Is strategic DATA stuck in my PIPELINE?

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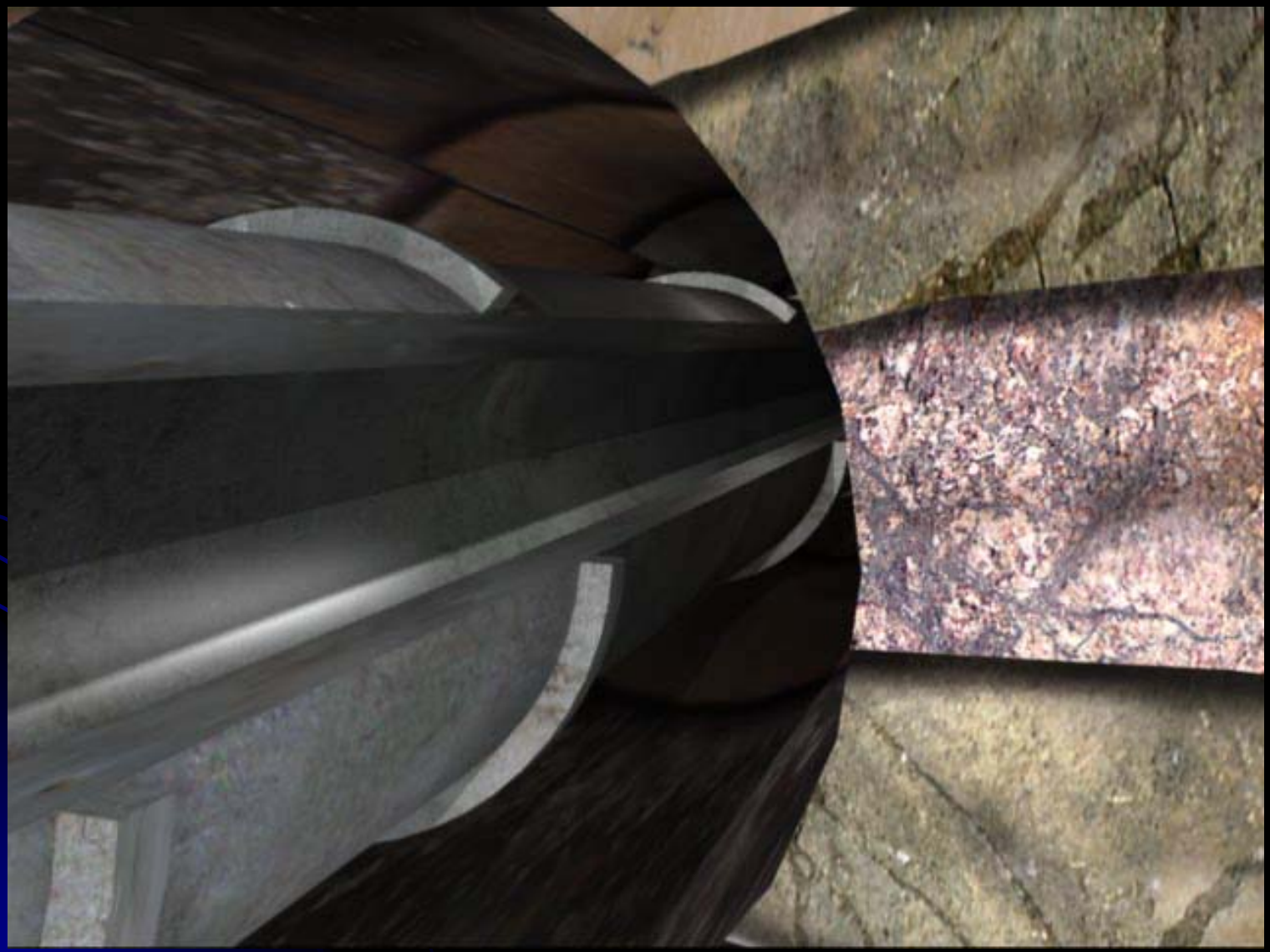
Philosophy…?

- "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"

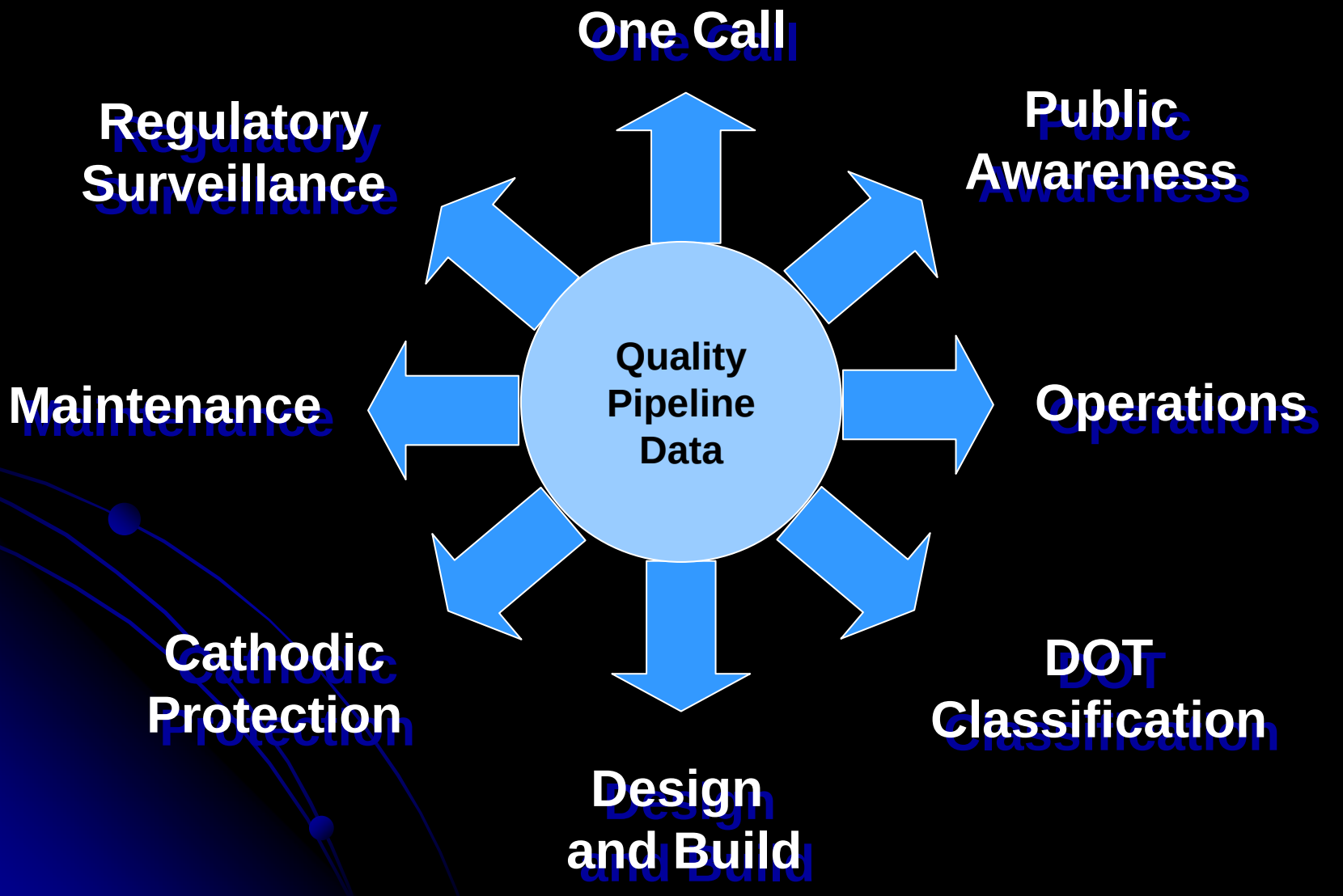
- Regulatory
- Environmental
- Production Equipment
- Measurement
- Pipeline Infrastructure
- Telecommunications
- General Infrastructure

- Regions
  - Domestic & International
- Realms
  - Onshore & Offshore
- Functions
  - Transmission, Production, Gathering, Injection, Disposal, Inter- & Intra-Field Transfer

