

# Technologies Framework Required to Support Pipeline Integrity

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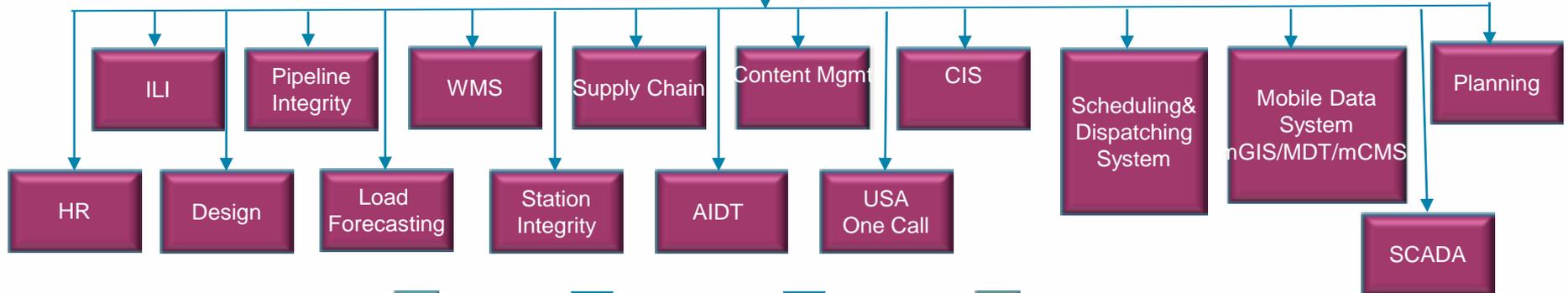
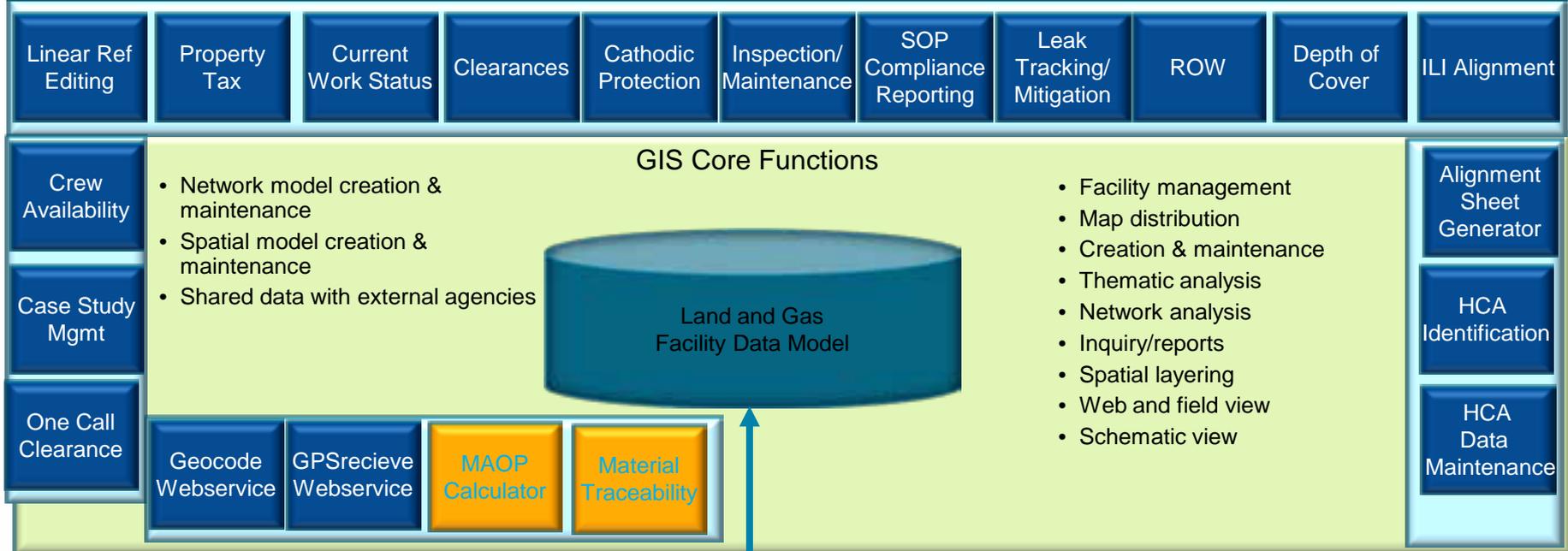
Concepts and Technologies

