Using New OSIsoft Tools for High ROI Projects at Marathon Oil

Presented by **Ken Startz – Marathon Oil Company**

Marathon Oil Facts & Figures - 2012

- Established in 1887
- Market Cap: ~ $24 billion (as of 3/20/13)
- Revenues: $15.7 billion
- Net Income: $1.6 billion
- Capital Expenditures*: $3.4 billion
- Net Liquid Hydrocarbon Sales: 282,000 BPD
- Net Natural Gas Sales: 902 million CFD
- Net Synthetic Crude Oil Sales: 47,000 BPD
- Net Proved Liquid Hydrocarbon, Natural Gas and Synthetic Crude Oil Reserves: 2.0 billion BOE
- Employees: ~3,400
- Headquartered in Houston, Texas

*Excludes acquisitions and includes accruals

Background

- Oil and gas exploration and / or production in eleven countries.
- PI System installations:
  - Houston, Equatorial Guinea (2) and Norway
- My first PI System implementation was at Robinson, Illinois Refinery in 1988.
- First OSIsoft Salesman was Pat Kennedy

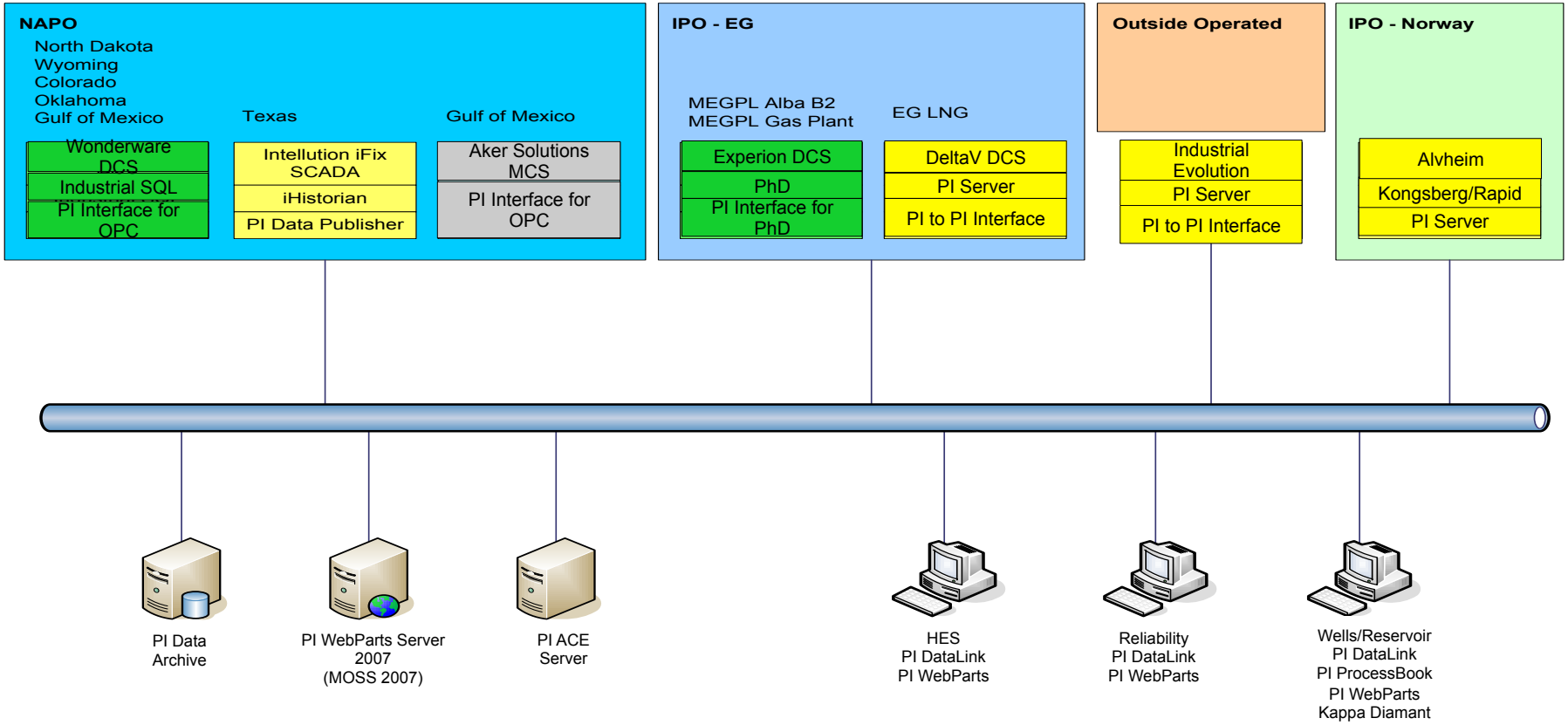
Business Challenges for 2012 / 2013

- Develop infrastructure for high frequency data needed for Drilling.
- Embrace new web-based tools like PI WebParts and PI Coresight.
- Leverage PI System investment in the new unconventional resource plays.
- Transfer knowledge to newer professionals (Great Crew change).
- Provide easy self-service visualization for engineers.
- Deliver mobility solutions on iPad.

