Improving Pipeline Leak Detection with Integrity Operations

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Michael Tankersley, Director, Pipeline Simulation

November 13th, 2019
Integrity Operations 2.1

Highlights:

• Working with Integrity Operations
  • Product Milestones in 2019
  • Current Pipeline Implementation Experience
• Product Update
  • Multiple Leak Detection Methods
  • Improvements to the User Experience
  • Gas Model Enhancements
• What’s Next - The Road Ahead
Integrity Operations 2.1

Product Release in 2019

Improvement Highlights

- Expands suite of leak detection methods
- Improves “ease of use & maintenance”
- Enhanced analytics & visualization
- Migration tools for quicker version upgrades

Leverages existing AVEVA Technology

- SimCentral Simulation Platform Configuration
- eDNA Historian
Pipeline Trainer 2.0

Product Release March 2020

Improvement Highlights

• Enhances the training experience
• Improves overall ease of use & maintenance
• Automates configuration of logic
• Multi-simulation solution (pipeline, process or power)

Leverages existing Aveva Technology

❖ SimCentral Simulation Platform Configuration HMI
❖ PLC1 Logic Emulator
❖ Cloud Platform Technology (future)
❖ Learning Management System

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New Product Manager

Pipeline Simulation

Introduction of Alexander Troxell

• Transitions from the Pipeline Simulation Innovation Team Lead
• 8 years of experience in Pipeline Simulation technology within the Project Delivery group as an engineer and Project Lead
• B.S. Chemical Engineering from University of Maryland
User Story – Midstream Pipeline Upgrade Project

Implementing the New Release of Integrity Operations
Customer Portrait

Calgary-Alberta Based Midstream Company

- Headquartered in Calgary, Alberta
- Operates liquid and natural gas pipelines primarily in Western Canada with a total capacity of approx. three million barrels per day
- Comprises conventional, transmission, oil sands and heavy oil pipeline assets
Calgary-Alberta Midstream Company

Integrity Operations Leak Detection System

- Utilizes a combination of real-time transient (RTTM) model leak detection and compensated volume balance (CVB) methods
- Current AVEVA RTTM LDS covers approx. 3,500 miles of pipeline
- Product types range from heavy crude oil to light hydrocarbons
Integrity Operations Upgrade

Project Implementation Strategy

- Current leak detection system is a combination of SimSuite V5.4 and V6.6
- SCADA and LDS upgrade happening simultaneously.
- Project consists of upgrading 44 pipelines total
- Implementation:
  - Migrate pipelines from SimSuite v5.4 and v6.6 to v6.7
  - Use Migration Tool to import pipelines from v6.7 to IO2.1. Clean up configuration after migration.
  - Offline Testing in IO2.1
  - System integration and online testing
Project Implementation: Data Migration

Project Migration Tools

- Data as a commodity
- Greatly reduces time to create models
- Tool is available for future version migrations
Project Implementation: Data Migration

Unified Object Model

- SimCentral Configuration
- Legacy Configuration
- 3rd Party Data

Unified Object Model

- SimCentral Configuration
- Integrity Operations
- Pipeline Trainer
Project Implementation: Hydraulic Modeling

SimCentral Hydraulic Modeling

- The next generation of hydraulic modeling with AVEVA Simulation
- Graphical pipeline overview
- Hydraulic model configuration
- Pre-built model libraries, default values, and model validation.

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Project Implementation: Application Building

SimConstruct Application Layer

- Application configuration layer that manages the build and deployment of model based applications.
- Leak detection and macro configurations
- Defines communications including gather sources and points
- Builds, launches, and deploys executives
Project Implementation: Model Deployment

Deploy Tool

• Define Sources and Multiple Destinations based on Network Topology.
• Built in archiving and roll-back functionality.
• Selective deployment to minimize bandwidth.
Model Migration

Video Showing the Migration, Import and Build of the WVP pipeline.
Project Implementation: Model Testing and Analysis

Product Updates
Project Implementation: Model Testing and Analysis

Historical Replay from online LDS

- Utility to replay either SCADA historical data files or simulation historical data
- Review events for performance analysis or auditing purposes
- Several supported data formats
- No need for replicated executives
- Simplified user interface
Project Implementation: Model Testing and Analysis

Threshold Tuning Tool

- Standalone tool that reduces the time required to set steady state and dynamic LD thresholds.
- Optimizing event analysis through improved historical data presentation.
- Overlaps imbalance for defined events for specified averaging periods.
- Provides visibility of the impact of threshold changes to the historical imbalance.
Project Implementation: Data Visualization

Data Visualization

• Connect and view data from multiple online and offline sources.
• Intuitive Model Tuning UI
Historical Data Replay

