

#### Regional Seminar Series

#### Houston, Texas, USA



# Using PI System to Model and Monitor World Class Oil and Gas Assets

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Marathon Oil Corporation

November 16, 2010

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# About Marathon Oil Corporation



- Marathon is an integrated international energy company engaged in exploration and production; oil sands mining; integrated gas; and refining, marketing and transportation operations.
- Marathon has principal operations in the United States, Angola, Canada, Equatorial Guinea, Indonesia, Libya, Norway, Poland, Kurdistan, and the United Kingdom.
- Marathon is the fourth-largest United States-based integrated oil company and the nation's fifth-largest refiner.



# Background



- Oil and gas production in ten countries. Refined product sales in 18 states.
- PI Systems:
  - Four in upstream (Houston, MEGPL, EGLNG, and Norway)
  - Eight in downstream (refineries in Illinois, Kentucky, Louisiana, Michigan, Minnesota, Ohio, and Texas)
  - A supply and distribution PI server was recently implemented in our downstream headquarters in Findlay, Ohio.
- Our first PI System implementation was Robinson, Ill in 1988. Our first PI System was sold to us by Pat Kennedy.



#### Business Challenges



- No easy way to retrieve time-series data for upstream assets
- Requirements to gather data from six different control systems (including system with no existing interface)
- Embrace standards such as thin client using SharePoint®
- Integrate with Digital Oilfield initiatives such as Viewpoint
- Retrieve data from JV partners
- Advanced computation capability to highlight problem areas and prioritize workflows
- Provide knowledge management and knowledge transfer to newer technical professionals
- Integration with modeling applications such as Kappa Diamant, Kappa Saphir, HYSYS, ECLIPSE.



#### Contents

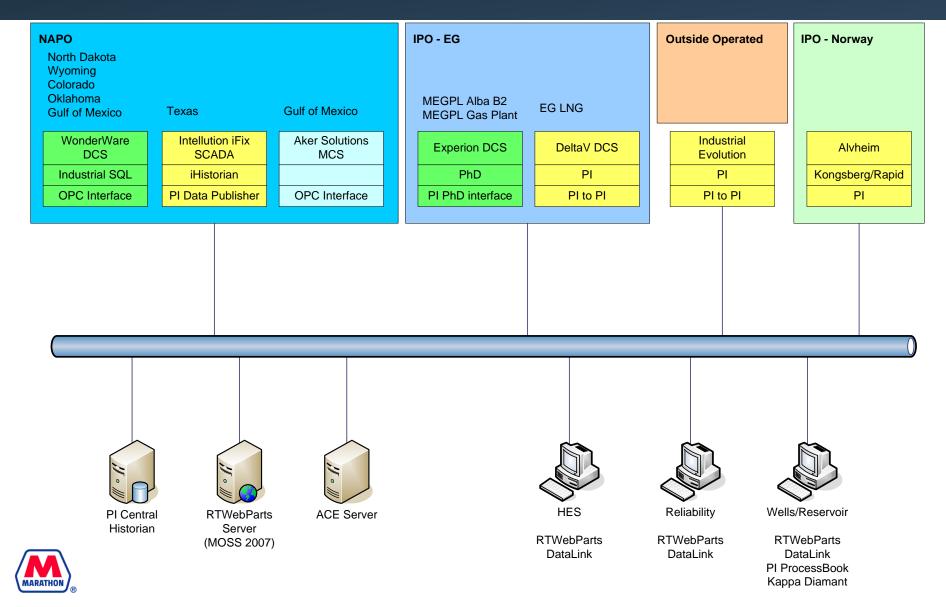


- Modeling: Equatorial Guinea
- Modeling: Droshky (Gulf of Mexico)
- Monitoring and Alerting: Mimm's Creek Plunger Lift Well Diagnostic Tools



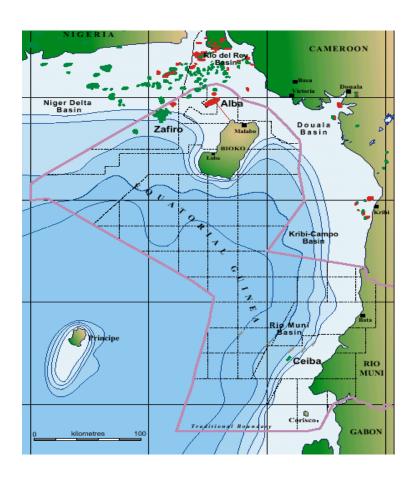
#### Central Historian Architecture Overview





# Marathon Equatorial Guinea





#### **Ownership in Alba Block**

Marathon 63.25% (65.21% W.I.)

