How to Improve Production Efficiency and Safety with Digital Intelligence

Phil Millette, Honeywell
Today’s Presenter

Phil Millette
Principal Industry Consultant
Honeywell Process Solutions

• 36 years of experience – plant / facility information management solutions over 5 continents

• Provide lead consulting to clients & to Honeywell teams on all aspects of performance improvement – across process safety, process & asset surveillance, production efficiency, reliability, supply chain

• Chemical Engineer, B.Eng 1979 from McGill University, Montreal.
Oil and Gas Price Uncertainty

• When will oil and gas prices recover?
  – Returns 7.5 Million Bing search results
  – Vastly different opinions and speculation
  – Settling later in 2015 as a medium term state – 2-3 year outlook – except in case of large unexpected events / shocks

• E&P Industry Response
  – OPEX savings, agility and efficiency for more profitability
  – Getting more from existing Investments
  – Simplification and scalability
  – Solution standardization
  – Reliability, visibility, safety
  – CAPEX and staff cuts
Launching Efficiency & Visibility Initiatives

Maximize Return for Producing Assets

Ensure Safety and Compliance

Smarter Operating Environments
Honeywell’s Digital Suites for Oil and Gas

DISCOVER

Improved Production Performance through Digital Intelligence

Six Digital Suites include:

- Operational Data
- Equipment Effectiveness
- Production Excellence
- Process Safety
- Production Surveillance
- Operational Performance
Digital Suites for Oil and Gas

Consulting, Software and Services

**Opportunity Cost Management:** Proactive Production Management with Improved Safety and Agility

**Intelligence:** via Templated, structured asset model including asset behavior, analytics, causal relationship identification, improved level of trusted data… plus flexibility to quickly modify business assumptions, production strategies on the fly

**Process Safety**
- Alarm Management
- Shut-Down Analysis
- Safety Valve Analysis
- Barrier Testing

**Process & Asset Surveillance / Equipment Effectiveness**
- Condition & Performance mgmt
- Equipment Integrity
- Transmitter Monitoring
- Control Valve Performance
- Corrosion Prediction

**Production Excellence**
- Operations Management
- Integrated Planning
- Production Management
- Operator Competency
- Process Control & Optimization

**Production Surveillance**
- Well Test Validation
- Well Surveillance
- Well Test Management

**Operational Data**
- Process History & Analytics

**Operational Performance**
- Enterprise Collaboration
- Performance Management
Maximize Return on Producing Assets

Customer Initiatives

• Increased efficiency with lower Opex
  • Integrated operations connecting fields, assets and corporate
  • Increased reliability and better visibility

• Exception-based surveillance
  • Automated, continuous, consistent surveillance
  • High performance calculations – millions analyzed per day

• Predictive maintenance
  • Health- and condition-based maintenance of assets

• Analytics- and metrics-based operating systems
  • Real-time measurement of asset integrity and performance

Digital Suites Key Solutions
• Production Surveillance
• Equipment Effectiveness
• Operational Performance

Proven Results
• $30M YOY via surveillance
• $5M YOY early notifications
• 5% increase in efficiency
• ROI in less than 6 months

Why Honeywell
• Low or no capital Investment
• Investment priority in upstream
• Global experience, local support
• Millions of assets being watched
• Direct upstream analytic expertise
Ensure Safety and Compliance

Essentials

- **Full visibility of safety system performance**
  - Monitor and analysis of safety system and valve performance
- **Protection of critical assets**
  - Alarm rationalization and management
  - Capture & manage pressure containment tests
  - History of safety system events to identify trends
- **Regulatory compliance**
  - Comprehensive reporting and recordation
- **Better prepared operators**
  - Training and operational simulation is practice environment

Digital Suites Key Solutions

- Process Safety
- Equipment Effectiveness
- Operational Performance

Proven Results

- 20% reduction in standing alarms
- 38% maintenance cost reduction
- Reduction in downtime
- Projects deployed in 6 months
- Reporting for compliance

Why Honeywell

- Used on more than 60 platforms
- Center of Excellence supported
- Easy integration to all systems
- Best in class alarm management
Smarter Operating Environments

• Remote Operations and Monitoring
  • Leverage expertise with limited resource
  • Role out standardized surveillance across all assets

