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UC 2010

Real Time Information — Currency of the New Decade

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Alliance Pipeline's Deployment of the PI System

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Alliance Pipeline

Outline

- Company overview
- History of PI system deployment
- Alliance PI system overview
- System users
- Results and benefits
- Current projects and initiatives
- Future plans for PI at Alliance Pipeline

Alliance Pipeline System



Alliance Pipeline System Overview

- Mainline length 2,988 km 1,857 miles
- Lateral length 731 km 454 miles
- Firm delivery contract capacity 1.325 Bcfd
- Average daily capacity 1.6 Bcfd
- Mainline compression 517,000 hp
- Maximum Canadian operating pressure 1743 psig
- Maximum US operating pressure 1935 psig

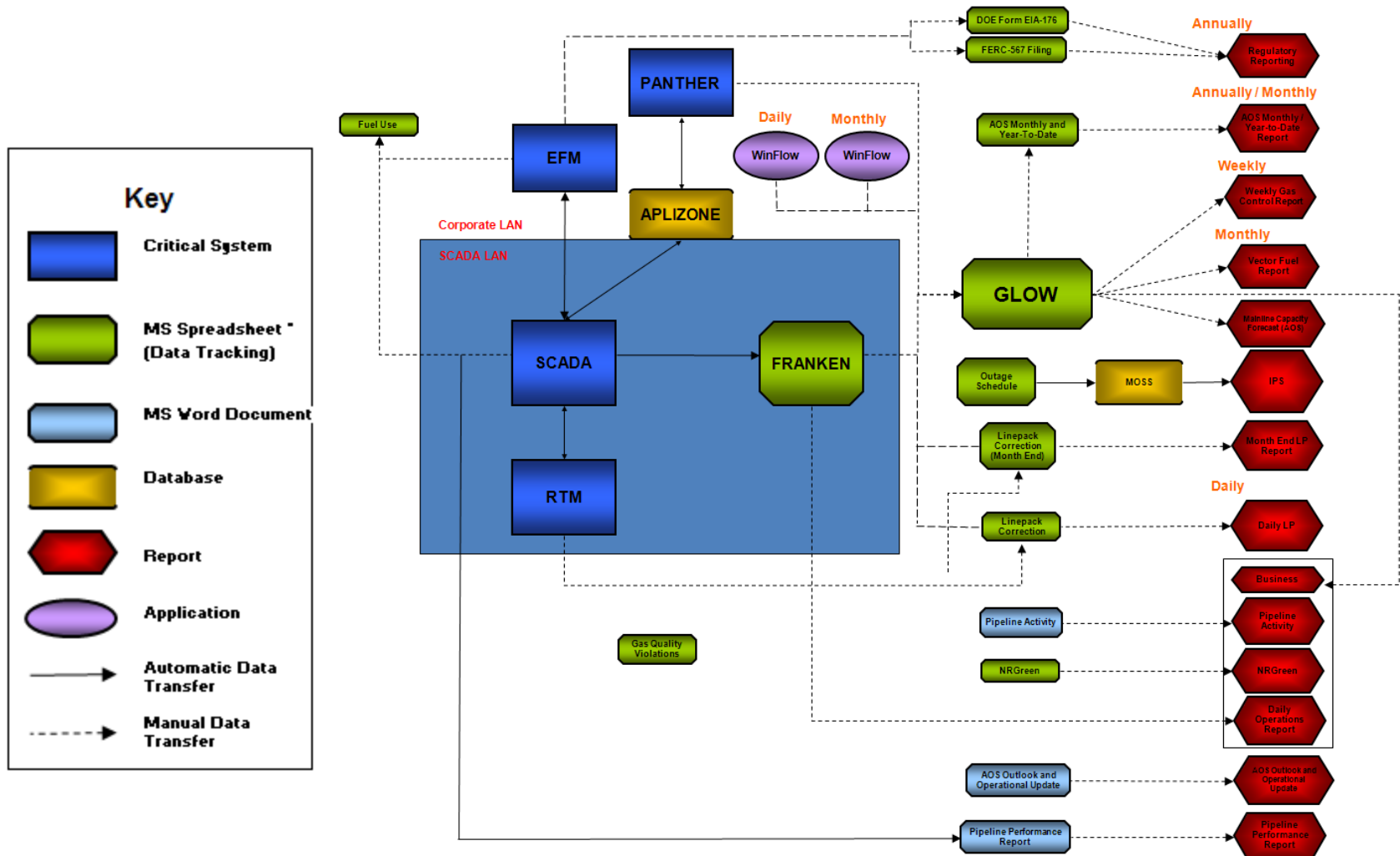
Alliance Pipeline System Overview

- Gas supply from 51 receipt points in WCSB
- 1 US receipt point
- 14 mainline compression stations
- 7 delivery interconnect in Chicago area plus Aux Sable NGL extraction plant
- Alliance delivers ~2.5% of US consumption

