



# Best Practices for Implementing Asset Framework

Presented by **Richard M Smith Jr**  
**Stephen Kwan, Product Manager**

INTERNATIONAL  PAPER

# Keep in Mind



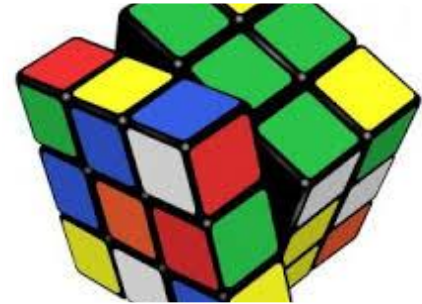
Who will consume  
the data?



There is no “right  
way” to building AF



Start small and  
build up



Solve a specific  
problem

# Get Started, with a Plan and a Purpose

Look for one or two business cases to define:

- Critical assets
- Data sources of
  - Time series
  - Meta data
  - Structure
- Someone has to maintain
- Change management



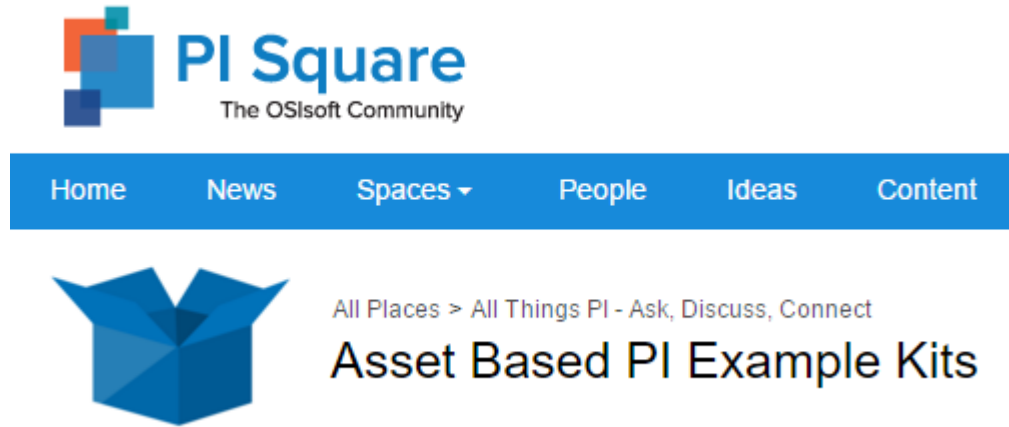
## Best Practice

- Only model what you have understood
- Only invest in resources if you have the use case



Don't try to boil the ocean or find theory of everything

# Need Examples to get Started?



- Customer examples - <http://www.osisoft.com/templates/presentation-list.aspx?id=1818>



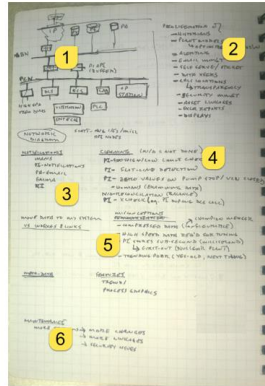
# International Paper

# Building the Case for AF (UC 2015)

- IT Service Providers Want to Simplify a Complicated Environment
- Management Wants Significant Return-on-Investment (ROI)

## Red-Eye Flight from OSISoft 2014 UC...

1. Typical Network
2. Proliferation
3. Notifications
4. Data Cleaning
5. Misconceptions
6. More...More... More



# How to Satisfy Many Customers?

- **IT Service Providers**
  - Simplify/Standardize Archaic Solutions
  - Leverage Software We Already Owned
- **Management and Operations**
  - Rapidly Solve High Value Problems
  - Solve Difficult Problems
    - Reduce Time Transforming Data into Information
    - Improve Data Visualization => Events and Batches
    - Alert When Operation Deviating from “Normal”
  - Replicate Solutions Across Enterprise
- **Me**
  - Leverage AF and Event Frames... and PI Coresight
  - Avoid Mill-Wide and Focus on Single Operating Lines/Units