Noble 33.75% (34.79% W.I.)

GEPetrol 3.00% (Carry)

#### **Ownership in Alba LPG Plant:**

Marathon 52.17% (65.21% W.I.)

Noble 27.83% (34.79% W.I.)

**SONAGAS** 20.00% (Repaid Carry)

Alba Field is located 18 miles NW of Bioko Island, Equatorial Guinea in Rio Del Ray Basin.

Water Depth ~250 ft

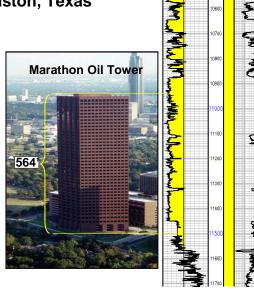


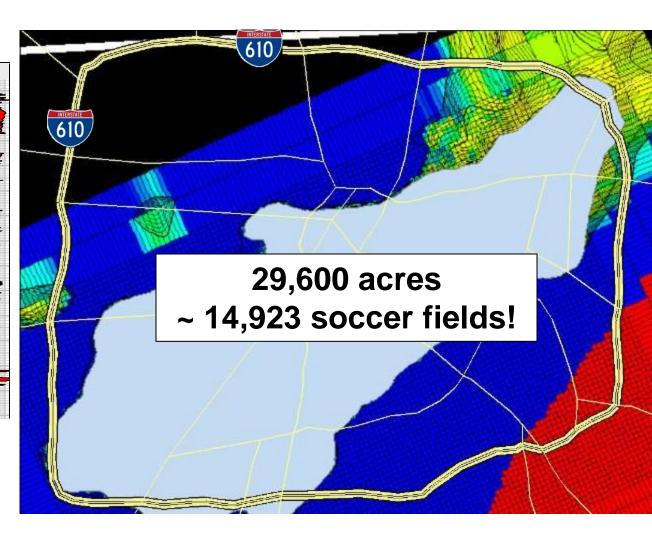
# Alba Field Is all about the scale!

Alba - 9



Alba 9 Well and Marathon Oil Tower Houston, Texas









# Finished Platforms













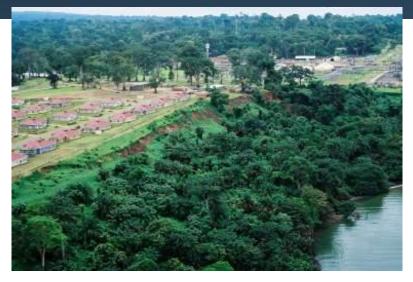
# MEGPL Gas Plant



# Housing Complex





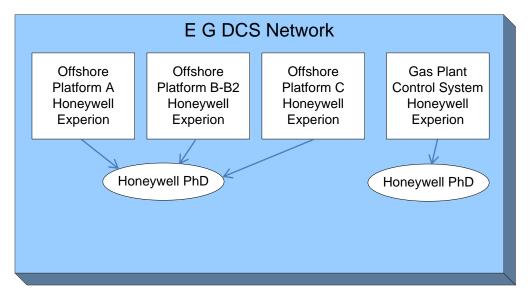


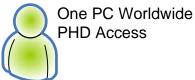




#### Equatorial Guinea - Before PI System



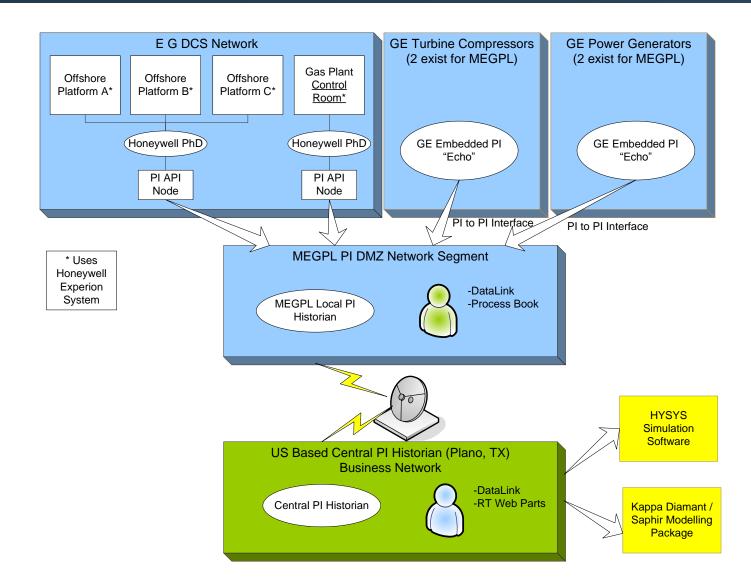






#### Equatorial Guinea - After Real-Time Infrastructure







#### **Equatorial Guinea - Benefits**



- Interface to HYSYS simulation package
- Interface to Kappa modelling packages
- Worldwide viewing of EG data
- Exports to GE and other service companies
- Time stamp matching of offshore and on-shore data