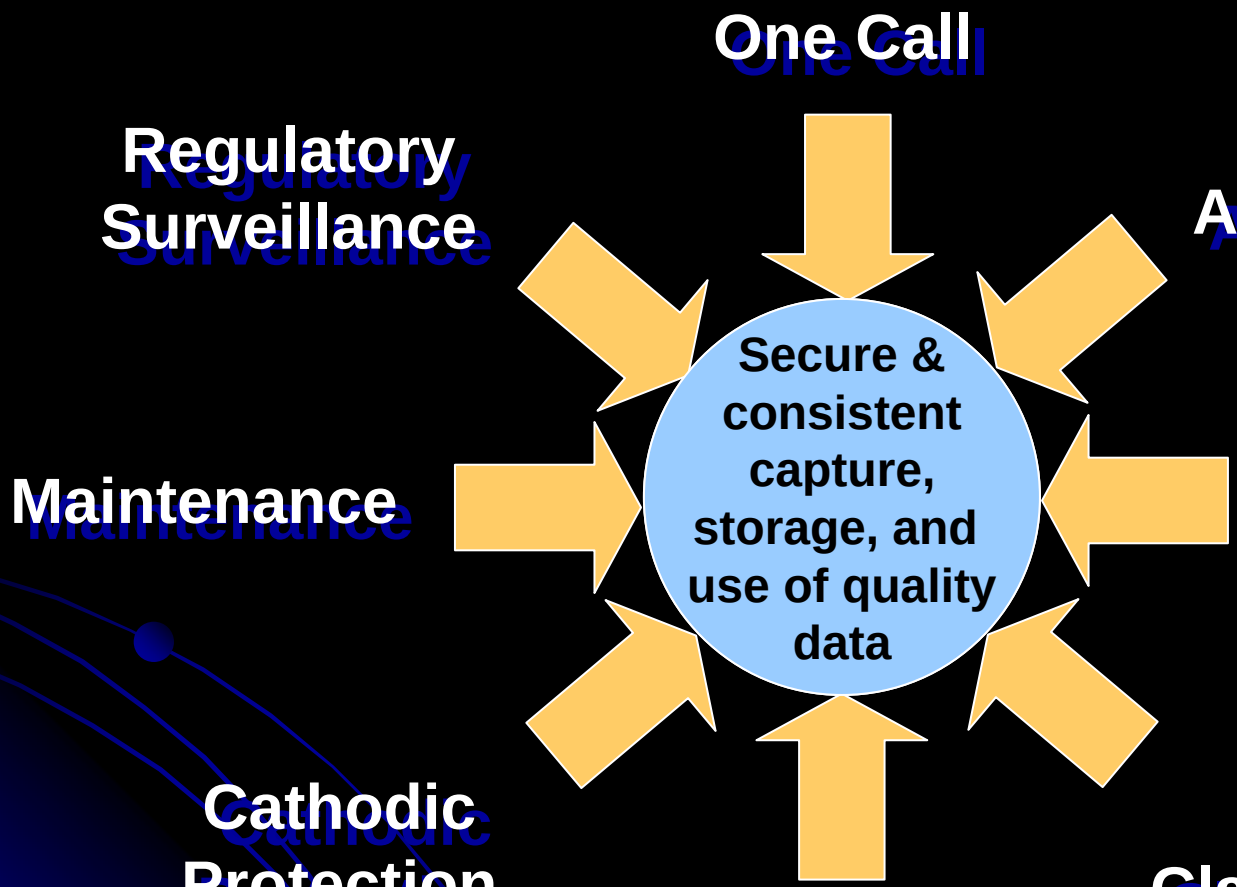
This Effort

Secondary Effect

Pipeline Data Supports…



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.

Next Waypoint

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History Lessons

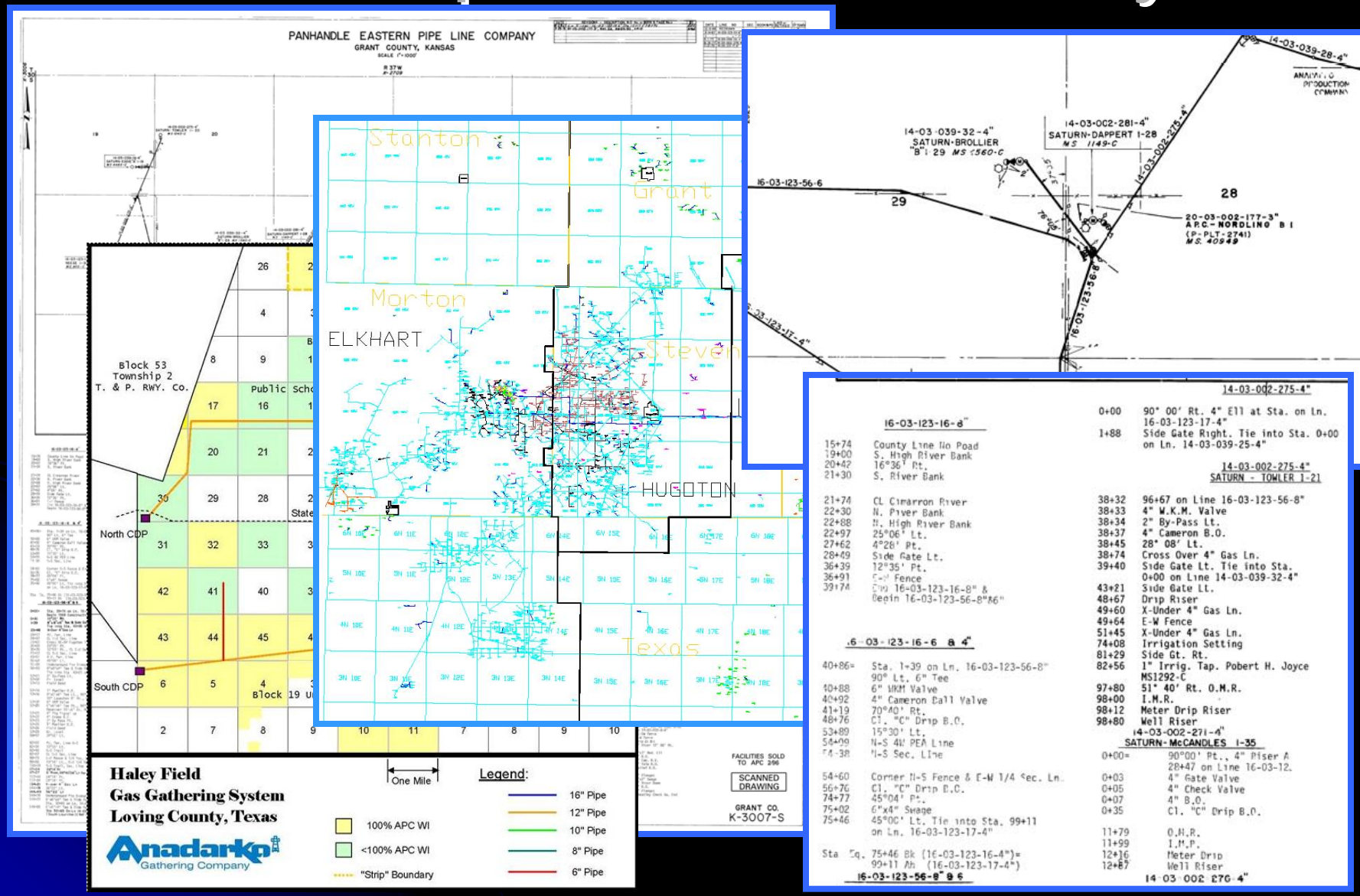
Horizontal Infrastructure

- 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?I (*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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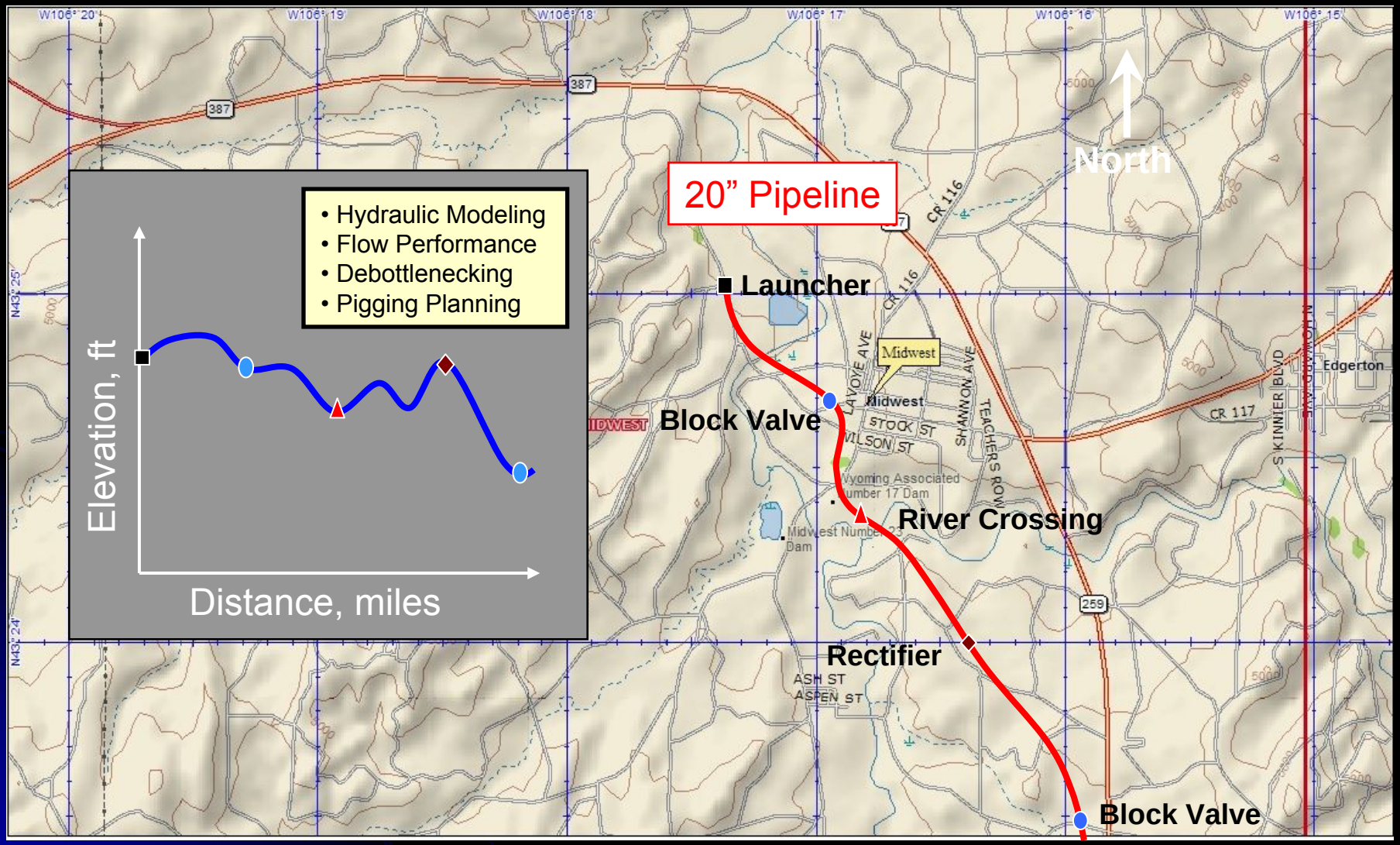
Our Vision of the Future