• Operational Simplification
  • Unified architecture and collaborative work environments
  • Streamlined work processes and human factors

• Enterprise software standardization
  • Engineered and warranted standard products
  • Lower total cost of ownership with less risk

• Easier supplier engagement
  • Simplified pricing & trusted partner relationship

Digital Suites Key Solutions
• Operational Data
• Process Safety
• Production Surveillance
• Equipment Effectiveness
• Operational Performance
• Production Excellence

Proven Results
• 6 major centers completed
• 30 year customer relationships
• Partnership programs
• Unmatched customer support

Why Honeywell
• One Honeywell
• Experienced global organization
• Standardized implementation
• Global standard products
• Emphasis as software company
Digital Intelligence: How to use Data Smarter

Essential attributes:

• Data must be well managed and connected
• Data must be accessible in real time
• Data must be shown in context
• Data must be visualized in a way that is easy to analyze and understand
Digital Transformation is Here
Ride the Wave
Enterprise Connectivity, Real Time Analytics, Collaboration...Powered by Mobility and the Cloud.
Enter to Win an Apple® Watch.
Smart Operations

Smart Operations put you in control of the ecosystem around you by providing visibility and access to situations which require action

Value-Driven

• Proven proficiency delivering value through our consulting-based approach to technology deployment

Connected Enterprise

• Transform enterprise information by connecting operational decisions at the site level to business objectives at the corporate level

Work Process Transformation

• Transform the way work processes are executed to improve the return on your people and technology investments
Enabling a Performance-Based Culture

Empower field operators to proactively manage safety and reliability in operations

Enable better planning and performance management by integrating fragmented upstream assets

Discover opportunities and risks in your operations (increased transparency) AND enable communication, collaboration with business stakeholders across the enterprise

- Reduce risk
- Best-in-class safety
- Regulatory Requirements
- Cost savings
- Compliance Standards

- Operate to Plan
- Maximize People
- Minimize Operating Expense
- Data Validation
- Compliance Standards

- Management Operating System
- Collaboration
- Remote Operations Enabler
- KPIs and Best Practices
We Serve the Oil & Gas Industry

HPS applications are installed at more than 5,000 sites, with more than 150,000 users daily.
Honeywell Upstream Differentiation

• Honeywell’s Capability
  – Solutions Consulting
  – Project Delivery
  – Post Delivery Support
  – Long-term support
  – Experience in managing large, global technology implementation programs

• Scalable software solutions that are automation system/equipment agnostic
  – Provide integration
  – Monitoring and analytics capabilities
  – Across different data sources

• Experience in setting up remote operations and collaboration centers
  – Field Surveillance
  – Application and field support from onshore facilities
Technology Platform

Intuition® - The Foundation for Honeywell’s Advanced Solutions

Intuition® is the Honeywell platform for our Operations, Production, Asset Management and Collaboration solutions.
Exception Based Surveillance

• Needs
  – Monitor the health and performance of remotely located wells
  – Need to ensure Standard Operating Procedures

• Solution
  – Exception-based surveillance

• Benefits
  – Eliminates the need for manual monitoring
  – Removes requirement for multiple system data access
  – Improves Well, Reservoir and Facilities Management operating practices

• Results
  – ROI achieved in first few months of operation
Process Safety Analyzer – PSA - Overview
Phil Millette, Honeywell
Problem statement

• How to better facilitate
  – Validation, Verification, Documentation of Safety & Process Shutdown systems

• Understanding the workflows involved and the reasons they are in place

• Objective:
  – Achieve more structured approach – provide better basis for showing own organization and external parties actual system function documentation
Reason this needs attention

• Often implemented as ad hoc, spreadsheet and manual verification processes
• Intensive, individual work
• No guarantee of consistent checks
• In-house tools
• Need more than capture of initiating conditions

• How to achieve provable safety, exception based safety inspection
Sample workflows

• Immediate post shutdown and retrospective analysis
  – good function review using SDA;
  – identify any bad actors – behaviour not as expected
  – generate work request for fix;
  – report to authorities;
  – in case of all good function; document into fixed format

• Retrospective analysis of shutdown events in groups, by plant / process area, by platform etc.