PI Deployment at Alliance

- Initiated project to implement a real time data historian
- Phase I to address problems:
 - Data integrity
 - Data calculated and stored in local Excel spreadsheets
 - Manual processes
 - Manual setup, data entry, distribution, and archiving
 - Data access
 - Data only existed on mission critical systems that very few had access to
 - Data requests had difficulties and were long in duration
 - Performance impacts on mission critical systems
 - Difficult to maintain

PI Deployment at Alliance



Alliance PI System Overview

- PI Collective
 - 50,000 tag system
 - HA redundant pair
 - Located at MCC and BCC
- 7 server machines
- 4 Interfaces
 - OPC, RDBMS, UFL
- ProcessBook
- DataLink
- PI Data Access
 - ODBC and OLE DB
- Citrix access

Data Sources

Honeywell Experion PKS (SCADA)

- OPC interface

FlowCal (Electronic Flow Measurement)

- RDBMS interface

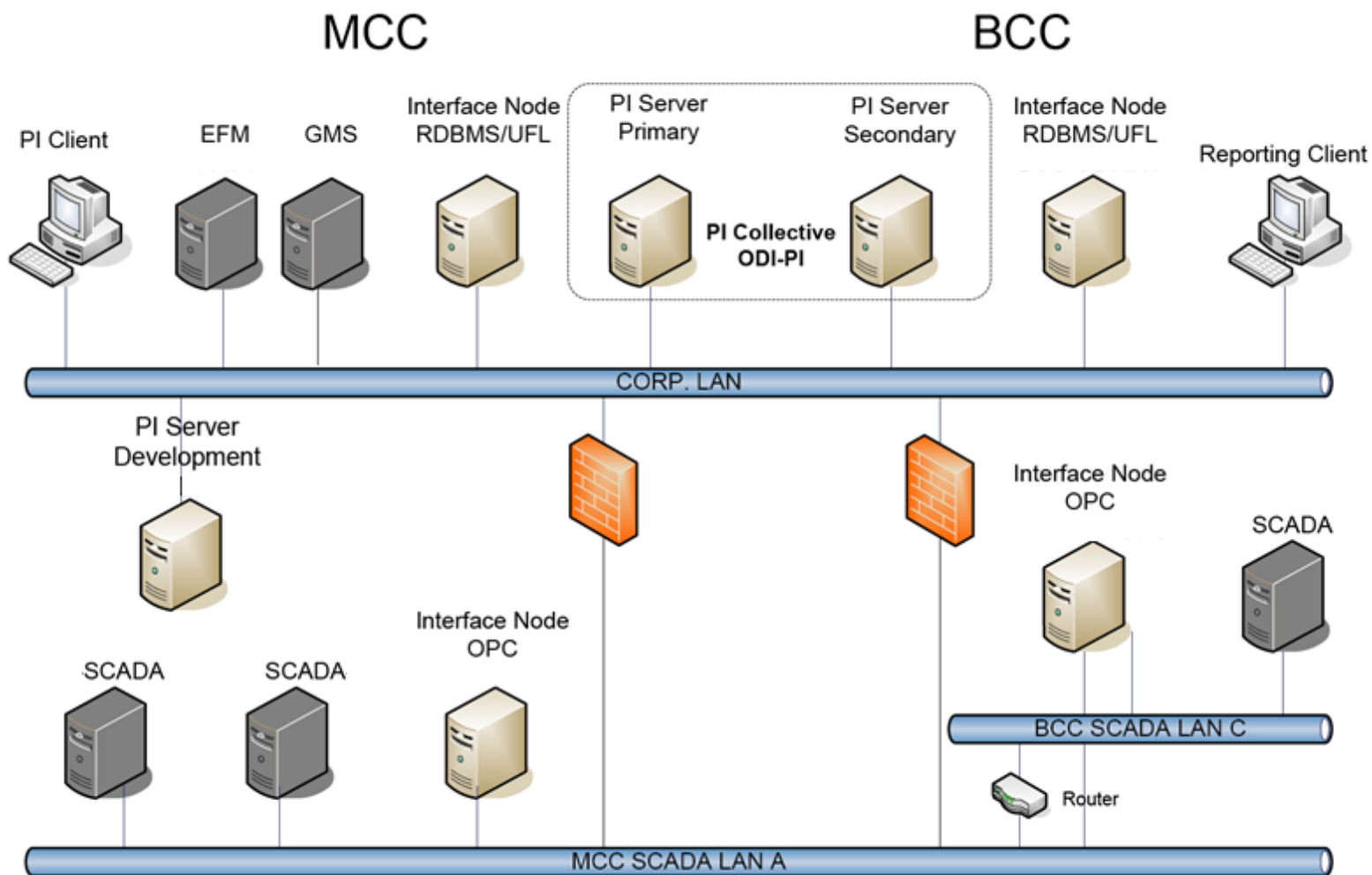
Panther (Gas Management System)

- RDBMS interface

Other data sources (spreadsheet calculations)

- UFL interface

Alliance PI System Architecture



Data in PI

~37,000 tags

- EFM

- 24,000 tags
- Volume, energy, pressure, temperature, heating value, composition, mass heating value, specific gravity

