Is strategic **DATA** stuck in my **PIPELINE**?

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2008 ESRI International User Conference
San Diego, California
6 August 08
Philosophy…?

- "Insanity – Doing the same things over and over again and expecting different results.” – Albert Einstein

- “If you don’t know where you are going, any road will take you there.” – Lewis Carroll

- To do “more with less” working smarter isn’t enough! We need better methods and tools. – Internal Anadarko sentiment
Today’s Journey & Waypoints

- Stuck PIG! What?
- Better data for pipelines.
- A peek at our past.
- Our vision of the future.
- Managing corporate data; our plan.
- Some tools we’ll use to get there.
- Quality…. ”Where’s the beef pork?”
- Results from the Field!
- Questions?
Stuck Pig! Data! WHAT?!
Possible Stuck Data

- Diameter(s)
- Wall thickness(es)
- Spec
- Grade
- External Coating
- Internal Coating
- Joints & Method Used
- Weld Procedure
- NDE Tests & Results
- Hydro-Test Results
- Soil Type
- Trenching Method
- Burial Depth
- Backfill Material
- Rock Protection
- Cathodic Protection
- Injection Points
- ROW Remediation
Next Waypoint

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Focus Areas for “Better Data”

- Regulatory
- Environmental
- Production Equipment
- Measurement
- Pipeline Infrastructure
- Telecommunications
- General Infrastructure

Regions
- Domestic & International

Realms
- Onshore & Offshore

Functions
- Transmission, Production, Gathering, Injection, Disposal, Inter- & Intra-Field Transfer

This Effort

Secondary Effect
Pipeline Data Supports...

One Call

Public Awareness

Regulatory Surveillance

Operations

Quality Pipeline Data

DOT Classification

Design and Build

Cathodic Protection

Maintenance
Pipeline Activities Require...

- Secure & consistent capture, storage, and use of quality data
- One Call
- Regulatory Surveillance
- Public Awareness
- Maintenance
- Operations
- DOT Classification
- Cathodic Protection
- Design and Build
- Pipeline Activities Require...
Why this is needed! - Examples

- Foreign Pipe!
  - Pipe of suspect quality in unknown locations
- Power Poles
  - Near miss of a pipeline
- Hot-Tap Surprise
  - Wrong data; line could not be tapped (ever!)
- Which way did it go?
  - Interconnect valves: How many? Where? Open?
- We told you what?!
  - Accuracy - “Our lines are within 50 feet.”
- Data Collection Results
  - Feedback from the field: less staff, more work.
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History Lessons

- How did we capture data on our pipelines?
  - “Not at All”  (Production and “gathering” lines?)
  - Tribal Knowledge  (”VEGAS” - What happens here, stays here!)
  - Unstructured / Unofficial Documentation
  - General Construction Records  (Some data; limited detail)
  - “Work Packs” and “Job Books”  (Great detail, but….)
  - Internal Mapping Efforts  (”Here’s a line but where’s the detail?”)
  - Contract Surveys  (”out of sight…and mind”)
  - Vendor’s Data  (”Surely they will remember!”)
History Lessons…continued

- How did we store and access captured data?
  - What access? (Was this required?)
  - Which formats? (Does it matter? Should it?)
  - What location? (The best! The file cabinet in my office!)
  - Interconnectivity? (“You mean I can do something with the data?”)
  - Standards (…any road will take you there?)
  - “Tools” (“Teach a man to fish…”)
Examples of our History
Lessons Learned

- **What does History tell us?**
  - Minimal data captured
  - Lack of consistent methods and standards
    - What is captured? Which attributes? How?
  - Questionable data quality
  - Limited data functionality and usage
  - Inconsistent storage and access
  - Difficult integration with “other” data, such as:
    - Satellite Imagery, Land Data (ROW, Drilling Locations, Wetlands, Tax Districts, etc.), O&M Data (costs, failures, etc.), Infrastructure (Roads, Utilities, etc.)
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Our Vision of the Future

- Hydraulic Modeling
- Flow Performance
- Debottlenecking
- Pigging Planning

20” Pipeline

North

• Launcher
• Block Valve
• River Crossing
• Rectifier
• Block Valve
Our Vision of the Future

Name, Address, Phone Numbers
Building Type, Floors, Units
Mobility Restrictions, Parking, Etc.