• Pre-shutdown
  – Identify any overrides/ blocks/ bypasses etc
  – Review expected sequences by plant area

• Regular use of reports to show such as safety bypasses/ inhibits, blocks/suppresses/overrides (whatever terminology used at site)
Safety Valve Scout Example

- Safety Valve Scout is configurable to suit user requirements. Examples of information shown includes:
  - OK operations (command and response received within maximum travel time, including calculation of actual travel time)
  - Operations with long travel time or a travel time exceeding a warning limit
  - Failed operations (e.g. operations with no command)

- Also supports:
  - Trending of travel time development
  - Send alerts for long travel time (via PHD OPC Server)
PSA - Shutdown Analyzer (SDA) function - Overview

- Verifies that the ESD / PSD systems have performed as expected according to the “master”
  - Master is normally the cause & effect diagrams

- Enables cause and effect analysis at any time after the shutdown has taken place

- Time-saving since the analysis is done automatically

- Highly configurable

- Supports storing relevant operator comments

- Various filters to simplify analysis

- Support for SSRS Reports (SQL Server Reporting Services)

- Bulk Load Utility – eases initial load and incremental management of change
**SDA User interface: Detailed description**

<table>
<thead>
<tr>
<th>List of shutdowns</th>
<th>Thin Client – runs in Internet Explorer</th>
<th>Publish report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator Overall Comments</td>
<td>Engineer Overall Comments</td>
<td>Comments pr. Cause and Effect</td>
</tr>
<tr>
<td>Actual travel time (calculated) used to safe state</td>
<td>State information (required state, state after SD)</td>
<td></td>
</tr>
</tbody>
</table>

### Content-sensitive filters for each column

### Status of the shutdowns

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Area</th>
<th>Type</th>
<th>Status</th>
<th>Result</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016-05-01 10:00:00</td>
<td>Al</td>
<td>PS</td>
<td>4.27</td>
<td>Published</td>
<td>OK</td>
<td></td>
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### Flag indicating status of effect

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Area</th>
<th>Type</th>
<th>Status</th>
<th>Required state</th>
<th>State after SD</th>
<th>Travel Time (min)</th>
<th>State before SD</th>
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### SDA User interface: Detailed description

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- **Flag indicating status of effect**
- **Content-sensitive filters for each column**
- **Status of the shutdowns**
Shutdown Analyzer Reports

• Shutdown Report is configurable to suit user requirements
  – SingleEvent view (e.g. for Operators)
  – Engineer view (e.g. Could contain more equipment information, etc.)
  – Blowdown view (for Blowdown analysis, pressure is checked at a given time delay after shutdown time)
SIL Reports Example: Test Interval

