
12h
3/24/2025 10:22:37 AM
Inactive Pod - P
2,759.89 psi
Inactive Upper Annular - P
1,352.61 psi
Inactive Lower Annular - P
1,342.46 psi
Inactive Manifold Annular - P
1,461.23 psi
Inactive Wellhead Connector - P
1,343.74 psi

Solution Architecture – Subsea Solutions RTM



Black Box Azure Pipeline to WITSML Store

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RTM

WITSML Collector Custom dotnet service

AVEVA PI System – Real Time Monitoring

AVEVA

Custom Sequence Visualization

Reporting and Manual Data Entry

ASSET INTELLECT

DIMENSION SOFTWARE

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PI System Auto Tag Builder

All template-based build

Non Shear EDS	\\%@\Subsea Solutions|~Configuration|PI Server%\%@~Configuration|Tag Prefix%.%@.|Tag Config|Tag Name%;ptclassname=classic;pointty
Pod Casing EDS Status	\\%@\Subsea Solutions|~Configuration|PI Server%\%@~Configuration|Tag Prefix%.%@.|Tag Config|Tag Name%;ptclassname=classic;pointty
Tag Config	
compressing	SELECT [%Attribute%] FROM [%Template%] WHERE [Attribute Name] = '%..|..|Attribute%' AND [Tag Prefix] = @[|~Configuration|Tag Prefix]
descriptor	SELECT [%Attribute%] FROM [%Template%] WHERE [Attribute Name] = '%..|..|Attribute%' AND [Tag Prefix] = @[|~Configuration|Tag Prefix]
digitalset	SELECT [%Attribute%] FROM [%Template%] WHERE [Attribute Name] = '%..|..|Attribute%' AND [Tag Prefix] = @[|~Configuration|Tag Prefix]
displaydigits	SELECT [%Attribute%] FROM [%Template%] WHERE [Attribute Name] = '%..|..|Attribute%' AND [Tag Prefix] = @[|~Configuration|Tag Prefix]
engunits	SELECT [%Attribute%] FROM [%Template%] WHERE [Attribute Name] = '%..|..|Attribute%' AND [Tag Prefix] = @[|~Configuration|Tag Prefix]

Really long PI Point data reference template definition to generate all tags.
\\%@\Subsea Solutions|~Configuration|PI Server%\%@~Configuration|Tag Prefix%.%@.|Tag Config|Tag Name%;ptclassname=classic;pointtype=%@.|Tag Config|pointtype%;...

Tables as Tag builders

Name	Value Type
Attribute Name	String
Tag Prefix	String
Tag Name	String
Tag ID	String
compressing	Int16
descriptor	String
digitalset	String
displaydigits	Int16
engunits	String
instrumenttag	String
location1	String