20” Pipeline

Populated Structures
Our Vision of the Future

Leased Acreage

20” Pipeline

DOT Class 2

DOT Class 2

DOT Class 3

Block C

Block J

Block K
Our Vision of the Future

System Surveillance
- Performance Metrics:
  - revenues and expenses
  - capital requirements
  - maintenance activity
  - equipment availability
  - headcount utilization

- Financial and Operating Data by:
  - region or area
  - line, point, or event
  - contract and lease
Data Sources....for the Future

- Pipe, Features, and Attributes – PODS & SDE
- TOPO & Satellite – Raster Depot & I-Cubed
- Land, Leases – Tobin Land Suite (TLS)
- Land, ROW – Landworks (LPM)
- Wells – Well Information System (WINS)
- Hydraulics – Flow Desk (Gregg Engineering)
- Buildings – Imagery & Ground Survey
- Financial – SAP Financial / Control (FICO)
- Maintenance – SAP Plant Maintenance (PM)
- Documents – Documentum, FileNet, LiveLink
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Pipeline Open Data Standard

PODS

- Oracle Database
- Stores pipeline and peripheral asset data
- Industry Standard
- Extendable
- Used by:
  - E&P Companies
  - Contractors
- Version 4.0 (& 4.01, 4.02)
  - Maturing
  - 179+ primary tables
Other Reasons for PODS

- Repository for all corporate pipeline data
  - Shut down redundant legacy systems
  - Reduce costs and consolidate data (KM, WGR, APC)

- Central system to **aggregate** and serve up data
  - Pipe centerline location, features, and attributes
  - Capture changing characteristics along pipeline
  - Drive consistency in capturing critical information

- Leverage existing corporate tools and systems
  - Enable data sharing with other systems
  - Eliminate gaps and overlaps of data (~ authoritative)
  - Develop a holistic “view” (**land, finance, ops**, ……)
  - Improve surveillance and analytical capabilities
Database Connectivity

PICTURE DATA

Storage & Use

Contractors

Surveyors

In-House Staff

Conversion Process

“Others” w/ Low-end Units

“Staging” PODS Database

Data Scraping (Survey Notes, Reports, Drawings, etc.)

Alignment Sheets and Reports

PetroWeb

ArcMap (Desktop)

GIS Server (Web-Client)

Other Clients & Applications

Master PODS Database

Legacy Pipeline Data

Historical PODS Database

Landworks LPM

SAP

PIPELINE DATA STORAGE & USE

Surveyors

Alignment Sheets and Reports

PetroWeb

ArcMap (Desktop)

GIS Server (Web-Client)

Other Clients & Applications

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Without PODS where else would PIPELINE data fit?
Solution Summary

● Priorities
  ● 1st, New Systems - “Stop the flow of blood”
  ● 2nd, Legacy Systems - “Document our past”

● “Right Sized”
  ● Capture the right data, the first time
  ● Leverage what we collect (“80/20” rule)
  ● Plan for growth (“needs”, data)

● “Think Strategic”
  ● Utilize existing corporate infrastructure & tools
  ● Capitalize on valued-added workflows
Improved One-Call Submissions

RESULTS – “Efficiency”
Minimum Area, Effort, and Resources Required.

Location Confidence
Low: Large X Value
High: Small X Value

Location Uncertainty

Pipeline
Buffer
Monitoring with IMAPS
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Data Capture Carousel

Web-Client Based

4. Check-in

5. QA/QC

Handheld “Full”

Handheld “Ready”

Spatial Correction

“Staging” PODS Database

History PODS Database

Master PODS Database

Among other applications:

PODS Staging Database

PODS History Database

PODS Master Database

“Host”

ArcMap

PetroWeb

SAP

Alternate Entry Point (for contractors)

1. Check-out

2. Capture Data

3. Upload

Field Based Activity
PODS...but how?

- Collect data into PODS
  - PODS on the handheld
- Manage with “filtering”
  - Function
    - Pipeline Operator
    - CP Technician
    - Mechanic
    - I&E Technician
    - Measurement Tech.
    - Construction Inspector
  - Focus
    - Online (“inside the line”)
    - Offline (“outside the line”)
    - Unassociated (“not part of the line”)

What data do you need NOW versus in the FUTURE?

- Reduce number of tables
- No list “longer” than the screen
- Minimal “clicks” for input
- Drop-down lists for consistency
### Configuring PODS

#### Roles and Features

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>GPS Super User</th>
<th>CP Technician</th>
<th>Pipeline Operator</th>
<th>Maintenance Plant</th>
<th>E&amp;H Technician</th>
<th>Measurement Technician</th>
<th>Construction Inspector</th>
<th>Point Feature</th>
<th>Line Feature</th>
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<td></td>
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</tr>
</tbody>
</table>
“Smart” Lists

- Leverage Look-up Lists
  - Guide the input
  - “Enforce” the definitions
  - Minimize error
    - TX, Texas, texas, tejas...
  - Allow new items
  - Monitor the process
  - One master list database
  - Regionalize choices
  - Centralized updates
Data Collection “Foundation”

Leverage a common application for multiple uses and rapid deployment...

Common Hardware & Software
Hardware Spectrum

- Easiest tools for majority of users.
- Commonly present with field staff.
- Low cost, reasonable capabilities.