- SCADA

- 12,000 tags
- Volume/flow, energy/rate, pressure, temperature, heating value, composition, speeds, and more

- Gas Management System (Panther)

- 50 tags
- AOS, scheduled volumes, OBA, shipper accounts

- 80 Performance Equations

- Projected gas day volume / energy of receipt and deliveries
- Total volume / energy, average heating value of multiple sites

- 150 spreadsheet calculations

Data Backfilling

- Backfilled archives on an offline development PI server
- EFM and Gas Management System data
 - 9 years of history (from company startup)
 - Used RDBMS interface
 - Fast
 - 2 to 3 days
- Spreadsheet calculations
 - 5 years of history
 - Used a Perl script with UFL interface
 - Fairly quick
 - 2 to 3 weeks

Data Backfilling

- SCADA data
 - 5 years of history
 - Used OPC HDA interface
 - Slow, had challenges with Experion
 - 3 to 4 months



Data Backfilling

- User acceptance of backfilled data
 - Data comparisons between source systems and PI
 - Spot checks on data
 - Data verified over large time periods
 - Excel and Perl scripts
 - Random samples
- System went operational Q1 2009
 - Archives were backfilled, verified, and loaded in reverse order (e.g. 2009, 2008, 2007...)

Training

- Sent representatives from various groups to PI client tool training at OSIsoft's Calgary office
 - ProcessBook
 - DataLink
 - PI WebParts
- Became “experts” in group
- Real Time Systems team members attended the System Manager training course

Users

Gas Control

- Operational dashboards
 - ProcessBook
 - Custom displays
 - Remote monitoring when operating at the BCC
- Operational reports
 - DataLink
 - Less manual processes
 - Gas Control Coordinators save 1 to 1.5 hours per day producing reports
- Operational data
 - Gas Controllers import operational data into Excel
- Data requests
 - Easier to process data requests