# Droshky - Background

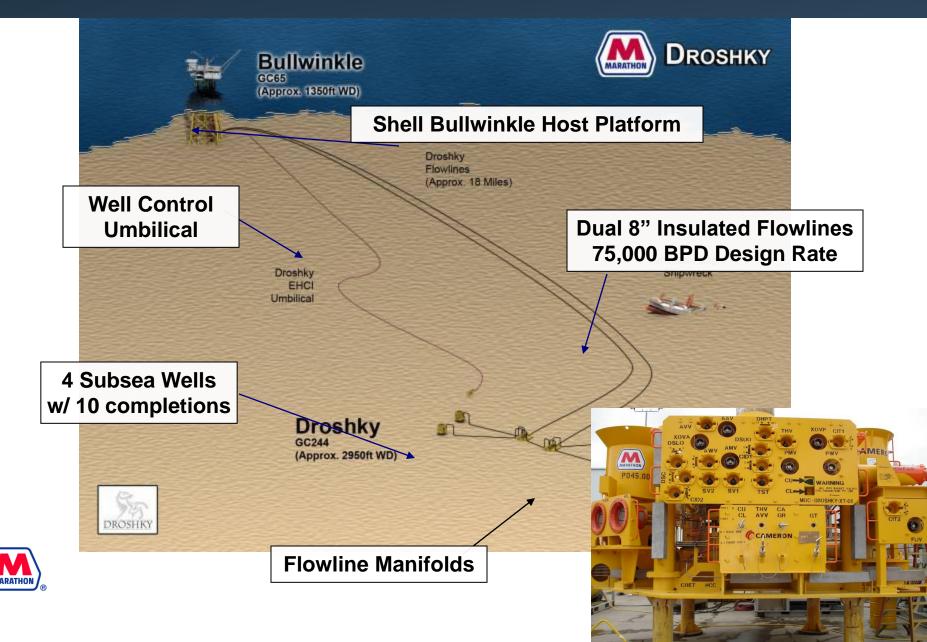


- The field is 100 percent Marathon (WI). The sub-sea wells tie back to DOR's Bullwinkle Platform, Gulf of Mexico. The tie back is through an 18mile pipeline.
- The majority of the data is being acquired from Aker Solutions sub-sea control system.
- Some data will be extracted from DOR's PI System, coming from Industrial Evolution.
- First production was July, 2010.
- Downhole calculations by Baker-Hughes DHTP Calibration server on the platform.
- Re-calibrations performed monthly by Baker-Hughes in Houston office.