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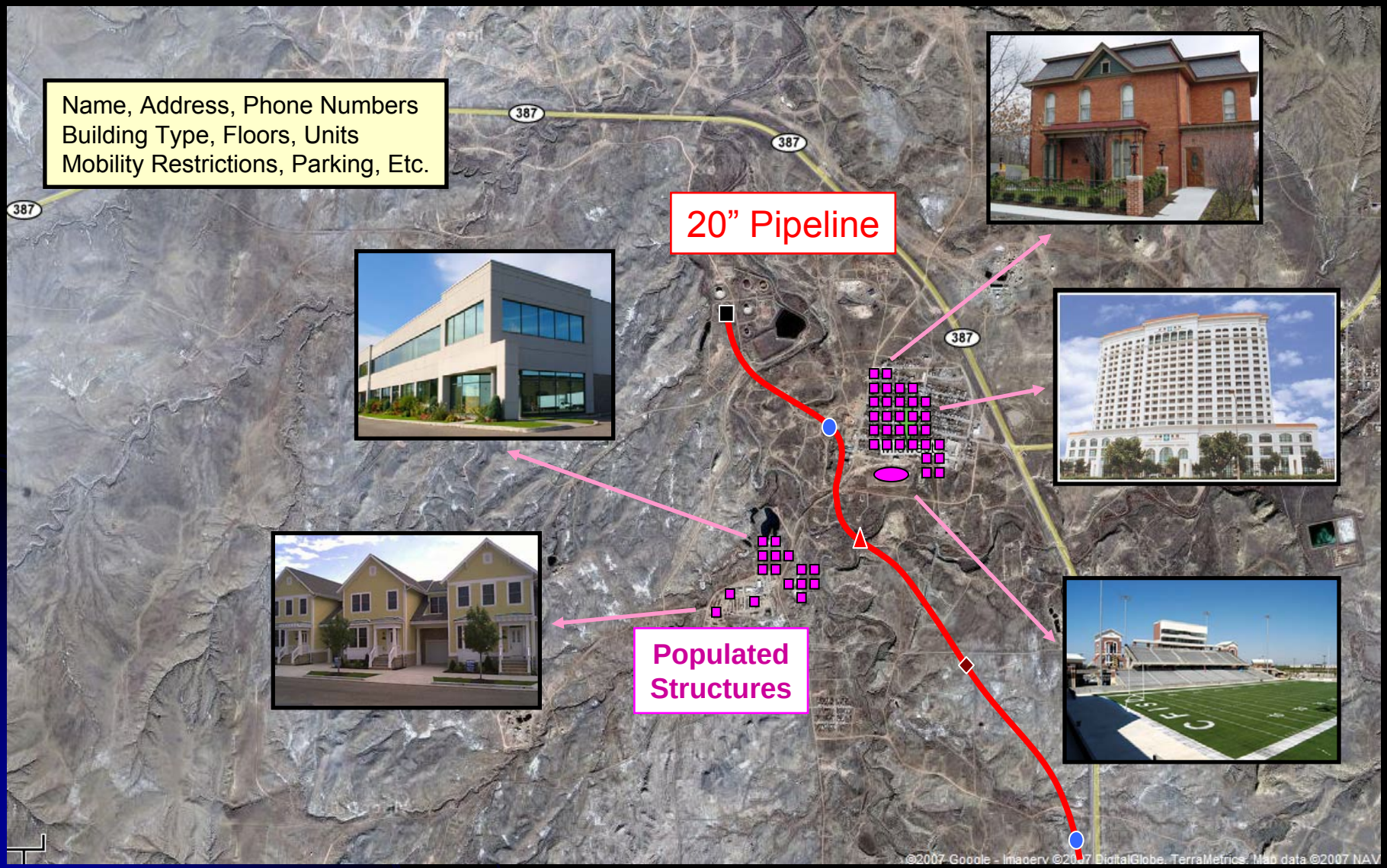

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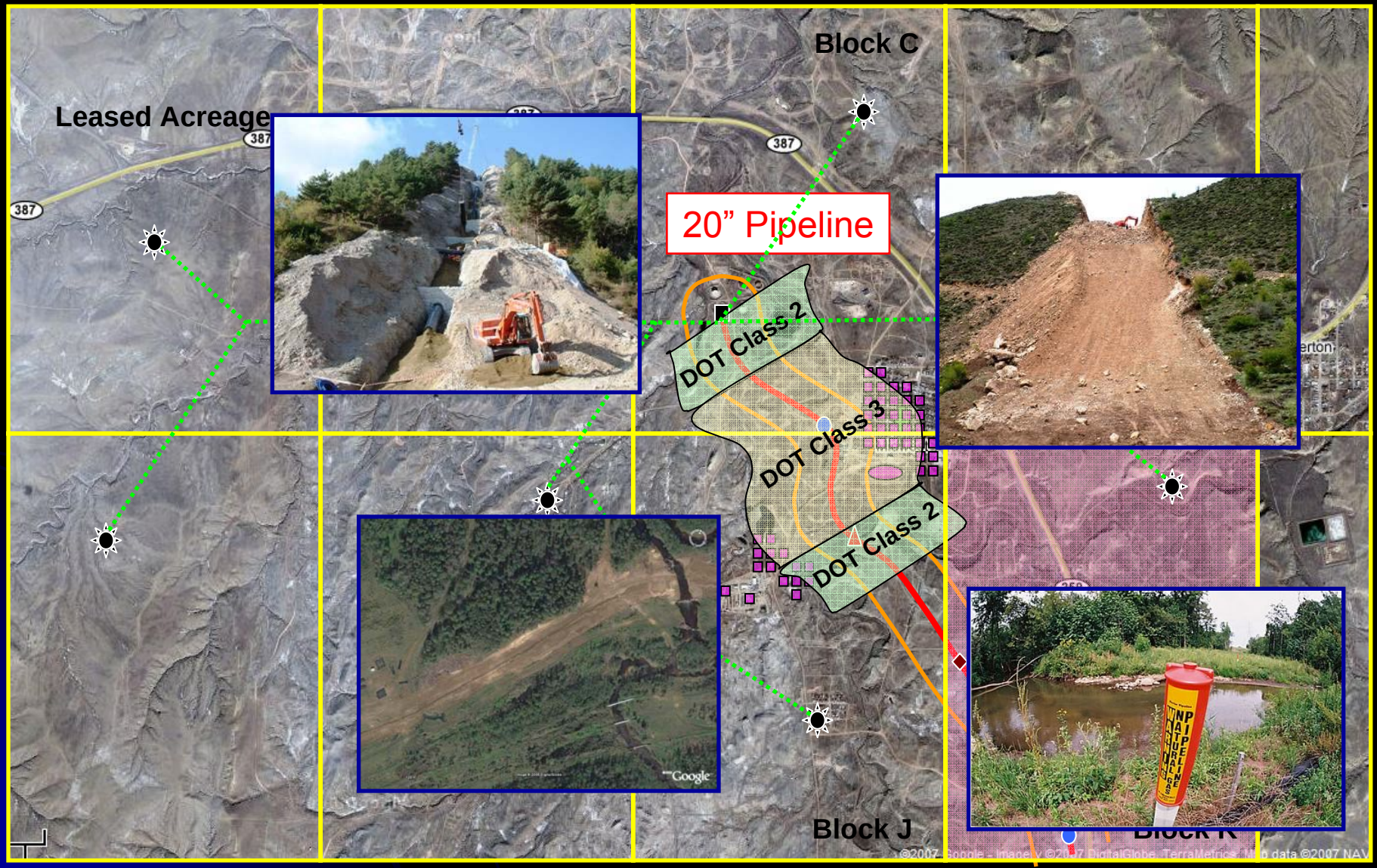