<table>
<thead>
<tr>
<th>Tag Name</th>
<th>Service Description</th>
<th>Test</th>
<th>Test Interval (hrs)</th>
<th>Remaining Time to Test (hrs)</th>
<th>Last Test Date &amp; Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>43PST10163_HH</td>
<td>LP flare return pump discharge pressure</td>
<td>ESD Full Stroke</td>
<td>8760</td>
<td>-3279</td>
<td>02.02.2013 00:05:02</td>
</tr>
<tr>
<td>43XSV10064</td>
<td>HP flare return pump discharge valve</td>
<td>PSD Full Stroke</td>
<td>8760</td>
<td>-3231</td>
<td>04.02.2013 00:05:02</td>
</tr>
<tr>
<td>43XSV10164</td>
<td>LP flare return pump discharge valve</td>
<td>PSD Full Stroke</td>
<td>8760</td>
<td>-8051</td>
<td>16.01.2013 00:05:02</td>
</tr>
<tr>
<td>96ABPXX-001</td>
<td>MGD typical (Gas detector area PXX) gas vote 1</td>
<td>ESD Full Stroke</td>
<td>8760</td>
<td>-3297</td>
<td>03.12.2013 00:05:00</td>
</tr>
<tr>
<td>96BFPXX-001</td>
<td>MFID typical (Flame detector area PXX) fire vote 1</td>
<td>ESD Full Stroke</td>
<td>8760</td>
<td>-399</td>
<td>02.06.2013 00:05:02</td>
</tr>
<tr>
<td>96BFMXX-001</td>
<td>MMCA1 typical (Manual call point Aut. Area PXX)</td>
<td>ESD Full Stroke</td>
<td>8760</td>
<td>-1143</td>
<td>02.05.2013 00:05:02</td>
</tr>
<tr>
<td>96BSFXX-001</td>
<td>MFDA1 typical (Smoke detector Aut. Area PXX) fire vote 2</td>
<td>ESD Full Stroke</td>
<td>8760</td>
<td>-1056</td>
<td>04.05.2013 00:05:02</td>
</tr>
<tr>
<td>96BSV0004</td>
<td>SBS2/SBV2 Typical (Blowdown valve with 2 solenoids)</td>
<td>ESD Full Stroke</td>
<td>8760</td>
<td>-3551</td>
<td>05.01.2013 00:05:00</td>
</tr>
<tr>
<td>96BSV0005</td>
<td>SBS2/SBV2 Typical (Blowdown valve with 3 solenoids)</td>
<td>ESD Full Stroke</td>
<td>8760</td>
<td>-8051</td>
<td>15.01.2013 00:05:00</td>
</tr>
<tr>
<td>96EH100-A01-01-Q07</td>
<td>SS81/B8 Typical (Breaker with breaker feedback)</td>
<td>ESD Full Stroke</td>
<td>8760</td>
<td>-5457</td>
<td>01.02.2014 00:05:02</td>
</tr>
<tr>
<td>96ESV0008</td>
<td>SS82/SBV1 PS Typical (ESV Valve 3 sol with partial stroke)</td>
<td>ESD Partial Stroke</td>
<td>8760</td>
<td>-8051</td>
<td>15.01.2013 00:05:00</td>
</tr>
<tr>
<td>99GIMV0001</td>
<td>SBF typical (Fire Damper SM)</td>
<td>ESD Partial Stroke</td>
<td>8760</td>
<td>15.01.2013 00:05:00</td>
<td></td>
</tr>
<tr>
<td>99HSS0001</td>
<td>MBS typical (CAP push button) NAS X X Initiator</td>
<td>ESR Partial Stroke</td>
<td>8760</td>
<td>1749</td>
<td>01.03.2014 00:05:02</td>
</tr>
</tbody>
</table>

Test Interval Report

Generated: 18.09.2014 16:51:52
### SIL Reports Example: Failure Rate

**SIL Report**

**Failure Rate Report**

<table>
<thead>
<tr>
<th>Final Element Type</th>
<th>Final Element Description</th>
<th>Best Estimate</th>
<th>Conservative</th>
<th>RF Reduction Factor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety valves</td>
<td>All ESV and XSV valves</td>
<td>5.71E-07</td>
<td>7.71E-07</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Calculated (*10^-6)</td>
<td>7.71E-07</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Start of Period</td>
<td>01.01.2012</td>
<td>00:00:00</td>
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<tr>
<td></td>
<td>Operations</td>
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<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Critical Faults</td>
<td>0</td>
<td>2</td>
<td>Time in operation(hrs)</td>
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<td></td>
<td>Tested Units</td>
<td>32</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time in operation(hrs)</td>
<td>17560</td>
<td></td>
<td></td>
</tr>
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<td></td>
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</tr>
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<td>Final Element Description</td>
<td>Best Estimate</td>
<td>Conservative</td>
<td>RF Reduction Factor (%)</td>
</tr>
<tr>
<td></td>
<td>Start AFFF pump</td>
<td>6.71E-05</td>
<td>9.06E-05</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Includes all equipment from</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>start command to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calculated (*10^-6)</td>
<td>9.06E-05</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Start of Period</td>
<td>01.01.2012</td>
<td>00:00:00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operations</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td></td>
<td>Critical Faults</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tested Units</td>
<td>6</td>
<td>0</td>
<td>Time in operation(hrs)</td>
</tr>
<tr>
<td></td>
<td>Time in operation(hrs)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Element Type</td>
<td>Final Element Description</td>
<td>Best Estimate</td>
<td>Conservative</td>
<td>RF Reduction Factor (%)</td>
</tr>
<tr>
<td></td>
<td>Start Emergency Generator</td>
<td>6.71E-05</td>
<td>9.06E-05</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Includes all equipment from</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0-Volt detection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calculated (*10^-6)</td>
<td>9.06E-05</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Start of Period</td>
<td>01.01.2012</td>
<td>00:00:00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operations</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Critical Faults</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tested Units</td>
<td>6</td>
<td>0</td>
<td>Time in operation(hrs)</td>
</tr>
<tr>
<td></td>
<td>Time in operation(hrs)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Element Type</td>
<td>Final Element Description</td>
<td>Best Estimate</td>
<td>Conservative</td>
<td>RF Reduction Factor (%)</td>
</tr>
<tr>
<td></td>
<td>Start FW pump</td>
<td>6.71E-05</td>
<td>9.06E-05</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Includes all equipment from</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>start command to</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