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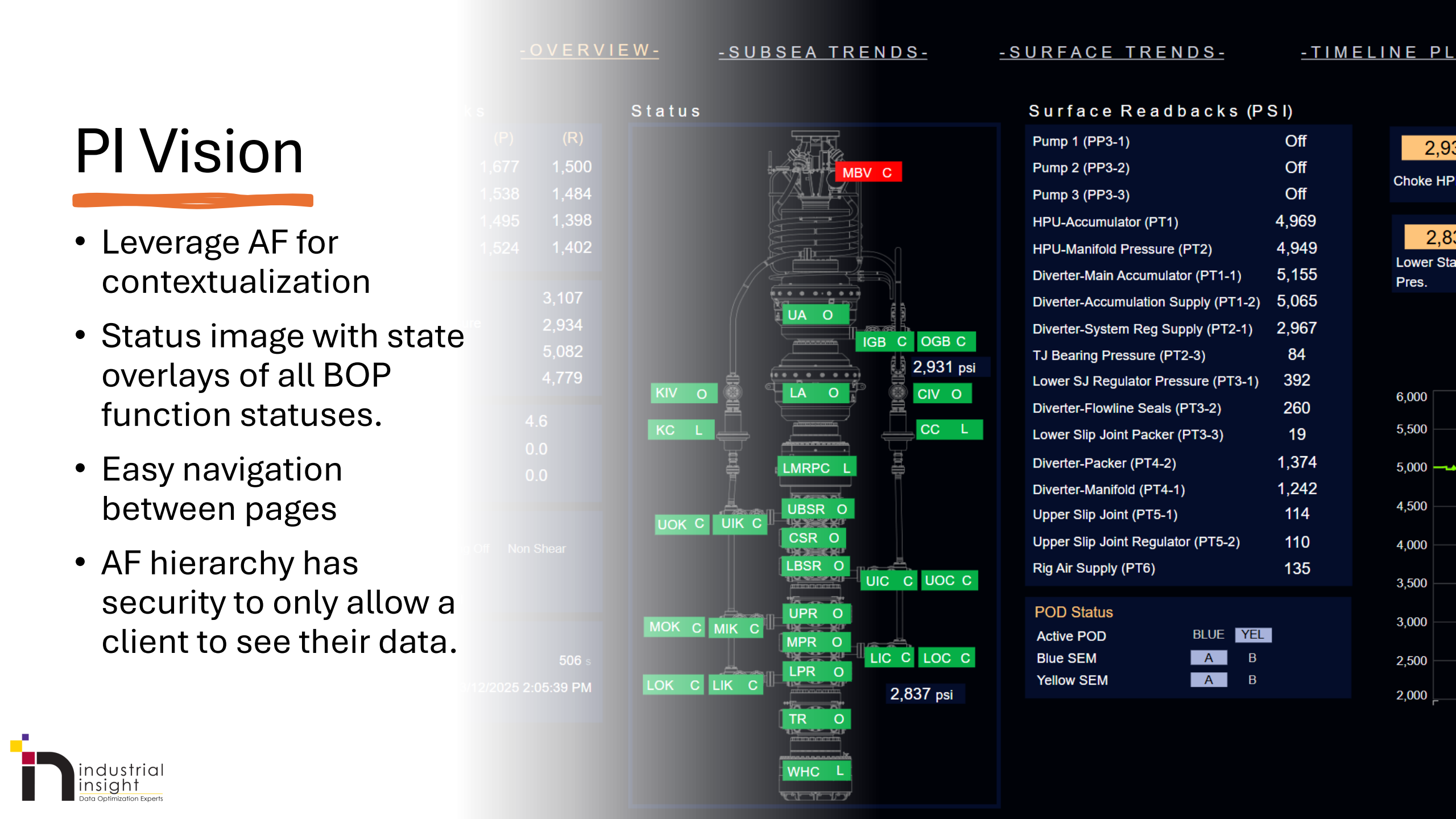
PI System Continued

- Active Pod Requirement
  - Need to have a single tag to look at current pod state
  - Problem is with redundant control systems each control system has its own set of tags.
  - Solution: Setup an “Active Pod” element that aggregates the currently active control system

Name	Expression
ActivePod	`If '..|Pod Select' = "Block/Vent" then Exit() else '..|Pod Select'`
ActiveSEM	`If ActivePod = "Blue Pod" Then '..\Blue Pod|Pod SEM Select' else If ActivePod = "Yellow Pod" Then '..\Yellow Pod|Pod SEM Select' else NoOutput()`
SEM	`Right(Left(String(ActiveSEM),5),1)`
Target	`IF ActivePod = "Yellow Pod" AND SEM = "A" THEN '..\Yellow Pod\SEM-A\Solenoid Firing Status|Choke Stabs' ELSE IF ActivePod = "Yellow Pod" AND SEM = "B" THEN '..\Yellow Pod\SEM-B\Solenoid Firing Status|Choke Stabs' ELSE IF ActivePod = "Blue Pod" AND SEM = "A" THEN '..\Blue Pod\SEM-A\Solenoid Firing Status|Choke Stabs' ELSE IF ActivePod = "Blue Pod" AND SEM = "B" THEN '..\Blue Pod\SEM-B\Solenoid Firing Status|Choke Stabs' ELSE NoOutput()`

PI Vision

- Leverage AF for contextualization
- Status image with state overlays of all BOP function statuses.
- Easy navigation between pages
- AF hierarchy has security to only allow a client to see their data.