Contents

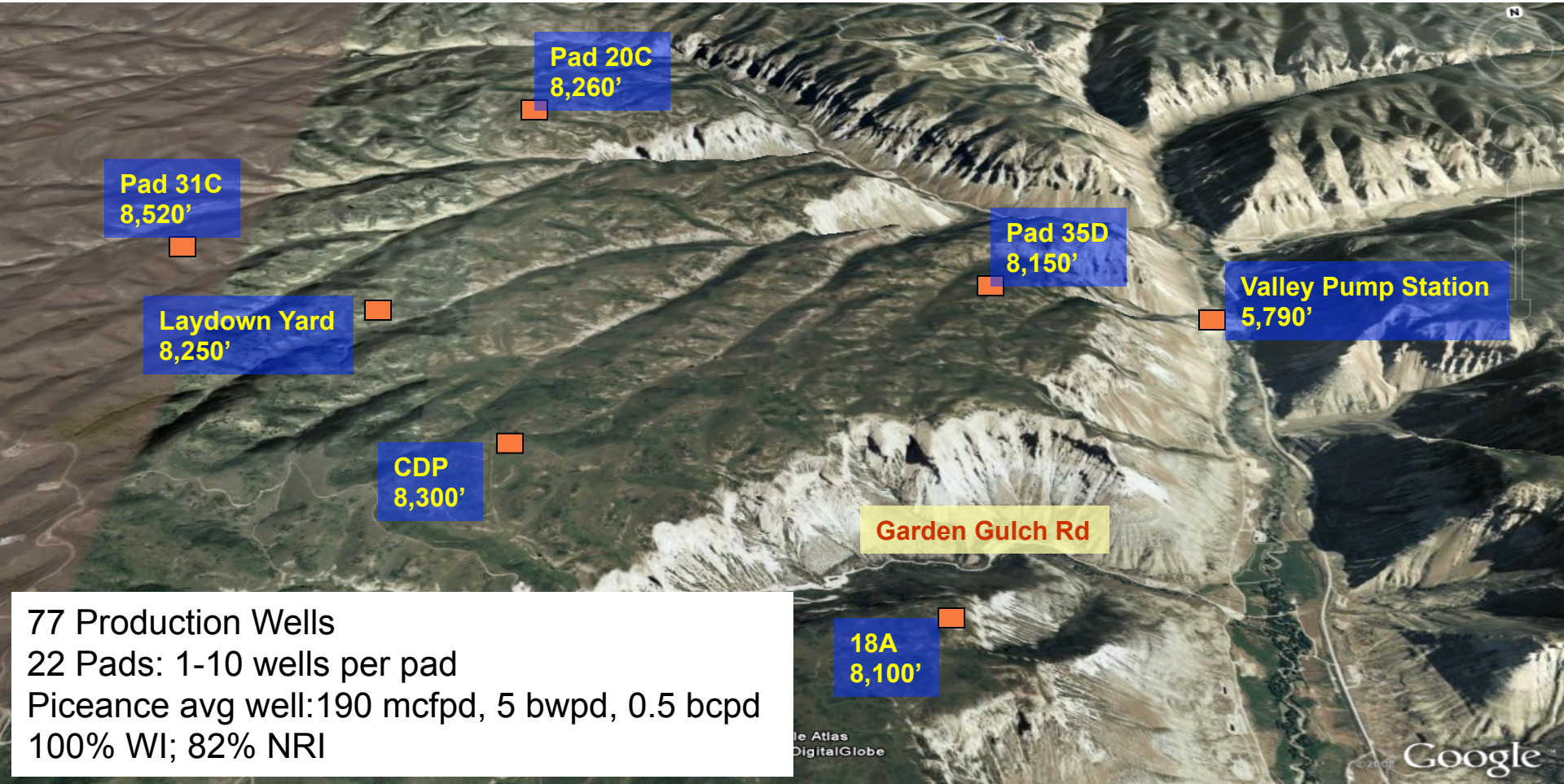
- Production Operations: Piceance Asset (Colorado)
- MaraDrill™ (Drilling Proof of Concept)

Real-Time Infrastructure for Production Operations



Piceance Asset: Garden Gulch Cliff Road

Piceance Field Overview



77 Production Wells
22 Pads: 1-10 wells per pad
Piceance avg well:190 mcfpd, 5 bwpd, 0.5 bcpd
100% WI; 82% NRI

View of field area from the Garden Gulch Ext. Road

Pad 1C (10 well pad)

Entire Pad including Facilities

- Piceance Operations

Piceance Background

- Mesas in Western Colorado.
- Began production operations in 2007.
- 77 wells based on 27 pads.
- Primarily gas.
- Data collected in PI Server.
- New engineer from another company with better visualization than Wonderware Active Factory.
- Visualization developed by operations engineer in one half day!