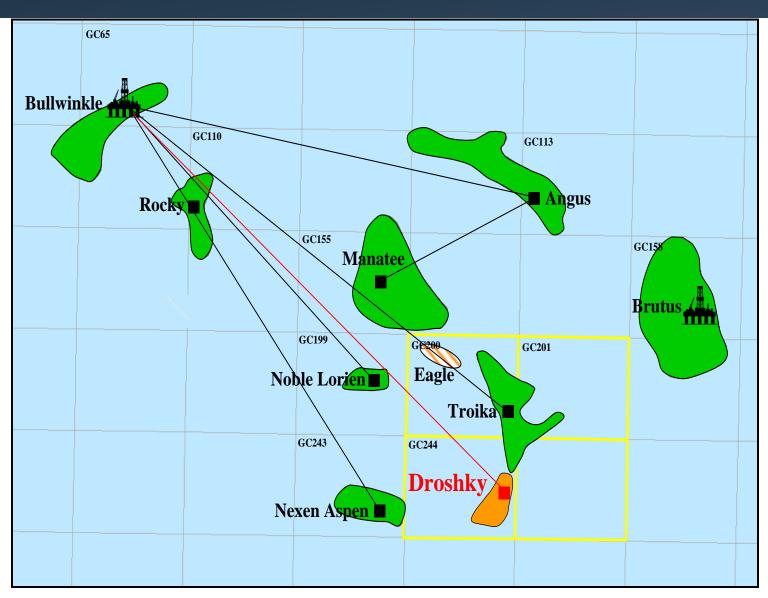


#### Subsea facilities











#### Umbilical

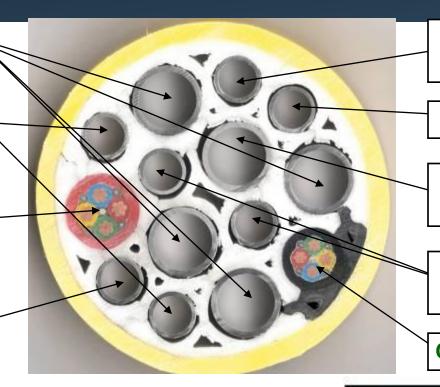


**Methanol** 

HP Hydraulic Power

Electrical Power

Asphaltene /
Paraffin
Inhibitor



Chemical / Scale Inhibitor

**Spare** 

**Annulus Monitoring** 

LP Hydraulic Power

**Communication** 

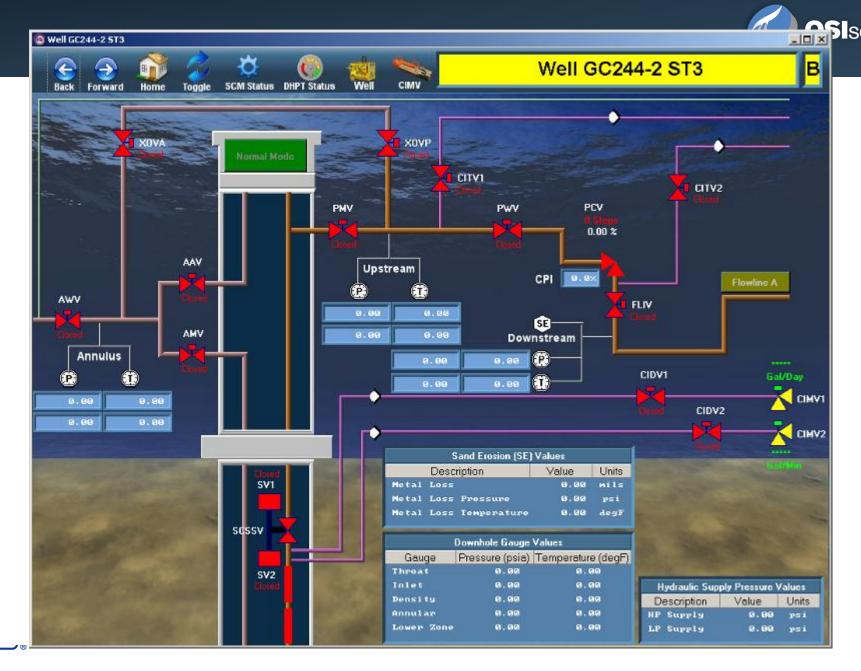
- 18.5-mile "extension cord" that connects the tree control pods to host platform
- Allows monitoring and control of the wells



E 2319787.82 # 10127401.37 03/11/09 STA 932+17.18 DCC -15.5 16:30:00 D 1238.4 Alt 8.2 Hdg 35.7 H20: A2 Post Installation