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Custom Sequence Visualization

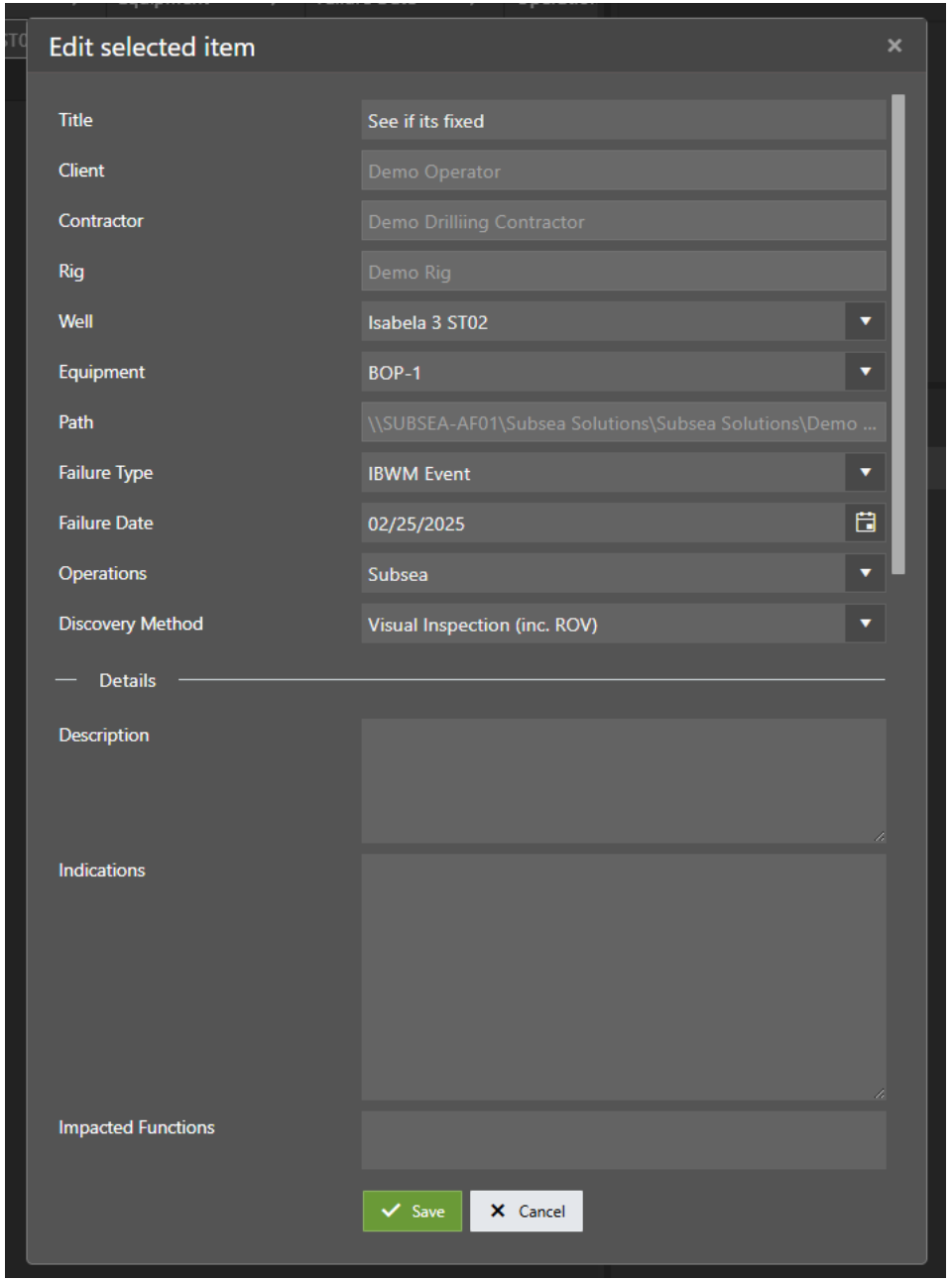
- Easy visual and validation of cascading BOP functions.
- Visual is a custom dotnet website that queries the AFSDK for config and values and is embedded via iFrame into the display.