# My Selection Criteria for Picking Projects

- High Return and Unit Level Scope
  - Mill-Wide/Enterprise Projects Create Lots of “Help”
- Look for High Replication Potential
  - 10 Times... 50 Times... 1000 Times
- Leverage AF Features
  - We Are Not Just Replacing Performance Equations
- Find Hard to Analyze Scenarios
  - 3+ Hours -> 5 Minutes
- Know How to Collect/Transform/Visualize/Alert Operators



# AF Projects (2015-Present)

- **Batch Digester Performance (2015)**
- Paper Machine Winder Performance (2015)
- Paper Machine Sheet Break Analysis (2016)
- Track/Alarm on Heat Exchanger Fouling (2016)
  
- Pick a Project...
  - **We Are Going to Make Mistakes...**
  - **Admit it... Get Over it... and Get Started!!!**

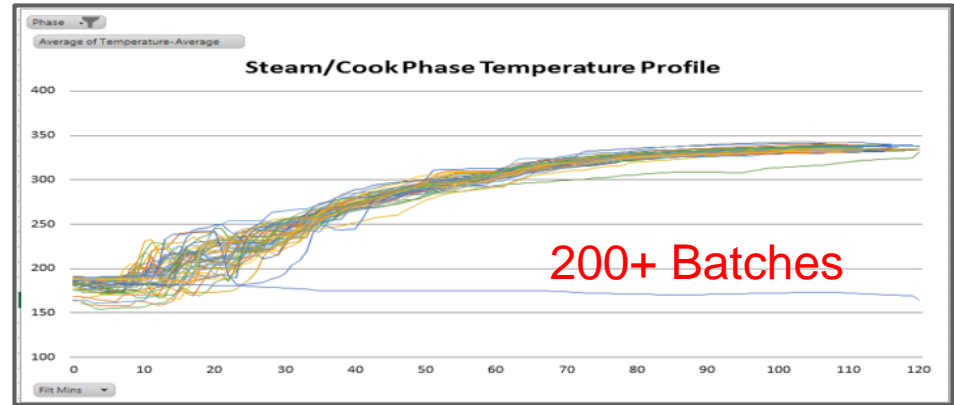
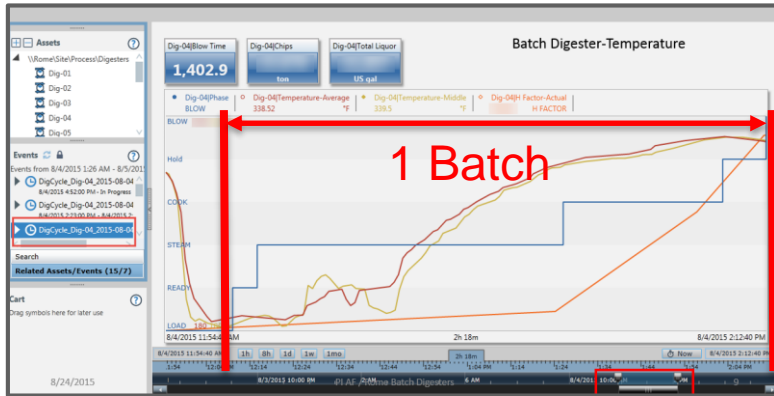
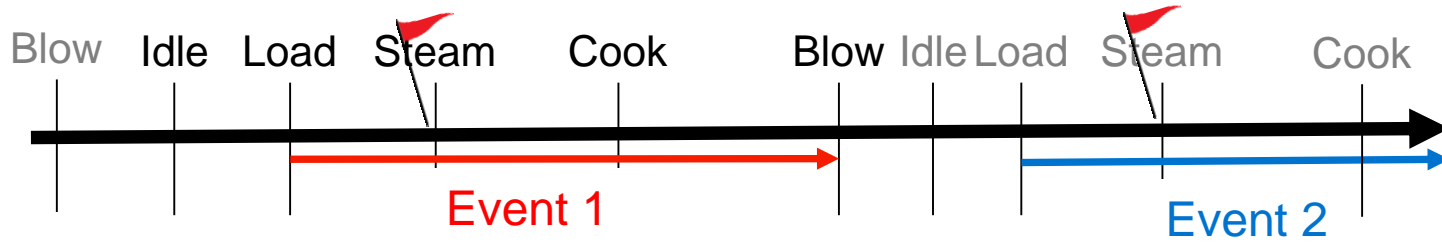