# BLACK & VEATCH PIPELINE INTEGRITY REFERENCE FRAMEWORK



# Black & Veatch Reference Architecture

## GIS Based Gas Utility Applications







# 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



# Engineering/Planning

- **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



# Technology Heat Map

	GIS	EAM	MWM	CMS	IM	Engr	SCADA	Spatial BI
As-Built Recording	● X	X		X				
Preventative Maintenance	● X	X	X	X				X
Corrective Maintenance	● X	X	X	X				
Engineering Planning	● X	X	X			X		
Integrity Management	● X	X	X	X	X		X	X
OPS Awareness	● X	X	X			X	X	X



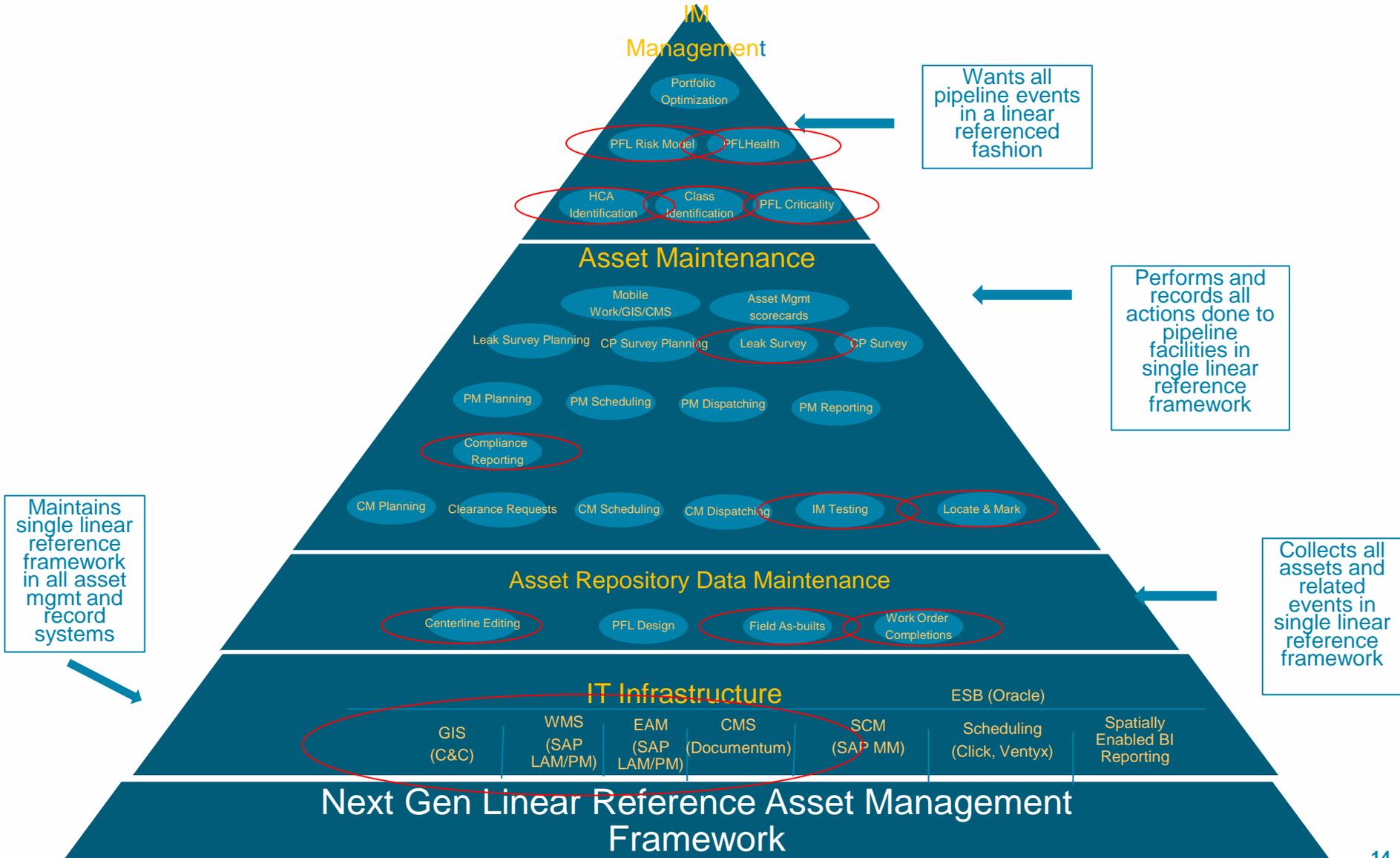
Where Business and Technology Meet

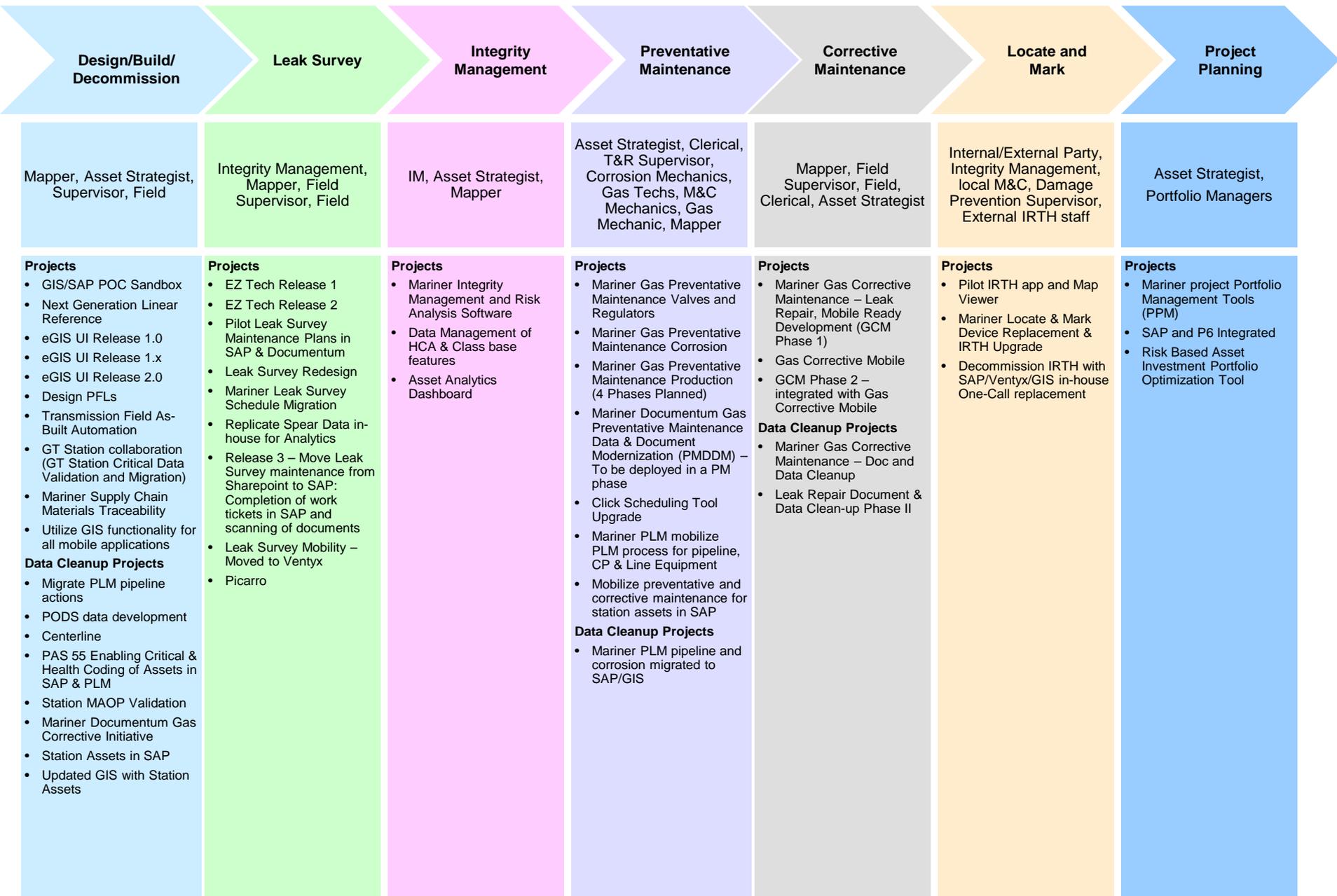
# PG&E'S IMPLEMENTATION ROADMAP



# Transmission Gas Roadmap

## Need for Linear Referenced Asset Management

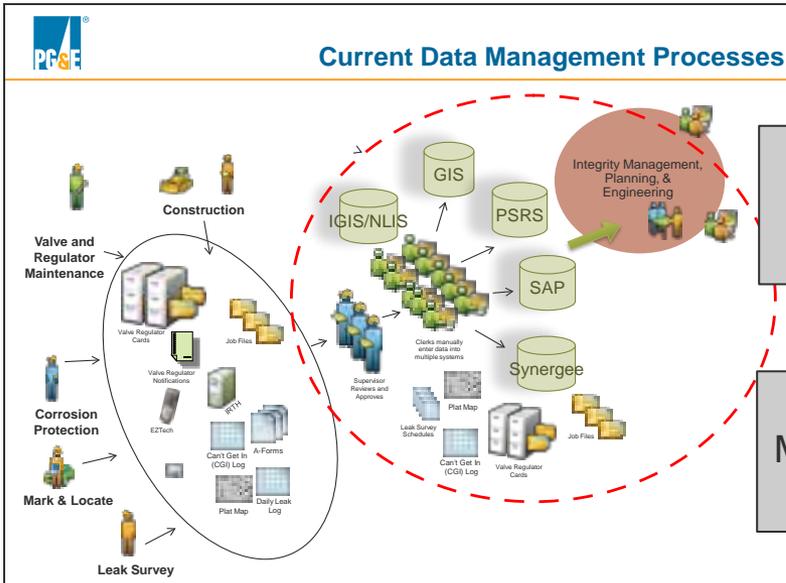