Users

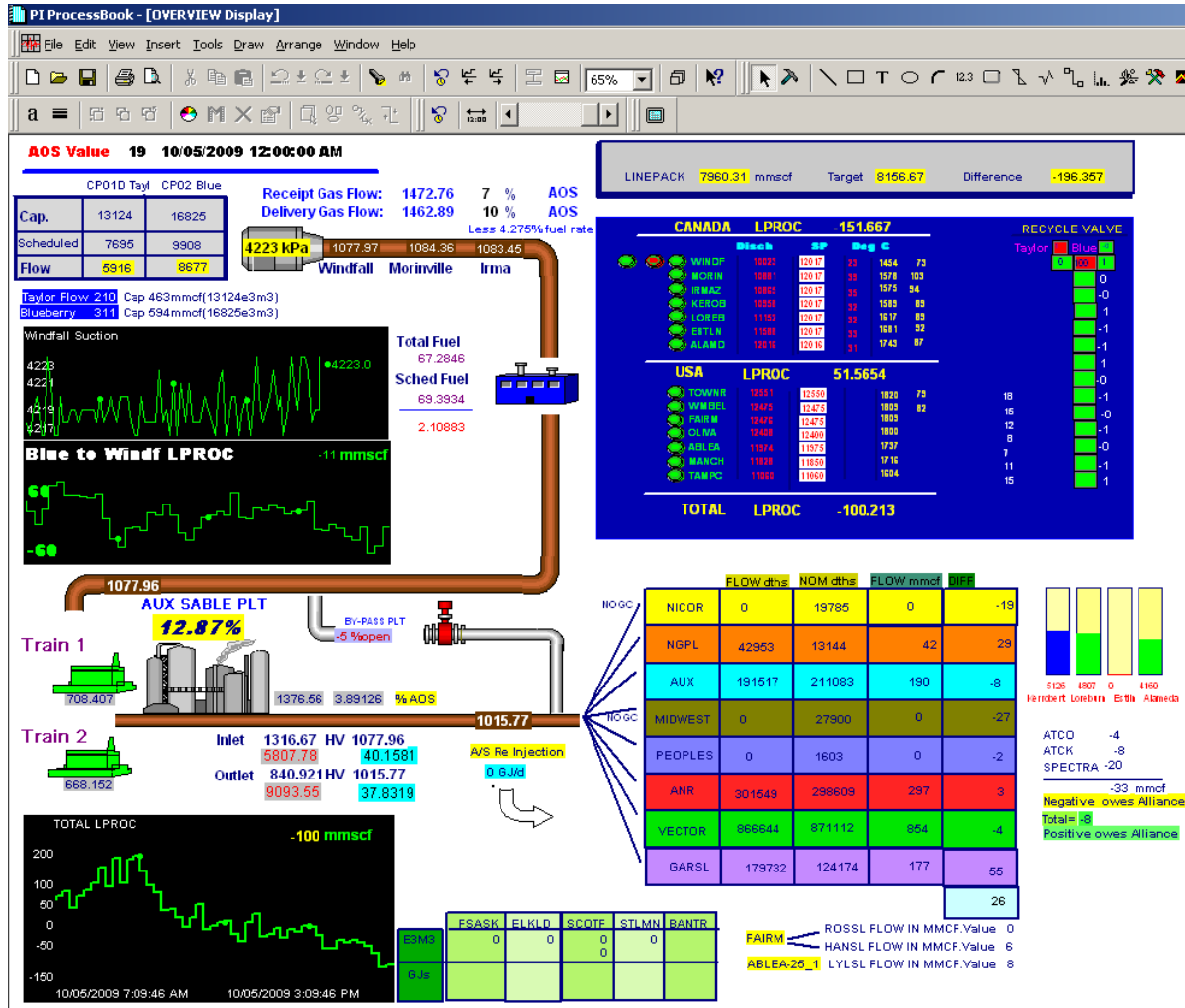
System Planning group

- Data for analysis in other applications (e.g. hydraulic modeling, statistical analysis)
 - DataLink templates
 - ODBC

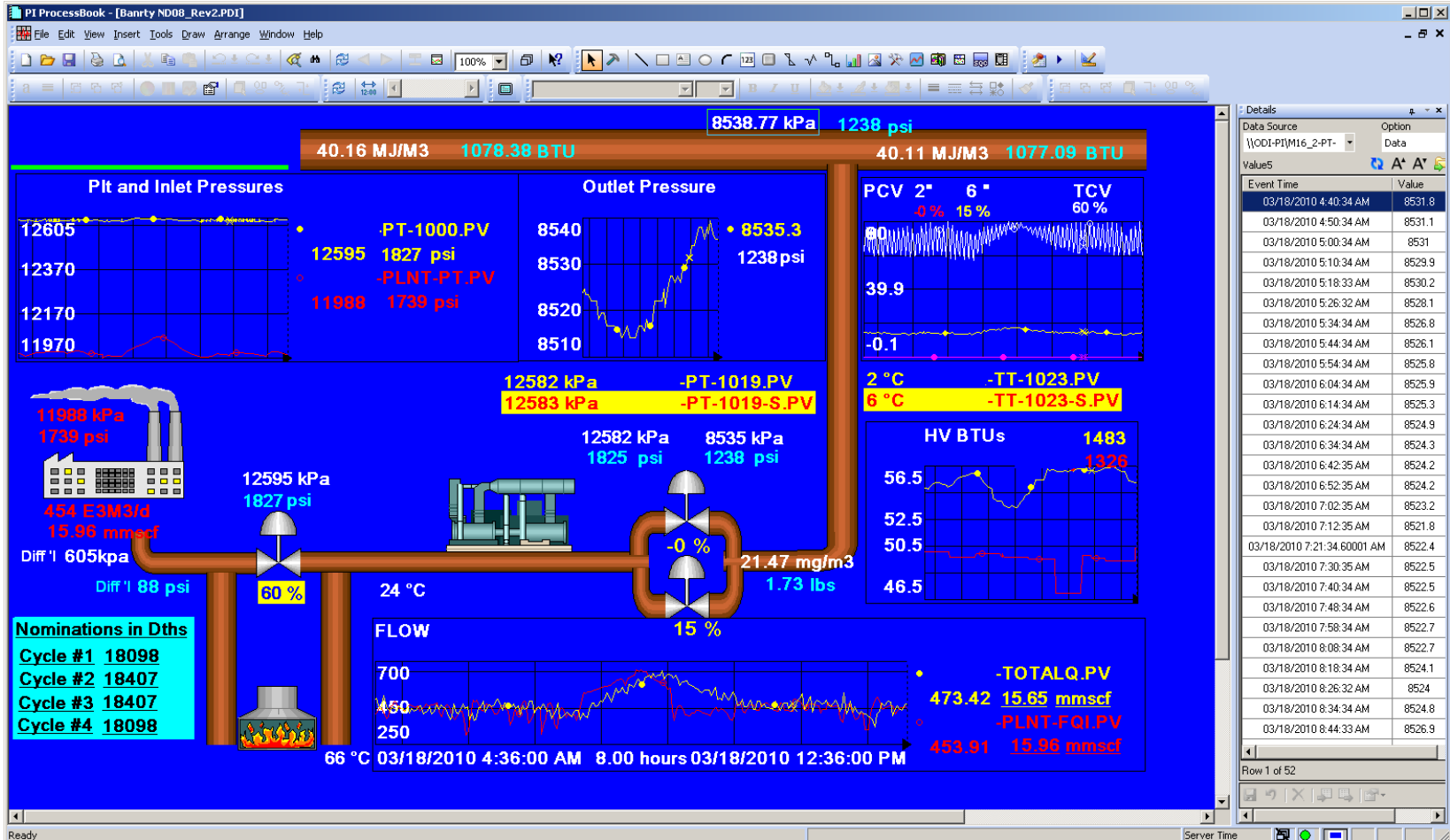
Real Time Systems group

- Data requests
 - Typically get 2-3 data requests each week
 - Easier to process requests
 - No longer have to back load data on to servers
 - No more performance impacts to mission critical systems
- Reporting
 - Easier to produce and maintain