# Batch Digester Project Requirements (2015)

- **Problem: Low Performance and Dropping**
  - Digesters Convert Wood Chips to Pulp
- Mill Needed to Improve Data Analysis
  - Chips, Chemicals by Digester
  - Create Temperature Profile Curves
  - Meta Data (Dig #, Line #, Crew, etc.)
- Mill Wanted to Improve Data Visualization



# What is a Digester Batch?



# Did We Make Mistakes? Yes...

- **“Bad” Phase PI Tags (Inconsistent Equations)**
  - Fixed 3 Years of Data Archive History
- **Template Changes => “Bad” Event Frames**
  - Added “isFullBatch” Flag to Event Frame Template
- **Missed Meta-Data for Reporting and Replication**
  - Added to Template and Retrigger Events
- **Writing “Steam-Start-Time” to PI Took Iterations**
  - Change and Retrigger...Change and Retrigger... Change and Retrigger...
  - Event Backfill Was Hard in 2015, But is Easy Today
- **Mills Differ in Configuration and Units of Measure**
  - Continuing Opportunity for Improvement



# Development Methodology

- 1. Create in Development Environment (Loveland, Ohio)**
  - a. Read Data from Facility; Write Data to Development PI Server
  - b. Built Elements and Analyses
  - c. Configure 3 Digesters... Backfill 3 Days... Validate
  - d. Build Test Reports... Review w/ Operations
- 2. Configure 1<sup>st</sup> 3 Digesters at Facility**
  - a. Transfer Templates and Reports to Facility
  - b. Read Data from Facility; Write Data to Facility PI Server
  - c. Backfill 7-10 Days and Validate; Review w/ Operations
  - d. Backfill Same Digesters for 3 Years
- 3. Configure Remaining Digesters at Facility**
  - a. Repeat Step 2
- 4. Go To Step 1 for Enhancements**

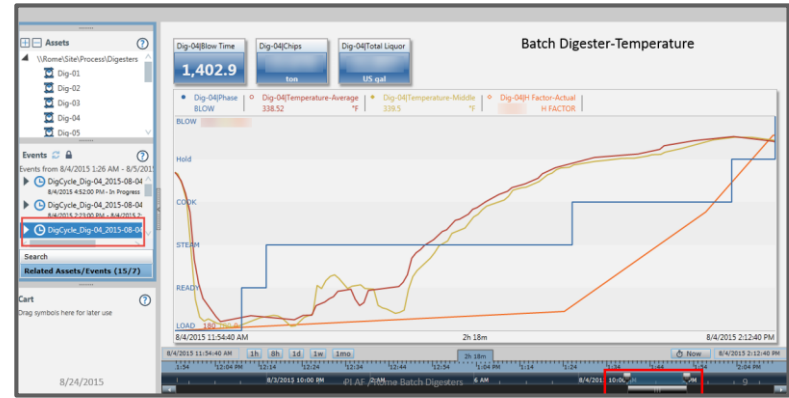
# Build the AF Element

- 55 Element Attributes
- 51 Event Frame Attributes
- 2 Lines / 15 Digesters
- PI Coresight & PI ProcessBook Displays Leverage Assets