# Current and Future Data Management

## Current Data Management Processes



Update core enterprise systems

Complete MAOP Validation Program

## Future Data Management Processes



Unified platform of automated solutions and robust governance to provide and sustain real time, accurate, traceable, verifiable, and complete asset information

Multiple systems with manual and automated methods



# SAP Asset Hierarchy - Non Linear

GT Line Level Functional Location/Equipment Structure has supported current business activities but lack integrated linear capabilities that LAM provide.

**Today**

Functional Location Structure: Structure List			
Functional loc.	GT	Valid From	01/17/2013
Description	GAS TRANSMISSION		
- GT	GAS TRANSMISSION		G ECES ECES
- GT.INST	INSTRUMENTS		G ECES ECES
GT.INST.COGI	COMBUSTIBLE GAS INDICATORS		G ECES ECES
GT.INST.GAGE	GAUGES		G ECES ECES
GT.INST.OTHR	OTHER INSTRUMENTS		G ECES ECES
GT.INST.RCDN	RECORDERS		G ECES ECES
GT.LCNG	LNG/CNG OPERATIONS		G ECES ECES
- GT.LINE	PIPELINES		G ECES ECES
GT.LINE.DCUST10027	DCUST10027 FANOCHE ENERGY CENTER		G ECES ECES
GT.LINE.FORGN	PIPELINES		G ECES ECES
GT.LINE.L-0002	LINE 2		G ECES ECES
GT.LINE.L-0002.CORR	LINE 2 CORROSION		G ECES ECES
GT.LINE.L-0002.CORR.ANOD	LINE 2 CORROSION ANODE		G ECES ECES
42582278	ANODE, L002. MP 147.62	G ECES	TY0028120
GT.LINE.L-0002.CORR.CUPN	LINE 2 CORROSION COUPON		G ECES ECES
GT.LINE.L-0002.CORR.ETSX	LINE 2 CORROSION ETS		G ECES ECES
GT.LINE.L-0002.CORR.RECT	LINE 2 CORROSION RECTIFIER		G ECES ECES