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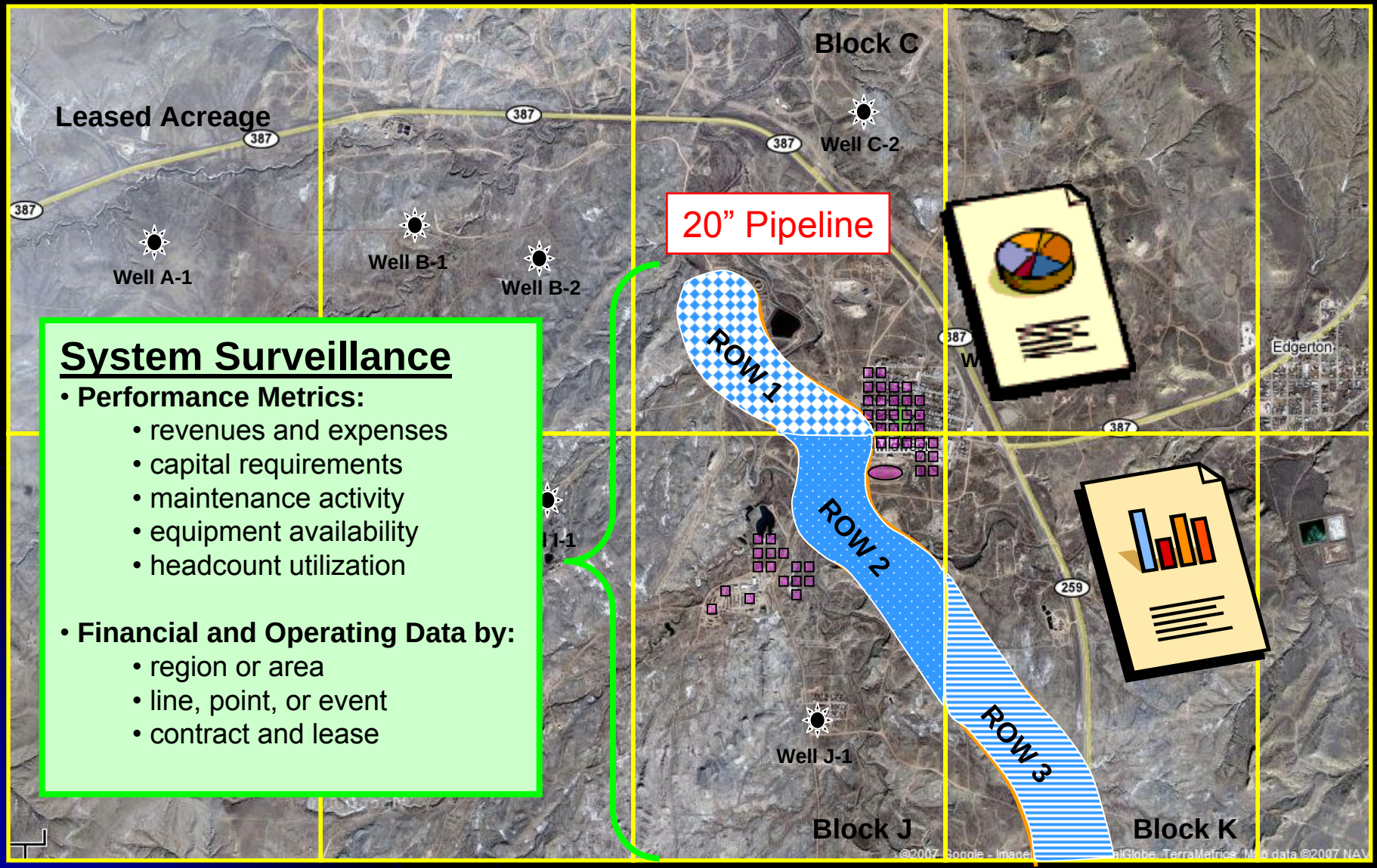

System Surveillance

- **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 – Landwork
- 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

Integration

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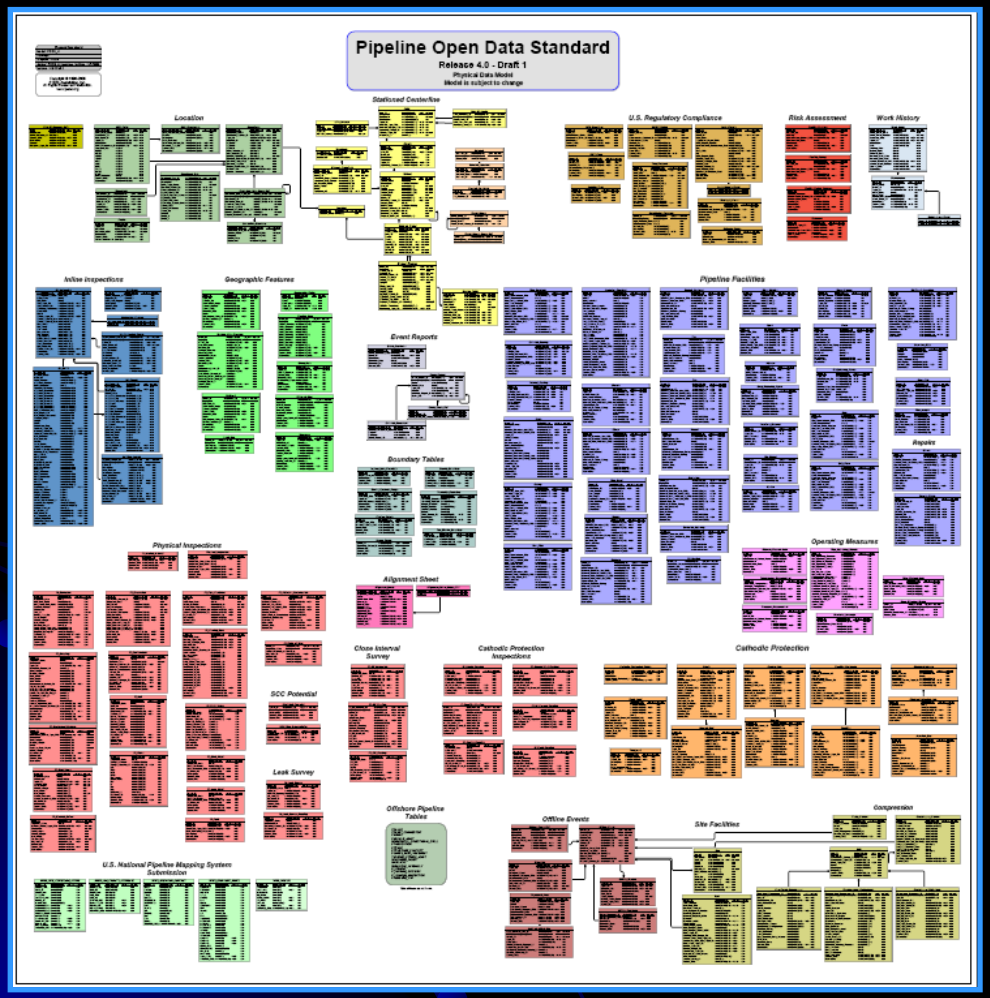
Pipeline Open Data Standard