Control Network

Wonderware
InSQL
Active Factory

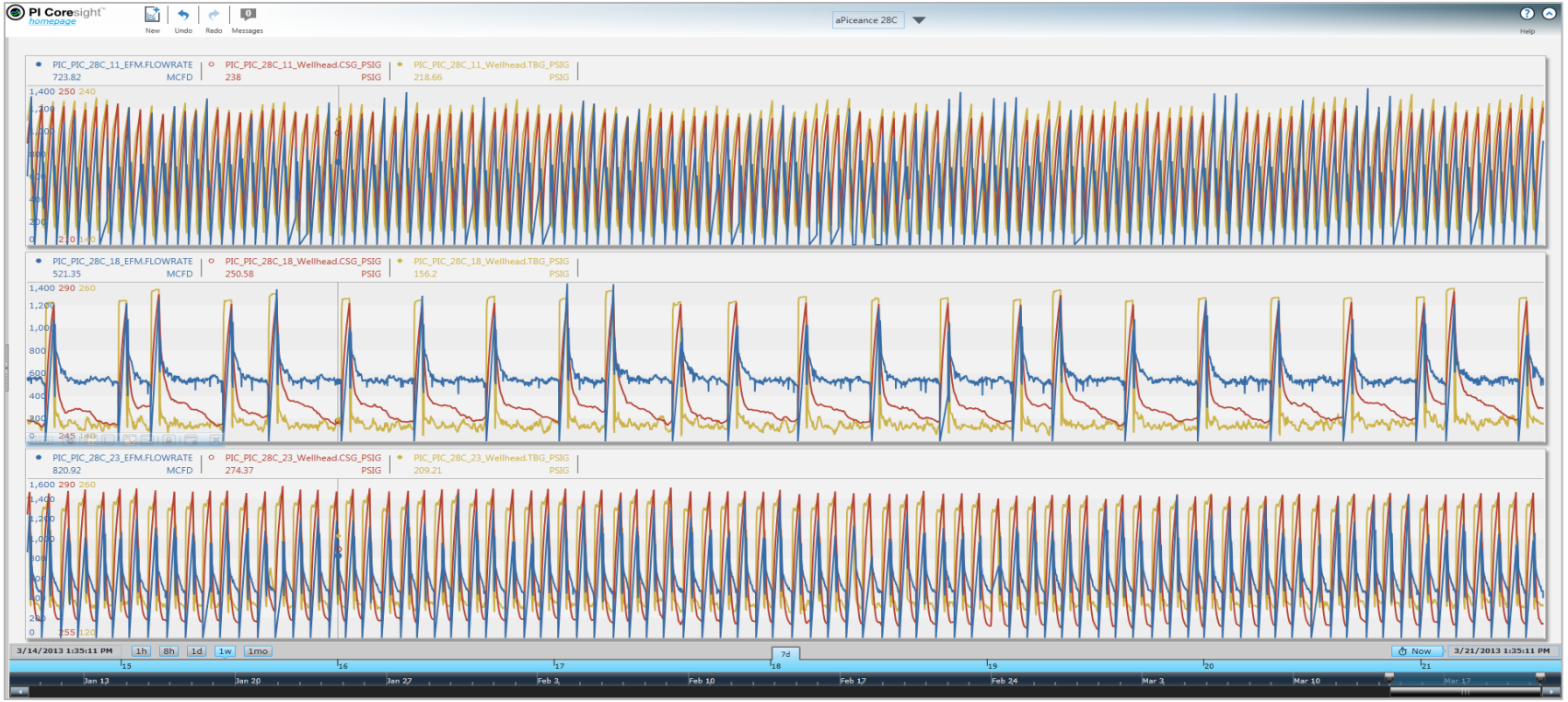
CITRIX

Business Network

PI System
2010

PI Coresight

PAD 28-C on PI Coresight



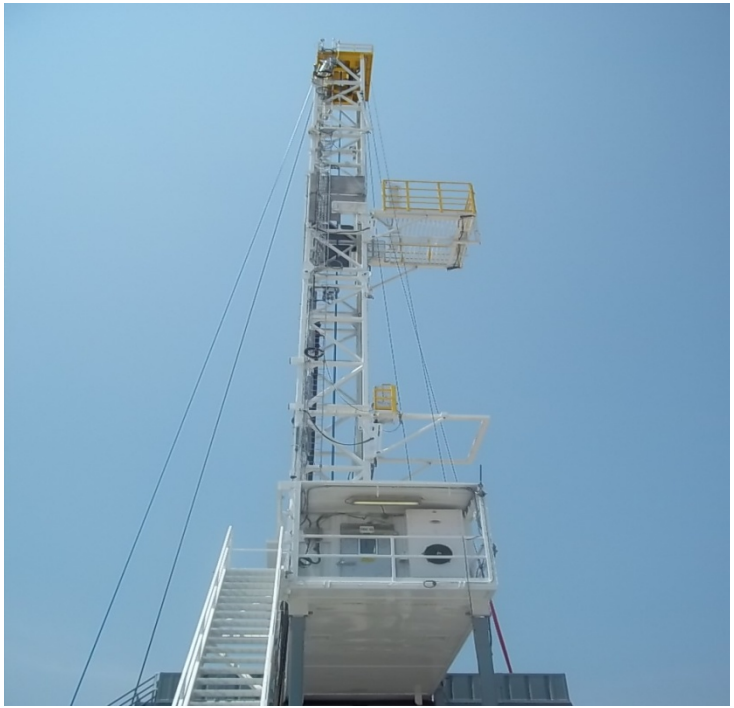
Piceance - Benefits of PI Coresight

$$Benefit = 0.5\ hours/day * \$60/1\ hour * 5\ days/1\ week * 48\ weeks/1\ year = \$7200\ /yea$$

720%

- Gets operators out of office and on-route quicker.
- Reduces contract labor.
- Provides look back at 1 year of production history vs. 1 month.

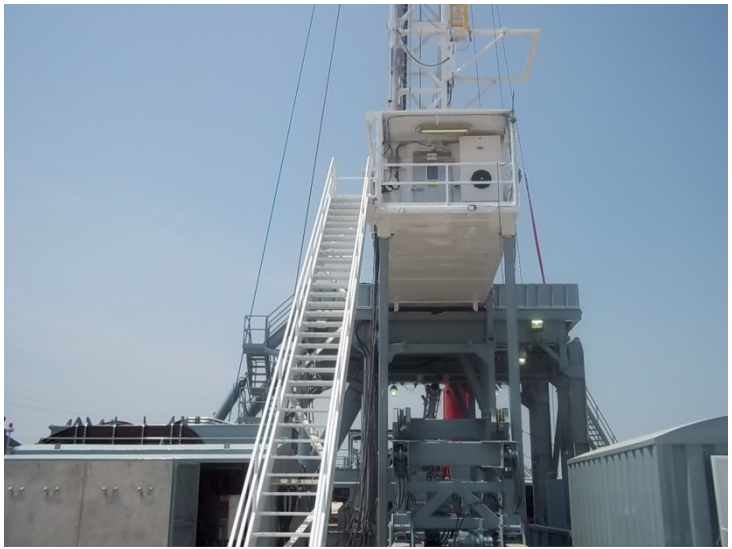
MaraDrill™



MaraDrill™ Background

- Land-based drilling rigs in Eagle Ford and Bakken.
- Primarily oil.
- Horizontal wells.
- Factory drilling.
- Rigs operated by Helmerich & Payne (H & P).
- Data extracted from OMRON Control System and aggregated with 3rd party vendor data, using PI Interface for OPC HDA.
- POC started January, 2012.