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SIL Reports Example: Demand Overview

### Demand Overview Report

<table>
<thead>
<tr>
<th>Start Date</th>
<th>18.06.2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Date</td>
<td>19.06.2014</td>
</tr>
<tr>
<td>Initiator</td>
<td>ALL</td>
</tr>
</tbody>
</table>

#### LP flare return pump discharge pressure

<table>
<thead>
<tr>
<th>Design Proc. D.</th>
<th>Status</th>
<th>Process Demand Rate</th>
<th>Process Demands</th>
<th>Fault Demands</th>
<th>Test Demands</th>
<th>Total Demands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate Limit</td>
<td>OK</td>
<td>.25</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

#### MFD typical (Flame detector area PXX) fire vote 1

<table>
<thead>
<tr>
<th>Design Proc. D.</th>
<th>Status</th>
<th>Process Demand Rate</th>
<th>Process Demands</th>
<th>Fault Demands</th>
<th>Test Demands</th>
<th>Total Demands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate Limit</td>
<td>Warning</td>
<td>2.5</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

#### MMCA1 typical (Manual call point Aut. Area PXX)

<table>
<thead>
<tr>
<th>Design Proc. D.</th>
<th>Status</th>
<th>Process Demand Rate</th>
<th>Process Demands</th>
<th>Fault Demands</th>
<th>Test Demands</th>
<th>Total Demands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate Limit</td>
<td>OK</td>
<td>.25</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>
SIL Reports Example: Demand History

Demand History Report

Start Date: 18.03.2010
End Date: 19.06.2014
Initiator: ALL

SIF Name | SIF Description
---|---
43PST10163_HH | LP flare return pump discharge pressure

<table>
<thead>
<tr>
<th>Demand Date and Time</th>
<th>Logged Demand Type</th>
<th>Manual Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.02.2014 00:05:00</td>
<td>Process Demand</td>
<td></td>
</tr>
<tr>
<td>11.02.2014 00:05:00</td>
<td>Process Demand</td>
<td></td>
</tr>
<tr>
<td>03.08.2013 00:06:00</td>
<td>Fault Demand</td>
<td></td>
</tr>
<tr>
<td>03.07.2013 00:06:00</td>
<td>Fault Demand</td>
<td></td>
</tr>
<tr>
<td>02.07.2013 00:06:00</td>
<td>Test Demand</td>
<td></td>
</tr>
<tr>
<td>01.07.2013 00:06:00</td>
<td>Process Demand</td>
<td></td>
</tr>
<tr>
<td>22.05.2013 00:06:00</td>
<td>Process Demand</td>
<td></td>
</tr>
<tr>
<td>21.05.2013 00:06:00</td>
<td>Process Demand</td>
<td></td>
</tr>
<tr>
<td>16.05.2013 00:06:00</td>
<td>Process Demand</td>
<td></td>
</tr>
<tr>
<td>15.05.2013 00:06:00</td>
<td>Process Demand</td>
<td></td>
</tr>
<tr>
<td>10.05.2013 00:06:00</td>
<td>Process Demand</td>
<td></td>
</tr>
<tr>
<td>09.05.2013 00:06:00</td>
<td>Process Demand</td>
<td></td>
</tr>
<tr>
<td>04.05.2013 00:06:00</td>
<td>Process Demand</td>
<td></td>
</tr>
<tr>
<td>03.05.2013 00:06:00</td>
<td>Process Demand</td>
<td></td>
</tr>
</tbody>
</table>
### SIL Report Example: Final Element Verification

**SIL Report Summary**

- **Start Date:** 18.05.2010
- **End Date:** 18.06.2014
- **Generated:** 18.06.2014 13:55:50
- **Tag Name:** ALL