Asset Intellect Solution

- COTS Software was a major reason for going with Dimension.
- Easy integration with Asset Framework and PI
- Combine AF with asset relative custom SQL database
- Filter your database queries based on your current path in Asset Intellect
- Security with Asset Framework and Asset Intellect combined allows each client to only see their data.
- Easy Manual Data Entry

BSSE Issue Tracking

- Failure, Observation, and other reports
- Easy Manual Data Entry
- Design SQL database backend and then define the form fields to fill it out.
- Manual Data Entry to:
  - SQL Database
  - AF Elements / Attributes
  - AF Event Frames / Attributes
  - PI Tags via AF Attributes
- Entry via Popup form, embedded form, and in grid.



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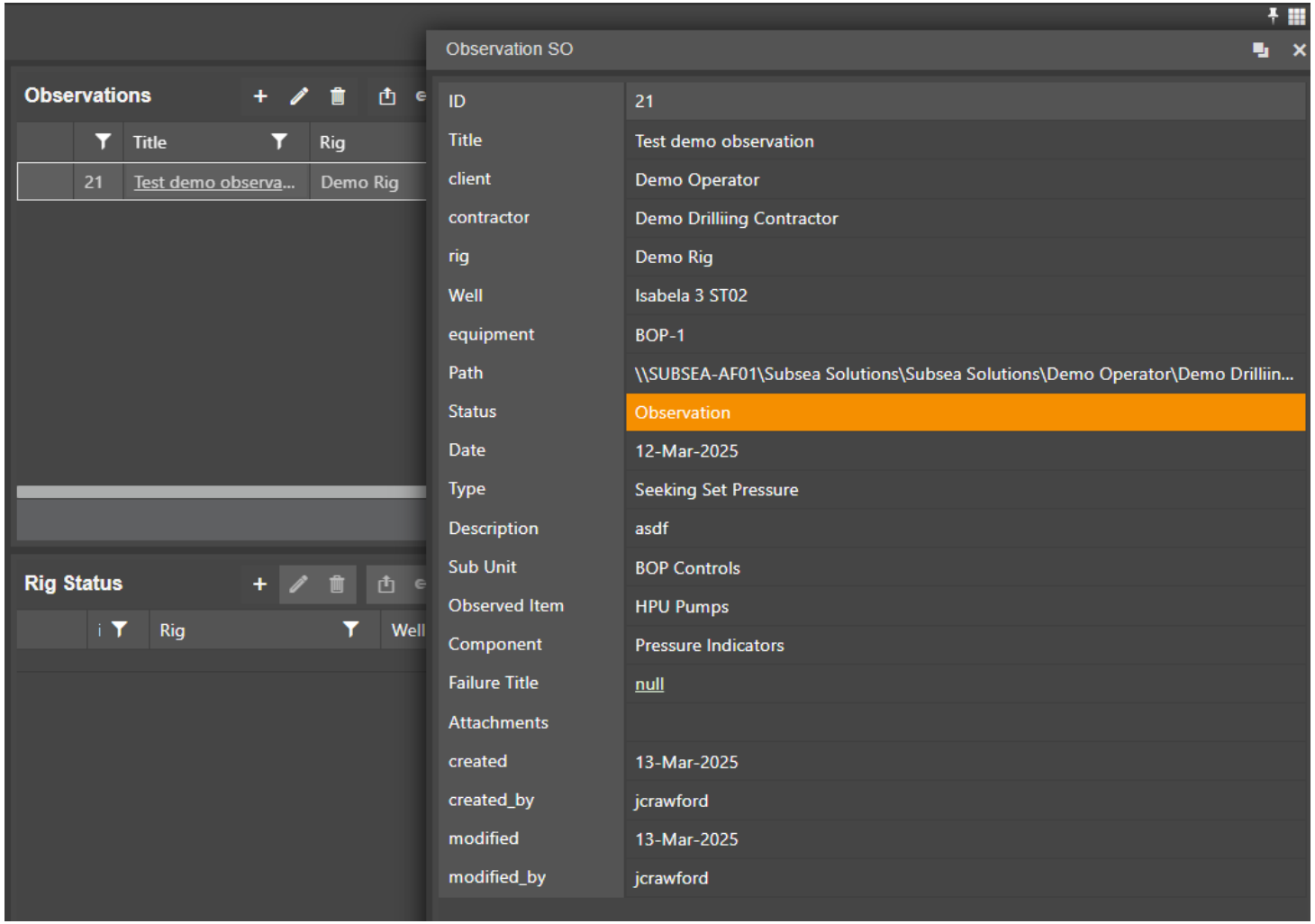
Slideouts