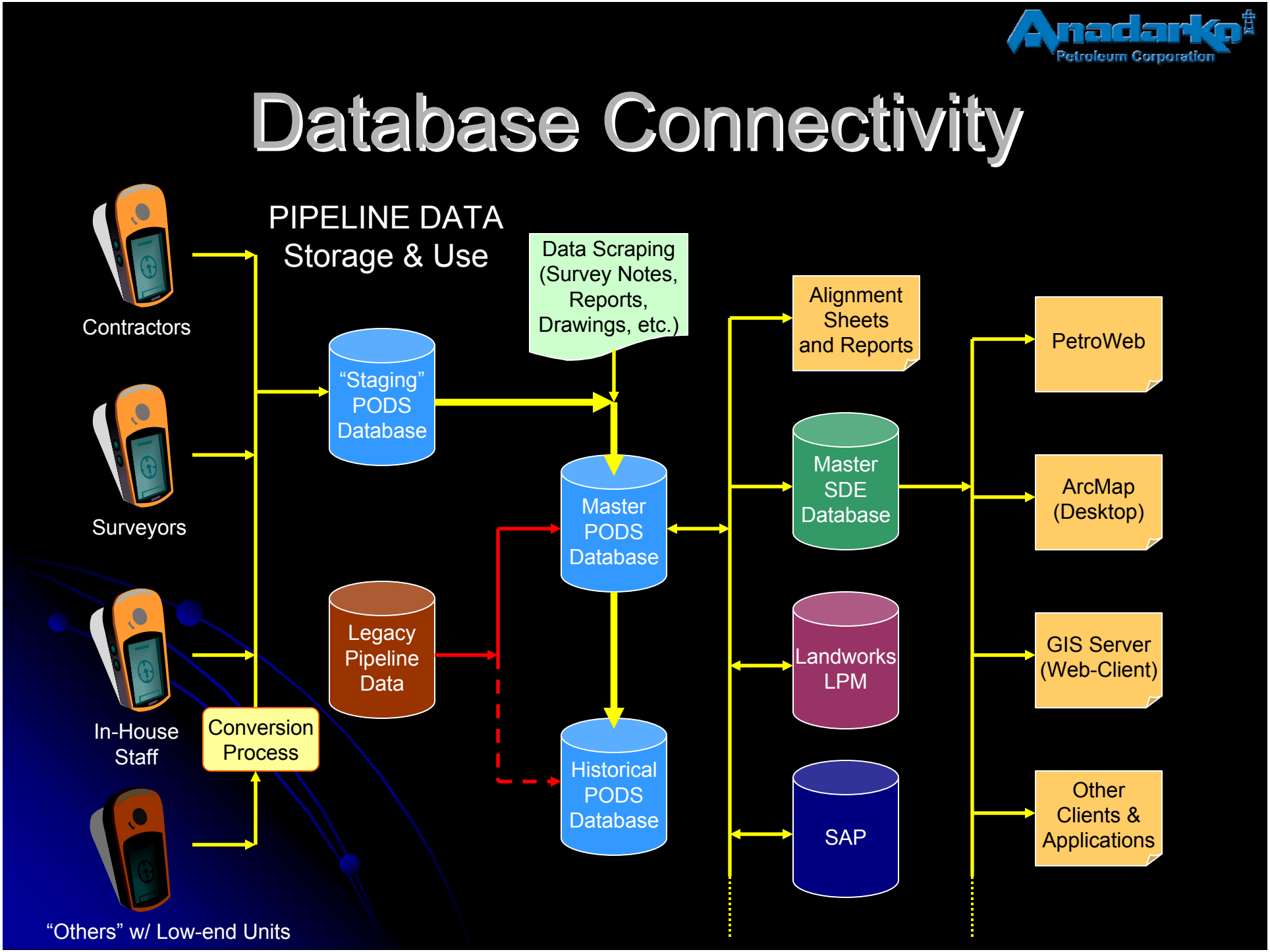
PODS

- 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

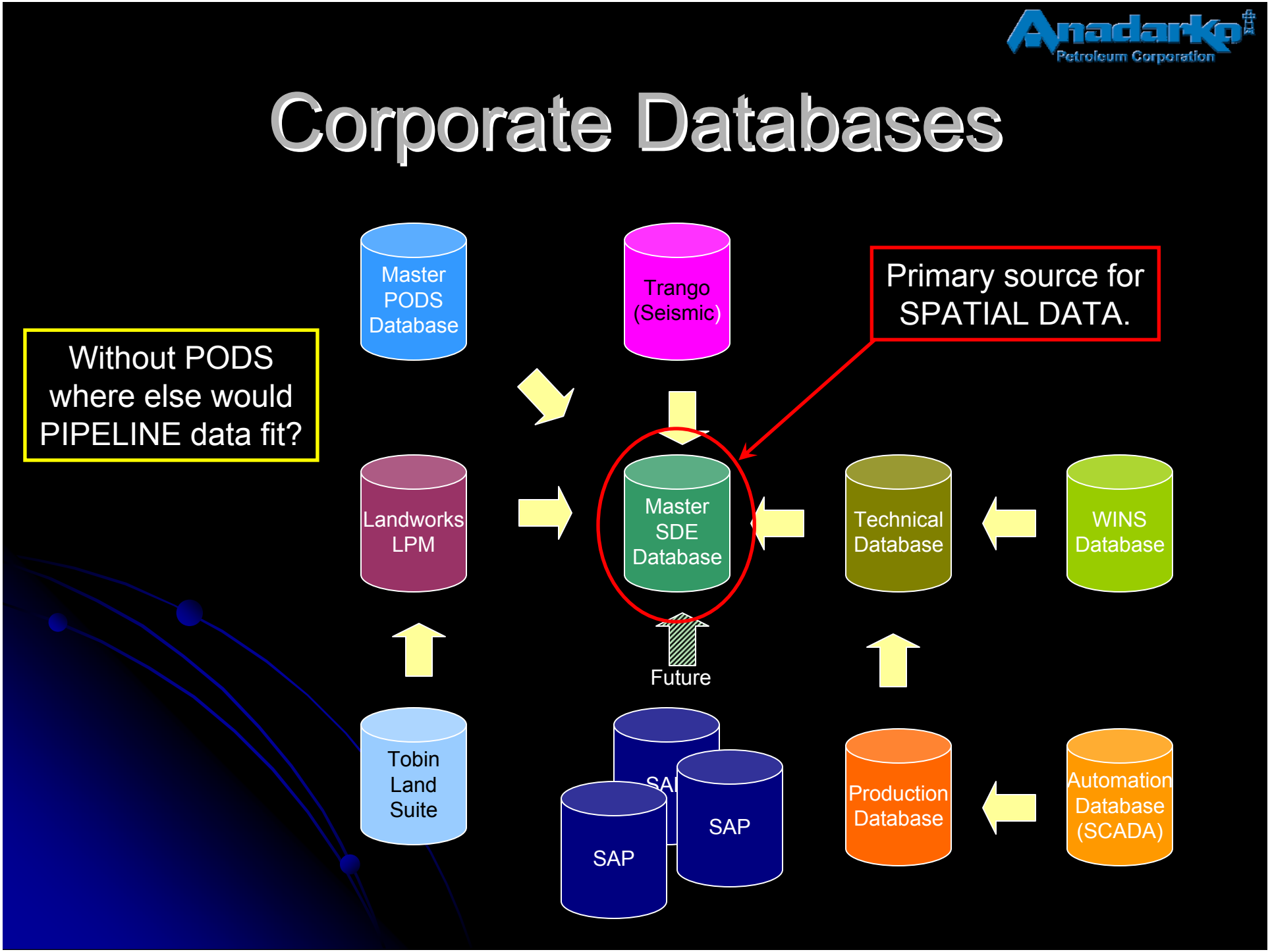
Other Reasons for PODS

- **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



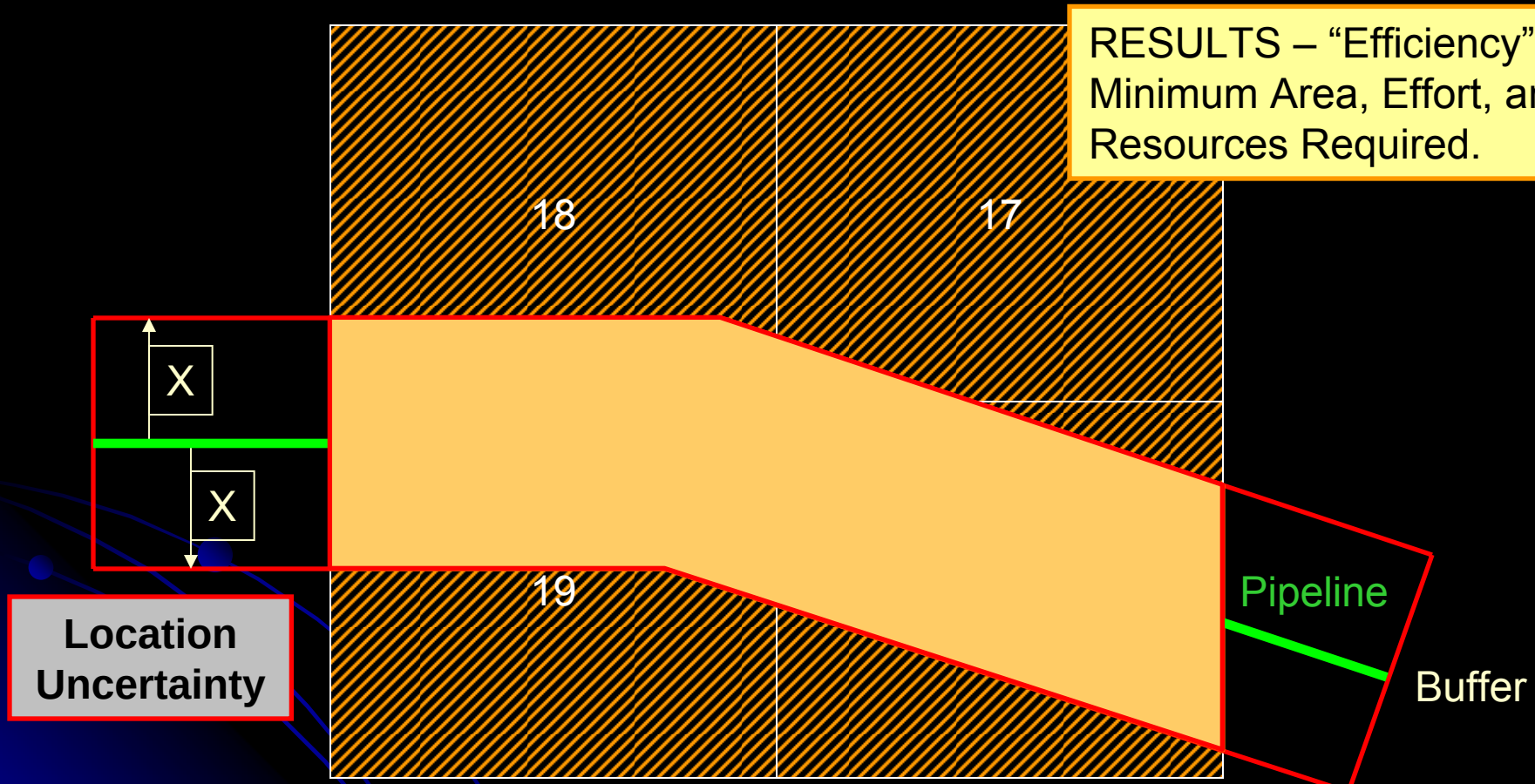
Corporate Databases

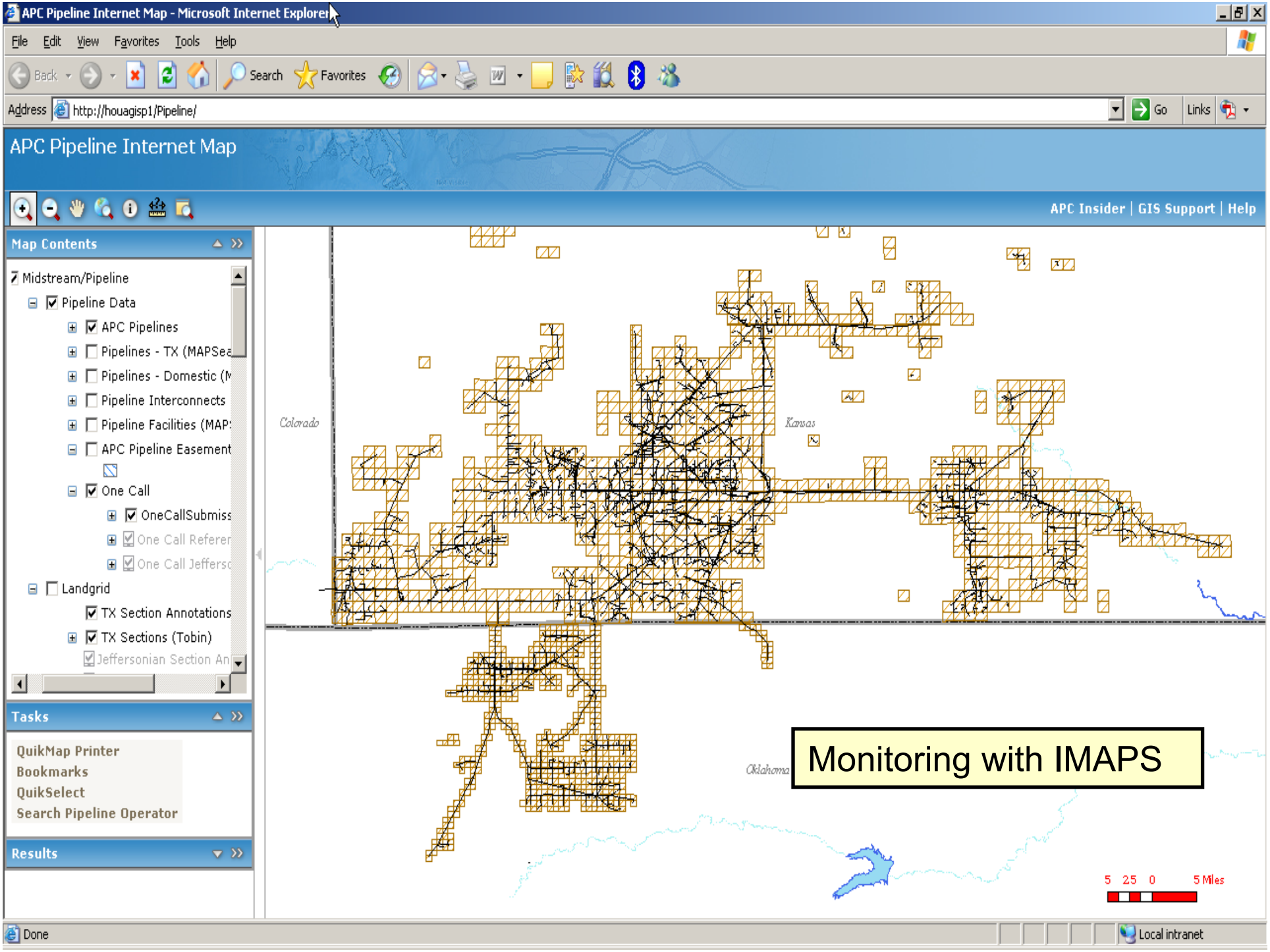


Solution Summary

- 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




APC Pipeline Internet Map - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://houagisp1/Pipeline/
Go Links
APC Pipeline Internet Map
APC Insider | GIS Support | Help