Filter	Name	Value
Category: <None>		
Category: Process		
Blow Time	127.846008	1
Chip Moisture	Bad Input	
Chips	0 ton	
Chips-Dry	0 ton	
Level	35.98644 in	
Category: Configuration		
CycleID	\\S29EPIDEV01\Dig-01.Unit Nam...	
FacilityAbbr	RM	
Line ID	1	
Unit ID	1	
Unit ID-Last Blow	2	
Unit Name	\\LO_s29epidev01\Dig-01.Unit N...	
Volume	ft3	
Category: Duration		
CookMinutes	29.93333 min	
FirstSteamTimeStamp	2/1/2017 11:45:52 PM	
HoldMinutes	0.3 min	
LoadMinutes	14.61667 min	
MinutesSinceFirstSteam	0 min	
ReadyMinutes	17.3500003814697 min	
StartBlowTimeStamp	2/2/2017 1:27:11 AM	
SteamMinutes	71.08334 min	
Category: Liquor		
Black Liquor	0 US gal	
EA-Cook Program	0 lb/ft3	
EA-Lab	4.7875324675325 lb/ft3	
EA-Residual	0 lb/ft3	
Category: Press		
Overpressure	0 psi	
Pressure A	0 psi	
Pressure Average	0.004187529 psi	
Pressure B	0.009567942 psi	
Relief Valve-Large	0	
Relief Valve-Small	0	
Category: Quality		
H Factor-Actual		
H Factor-Target (Line)		
H Factor-Target (Unit)	I/O Timeout	
Category: Status		
Blow Valve Limit	CLOSED	
Capping Valve Limit	UNKNOWN	
Crew	B	
Phase	INACT	
PhaseCode	0	
PhaseDigCode	0	
Species	%@... Species%	
Status	Manual	
Category: Steam		
Steam-HP Flow	0 lb/h	
Steam-HP Total Lbs	I/O Timeout	
Steam-HP Valve Position	1 %	
Steam-LP Flow	Excluded	
Steam-LP Total Lbs	Excluded	
Steam-LP Valve Position	Excluded	
SteamMinutes	71.08334 min	

# Validate Data and Calculation Assumptions

- Are Key Inputs Working?
- Is the Batch Phase Correct?
- Is the Process Data Correct?

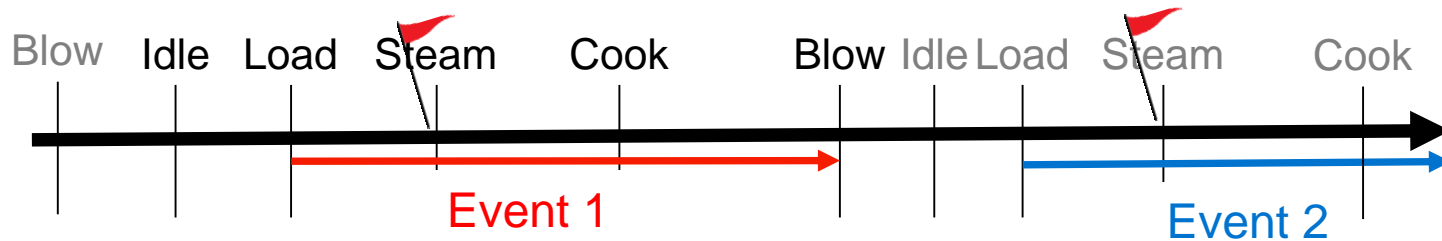


- Corrections Were Required, But After Fixes We Could...
  - Build Batch/Phase Models and Event Frames



# Build Analyses in AF

- **Batch Phases Generated by DCS**
- **DigCycle Analysis**
  - Event Frame to Summarize Batch Information
  - Incorporated **isFullBatch Flag** into Event Frame
- **DigCycleID Analysis**
  - Mill Wanted to Trend Minutes Each Phase PI Tags
- **DigFirstSteam Analysis**
  - | Flag Timestamp Steam Begins (Temperature Profile)