Operational Dashboards



Operational Dashboards



Reporting

TOTAL PHYSICAL PIPELINE SUMMARY					Volume		Energy	
	E3M3	MMscf	GJ	Dth				
Linepack	230735.1	8145.2	9255282.9	8772314.3				
Actual Receipts	46129.0	1628.4	1858408.6	1761431.2				
Actual Deliveries	39250.1	1385.6	1710463.2	1621206.1				
Actual Fuel and Utility Gas	1871.1	66.1	75287.6	71358.9				

SCHEDULED VOLUMES SUMMARY					Volume		Energy	
	E3M3	MMscf	GJ	Dth				
Total Scheduled Receipts	46291.1	1634.1	1863741.0	1766485.4				
Total Scheduled Deliveries	43898.3	1549.7	1778847.6	1686022.0				
Total Scheduled Fuel and Utility Gas	1898.1	67.0	76324.0	72341.2				

CANADIAN PIPELINE PHYSICAL SUMMARY					Volume		Energy	
	E3M3	MMscf	GJ	Dth				
Linepack	114937.4	4057.4	4610844.1	4370236.4				
Actual Receipts	46084.8	1626.8	1855494.1	1758668.9				
Actual Deliveries	43686.5	1542.2	1752656.3	1661197.4				
Actual Fuel and Utility Gas	1221.4	43.1	49147.0	46582.3				

ESTIMATED CANADIAN PIPELINE IMBALANCE					Volume		Energy	
	E3M3	MMscf	GJ	Dth				
Receipt Imbalance	4005.6	141.4	168071.1	159300.7				
Delivery Imbalance	-1022.2	-36.1	-48722.7	-46180.2				
Fuel and Utility Gas Imbalance	43.6	1.5	1818.0	1723.1				

USA PIPELINE PHYSICAL SUMMARY					Volume		Energy	
	E3M3	MMscf	GJ	Dth				
Linepack	115798.7	4087.8	4644438.8	4402077.9				
Actual Receipts	43686.5	1542.2	1752656.3	1661197.4				
Actual Deliveries	42404.4	1496.9	1710463.2	1621206.1				
Actual Fuel and Utility Gas	648.9	22.9	26101.7	24739.6				

ESTIMATED USA PIPELINE IMBALANCE					Volume		Energy	
	E3M3	MMscf	GJ	Dth				
Receipt Imbalance	-1022.3	-36.1	-48723.1	-46180.6				
Delivery Imbalance	-1493.9	-52.7	24441.2	23165.8				
Fuel and Utility Gas Imbalance	-71.5	-2.5	-2893.4	-2742.4				

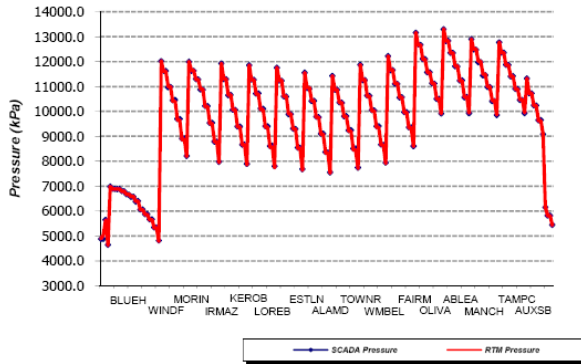
LINEPACK SUMMARY					Volume		Energy	
	E3M3	MMscf	GJ	Dth				
Start of Day Linepack	228262.0	8057.9	9156277.6	8678475.4				
Receipt Imbalance	-162.1	-5.7	-5332.4	-5054.2				
Delivery Imbalance	-4648.2	-164.1	-68384.4	-64815.9				
Fuel and Utility Gas Imbalance	-27.0	-1.0	-1036.4	-982.3				
Estimated End of Day Linepack	232775.2	8217.2	9081524.3	8607622.9				
Actual End of Day Linepack	230735.1	8145.2	9255282.9	8772314.3				
Estimated Lost & Unaccounted For	-2040.1	-72.0	173758.6	164691.3				
Target Linepack	229550.0	8103.3	9207943.1	8727444.9				
Deviation	0.52%	0.52%	0.51%	0.51%				

