Technologies Framework Required to Support Pipeline Integrity

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Tom Helmer, Solutions Architect, Black & Veatch
Concepts and Technologies
BLACK & VEATCH PIPELINE INTEGRITY REFERENCE FRAMEWORK
### GIS Based Gas Utility Applications

<table>
<thead>
<tr>
<th>Linear Ref Editing</th>
<th>Property Tax</th>
<th>Current Work Status</th>
<th>Clearances</th>
<th>Cathodic Protection</th>
<th>Inspection/Maintenance</th>
<th>SOP Compliance Reporting</th>
<th>Leak Tracking/Mitigation</th>
<th>ROW</th>
<th>Depth of Cover</th>
<th>ILI Alignment</th>
</tr>
</thead>
</table>

### GIS Core Functions

- Network model creation & maintenance
- Spatial model creation & maintenance
- Shared data with external agencies

**Land and Gas Facility Data Model**

- Facility management
- Map distribution
- Creation & maintenance
- Thematic analysis
- Network analysis
- Inquiry/reports
- Spatial layering
- Web and field view
- Schematic view

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### Proposed Applications

- Pipeline Integrity
- WMS
- Supply Chain
- Content Mgmt
- CIS
- Scheduling & Dispatching System
- Mobile Data System
- SCADA

### Proposed Interfaces

- HR
- Design
- Load Forecasting
- Station Integrity
- AIDT
- USA One Call

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### Native GIS

### Proposed Applications

### Proposed Interfaces

### Major PG&E Enhancements

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### Black & Veatch Reference Architecture
Benefits of Reference Architecture

- GIS Centerline editing paradigm to support linear asset management and pipeline integrity event management
- EAM with linear asset management (LAM) functionality
- Linear Asset Repository managed by GIS, EAM, and Content Management
- Single software framework to build applications to support asset management and survey planning, monitoring and compliance reporting for leak surveys, CP surveys, valve inspections, regulator inspections
- Fully integrated field workforce environment bringing mGIS, work order and document management functionality
- Single software framework (spatially enabled BI) to support asset manager and operations center
- Case Study Management environment reused for planning, integrity management and operational awareness
Planning and Coordination of Corrective and Preventive Maintenance work

- eGIS planning application
- eGIS work order status application
- eGIS compliance reporting framework: program to date, ytd, rest of year forecast by month
- eGIS cathodic protection area generation application
- eGIS scheduling application integrated with EAM and MWM for ‘area’ based surveys: CP, Leaks
Mobile GIS Applications

- Center on current work order
- Pre-fill work order with location, environmental and facility information
- Show list of related drawings
- Show list of related SOP instructions
- Highlight current GPS location
- Show route from current location to next work order
- Show route for all selected work orders
- Show route for all work orders
- Show key valves for current work order
- Show known HCA areas in proximity
- Show known leaks in proximity
- Show ROWs
- Show Easements
- Show access instructions/contact information
- Show current clearances on line
- Show current abnormal states, configurations and SCADA readings
• Case Study Management Environment
• Integrations with load forecasting system, CIS and SCADA
• Show thematic map driven from SCADA historian readings and Hydraulic Modeling calculations
• Allow user to view gas system either schematically or geo-referenced
• Allow user to turn on satellite imagery behind geo-referenced view
• Allow user to view Hydraulic forecasted degree days results
• Allows user to view overlay of current operating conditions with planning results
• Allow user to publish planning results as a degree day
Design Drawing Coordination

- Integration with GIS for reference design layers
- Design Vault to Content Management for drawing coordination
- Drawings made available to field force in integrated fashion
Operational Awareness

- Typically requires Spatially Enabled BI technology, SCADA integration, MWM integration, Hydraulic Model integration
- Show current crew locations
- Show thematic map of crews locations sized based on time to make current location safe (location with availability view)
- Show thematic map driven from SCADA readings and Hydraulic Model calculations
- Show dashboard based on SCADA readings and Hydraulic Model calculations
- Allow user to view gas system either schematically or geo-referenced
- Allow user to turn on satellite imagery behind geo-referenced view
- Allow user to view Hydraulic Model forecasted degree days results
- Allows user to view overlay of current operating conditions with planning results
Asset Manager’s Environment