#### Tag Name and Description

<table>
<thead>
<tr>
<th>Tag Name</th>
<th>Description</th>
<th>Number of Safety Operations</th>
<th>Number of Critical Faults</th>
<th>Fault Operations</th>
<th>All Operations</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>99BSV0004</td>
<td>SBS2/SDV02 Typical</td>
<td>12</td>
<td>9</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99BSV0005</td>
<td>SBS2/SDV02 Typical</td>
<td>20</td>
<td>15</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99XS0001</td>
<td>SBS1/SDV (Shutoff Damper)</td>
<td>20</td>
<td>15</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99XS0002</td>
<td>SBS3/MA (Deluge/Mist valve)</td>
<td>20</td>
<td>15</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99PA001A</td>
<td>SBE (SM) typical (Fire Water)</td>
<td>2</td>
<td>1</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99PA002-Q07</td>
<td>SBS1/SEB01 typical (Open)</td>
<td>2</td>
<td>1</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99SMV0001</td>
<td>SBF typical (Fire Damper SM)</td>
<td>2</td>
<td>1</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99XS0003</td>
<td>SBS3 Typical (Foil Valve)</td>
<td>1</td>
<td>0</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99EH100-A01-01</td>
<td>SBS1/EB Typical (Breaker)</td>
<td>2</td>
<td>1</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99ESV0006</td>
<td>SBS2/SDV01 PS Typical</td>
<td>20</td>
<td>15</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99XS0007</td>
<td>LP flare return pump</td>
<td>12</td>
<td>9</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99ESV0009</td>
<td>HP flare return pump</td>
<td>20</td>
<td>15</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
<tr>
<td>99XS0006</td>
<td>SBS1/SDV01 PS Typical</td>
<td>12</td>
<td>9</td>
<td>View</td>
<td>View</td>
<td>View</td>
</tr>
</tbody>
</table>
SIL Reports  Example: Valve Stroke Test

![Image of SIL Report]

**SIL Report**

**Valve Stroke Test Historical Report**

<table>
<thead>
<tr>
<th>Tag Name</th>
<th>Service Description</th>
<th>Valve Test Interval (hrs)</th>
<th>Traveltine Fullstroke (s)</th>
<th>Stroke Length (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>36ESV0008</td>
<td>66MV1 #1 6# Typical</td>
<td>24/70</td>
<td>15.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PSD PS</th>
<th>ESD PS</th>
<th>Full Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remaining time to test (hrs)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Result</th>
<th>Test Date &amp; Time</th>
<th>Test Temp °C</th>
<th>Travel Time Min./Sec.</th>
<th>Test Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSD Test</td>
<td>FAULT 31.01.2013 12:00.00</td>
<td>0.00</td>
<td>/ 14.00</td>
<td></td>
</tr>
<tr>
<td>PSD Test</td>
<td>FAULT 24.01.2013 00:00.00</td>
<td>0.00</td>
<td>/ 14.00</td>
<td></td>
</tr>
<tr>
<td>PSD Test</td>
<td>PASS 16.01.2013 00:00.00</td>
<td>0.00</td>
<td>3.00 / 14.00</td>
<td></td>
</tr>
<tr>
<td>PSD Test</td>
<td>PASS 08.01.2013 00:00.00</td>
<td>0.00</td>
<td>3.00 / 14.00</td>
<td></td>
</tr>
<tr>
<td>ESD Test</td>
<td>FAULT 31.01.2013 00:00.00</td>
<td>0.00</td>
<td>/ 14.00</td>
<td></td>
</tr>
<tr>
<td>ESD Test</td>
<td>FAULT 23.01.2013 00:00.00</td>
<td>0.00</td>
<td>/ 14.00</td>
<td></td>
</tr>
<tr>
<td>ESD Test</td>
<td>PASS 18.01.2013 00:00.00</td>
<td>0.00</td>
<td>2.00 / 14.00</td>
<td></td>
</tr>
<tr>
<td>ESD Test</td>
<td>PASS 07.01.2013 00:00.00</td>
<td>0.00</td>
<td>2.00 / 14.00</td>
<td></td>
</tr>
</tbody>
</table>
Benefits

• Lower unplanned down time

• Increased safety
  - Increased safety by simplified verification of automated safety actions, better documentation and HISTORY of actual system function
  - Reduced down time due to less checking of shutdown system and safety valves