- Learning not steep, but not insignificant.
- "Other" activities like post processing.
- Limited budgets; maximize tool use.
- Easiest tools for majority of users.
- Smaller core of power users.
- Small team of experts (staff & consultants)
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Data Collection

- “It’s all about the data!”
  - Garbage in, garbage out. (~ bad decisions)

- Data Sources
  - Contractors (primary)
  - Survey Crews (secondary)
  - Field Staff (tertiary & ad-hoc)

- Accuracy*
  - The “best” we can get. (~cost / benefit)
    - Leverage our field staff and existing equipment!

* The terms “Accuracy” and “Precision” are often confusing and will be defined later.
Precision vs. Accuracy

- **Accuracy** is the degree of veracity (*closeness to the actual value*) or “bulls eye” while **precision** is the degree of reproducibility, or “grouping”.

![High accuracy, low precision](image1)

![Low accuracy, high precision](image2)

Quality Proposition

- We want to use spatial data and feature attributes from a **variety of sources**.

- **All data is good, but it’s NOT created equal.** Some needs to be precise; much doesn’t.

- We must **capture and use** information on data accuracy and precision (or “quality”) in order to effectively leverage the data.
Data Collection Quality Issues

- **How can we leverage different GPS devices?**
  - High, medium, and lower accuracy.
  - Professional surveys, and field staff observations.

- **Can we address differences in “observed” data?**
  - Touch it, see it, measure it. (~high confidence)
  - Hear say, guesses, old maps. (~low confidence)

- **What level of accuracy do we require?**
  - Varies by feature (centerline versus a valve)
  - Different by activity (new versus existing)
Data Collection Solutions

- Develop metrics to quantify “quality”
  - Position Quality (*How accurately do we know the location?*)
  - Data Quality (*How representative is the data we are locating?*)

- Provide guidance on the accuracy required
  - What is needed (e.g., edit or addition)?

- Develop a quality matrix, with recommendations
  - Provide quality combinations for data collection

- Store quality metrics for each point collected

- Provide editing and analytical capabilities
  - Sort, report, edit, replace, etc. by any metric
Data Source Rankings

Confidence from “High” to “Low”  (DRAFT)

1. “On the Pipe” – Touch it
2. Visual reconciliation (open ditch, pothole, pipeline appurtenance)
3. Probe metal lance or locator) with confirmation
4. Vertical protrusion (vent riser, wire test lead)
5. Marker or sign post
6. Soil disturbance or subsidence
7. Reference (to another non-precise location; chain notes)
8. Low Quality Map (hand sketch, large scale maps)
9. Verbal
10. Non-georeferenced photographs
11. Personal memory
12. Best guess
### Position “Grade” Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveying</td>
<td>Accuracy* &lt; 1 cm</td>
</tr>
<tr>
<td></td>
<td>Trimble 5800 System</td>
</tr>
<tr>
<td>Precision Mapping</td>
<td>Accuracy &lt; 30 cm</td>
</tr>
<tr>
<td></td>
<td>e.g., Trimble GeoXH</td>
</tr>
<tr>
<td>High-End Mapping</td>
<td>Accuracy &lt; 1 m</td>
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<tr>
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<td>e.g., Trimble GeoXT</td>
</tr>
<tr>
<td>Mid-Grade Mapping</td>
<td>Accuracy &lt; 3 m</td>
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<tr>
<td></td>
<td>e.g., Trimble GeoXM</td>
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<tr>
<td>Low-End Mapping</td>
<td>Accuracy &lt; 5 m</td>
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<td>e.g., Trimble Juno ST</td>
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<tr>
<td>Recreational</td>
<td>Accuracy &lt; 15m</td>
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<tr>
<td></td>
<td>Garmin, Magellan, etc.</td>
</tr>
<tr>
<td>Other</td>
<td>In-accuracy &gt; 15 m</td>
</tr>
</tbody>
</table>

*Accuracies are based on published “post processed” data. Specific equipment shown for reference only.
Proposed Attributes

**Location Quality**
- **Survey**
  - Accuracy ≤ 10 cm
- **High-end Mapping**
  - Accuracy ≤ 1 m
- **Low to Mid Mapping**
  - Accuracy ≤ 5 m
- **Recreational Grade**
  - Accuracy ≤ 15 m
- **Unknown**
  - In-accuracy > 15 m

**Data Source Quality**
- **Direct**
  - Accuracy ~ < 1 m
- **Indirect**
  - Accuracy ~ 1 to 5 m
- **Inferred**
  - Accuracy ~ 5 to 10 m
- **Other**
  - Accuracy ~ 10 to 30 m
Defining the “ACCURACY REQUIRED” is the third axis to complete the matrix.

Better to know something exists (inaccurately) than not at all!

However…. too much “error” is not good. Does the item really exist?

Use Caution
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In closing...

- When it comes to:
  - capturing pipeline data, and
  - leveraging infrastructure information...
Thank You!

Questions! & Answers?