CURRENT COMPRESSOR STATION OPERATING CONDITIONS						
COMPRESSOR STATION	Status	Speed rpm	Suction Pressure		Discharge Pressure	
			kPa	psig	kPa	psig
Taylor C/S	Ready to Start	0	4817	698	4814	698
Blueberry Hill C/S			4153	602	6539	948
Blueberry Hill Unit 1	Running	8178	4134	599	6573	953
Blueberry Hill Unit 2	Ready to Start	0	4148	601	4133	599
Teepee Creek C/S	Running	899	5303	769	7143	1036
Gold Creek C/S	Running	1171	5474	793	6182	896
Carson Creek C/S						
Carson Creek Unit 1	Running	1299	5285	766	11643	1688
Carson Creek Unit 2	Running	1399	5416	785	11576	1678
Whitecourt C/S			5306	769	10499	1522
Whitecourt Unit 1	Running	1269	5246	760	10627	1541
Whitecourt Unit 2	Running	1125	5300	768	10589	1535
Paddle River C/S	Shutdown	2	2947	427	9682	1401
AB55 - Scotford P-300	Ready	0	183	26	154	22
AB55 - Scotford P-350	Ready	0	160	23	154	22
Windfall C/S			4501	652	11241	1630
Windfall Unit 1	Running	5919	4472	648	7409	1074
Windfall Unit 2	Ready to Start	0	7333	1063	7337	1064
Windfall Unit 3	Running	5793	7316	1061	11317	1641
Morinville C/S	Running	6044	7200	1044	11848	1718
Irma C/S	Running	6206	7933	1150	11634	1687
Kerrobert C/S	Running	6242	7793	1130	11541	1673
Loreburn C/S	Running	6196	7770	1126	11519	1670
Estlin C/S	Running	6318	7751	1124	11751	1704
Alameda C/S	Running	5310	8713	1263	11823	1714
Townier C/S	Running	4295	9695	1406	11916	1728
Wimbledon C/S	Running	4395	9743	1413	12100	1754
Fairmount C/S	Running	4271	10071	1460	12249	1776
Olivia C/S	Running	4174	10121	1467	12200	1769
Albert Lea C/S	Running	4198	9909	1437	12029	1744
Manchester C/S	Running	4034	9954	1443	11850	1718
Tampico C/S	Running	3956	9892	1434	10751	1559
Aux Sable Plant			9220	1337	5767	836

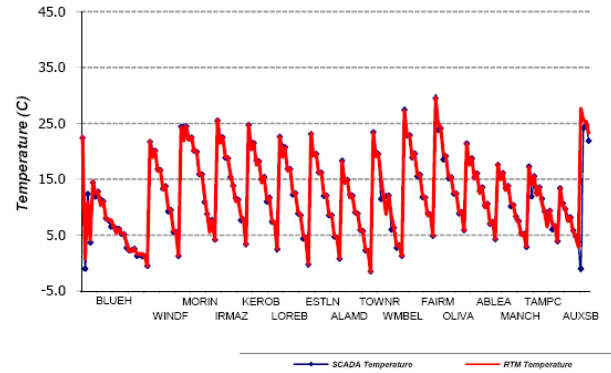
Reporting

Alliance Pipeline Limited Gas Control

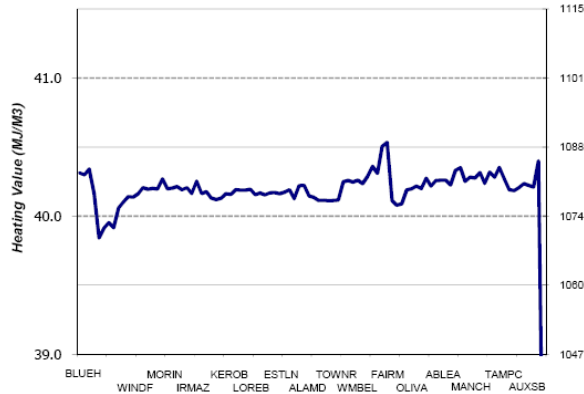
System Pressure Profile



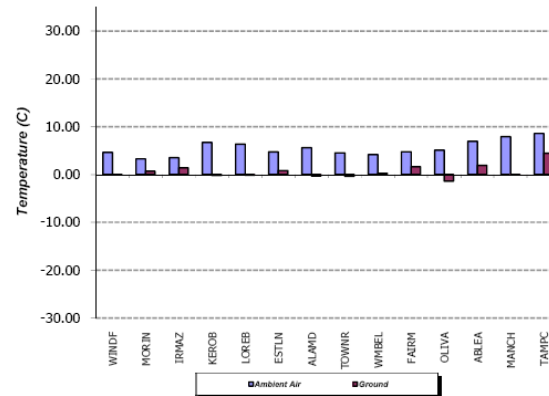
System Temperature Profile



System Heating Value Profile



Ambient Air / Ground Temperature Profile



Phase 1 Results

Phase I addressed:

- Data integrity
 - Excel is no longer a data historian
- Data access
 - Easy access to data (located on corporate network)
 - Better isolation of mission critical systems
 - Shorter times to process data requests
 - More “complete” set of data
- Automated processes
 - Reduction of manual data entry
- Flexibility \ Expandability

Phase 2

Requirement analysis for phase II

- Leverage existing products not currently implemented and maximize ROI
- Products to be implemented
 - PI Analysis Framework (AF)
 - PI Advanced Computing Engine (ACE)
 - PI WebParts
 - Interfaces

Phase 2

Requirement analysis for phase II

- Expand user base
 - Pipeline Integrity
 - Facility risk ranking
 - Pig runs
 - Fracture mechanics
 - Finance
 - NGL from receipts
 - Automation within weekly reports
 - Tech Services
 - Measurement data