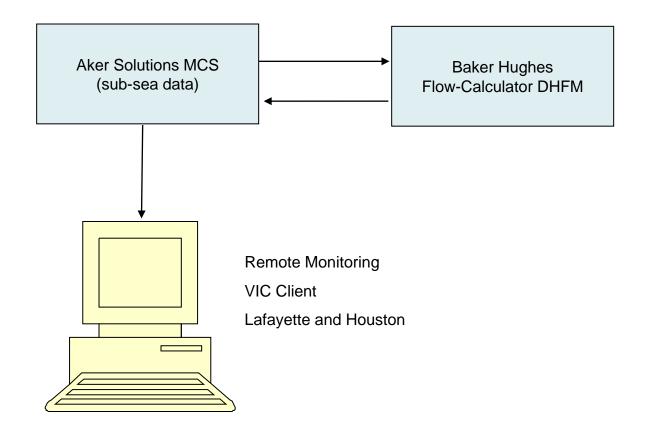




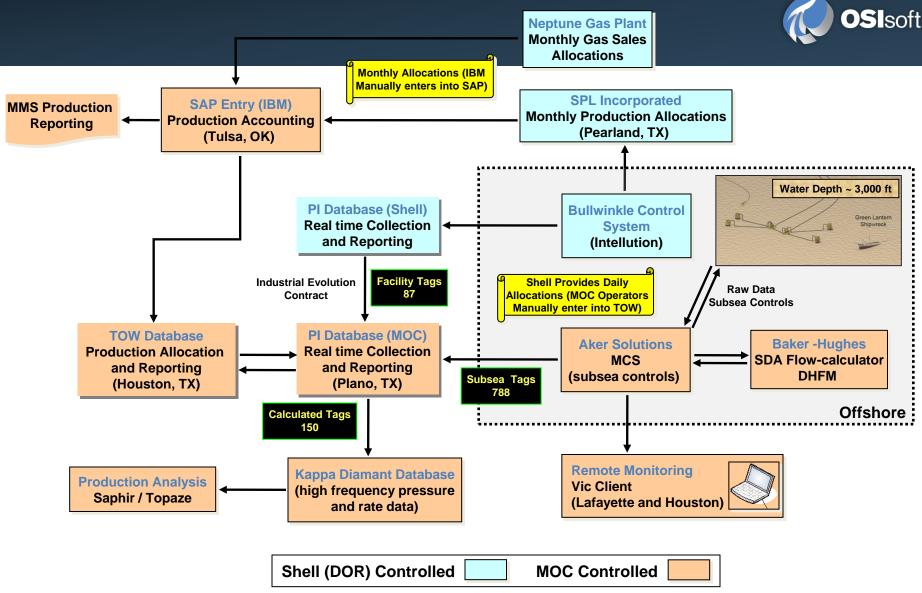


# Droshky - Without the PI System











# Droshky - Benefits



- Savings of \$5K per user for displays vs. VIC client
- Daily input deck for Eclipse models saving vs. hand-typing by engineers.
- Automatic daily entry into production allocation system (TOW)
- One source of the truth using PI OLEDB COM connectors into TOW.
- Monthly updates for re-calibration of Baker-Hughes downhole data using PI Universal File Loader (UFL). PI System is considered "Gold Database".
- Sub-surface modeling with automatic channel created to Kappa Modeling Suite.



## **Engineering Models Used**



- ECLIPSE: Sub-surface reservoir modeling for multi-phase flow through porous media. (Entire Field)
- Kappa Diamant/Saphir: Pressure transient analysis. Used in the early stages of a well to evaluate properties in the close vicinity to the well. (One well at a time)
- HYSYS: Topsides modeling. Usually used for offshore platforms. Maximize fluid recovery to optimize surface production facilities.



# Benefits (Modeling)



Project value estimates were based on 0.1% of worldwide production, based on greater well equipment reliability, and well characterization for future wells.



# Reservoir Engineer Quote



"A new well drilled and completed in Deepwater Gulf of Mexico can cost up to \$125 million. Proper reservoir characterization includes flow and pressure build-up data down to the six-second level, in order to avoid wasting capital on unproductive wells. The PI System will be instrumental in capturing this data."



# Mimm's Creek Plunger Lift Diagnostic Tool

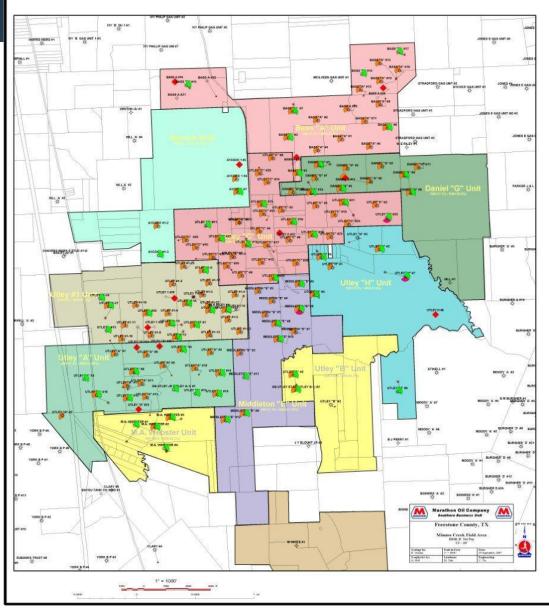


- Operators are overwhelmed with tasks (operate by exception)
- Requested by the Technology Services group (R & D function)
- Result of a six-month study to optimize production





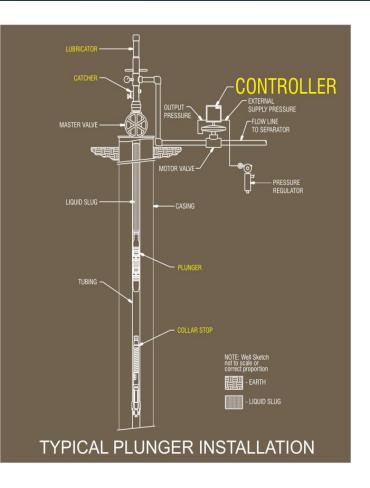
- Large number of gas wells
- •Spread out across numerous counties in Texas