Map Contents
Midstream/Pipeline
Pipeline Data
APC Pipelines
Pipelines - TX (MAPSea
Pipelines - Domestic (M
Pipeline Interconnects
Pipeline Facilities (MAP
APC Pipeline Easement
One Call
OneCallSubmiss
One Call Referer
One Call Jefferso
Landgrid
TX Section Annotations
TX Sections (Tobin)
Jeffersonian Section An
Tasks
QuikMap Printer
Bookmarks
QuikSelect
Search Pipeline Operator
Results
Colorado
Kansas
Oklahoma
Monitoring with IMAPS
5 25 0 5 Miles
Done
Local intranet

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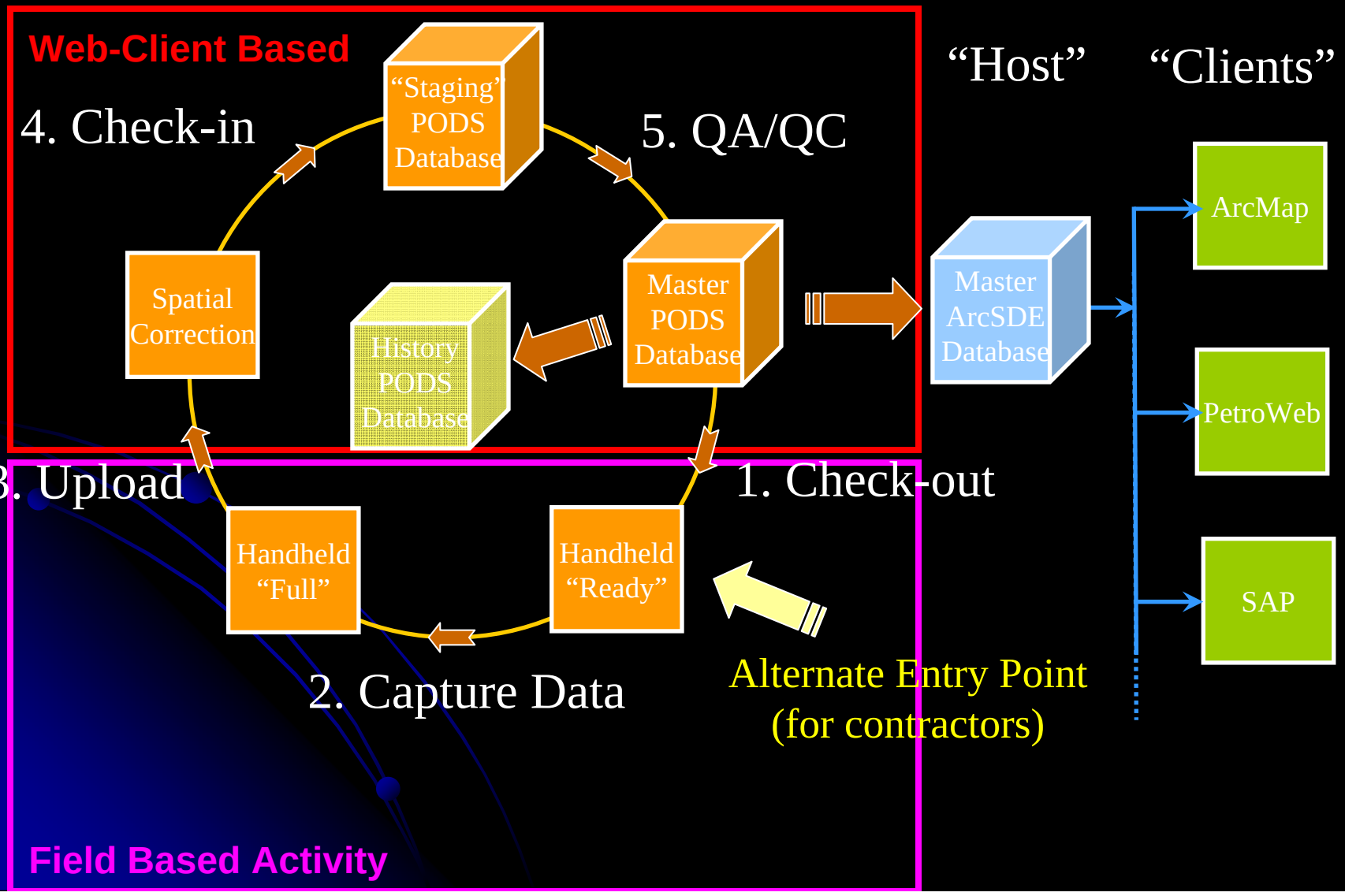
Data Capture Carousel