AF Implementation

- New users had difficulties understanding tags naming conventions
- Users requested a “Data Dictionary”
- Used AF to organize assets and alias tag names
- Users can easily navigate hierarchies to find data they are looking for
- Foundational for using other PI products and future growth
 - ProcessBook
 - PI WebParts
 - ACE calculations
- AF implementation time for ~40,000 tag system was 2 to 3 months
- Business users approved AF data structures

AF Implementation

PIAF-Dev - PI System Explorer

File Edit View Go Tools Help

Database Query Date Back Check In New Element New Attribute Search

Elements

- Elements
 - Help
 - APL
 - Layers
 - Alliance Pipeline Canada
 - 1 - Grande Prairie
 - 2 - Whitecourt
 - Compressor Stations
 - 3A - Windfall
 - AB47 - Carson Creek
 - AB48 - Whitecourt
 - Meter Stations
 - AB36 - Bigstone West
 - AB38 - Two Creeks
 - AB40 - Kaybob
 - AB41 - Kaybob South
 - Receipt Meter (Run 1)
 - Return Meter (Run 2)
 - AB45 - Kaybob South 3
 - AB46 - West Whitecourt
 - AB47 - Carson Creek
 - AB48 - Whitecourt
 - Pipeline
 - MBV 03-1
 - MBV 03-2
 - MBV 04-B
 - 3 - Mornville
 - 4 - Kerobert
 - 5 - Regina
 - Calgary
 - Alliance Pipeline US
 - 5 - Valley City
 - 7 - Mankato
 - 8 - Maquoketa
 - NRGreen Power
 - Aux Sable
 - Block Valves
 - Compressor Stations
 - Meter Stations - Deliveries
 - Meter Stations - Receipts
 - System Data
 - Waste Heat

Receipt Meter (Run 1)

General Child Elements Attributes Ports Model View Version

Search Group by Category

| Name | Value | Description | S... |
|---------------------|----------------------------------|---|------|
| Description | Kaybob South #1/#2 - Receipt Run | Description | S... |
| Equipment Number | 1010 | Equipment number | |
| Measured Data (EFM) | | Electronic Flow Measurement data | |
| Meter Location | AB41 | EFM meter location | |
| Meter Number | 111411 | EFM meter number | |
| Meter Type | Ultrasonic | Type of meter | |
| Mnemonic | KBOBS | Mnemonic | |
| Polled Data (SCADA) | | Scanned interval data from the SCADA system | |
| Actual Flow Rate | 2385.08056640625 m3/h | Actual flow rate | W... |
| Energy | 30725.75 GJ | Gas day energy | W... |
| Energy Rate | 140684.71875 GJ/d | Energy rate | W... |
| Flow Rate | 3507.64404296875 e3m3/d | Flow rate | W... |
| Gas Properties | | | |
| C1 | 90.8704528808594 %mole | C1 | W... |
| C2 | 7.03628301620483 %mole | C2 | W... |
| C3 | 1.07104504108423 %mole | C3 | W... |
| C6 | 0.0311219990253448 %mole | C6 | W... |
| C7 | 0 %mole | C7 | W... |
| C8 | 0 %mole | C8 | W... |
| C9 | 0 %mole | C9 | W... |
| CD2 | 0.336032003164291 %mole | CD2 | W... |
| HE | 0.0399999991059303 %mole | HE | W... |
| Heating Value | 40.1109046336035 MJ/m3 | Heating value | |
| IC4 | 0.0240059997886419 %mole | IC4 | W... |
| IC5 | 0.0017010000301525 %mole | IC5 | W... |
| N2 | 0.584855020046234 %mole | N2 | W... |
| NC4 | 0.001262939995463341 %mole | NC4 | W... |
| NC5 | 0.00158499996177852 %mole | NC5 | W... |
| Specific Gravity | 0.60643166303634644 | Specific gravity | |
| Pressure | 5405.4775390625 kPa | Pressue | |
| Temperature | 17.359033066406 °C | Temperature | W... |
| Volume | 766.340942382813 e3m3 | Gas day volume | W... |
| Yesterday Volume | 3679.4912109375 e3m3 | Gas day volume - yesterday | W... |
| Yesterday Energy | 147738.1875 GJ | Gas day energy - yesterday | W... |

