Foundational Asset Knowledge at PG&E

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Pacific Gas & Electric

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• UDC Gas Transmission Pipeline Integrity Reference Framework
• Where Linear Referenced Asset Management Fits at PG&E
• System Architecture of Gas Transmission (GT) GIS and Asset Management (FAK)
Concepts and Technologies

UDC PIPELINE INTEGRITY REFERENCE FRAMEWORK
Benefits of UDC’s Reference Architecture

- 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
- GIS Centerline editing paradigm to support linear asset management and pipeline integrity event management
- 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
GIS Based Gas Utility Applications

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

U.S.A. One Call

HR

Design

Load Forecasting

Station Integrity

AIDT

USA One Call

Scheduling & Dispatching System

Mobile Data System (mGIS/MDT/mCMS)

Planning

SCADA

Native GIS

Proposed Applications

Proposed Interfaces

Major PG&E Enhancements
<table>
<thead>
<tr>
<th>Technology Heat Map</th>
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<tr>
<td><strong>As-Built Recording</strong></td>
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Where Business and Technology Meet

PG&E’S GT IMPLEMENTATION ROADMAP
Transmission Gas Roadmap
Where Linear Referencing Fits at PG&E

IM Management
- Portfolio Optimization
- PFL Risk Model
- PFL Health
- HCA Identification
- Class Identification
- PFL Criticality

Asset Maintenance
- Centerline Editing
- PFL Design
- Field As-Builts
- Work Order Completions
- Leak Survey Planning
- CP Survey Planning
- Leak Survey
- CP Survey
- PM Planning
- PM Scheduling
- PM Dispatching
- PM Reporting
- Compliance Reporting
- CM Planning
- Clearance Requests
- CM Scheduling
- CM Dispatching
- IM Testing
- Locate & Mark

Asset Repository Data Maintenance
- Asset Repository Data Maintenance

Gas Transmission Linear Asset Management Framework

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

GT-GIS (FAK) Project
- Processes that should take advantage of GT-GIS in the future
- Wants all pipeline events in a linear referenced fashion
- 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

GT-GIS Project’s Focus
- Maintains single linear reference framework in all asset mgmt and record systems
## GT Business Area Roadmap

### Design/Build/Decommission
- Mapper, Asset Strategist, 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
- **GT-GIS (FAK)**
- 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

### Projects
- **Projects**
  - Leak Survey Redesign
  - Mariner Integrity Management and Risk Analysis Software
  - Data Management of HCA & Class base features
  - Asset Analytics Dashboard
  - **Data Cleanup Projects**
    - Mariner Gas Corrective Maintenance – Doc and Data Cleanup
    - Leak Repair Document & Data Clean-up Phase II

### Projects
- **Projects**
  - Mariner Gas Preventative Maintenance Valves and Regulators
  - Mariner Gas Preventative Maintenance Corrosion
  - Mariner Gas Preventative Maintenance Production (4 Phases Planned)
  - Mariner Documentum Gas Preventative Maintenance Data & Document Modernization
  - Click Scheduling Tool Upgrade
  - Mariner PLM mobilize PLM process for pipeline, CP & Line Equipment
  - Mobilize preventative and corrective maintenance for station assets in SAP (AMBBS)
  - **Data Cleanup Projects**
    - Mariner PLM pipeline and corrosion migrated to SAP/GIS

### Projects
- **Projects**
  - Mariner Locate & Mark Device Replacement & IRTH Upgrade
  - Decommission IRTH with SAP/Ventyx/GIS in-house One-Call replacement
  - **Data Cleanup Projects**
    - Mariner project Portfolio Management Tools (PPM)
    - SAP and P6 Integrated
    - Risk Based Asset Investment Portfolio Optimization Tool
FAK Components

Ability to Maintain PODS & Keep PODS & SAP Synchronized

Web Services

Enterprise Service Bus (Production)

Synchronization

Oracle

SAP

Enhanced GIS Platform
- Pipeline Data Repository
- Pipeline Linear Reference Measurement Support
- Industry-wide Applicability

GIS Asset Repository

Pipeline Data Repository based on Pipeline Open Data Standard (PODS)

Core SAP

Linear Asset Management

Geo.e Imbedded GIS Component

Work Order Management
Linear Reference GIS Platform (Intrepid)

Consolidate pipeline data attributes and all associated documents within a component-based GIS System of Record → “Traceable, verifiable and complete records”
Linear Referencing

- Pipeline Route
- Specifications
- Status
- Op Conditions
- Repair History
- Integrity Management

High Consequence Area
Linear- resembling, represented by, or consisting of a line or lines.  
(www.thefreedictionary.com/linear)

An asset is a plant, machinery, property, buildings, vehicles and other items that have a distinct value to an organization.

Linear Assets – assets resembling, represented by, or consisting of a line or lines (of continuous length). Linear assets can be roads, pipeline, transmission lines, rail track or any other equipment or structures whose purpose is to move or allow the movement of material, products or services.

Linear Asset Management (LAM)- systematic and coordinated activities and practices through which an organization optimally and sustainably manages its linear assets and asset systems, their associated performance, risks and expenditures over their life cycles for the purpose of achieving its organizational strategic plan for asset integrity management.

• Pipelines move water, oil, gas, sewage etc…
• Transmission Cable, move energy/electricity
• Roads allow the movement of vehicles
Linear Distributive Characteristics (LDC) allow for many characteristic assignment to a single linear Functional Location or Equipment with attributes (range event) that are independent regardless of length.

- Linear characteristics have multiple single values as prescribed by length.

This allows very large linear objects to be created and maintained without excessive segmenting of the asset structure.
Without LAM the traditional hierarchical structures of assets to represent a linear network is too complex for traditional Enterprise Asset Management (EAM) systems.

Linear referencing (for gas utilities) is described as; the distance along a pipeline of an object or event in relation to the start or end point of the parent object (pipeline).

SAP LAM is designed to leverage SAP’s Plant Maintenance functionality for linear asset management by way of linear referencing.
SAP LAM – LDCs, Assets, Work Orders
GEO.e Local View on Functional Location and Notification

- GEO.e tab on Functional Location
- Display Business Layers
- Shape based on Key Dates

- GEO.e tab on Notification
  - Zooms to Appropriate level (in this case 0-1200' of 2300' line)
  - Click and drag to edit Notification Start / End Point
GEO Explorer Business Layer

- Quick Search on Business Layer View
  - Work Orders, Notifications, Equipment
  - Double-click to open Object
Linear Referenced Asset Repository
<table>
<thead>
<tr>
<th>Category</th>
<th>As-Built Recording</th>
<th>Preventative Maintenance</th>
<th>Corrective Maintenance</th>
<th>Engineering Planning</th>
<th>Mark &amp; Locate</th>
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PG&E’s Technology Heat Map
Linear data improvements to EAM (Enterprise Asset Management) will enhance work processing, by improving all five stages of the work order life cycle.

**Initiation**-Locating equipment within the asset hierarchy is easier and more logical, aiding in *equipment ownership* at the technician level.

**Closeout**-Entering history against the right piece of equipment is critical in developing a *continuous improvement* culture.

**Execution**- When work is planned and scheduled better, overall asset integrity is improved facilitating *process safety*.

**Planning**- More accurate asset data facilitates better job planning *reducing non-value added* tasks and windshield time.

**Scheduling**- Better defined availability of *resources* (labor, materials, services, tools, equipment) within current operational constraints to meet the identified workload.
Thank You

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