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

Filtering Roles

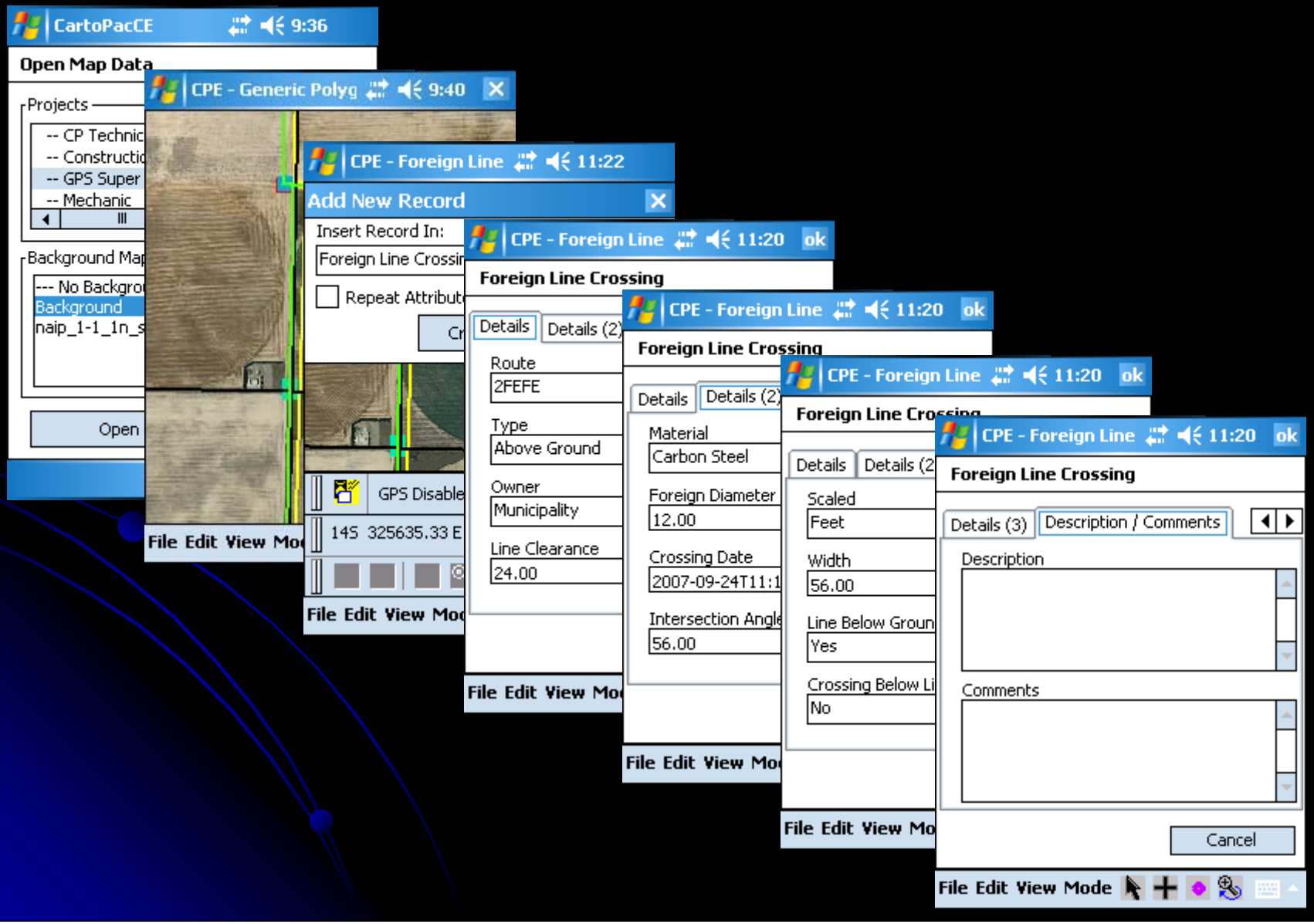
Type

Focus

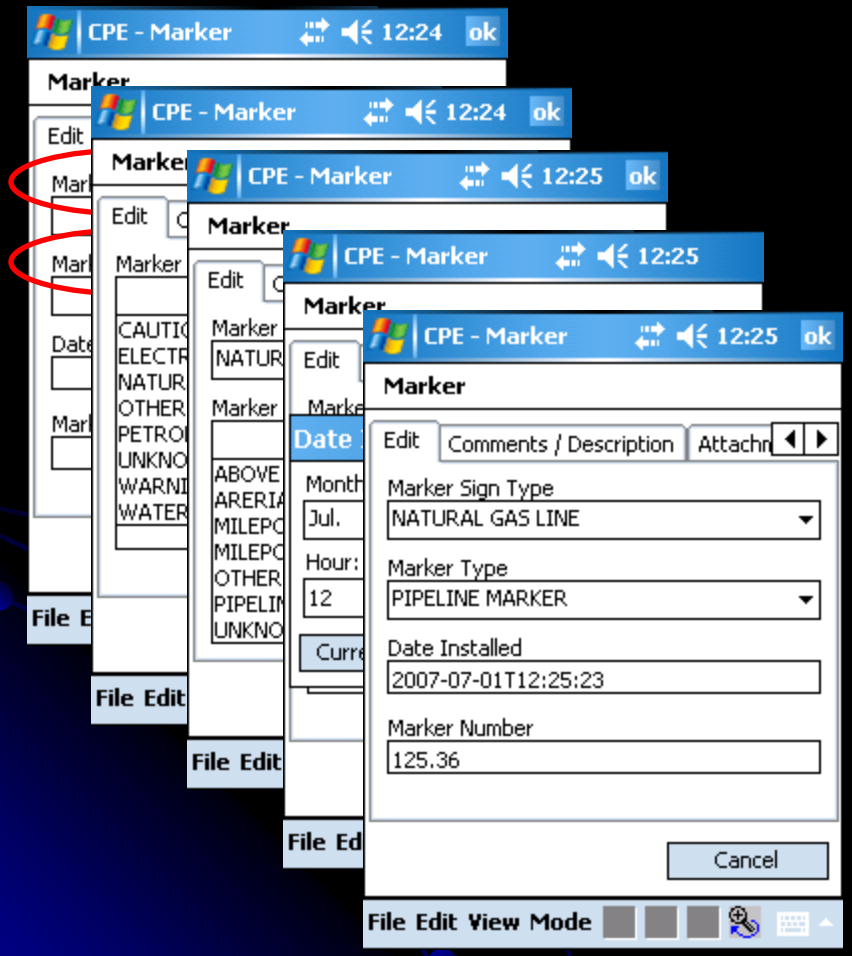
Database Features

Roles and Features Cross-reference (Filtering Method) / Feature Name	GPS Super User	CP Technician	Pipeline Operato	Maintenance Pe el	E&HS Technician	Measurement Te cian	Instrument Tech	Construction Inspector	Features used by 6 or more Roles	Point Feature	Line Feature	Polygon Feature	Online	Offline	Unassociated
Role =>	103	67	66	67	24	13	20	69	16	73	28	0	48	45	10
Anode	X	X						X	3	X				X	
Bond Reading	X	X							2	X				X	
Bond_lead	X	X					X	X	4	X				X	
Casing	X	X	X	X				X	5		X			X	
Cathodic_protection_range	X	X						X	3		X			X	
Centerline Segment	X		X	X				X	4		X		X		
Chemical_injection_log	X	X	X						3	X			X		
Chemical_injector	X	X	X	X				X	5	X			X		
Closure	X		X	X				X	4	X			X		
Coating Data	X	X		X					3		X		X		