• Typically requires Spatially Enabled BI technology integrated with: Leaks, repairs, survey areas, CP circuits, ILI data

• Show planned work for the year by month

• Show active ‘incidents’, historic repairs, environmental conditions

• Show events and related information from manual inspections, automated inspections, historic repairs

• Planning tools to increase number of PMs to reduce CM
<table>
<thead>
<tr>
<th>Technology Heat Map</th>
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</thead>
<tbody>
<tr>
<td>As-Built Recording</td>
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<tr>
<td>Preventative</td>
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<tr>
<td>Corrective</td>
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<td>Engineering Planning</td>
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<tr>
<td>Integrity Management</td>
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<tr>
<td>OPS Awareness</td>
</tr>
</tbody>
</table>

**Columns:**
- GIS
- EAM
- MWM
- CMS
- IM
- Engr
- SCADA
- Spatial BI
Where Business and Technology Meet

PG&E’S IMPLEMENTATION ROADMAP
Transmission Gas Roadmap

Need for Linear Referenced Asset Management

- **IM Management**
  - Portfolio Optimization
  - PFL Risk Model
  - PFL Health

- **Asset Maintenance**
  - HCA Identification
  - Class Identification
  - PFL Criticality
  - PM Planning
  - PM Scheduling
  - PM Dispatching
  - PM Reporting
  - Compliance Reporting

- **Asset Repository Data Maintenance**
  - Centerline Editing
  - PFL Design
  - Field As-builts
  - Work Order Completions

- **IT Infrastructure**
  - GIS (C&C)
  - WMS (SAP LAM/PM)
  - EAM (SAP LAM/PM)
  - CMS (Documentum)
  - SCM (SAP MM)
  - Scheduling (Click, Ventyx)
  - Spatially Enabled BI Reporting

**Next Gen Linear Reference Asset Management Framework**

- Performs and records all actions done to pipeline facilities in single linear reference framework
- Collects all assets and related events in single linear reference framework
- Maintains single linear reference framework in all asset mgmt and record systems
- Wants all pipeline events in a linear referenced fashion
## Business Area Roadmap

### Design/Build/Decommission
- Mapper, Asset Strategist, Supervisor, Field

### Leak Survey
- Integrity Management, Mapper, Field Supervisor, Field

### Integrity Management
- IM, Asset Strategist, Mapper

### Preventative Maintenance
- Asset Strategist, Clerical, T&R Supervisor, Corrosion Mechanics, Gas Techs, M&C Mechanics, Gas Mechanic, Mapper

### Corrective Maintenance
- Mapper, Field Supervisor, Field, Clerical, Asset Strategist

### Locate and Mark
- Internal/External Party, Integrity Management, local M&C, Damage Prevention Supervisor, External IRTH staff

### Project Planning
- Asset Strategist, Portfolio Managers

### Projects
- GIS/SAP POC Sandbox
- Next Generation Linear Reference
- eGIS UI Release 1.0
- eGIS UI Release 1.x
- eGIS UI Release 2.0
- Design PFLs
- Transmission Field As-Built Automation
- GT Station collaboration (GT Station Critical Data Validation and Migration)
- Mariner Supply Chain Materials Traceability
- Utilize GIS functionality for all mobile applications

### Data Cleanup Projects
- Migrate PLM pipeline actions
- PODS data development
- Centerline
- PAS 55 Enabling Critical & Health Coding of Assets in SAP & PLM
- Station MAOP Validation
- Mariner Documentum Gas Corrective Initiative
- Station Assets in SAP
- Updated GIS with Station Assets