- Largely segregated by equipment type (not hierarchical)
- Does not include System, Route, or clear Pressure Isolation zone / Sub-systems for Operations



# SAP Asset Hierarchy with LAM

With LAM linear referencing, functional location / equipment structure is more fit for purpose with pipeline maintenance and promotes enterprise asset management (EAM) best practice.

**Functional Location Structure: Structure List** **PoC**

Levels above Expand whole Mat. classes

Functional loc. GT Valid From 12/19/2012

Description GAS TRANSMISSION

Functional loc.	GT	Valid From	12/19/2012
42725119	1 ETS		9 ECES
GT_TM_YY_149	Line 149		
0.000	2,272.400	2,272.400 ZFT ZFT H	
42725120	1 Casting		9 ECES
42725120	1 ETS		9 ECES
42725130	2 ETS		
42725131	2 Casting		
GT_TM_YY_150	Line 150		9 ECES ECES
0.000	2,677.300	2,677.300 ZFT ZFT H	ZFT V
42724929	Serialized Valve 20"		9 ECES M777888
42725142	Casting1		9 ECES
42725143	ETS1		9 ECES
GT_TM_YY_153	Line 153		9 ECES ECES
0.000	2,272.400	2,272.400 ZFT ZFT H	ZFT V
42724951	Serialized Valve 20"		9 ECES M777888
42724952	Serialized Valve 20"		9 ECES M777888
42724953	Serialized Valve 20"		9 ECES M777888
GT_TM_YY_154	Line 154		9 ECES ECES
0.000	2,774.100	2,774.100 ZFT ZFT H	ZFT V
42724954	Serialized Valve 20"		9 ECES M777888
42724955	Serialized Valve 20"		9 ECES M777888
42725149	Casting1		9 ECES
42725150	ETS1		9 ECES
42725151	Casting2		9 ECES
42725152	ETS2		9 ECES
GT_TM_YY_155	Line 155		9 ECES ECES
GT_TM_YY_156	Line 156		9 ECES ECES

**Equipment on the line** (arrow pointing to 42725120)

**Length of Line** (arrow pointing to 2,272.400 ZFT ZFT H)



# Asset Hierarchy with LAM

Equipment records can also be linearized.

Functional loc.	GT	Valid From	12/19/2012
Description	GAS TRANSMISSION		
▶ 42725134	1 Casing	9 ECES	
▶ 42725135	1 ETS	9 ECES	
▼ GT_TM_YY_149	Line 149	9 ECES ECES	
•	0.000 2,272.400	2,272.400 ZFT ZFT H	ZFT Y
▶ 42725120	1 Casing	9 ECES	
•	128.160 328.160	200.000 ZFT ZFT	
▶ 42725129	1 ETS	9 ECES	
▶ 42725130	2 ETS	9 ECES	
▶ 42725131	2 Casing	9 ECES	
▶ GT_TM_YY_150	Line 150	9 ECES ECES	
▼ GT_TM_YY_153	Line 153	9 ECES ECES	
•	0.000 2,272.400	2,272.400 ZFT ZFT H	ZFT Y
▶ 42724951	Serialized Valve 20"	9 ECES M777888	
▶ 42724952	Serialized Valve 20"	9 ECES M777888	
▶ 42724953	Serialized Valve 20"	9 ECES M777888	
▼ GT_TM_YY_154	Line 154	9 ECES ECES	
•	0.000 2,774.100	2,774.100 ZFT ZFT H	ZFT Y
▶ 42724954	Serialized Valve 20"	9 ECES M777888	
▼ 42724955	Serialized Valve 20"	9 ECES M777888	
•	2,674.100 2,774.100	100.000 ZFT ZFT	
• M777888	Serialized Valve 20"	1 EA	
▶ 42725149	Casing1	9 ECES	