#### Plunger Lift Basics

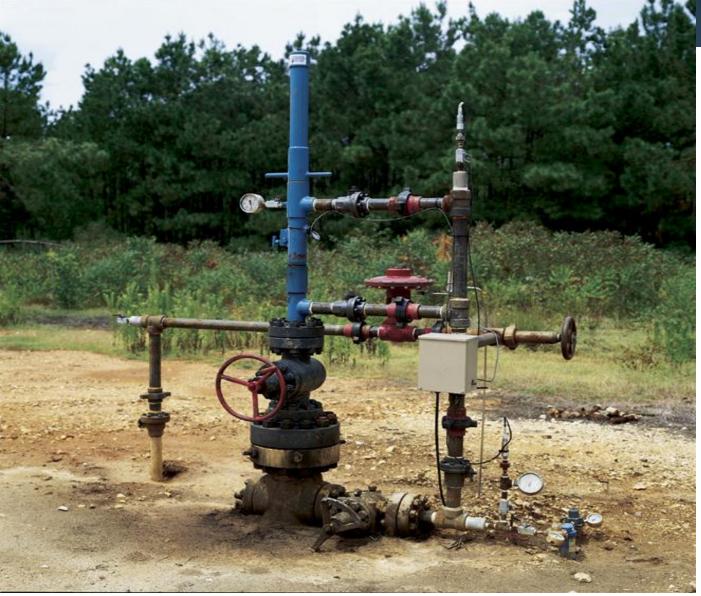




- Plunger is dropped through fluid in production tubing with bypass valve open
- Flow control valve (FCV) is opened and gas is injected below the plunger. This forces the bypass valve to close and the plunger to rise, carrying with it any fluid.
- Plunger is caught at top while fluid is produced.
- After a designated amount of time, FCV is closed, the plunger is dropped and the cycle repeats.
- Controller at surface orchestrates all of this.