MaraDrill™ Doghouse



Driller's Console

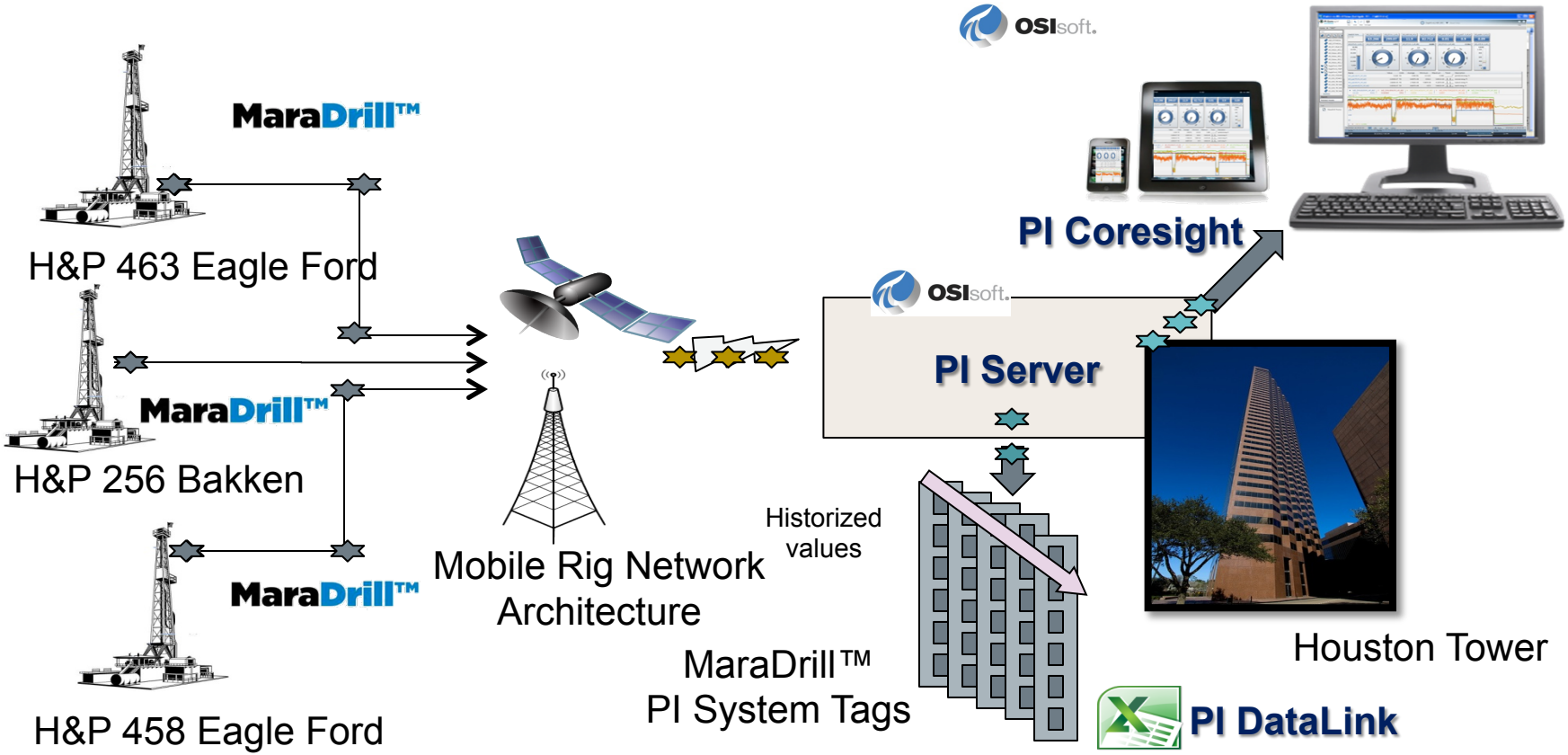
Common Drilling Data Tags

Engineering Units

ROP = Rate of Penetration – Ft / Hr
WOB = Weight on Bit – K Pounds
RPM = Revolutions per Minute – RPM
Mud Flow Rate – GPM
Torque – kFt*Lbs

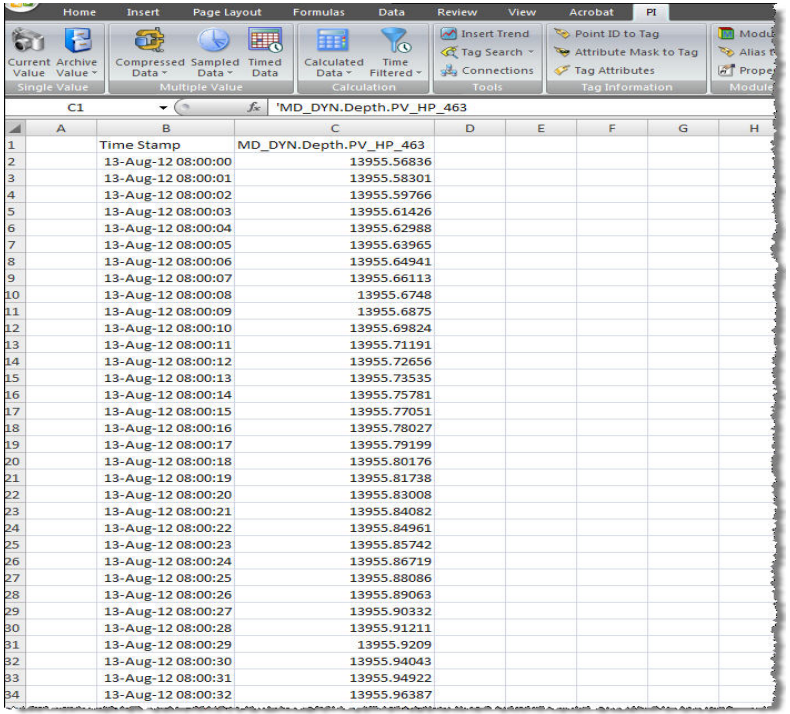
Need 1 second time stamp resolution!