- Easy configuration of slideouts, popups, and links for more information.
- Ease of dynamic and asset relative design.



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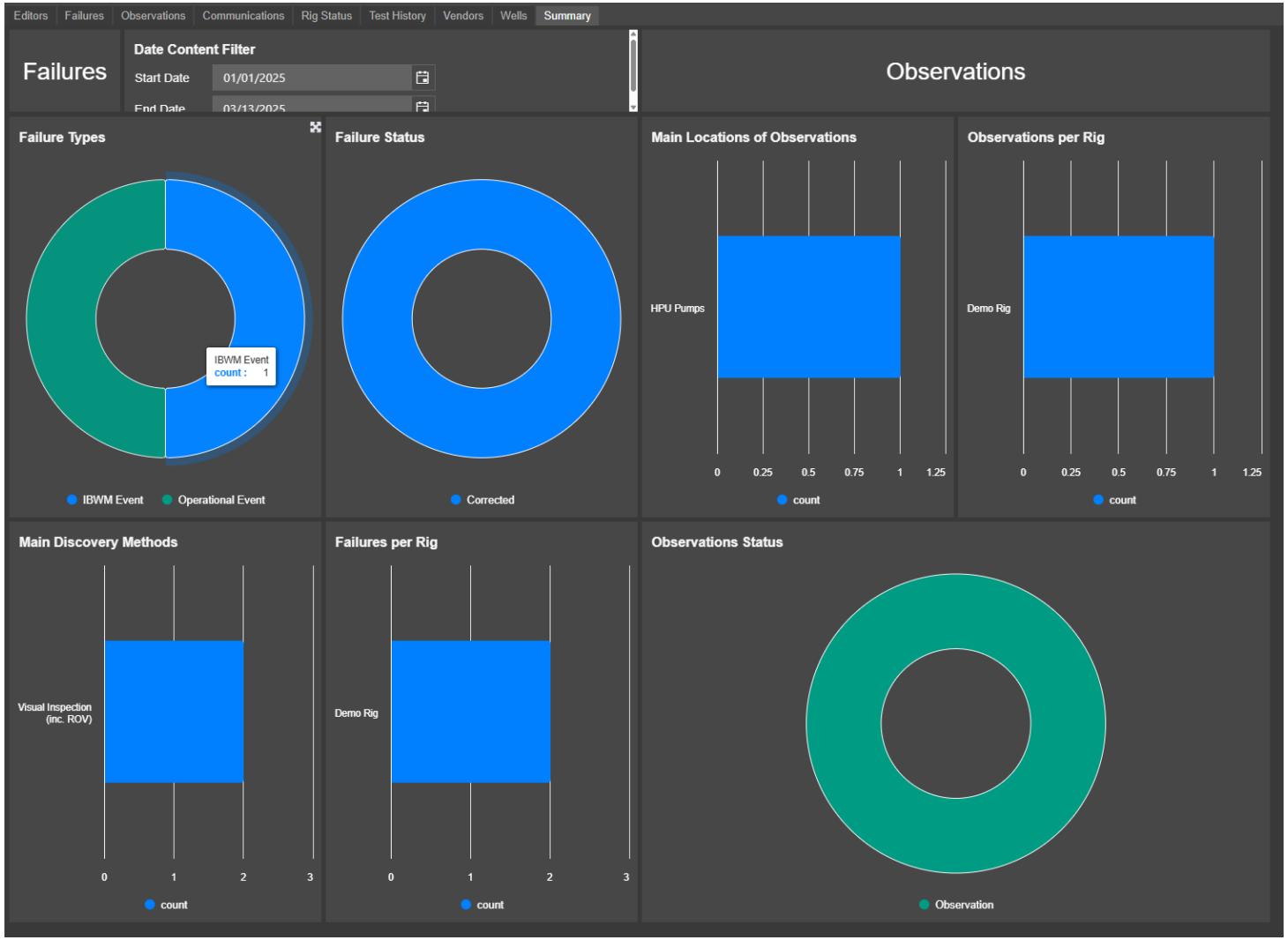
Business Intelligence