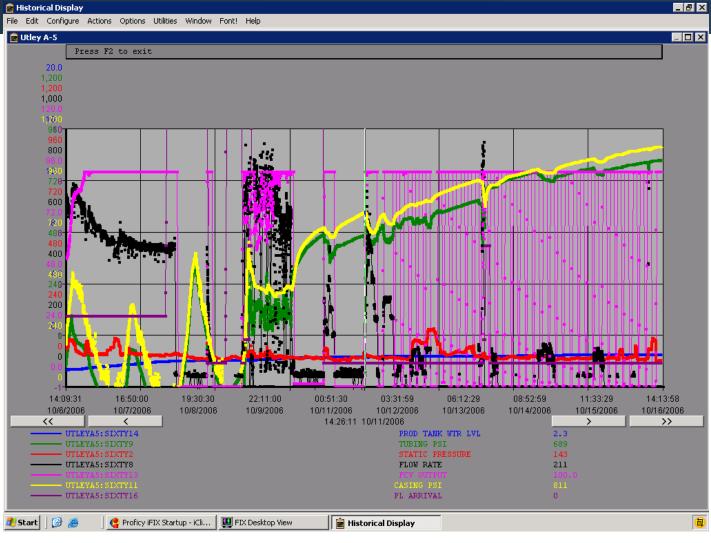








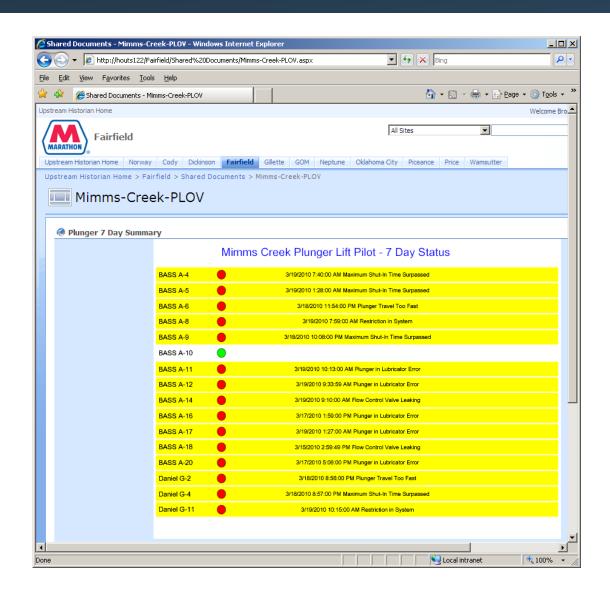






# Seven Day Status of All Wells

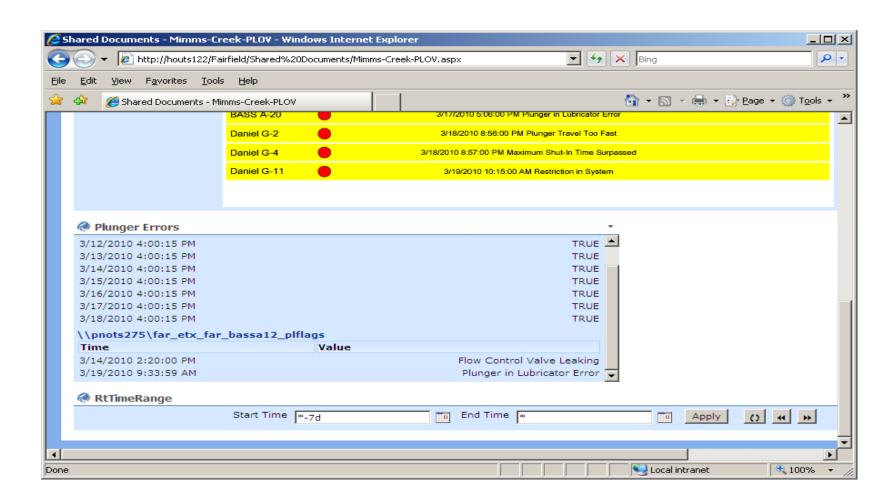






#### Seven Day Status of Individual Well

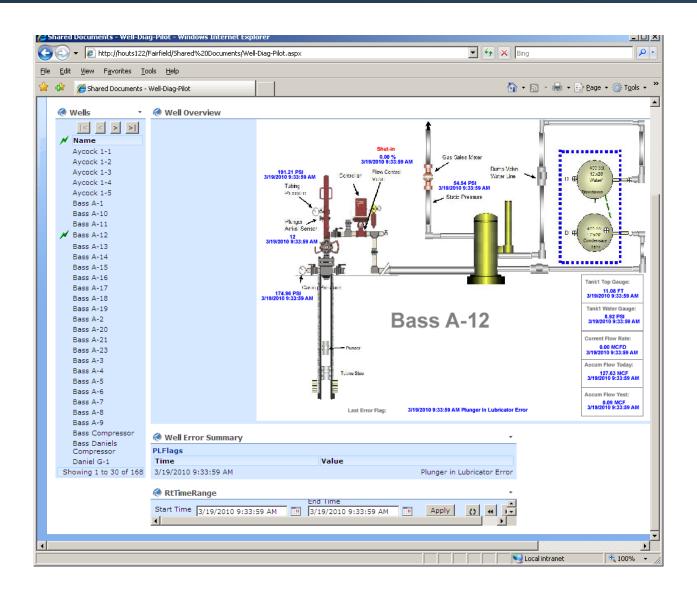






#### Well Status at the Time of the Last Error

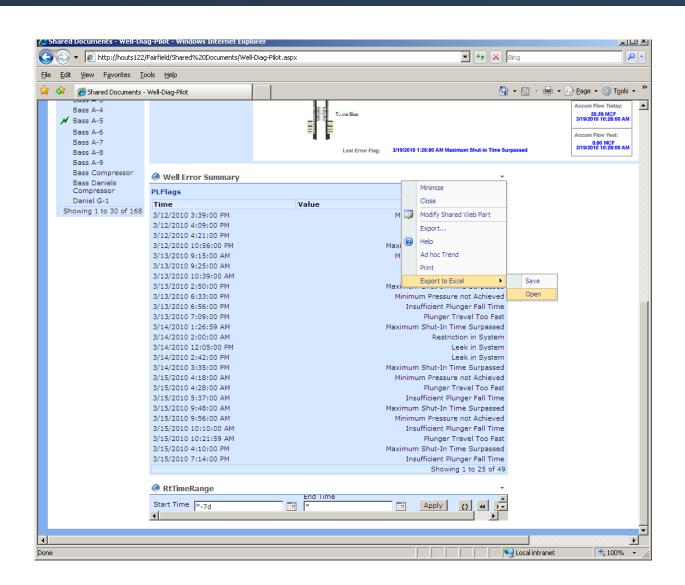






# **Exporting Well Errors to Excel**







# Resulting Spreadsheet



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	PLFlags	pnots275	PLFlags	uspo\fairfield\mimms creek\bass a-5	3/12/2010 4:09:00 PM	Insufficient Plunger Fall Time
	PLFlags	pnots275	PLFlags	uspo\fairfield\mimms creek\bass a-5	3/12/2010 4:21:00 PM	Plunger Travel Too Fast
	PLFlags	pnots275	PLFlags	uspo\fairfield\mimms creek\bass a-5	3/12/2010 10:56:00 PM	Maximum Shut-In Time Surpassed
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	PLFlags	pnots275	PLFlags	uspo\fairfield\mimms creek\bass a-5	3/13/2010 9:25:00 AM	Plunger Travel Too Fast
	PLFlags	pnots275	PLFlags	uspo\fairfield\mimms creek\bass a-5	3/13/2010 10:39:00 AM	Insufficient Plunger Fall Time
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	PLFlags	pnots275	PLFlags	uspo\fairfield\mimms creek\bass a-5	3/13/2010 6:56:00 PM	Insufficient Plunger Fall Time
	PLFlags PLFlags	pnots275	PLFlags PLFlags	uspo\fairfield\mimms creek\bass a-5 uspo\fairfield\mimms creek\bass a-5	3/13/2010 7:09:00 PM 3/14/2010 1:26:59 AM	Plunger Travel Too Fast Maximum Shut-In Time Surpassed