Data Workflow



MaraDrill™ – Data Acquisition: PI DataLink

- Collect MaraDrill™ data from OSIsoft. PI DataLink



	A	B	C	D	E	F	G	H
1		Time Stamp	MD_DYN.Depth.PV_HP_463					
2		13-Aug-12 08:00:00	13955.56836					
3		13-Aug-12 08:00:01	13955.58301					
4		13-Aug-12 08:00:02	13955.59766					
5		13-Aug-12 08:00:03	13955.61426					
6		13-Aug-12 08:00:04	13955.62988					
7		13-Aug-12 08:00:05	13955.63965					
8		13-Aug-12 08:00:06	13955.64941					
9		13-Aug-12 08:00:07	13955.66113					
10		13-Aug-12 08:00:08	13955.6748					
11		13-Aug-12 08:00:09	13955.6875					
12		13-Aug-12 08:00:10	13955.69824					
13		13-Aug-12 08:00:11	13955.71191					
14		13-Aug-12 08:00:12	13955.72656					
15		13-Aug-12 08:00:13	13955.73535					
16		13-Aug-12 08:00:14	13955.75781					
17		13-Aug-12 08:00:15	13955.77051					
18		13-Aug-12 08:00:16	13955.78027					
19		13-Aug-12 08:00:17	13955.79199					
20		13-Aug-12 08:00:18	13955.80176					
21		13-Aug-12 08:00:19	13955.81738					
22		13-Aug-12 08:00:20	13955.83008					
23		13-Aug-12 08:00:21	13955.84082					
24		13-Aug-12 08:00:22	13955.84961					
25		13-Aug-12 08:00:23	13955.85742					
26		13-Aug-12 08:00:24	13955.86719					
27		13-Aug-12 08:00:25	13955.88086					
28		13-Aug-12 08:00:26	13955.89063					
29		13-Aug-12 08:00:27	13955.90332					
30		13-Aug-12 08:00:28	13955.91211					
31		13-Aug-12 08:00:29	13955.9209					
32		13-Aug-12 08:00:30	13955.94043					
33		13-Aug-12 08:00:31	13955.94922					
34		13-Aug-12 08:00:32	13955.96387					

- **Functions that retrieve single value**
  - Current value
  - Value at a specific time
  - Tag attributes
- **Functions that retrieve series of values**
  - Evenly spaced (sampled) data
  - Compressed (archived) data
  - Sampled data for a user-specified array of timestamps

Pre-MaraDrill™ vs. MaraDrill™ Technology

- **Pre-MaraDrill™**

Data	Real-Time Parameters						Manually entered Parametes						
TimeStamp	Depth	ROP	W_b	rotary RPM	Torque	Q	MW	F	m	D_p	D_h	n	D_n
6/27/2012 11:09:50	297.8	384.35	14942.4472	223	2060	807	8.33	1.999	0.00	5.0	13.50	4	
6/27/2012 11:10:00	299	391.89	11464.4946	223	2060	807	8.33	1.999	0.00	5.0	13.50	4	
6/27/2012 11:10:10	300.3	500.47	11657.6955	223	2175	807	8.33	1.999	0.00	5.0	13.50	4	
6/27/2012 11:10:20	301.2	327.73	11013.6402	223	3067	807	8.33	1.999	0.00	5.0	13.50	4	
6/27/2012 11:10:30	301.9	327.73	14427.185	223	3456	807	8.33	1.999	0.00	5.0	13.50	4	
6/27/2012 11:10:40	301.9	327.73	0	223	3403	807	8.33	1.999	0.00	5.0	13.50	4	