# How to Visualize the Results?

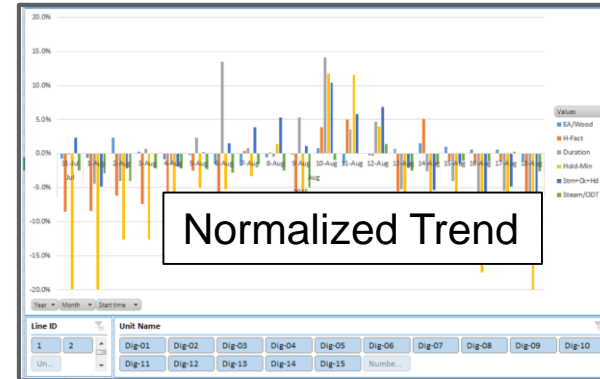
- **Potential Visualization Tools**
  - **User:** PI Datalink, PI ProcessBook, PI Coresight
  - **Developer:** PI OLEDB Provider, PI OLEDB Enterprise
- **Mill Chose to Use an Excel Spreadsheet Solution**
  - **OLEDB** to Retrieve Events (w/ VBA)
    - Too Many Attributes for PI Datalink
  - Pivot Tables and Pivot Charts to Filter and Analyze Data

# Data Visualization (Excel Pivot Charts)

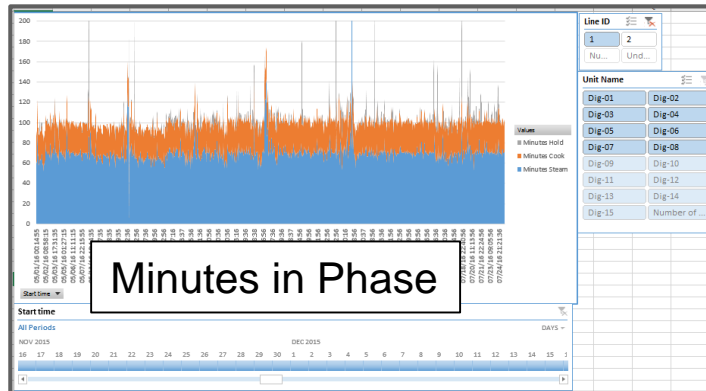
Valid Batch TRUE

Row Labels	Blow Count	Duration	Chips ODT	EA/Wood	WL/Ton	Steam/TN	H	Load-Min	Steam-Min	Cook-Min	Hold-Min
May	3381	02:22:45						23.6	70.2	32.77	4.6
1	1996	02:08:20						23.6	68.4	29.25	4.1
Dig-01	268	02:09:14						24.4	67.4	30.12	3.6
Dig-02	266	02:08:46						24.5	68.5	29.18	2.8
Dig-03	270									28.87	6.2
Dig-04	255									29.45	2.2
Dig-05	263									28.74	6.0
Dig-06	265	02:06:03						22.4	69.9	28.79	3.5
Dig-07	270	02:07:22						21.6	69.2	29.64	3.8
Dig-08	139	02:12:49						21.7	71.8	29.20	4.8
2	1385	02:43:30						23.6	72.8	37.83	5.3

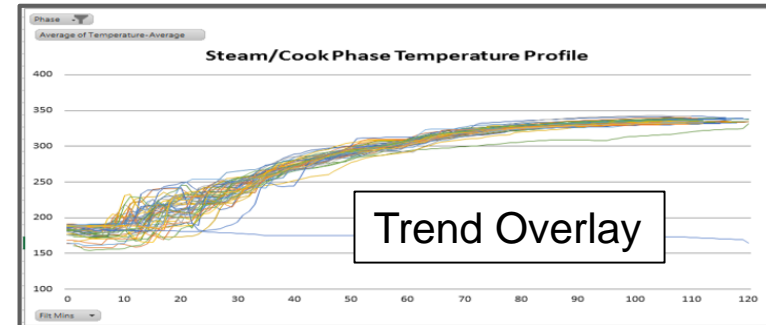
Monthly Summary by Line



Normalized Trend



Minutes in Phase



Trend Overlay

# Transform Data Into Events Into Dollars

- AF Transformed Raw PI Data Into Events
- Rick Extracted Events into Excel for Analysis
- Mill Used Overlapping Temperature Profiles for Visual Indicator
- Mill Analyzed the Batch Events Across Time and Digesters
  - **Weekly Analysis Dropped from 3+ Hours to 5 Minutes**
  - **Identified Process Issues in Minutes vs. Hours/Days**
- Identified Relationship Between Blowing Digester and Screens
- **Before: <75% of Target... After: >100% of Target**