	PLFlags PLFlags	pnots275 pnots275	PLFlags PLFlags	uspo\fairfield\mimms creek\bass a-5 uspo\fairfield\mimms creek\bass a-5	3/14/2010 1:26:59 AM 3/14/2010 2:00:00 AM	Maximum Shut-In Time Surpassed Restriction in System
	PLFlags PLFlags	pnots275 pnots275	PLFlags PLFlags	uspovainieid\mimms creek\bass a-5 uspo\fairfield\mimms creek\bass a-5	3/14/2010 2:00:00 AM 3/14/2010 12:05:00 PM	Restriction in System Leak in System
	PLFlags PLFlags	pnots275 pnots275	PLFlags PLFlags	uspovainieid\mimms creek\bass a-5 uspo\fairfield\mimms creek\bass a-5	3/14/2010 12:05:00 PM 3/14/2010 2:42:00 PM	Leak in System Leak in System
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## Pilot PI ACE Specifics

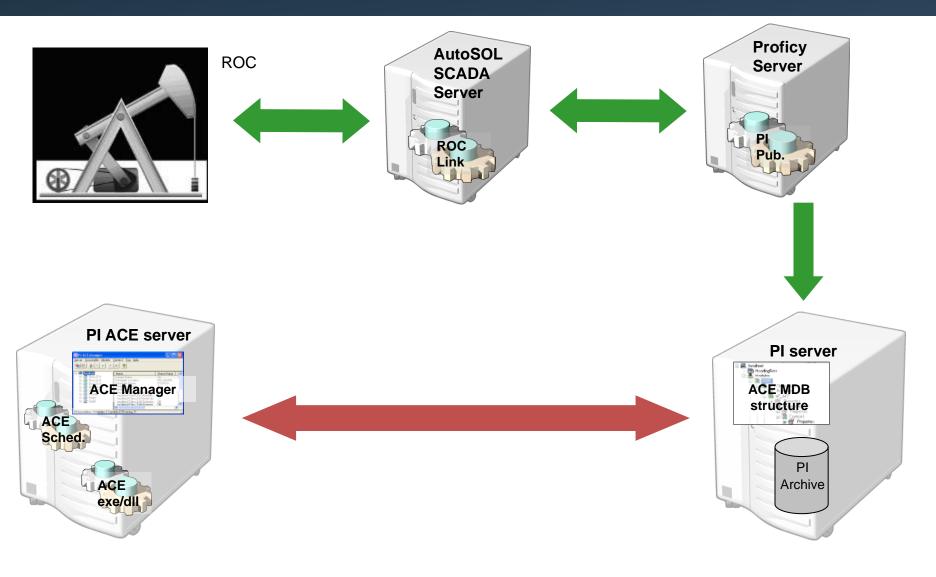


- A new well-state tag needed to be added for each well. The states are: Well Shut-In, Well Transition, Well Flowing.
- PI ACE kicks off the Well State Determination process every time a new value is written to the Valve Position Indicator tag.
- The remaining PI ACE calculations run based on the value of the Well-State tag.
- A new digital state tag was also added for each well to store current and historical error flags.





#### Fairfield SCADA and PI ACE Architecture



#### Benefits



- Reduce Lost Production
- Reduce Maintenance
- Opportunity to focus on higher value items
- Operators are better able to prioritize their daily routine
- Fewer problems "slip through the cracks"
- Conservative Estimate



#### Conclusions



#### OSIsoft Real-Time Infrastructure

- Visibility into Operations
- Separation of consumers
- Application Platform





# Thank you

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