Pason Data Calculator Spreadsheet

- **MaraDrill™ Technology**

OSIsoft. PI Server

PI DataLink

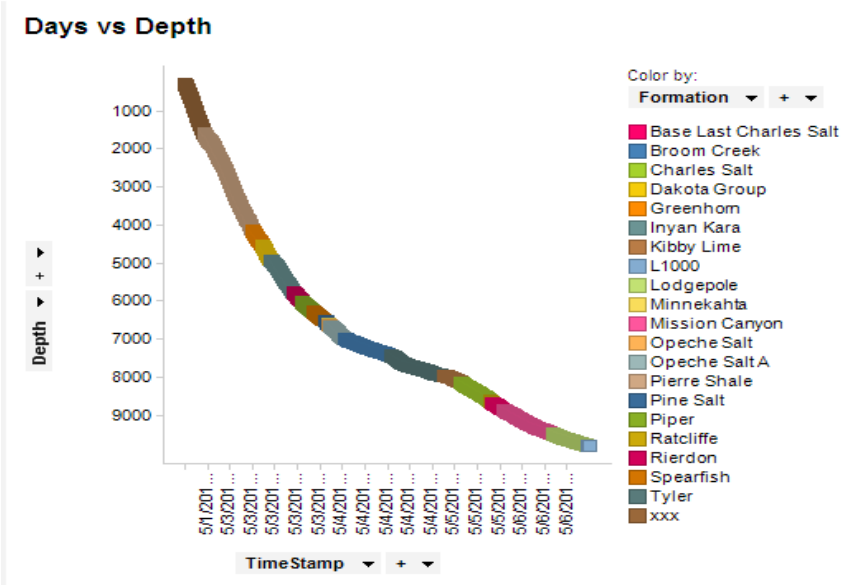
Intermediary Application

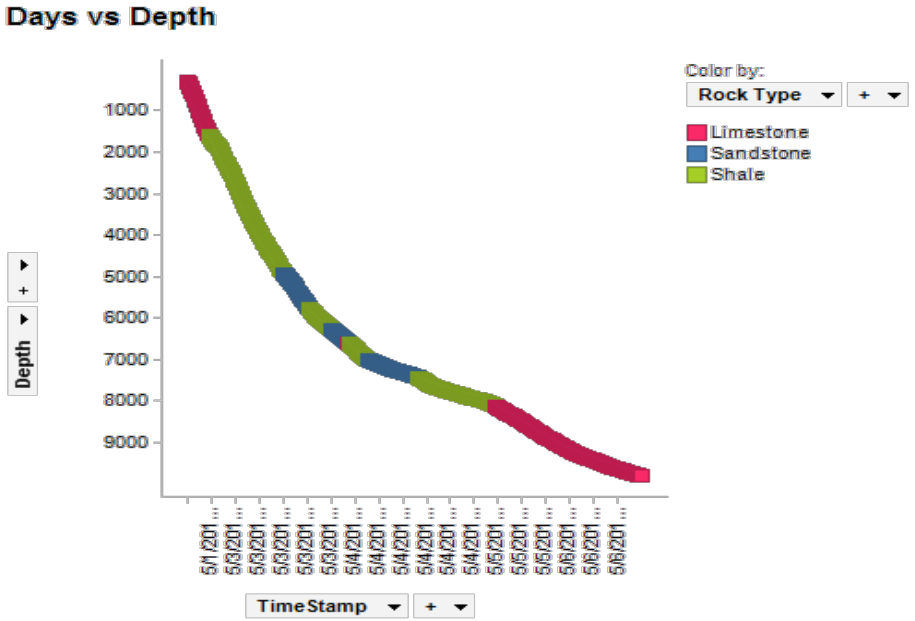
PI JDBC 2010 Provider

Spotfire

Tool for Advanced Analytics

Days vs Depth: H&P 256 - Aisenbrey 21-25H

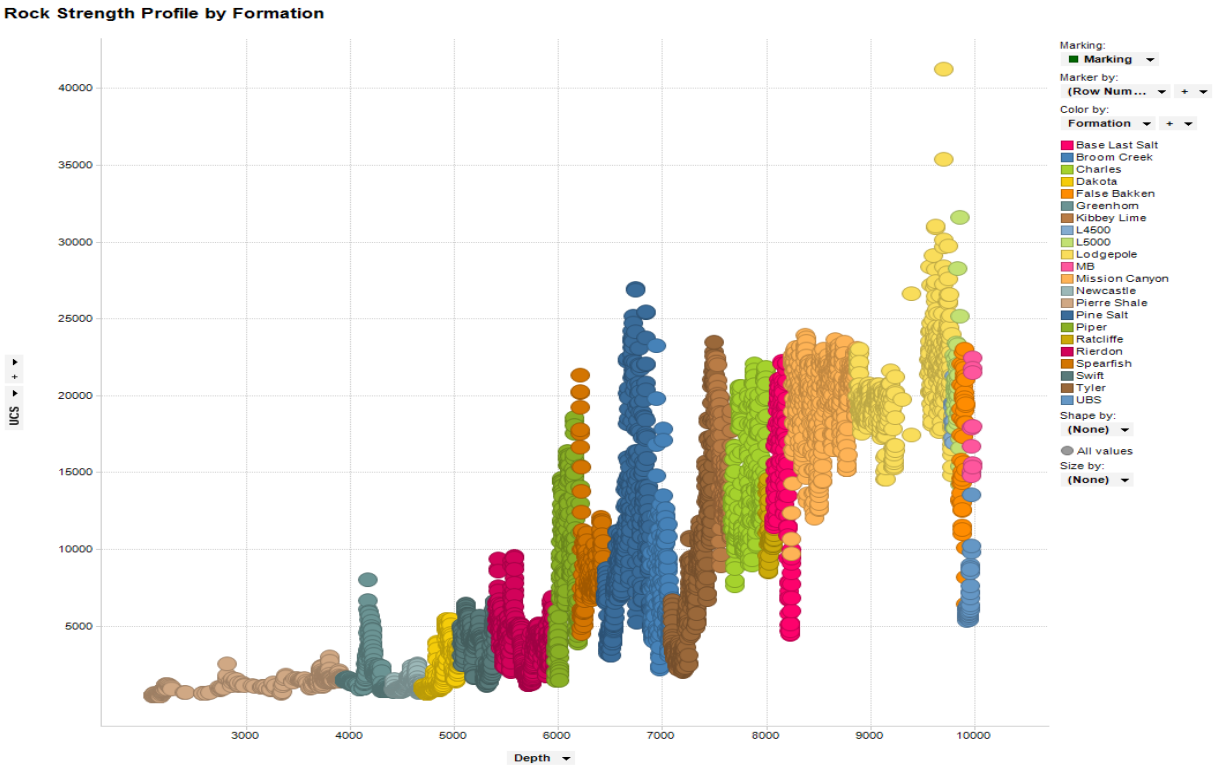




Post-Well Analyses with SpotFire

Rock Strength

Modeling the rock strength & predicting ROP on subsequent wells in the area to improve logistics and planning