# Return on Investment

Project	Implementation (Calendar Days)	Cost Payback (Calendar Days)
<b>Batch Digester (1<sup>st</sup>)</b>	<b>20</b>	<b>&lt;1</b>
PM Winder (1 <sup>st</sup> )	5	<1
PM Sheet Break Data Collection (1 <sup>st</sup> )	<1	n/a
<b>Batch Digester (2+)</b>	<b>5</b>	<b>&lt;1</b>
PM Winder (2+)	1-2	<1
Heat Exchanger (1 <sup>st</sup> Prototype)	5	?
Heat Exchanger (2+) (2017 Project)	0.2	varies

## In Summary – Rick's 9 Tips

1. Focus on **High Value Projects**
2. Develop Requirements with **Customer**
3. Focus on **Needs** and Not Wants
4. **Keep Scope Small and Focused**
5. Accept “Good Enough” Visualization
6. Incorporate **Self Diagnosis** Into Analysis
7. **Consider Replication** Issues During Development
8. Stay “**In-the-Box**” As Long As Possible
9. **Watch for New AF Features...** Can Greatly Simplify Effort



# Benefits of New AF Features (PM Winder Project)

Event Frame Template: EF:WinderReel		Event Frame Template: EF:WinderSet		AF 2015
Name	Expression	Name	Expression	
<input type="checkbox"/> Start triggers				
StartTrigger	'SequenceNumber-Set' >= 1	StartTrigger	'Rider Roll Relief' = "True" and 'Start Command' = "True"	
<input type="checkbox"/> End trigger				
EndTrigger		EndTrigger	'Rider Roll Raised' = "True"	

Event Frame Template: EF:Winder_2016		AF 2016	
Name	Expression	True for	Severity
<input type="checkbox"/> Variables			
vReelLocked	'UnwindCouplingClosed' = "TRUE"		
vCoreLocked	'RiderRollInRelief' = "TRUE"		
<input type="checkbox"/> Start triggers			
Reel	'UnwindCouplingClosed' = "TRUE"	Not Set	Information
Set	'RiderRollInRelief' = "TRUE" AND 'UnwindCouplingClosed' = "TRUE"	Not Set	Warning
<input type="checkbox"/> End trigger			
EndTrigger			

- AF 2015
  - 2 Analysis Templates
  - 6 Analyses
- AF 2016 (Severity)
  - 1 Analysis Template
  - 1 Analysis



# AF 2017 R2 and Beyond



# AF 2017 R2 – Planning Stage

## Enhanced Streaming Calculation

- Auto recalculation
- Calculations on event frames

## Manageability

- Support PI System Health

## Performance and Scalability

- Event frame scale
- Better diagnostics for analyses and notification rules
- Search capabilities

## Usability and Features

- Attribute display names
- Hierarchical enumeration sets
- Notifications push to phone

# AF 2018 and Beyond – Research

## Enhanced Streaming Calculation

- Integrate with 3<sup>rd</sup> party analytics – MATLAB, R, etc.

## Manageability

- Enterprise deployment
- Web based configuration

## Performance and Scalability

- PI Analysis Service scaling
- PI Notifications Service scaling

## Usability and Features

- Incorporate Data Quality into the PI System
- Flag stale data
- Identity provider



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# Contact Information

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## Questions

Please wait for the **microphone** before asking your questions



State your **name & company**

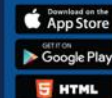
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谢谢

Danke

Merci

Gracias

**Thank You**

ありがとう

Спасибо

Obrigado

Go Save Some Money...