• Increased production regularity
  - Early fault detection, Less maintenance cost, increased regularity

• Supporting cooperation at site and remote access
  - Simplify the work in an integrated team
  - Providing real time information to everyone
  - Standardize working routines and simplification of the working processes
  - On-line monitoring of many equipment categories automated
Benefits

• Exception-based safety inspection – less wasted effort
  – Less time to complete planned shutdowns – focus on safety elements needing attention

• Lower manning required for shutdown-time valve stroke verification & other safety inspection work
  – Use event journal to capture all time stamps

• Lower insurance rates are a possibility with a proven, auditable, documented process for validation, verification of safety elements
Typical PSA Solution Architecture

Main Data Source
- (Main) Event Journal
- Process tags for blowdown analysis

Remarks
- Control/Safety System independent
- Only requires:
  - Event Journal
  - Few process tags

Key Inputs HON Requires:
- Cause & Effect (C&E) diagrams
- Total number of I/Os in C&E
- Total number of safety valves
PSA integration

• Based on SQL Server – data accessible by SQL from other requesting applications via ODBC

• Honeywell DAS – Data Access Services – provides ability to link PSA elements in DynAMo Operators LogBook, as logbook snippets.

• Any source of log information can be used as input
  – SOE, Experion Common Event Journal using PHD R320 EJC
  – Event logs from multiple systems
  – OPC A&E
  – Sit on top of DynAMo raw alarm & event log collector (as long as safety events piped through from control/ safety data source)

• Only requirement is common basis for native time stamp origin
  – And inclusion of safety-relevant events of interest in basic log capture
    ♦ At Safety system or DCS integrated log

• DOES not depend on any large numbers of tag values to be read
  – just the event log as primary information source.
SIF Function Health Monitoring
LOPA / IPL Monitoring
Using Asset Sentinel for REAL Time process safety health monitoring
Phil Millette, Honeywell
SIF Function health monitoring

Redundant Sensing

1oo2 PT
PT-2
PT-3

SIL3 Logic Solver

Redundant final element

1oo2 FE
ESDV-1
ESDV-2
The V-1 vessel has a design high pressure limit of 16 BarG
- Normally PIC-1 controller setpoint is 13 BarG
- The SIF trips at a setpoint of 15 BarG
- The PSV lifts to the flare system at 15.5 BarG
# PFDavg Calc for SIF

<table>
<thead>
<tr>
<th>From Table B.4, IEC61508-6</th>
<th>‘λ’ Failures per hour</th>
<th>‘β’ Common cause</th>
<th>‘Ti’ Testing interval in months</th>
<th>‘MTTR’ Mean time to repair in hours</th>
<th>‘DC’ in percent</th>
<th>PFD$_{avg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1oo2 Sensors (Pressure transmitters)</td>
<td>$1 \times 10^{-6}$</td>
<td>5</td>
<td>24</td>
<td>8</td>
<td>90</td>
<td>$4.4 \times 10^{-5}$</td>
</tr>
<tr>
<td>Logic Solver (SIL 3) (data NOT from table B.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$5 \times 10^{-4}$</td>
</tr>
<tr>
<td>1oo2 Final elements (On-off valves)</td>
<td>$5 \times 10^{-5}$</td>
<td>5</td>
<td>24</td>
<td>8</td>
<td>0</td>
<td>$7.4 \times 10^{-2}$</td>
</tr>
</tbody>
</table>
From SIF to overall LOPA / IPL

• Viewing the SIF in the context of the LOPA – other, non SIF, independent protection layers (IPLs)
  – Status of basic controls (as applicable)
  – Status of alarms
  – Any information about status of relief valves, deluge systems
  – Static, manual entry elements such as confirmation of tank containment dike visual inspection.

• Instrument / IPL testing management
  – Calibration history for devices
  – Manage test history, approvals, capture & link scanned images of test results etc.

• Links to CMMS
  – Work order requests
  – Maintenance History (and on non SIF protection layers)
  – Inventory of parts for sensors / final elements
SIF overview & status

- Safety engineer gets alerts and reviews status of each safety instrument as well as the risk reduction factor.

- MTTR window is the window in which any issue in safety instrument needs to be attended.

- If asset does not become healthy within this time period the SIF status goes to highly degraded mode.