Handheld Collection



“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

Number of Users

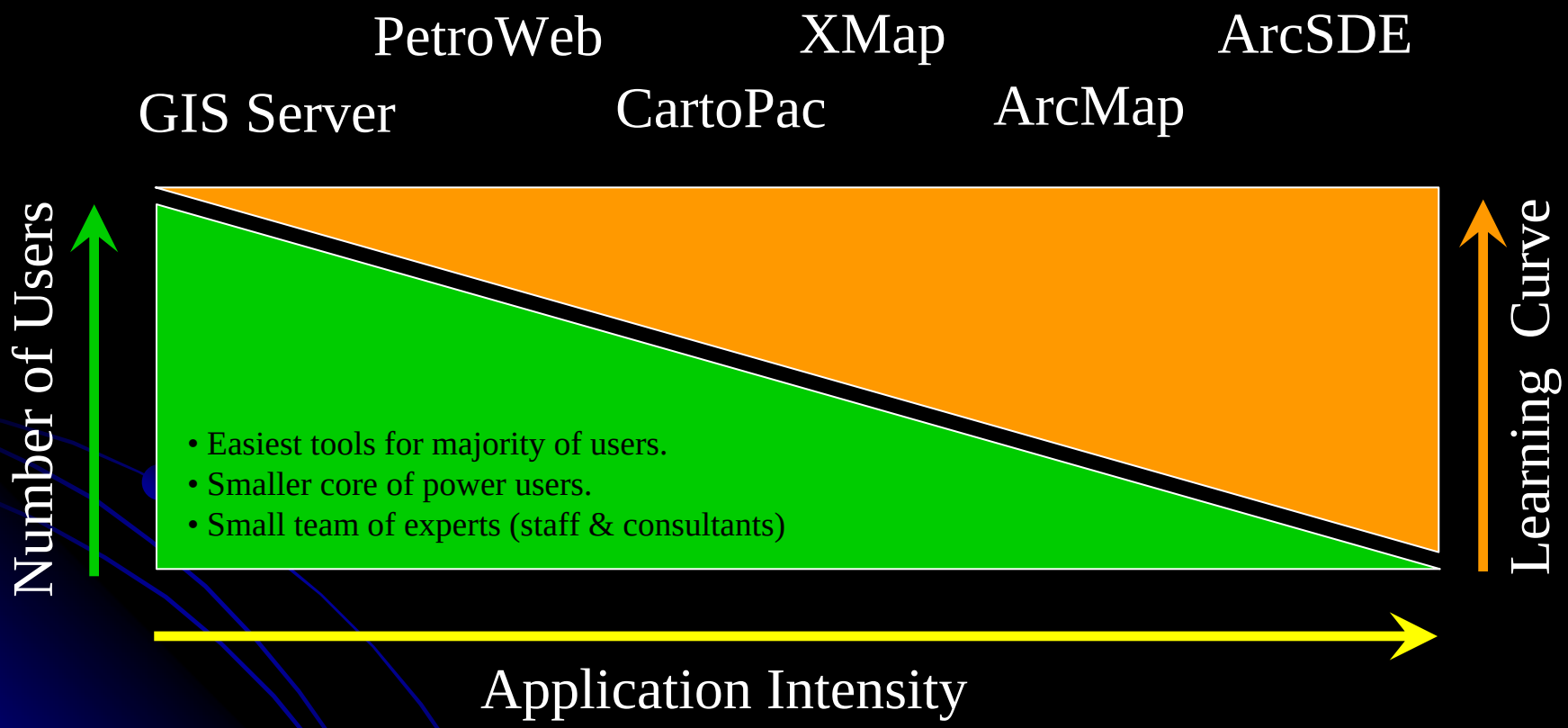
- Easiest tools for majority of users.
- Commonly present with field staff.
- Low cost, reasonable capabilities.

- Learning not steep, but not insignificant.
- " Other" activities like post processing.
- Limited budgets; maximize tool use.

Learning Curve

Equipment Cost

Software Spectrum



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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.

Low accuracy, high precision.

Source: http://en.wikipedia.org

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 leveled 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*)

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

Position "Grade" Categories

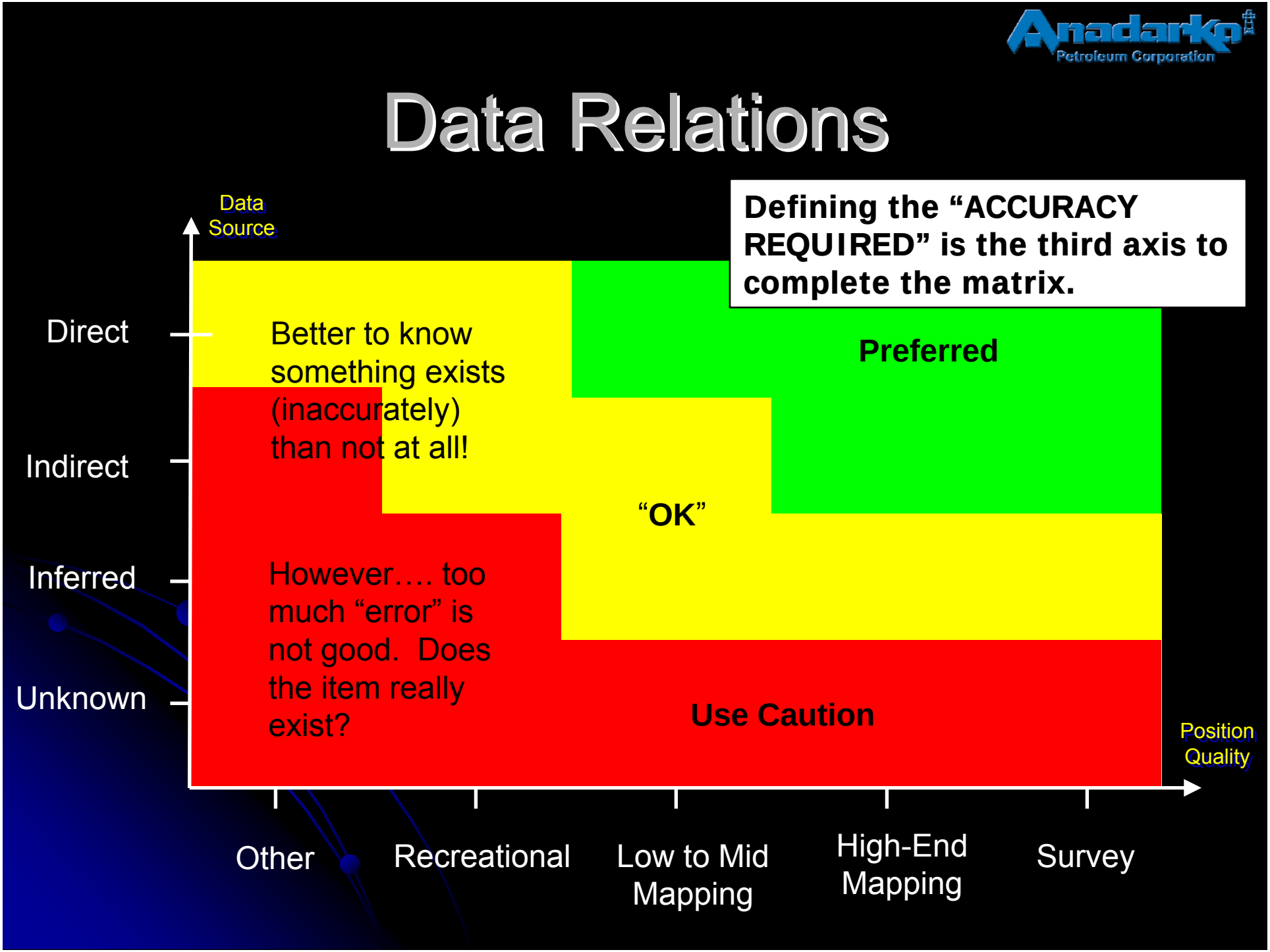
- Surveying
  - Accuracy* < 1 cm
    - Trimble 5800 System
- Precision Mapping
  - Accuracy < 30 cm
    - e.g., Trimble GeoXH
- High-End Mapping
  - Accuracy < 1 m
    - e.g., Trimble GeoXT
- Mid-Grade Mapping
  - Accuracy < 3 m
    - e.g., Trimble GeoXM
- Low-End Mapping
  - Accuracy < 5 m
    - e.g., Trimble Juno ST
- Recreational
  - Accuracy < 15m
    - Garmin, Magellan, etc.
- Other
  - In-accuracy > 15 m

*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

Data Relations



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In closing…

- When it comes to:
  - capturing pipeline data, and
  - leveraging infrastructure information…

Anadarko Petroleum Corporation

Thank You!

Questions! & Answers?