- Can do BI style visuals and interactivity without the normal BI tools.
- Can use and embed PowerBI and similar if desired.
- Flexibility is the name of the game here.



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Alarms & Analytics

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Alarms

- Critical pressures points
  - LPA (HPU, subsea accum., Subsea regulators, pilot, air, diverter accum.)
- Loss of signal
- Emergency function activations
- Faults
- Differential pressure
- Operations/sequence alarms
- *Tag availability*

Analytics

- Calculated consumption rates
- Health tools *(development)*
  - Annular *(element/operator)*
  - HPU *(accumulators)*
  - Packers *(ram position)*

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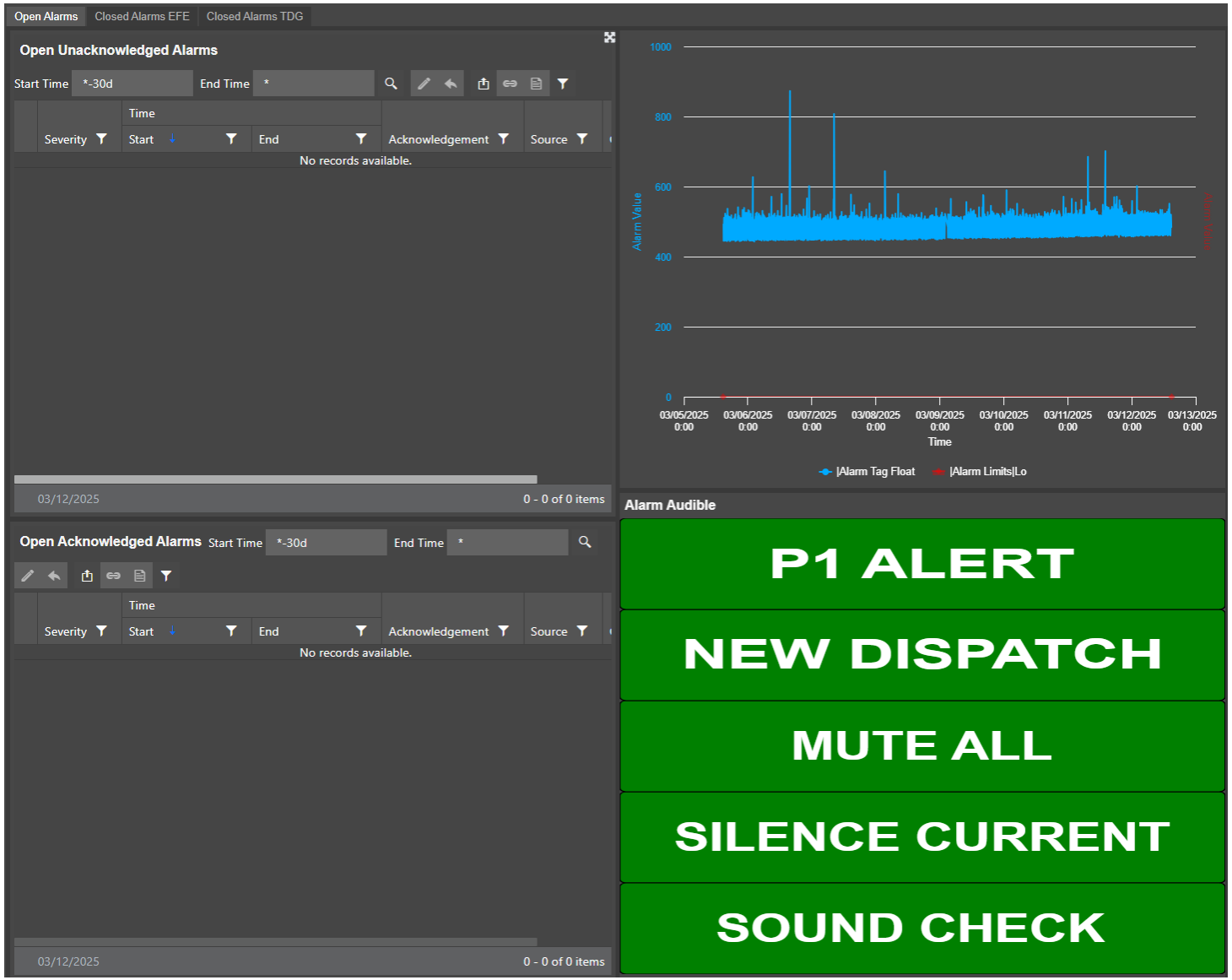
Alarm Dashboard