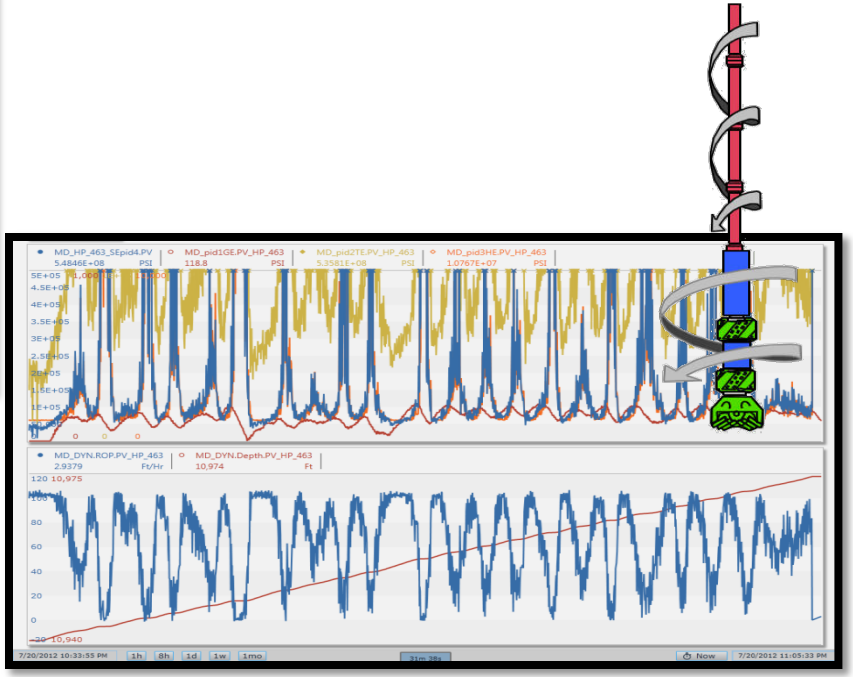


PI Coresight – Stick-Slip Identification: H&P 463

"Perfect" drilling

Stick-slip: Non-uniform rotation of the bit/BHA

- Sticking phase → bit stops
- Slipping phase → bit "breaks" free
- Drillstring torsional oscillations



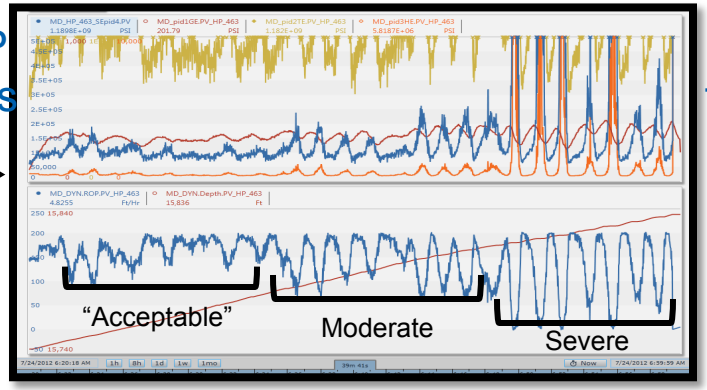
Stick-slip

Real-Time Optimization PI Coresight

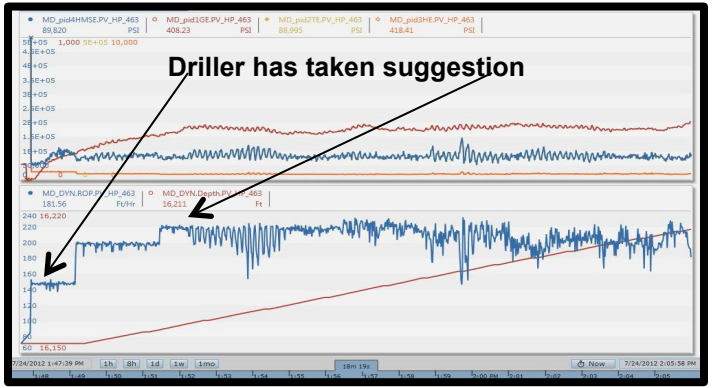
Stick-Slip Identification …few stands later… Stick-Slip Mitigation

40% Sustained Increase in Rate of Penetration

Avg. ROP for stand is **144 ft/hr**



Avg. ROP for stand is **201 ft/hr**



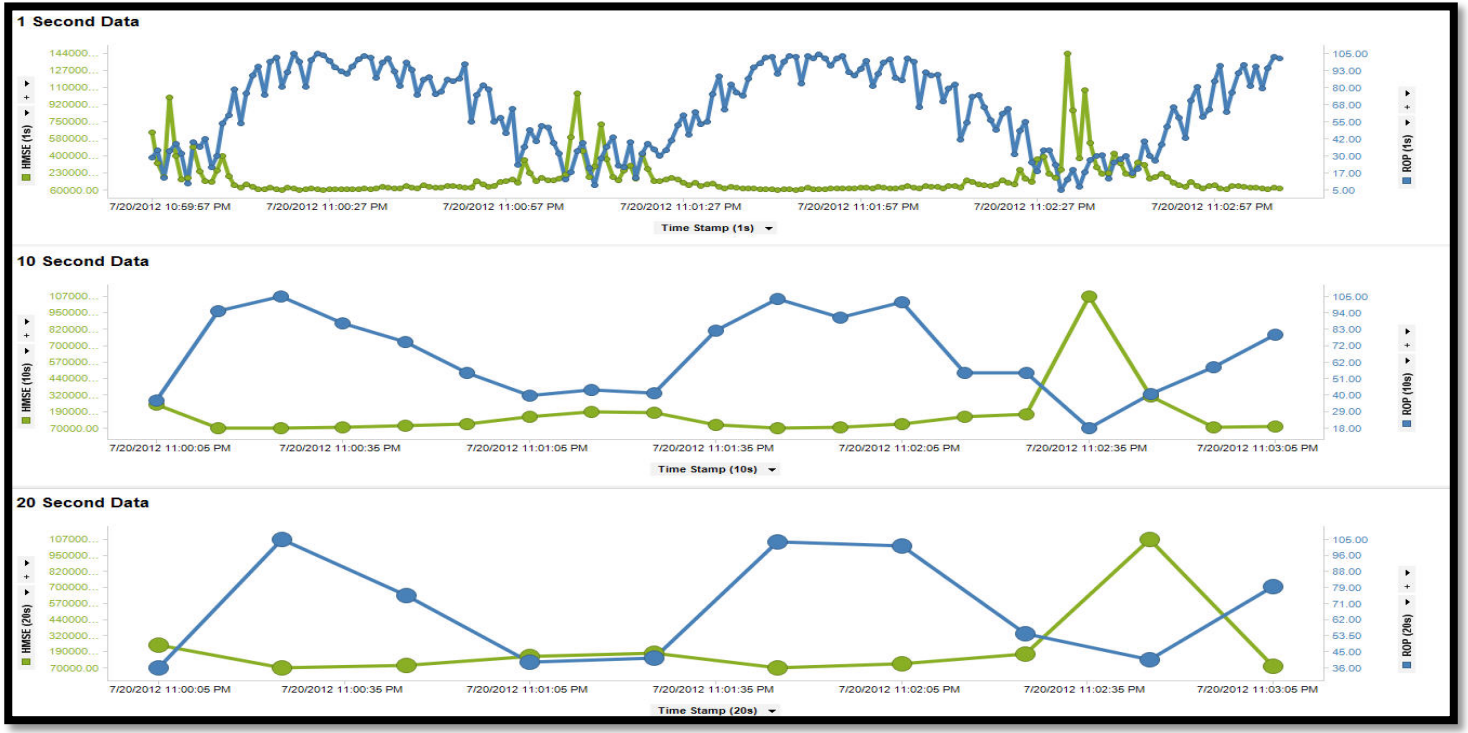
PI Coresight/SpotFire – Stick-Slip Analyses