8 Attributes

Low Intervention Initiative

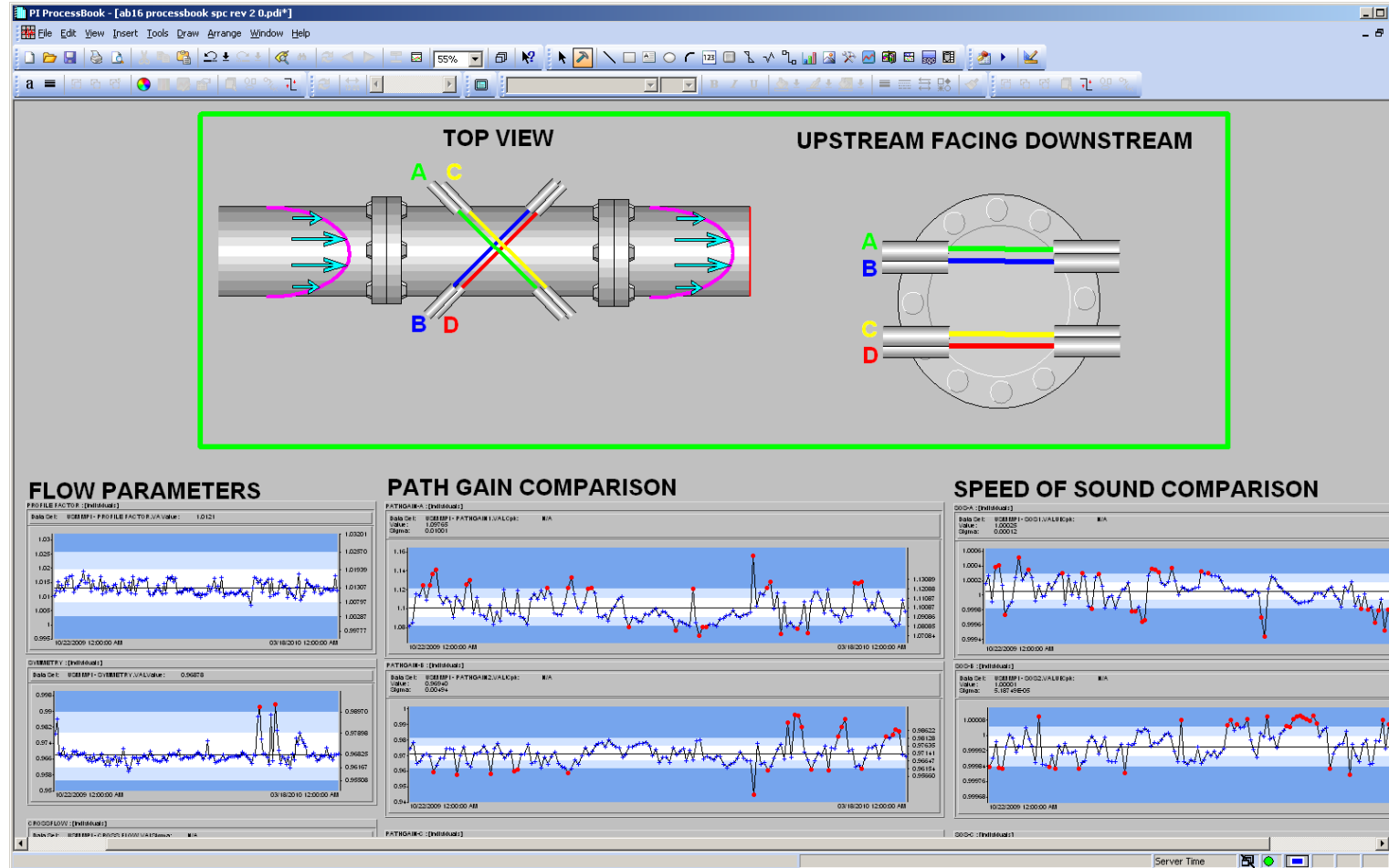
- Granted approval by Measurement Canada for the use of gas meters without verification and sealing, at the Low Intervention Trade Transaction level (Bulletin G-14)
- Process defines the procedure for justifying suitable maintenance and calibration frequencies for custody transfer equipment based on combined knowledge of statistical analysis of historical performance / diagnostic data and site risk assessments
- Condition based maintenance and calibration-by-exception on all custody transfer ultrasonic meters
- Application of statistical process control (SPC) to determine deviations from baseline conditions
- Justifies the degree of intervention applied to measurement equipment at a given facility

Low Intervention Initiative

OSIsoft products required

- RtSQC
- AF
- ACE
- PI Notifications
- ProcessBook
- DataLink
- PI WebParts

Low Intervention Initiative



Low Intervention Benefits

- Enhanced measurement accuracy
- Strengthened knowledge of equipment performance and reliability
- Avoid unnecessary maintenance
- Optimization of field and material resources
- Decreased reliance on Measurement Canada limited inspection resources
- Reduced impact and loss productivity to Alliance and its shippers
- Proactive risk mitigation through early detection of potential measurement issues
- Decreased capital and lifecycle cost
 - Cost savings of \$70,000 over the lifetime of each facility
 - Applied to 60 ultrasonic metering sites at inception could have resulted in savings of \$4,000,000

Future plans for PI at Alliance Pipeline

Other phase II opportunities:

- New reporting methods
- Migrate existing reports
- Data provider to SAP
- New data sources
- Replacement of old systems
 - Access for field technicians
- Data templates for hydraulic models
- KPIs
- Dashboards
- Automatic tag creation
- Internal training plan

Wrap Up

- Phase I of the project addressed our immediate needs
- PI was easy to install and implement
 - Experienced challenges backfill data due to behavior of our existing systems
- Smooth operation, no major problems
- Business users are very pleased with PI functionality
- Low Intervention initiative could save Alliance approximately \$70,000 per facility
- Excitement at Alliance about future PI growth



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Thank you

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