- Ability to enunciate alarms without a SCADA system using images and injecting real time data into them.
- Dashboard to receive Event Frames as alarms and use AF acknowledgements to manage them.
- Click an alarm and see the trend for the time of interest in Asset Intellect or PI Vision



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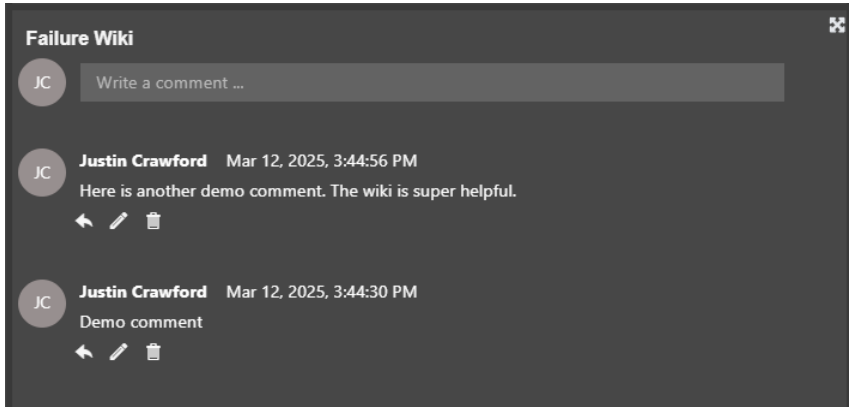
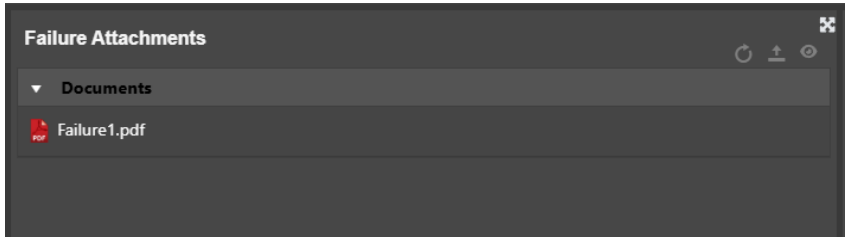
Other Benefits

- The wiki allows threaded comments unique to each SQL record, AF Event Frame, AF Element, etc.
- Ease of adding attachments that are related to each SQL record same as the wiki.
- We chose to go with Asset Intellect because the project is never fully scoped, so it provides us the freedom to build what we need now with the ability to build whatever is dreamt up in the future.





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Subsea Solutions rolls out an RTM Solution for BOPs

Challenge

- Real-time monitoring of the rig's blowout preventer using existing data pipelines off the rig
- Visualization of function sequencing
- Manual reporting processes led to mistakes.

Solution

- Deployed AVEVA™ PI System™, Dimension Asset Intellect, and custom .NET solutions to streamline data collection, access, analysis, manual data entry, and reporting

Results

- Improving reliability and performance through visibility
- Ease of navigation for 3rd party users and clients
- Provided the ability to layer trends to assist with troubleshooting
- Avoided **$7-10MM** of downtime due to unplanned stack pull

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Questions???


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Thank you

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