<table>
<thead>
<tr>
<th>Projects</th>
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<tbody>
<tr>
<td>- EZ Tech Release 1</td>
<td>- Mariner Integrity Management and Risk Analysis Software</td>
<td>- Mariner Gas Preventative Maintenance – Leak Repair, Mobile Ready Development (GCM Phase 1)</td>
<td>- Mariner project Portfolio Management Tools (PPM)</td>
</tr>
<tr>
<td>- EZ Tech Release 2</td>
<td>- Data Management of HCA &amp; Class base features</td>
<td>- Mariner Gas Preventative Maintenance Corrosion</td>
<td>- SAP and P6 Integrated</td>
</tr>
<tr>
<td>- Pilot Leak Survey Maintenance Plans in SAP &amp; Documentum</td>
<td>- Asset Analytics Dashboard</td>
<td>- Mariner Gas Preventative Maintenance Production (4 Phases Planned)</td>
<td>- Risk Based Asset Investment Portfolio Optimization Tool</td>
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<tr>
<td>- Mariner Leak Survey Schedule Migration</td>
<td>- Click Scheduling Tool Upgrade</td>
<td>- Leak Repair Document &amp; Data Clean-up Phase II</td>
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<tr>
<td>- Replicate Spear Data in-house for Analytics</td>
<td>- Mariner PLM mobilize PLM process for pipeline, CP &amp; Line Equipment</td>
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<tr>
<td>- Release 3 – Move Leak Survey maintenance from Sharepoint to SAP; Completion of work tickets in SAP and scanning of documents</td>
<td>- Mobilize preventative and corrective maintenance for station assets in SAP</td>
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<td>- Leak Survey Mobility – Moved to Ventyx</td>
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<td>- Picarro</td>
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</table>

### Data Cleanup Projects
- Mariner PLM pipeline and corrosion migrated to SAP/GIS

- Pilot IRTH app and Map Viewer
- Mariner Locate & Mark Device Replacement & IRTH Upgrade
- Decommission IRTH with SAP/Ventyx/GIS in-house One-Call replacement

- Mariner project Portfolio Management Tools (PPM)
- SAP and P6 Integrated
- Risk Based Asset Investment Portfolio Optimization Tool
Current and Future Data Management

Current Data Management Processes

- Valve and Regulator Maintenance
- Corrosion Protection
- Mark & Locate
- Leak Survey
- GIS
- PSRS
- SAP
- Synergee
- Integrity Management, Planning, & Engineering

Update core enterprise systems

Complete MAOP Validation Program

Multiple systems with manual and automated methods

Unified platform of automated solutions and robust governance to provide and sustain real time, accurate, verifiable, and complete asset information
GT Line Level Functional Location/Equipment Structure has supported current business activities but lack integrated linear capabilities that LAM provide.

- Largely segregated by equipment type (not hierarchical)
- Does not include System, Route, or clear Pressure Isolation zone / Sub-systems for Operations
With LAM linear referencing, functional location / equipment structure is more fit for purpose with pipeline maintenance and promotes enterprise asset management (EAM) best practice.

<table>
<thead>
<tr>
<th>Functional Location Structure: Structure List</th>
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<tbody>
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Equipment records can also be linearized.

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</tbody>
</table>

Location of the equipment
Through the GEO.e tab on work orders, notifications and object master records asset detail information can be accessed using the drop down menu. Results can be reviewed for analysis in SAP list reporting.

Analyze-
- Cost
- Orders Types
- Emergency Work
- Notifications
# Technology Heat Map

<table>
<thead>
<tr>
<th>Category</th>
<th>GIS Intrepid</th>
<th>EAM SAP LAM</th>
<th>MWM Ventyx</th>
<th>CMS Documentum</th>
<th>IM IRAS</th>
<th>Engr SynerGEE</th>
<th>SCADA PI</th>
<th>Spatial BI</th>
<th>SAP DW</th>
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- X indicates presence of technology.

*Note: All categories are not shown in the table.*
Questions?