- **Importance of 1 second data**

MaraDrill™

Other vendors

Rig Display



PI Coresight - Stick-Slip

Stick-Slip is Expensive

- Increased bit cost due to number of runs, repair/replacement charges
- Increased hourly cost due to motor usage
- Increased drilling time due to accelerated dulling (low ROP)
- Increased trip time due to number of runs
- Increased costs associated with downhole tool damage (MWD, LWD)

MaraDrill™ Benefits

- May replace third party real-time data aggregation software.
- Accessible real-time data at the rig and to remote employees, enabling more efficient decision making.
- Consistent and easy-to-access data. More eyes on the data.
- Drilling time and capital well cost savings:
  - Potential $ 1 MM / rig / yr for every 5% reduction in drill time.
- Reduced vibration and damage to downhole tools
- Continuous optimization onsite and retrospective post-well analysis

PI System Helps Drillers Too!

Conclusions

Utilizing OSIsoft's Real-Time PI System Infrastructure

- Standardize Operational Data
- Separation of Consumers
- Application Platform

Utilizing Microsoft's SharePoint Platform

- Visibility to Anyone
- Easily Configured / Flexibility
- One Version of the Truth

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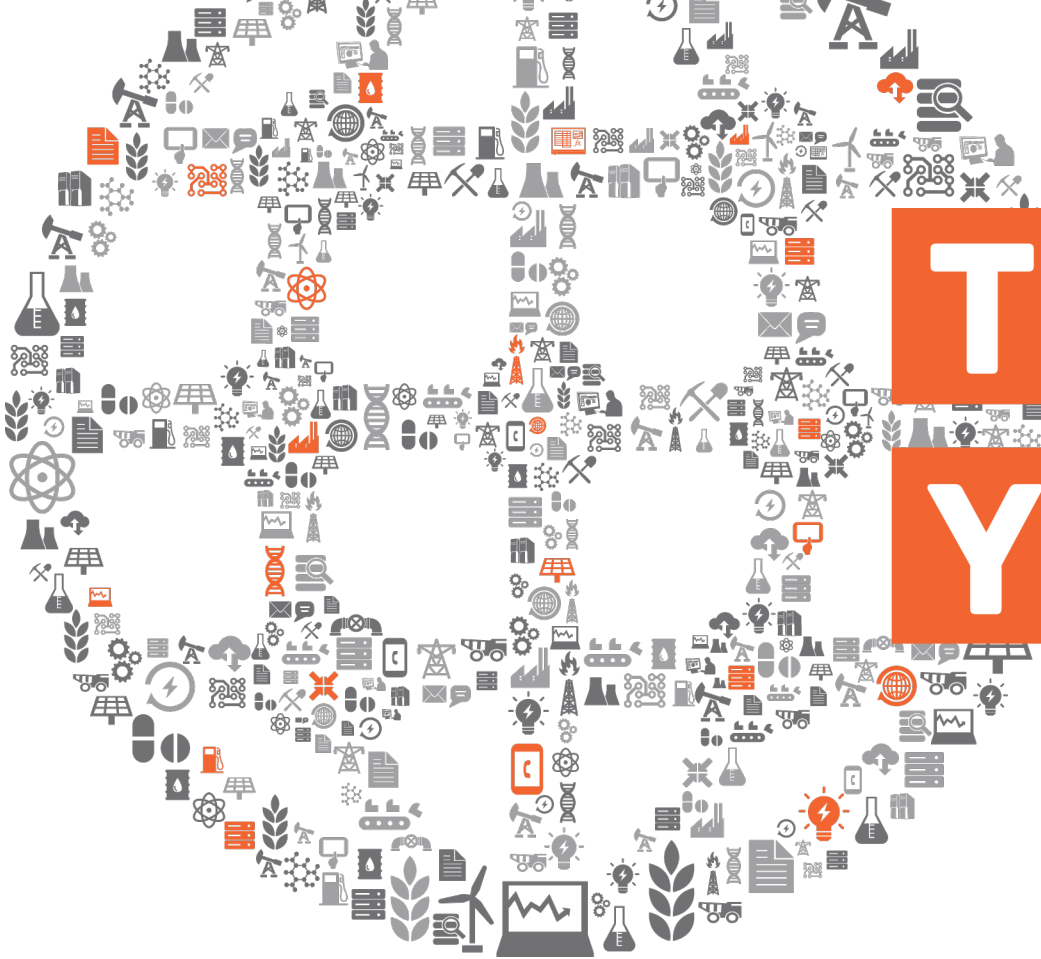
Marathon Oil Company



THANK YOU

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