Video showing the startup of Historical Data replay, play back a leak viewing response in DataVisualization.
Pipeline Integrity Monitoring

Multiple Leak Detection Methods under a Single Application

The Nucleus of Integrity Operations:

- One common environment
- Multiple LD methods
- Covers all types of pipelines
- Mix and match methods
- Migrate from one to another
- Upgrade easily to latest release
- SCADA independent
Pipeline Integrity Monitoring

Pluggable Realtime Simulation Architecture

- Single configuration environment
- Single communication API
- Model or algorithm as a service
- Mix and match methods for specific pipeline needs
Integrity Operations 2.1 SP1

SimConstruct Enhancements

- Additional Search and Filter Options
- Site Specific Gather
- Enhanced Error Messages
- More Intuitive Workflow
Integrity Operations 2.1 SP1

Generic Product Type (Phase 1)

- Base implementation of a Chevron ethylene solution
- Allows runtime reference to generic product properties like those from National Institute of Standards and Technology (NIST) Database or external correlations.
Gas Model Enhancements

- Compressor model isentropic head calculation improvements
- Additional options for compressor data input
- Gas compressibility in non-standard conditions
- Model stability in non-standard conditions
- Improved initial value calculation for model startup
- Validation against historical data in progress
The Road Ahead

Product Road Map
# Integrity Operations Roadmap

<table>
<thead>
<tr>
<th>2019 Strategy</th>
<th>2020 Strategy</th>
<th>Longer Range Strategy</th>
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<tbody>
<tr>
<td>• Implement features that will improve ease of use and long term maintainability of the software</td>
<td>• Continue our efforts at improving ease of use and lower costs of ownership</td>
<td>• Continue to improve ease of use</td>
</tr>
<tr>
<td>• Expand and consolidate the leak detection methods into a single user environment</td>
<td>• Expand LDS Methods</td>
<td>• Expand LDS Methods within our offering</td>
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<td></td>
<td>• Continue our efforts at improving ease of use and lower costs of ownership</td>
<td>• Improve our use of data analytics tools to improve LD performance monitoring</td>
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<td></td>
<td>• Expand LDS Methods</td>
<td>• Improve our use of data analytics tools to improve LD performance monitoring</td>
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<tr>
<th>2019 in Development</th>
<th>2020 Short-term Development</th>
<th>Longer Range Plans</th>
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<tbody>
<tr>
<td>• Ease of use:</td>
<td>• Ease of use:</td>
<td>• Expanding LDS Methods:</td>
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<tr>
<td>• Release of Integrity Operations 2.1</td>
<td>• Installation Manager</td>
<td>• Implement Signal Recognition (using machine learning algorithms)</td>
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<td>• SimCentral Graphical Configuration Environment</td>
<td>• Improve SimCentral GUI “fit for purpose” with Integrity Operations</td>
<td>• Rupture Detection using Pattern Recognition</td>
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<td>• Centralize user configuration to SimCentral &amp; SimConstruct</td>
<td>• Expand Threshold Tuning Tool</td>
<td>• Improve Gas Leak Detection Methods</td>
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<tr>
<td>• SimSuite V6.7 Migration Tools</td>
<td>• Expanding LDS Methods:</td>
<td>• Negative Pressure Wave integration into IO platform</td>
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<td>• Integrated Pressure Loss methods in Integrity Operations user environment</td>
<td>• Next generation batch tracker application</td>
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<td></td>
<td>• ROCC (Rate of Change Combinations)</td>
<td>• Ease of use:</td>
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<td></td>
<td>• Integrity Operations Liquid Suite Version (SCADA independent version)</td>
<td>• Continuous improvement in ease of use</td>
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<tr>
<td>• Expanded LDS Methods:</td>
<td></td>
<td>• Upgrade current SimSuite hydraulic model to next generation (i.e. SimCentral)</td>
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<tr>
<td>• Compensated Volume Balance LDS</td>
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<td>• Implement steady state and transient based analysis within SimCentral for midstream</td>
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<td>• Improved Data Analytics Tools:</td>
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<td>• eDNA Leak Detection Historian</td>
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<tr>
<td>• New Data Visualization Tools</td>
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<td>• Threshold Tuning Tool</td>
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<td>• Historical Playback</td>
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• Business Partnership with LIWACOM (Gas Pipeline Simulation)
What is Next?

- Targeted Q3 2020 Release
- Additional 3rd Party Data Import
- Advanced Gas Properties
- SCADA Agnostic CVB\PLM
- Continued SimCentral Integration
- Standalone Pressure Loss
ABOUT AVEVA

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