Location of the equipment



# SAP GEO.e Analyze Data

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-

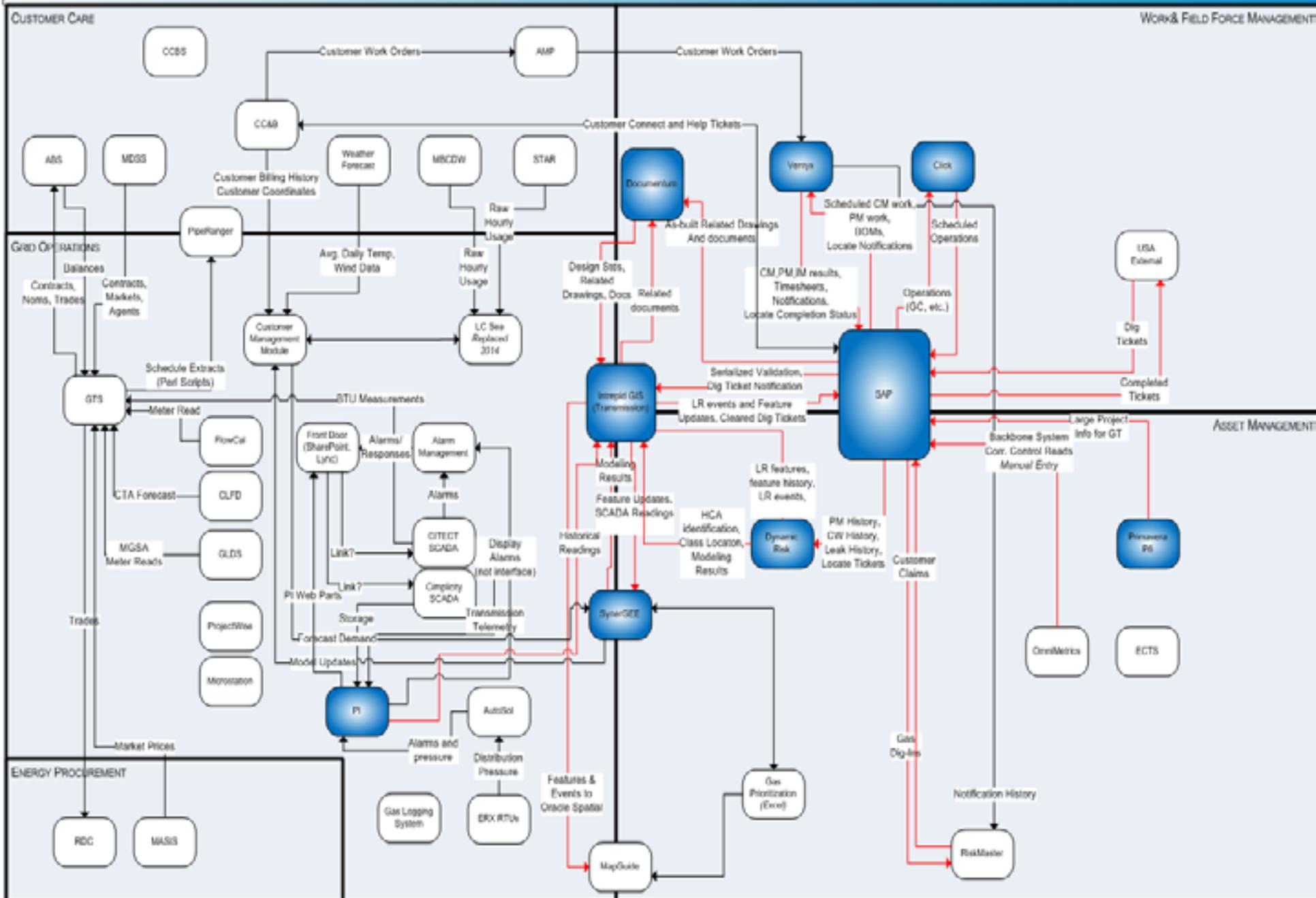
- Cost
- Orders Types
- Emergency Work
- Notifications

The screenshot displays the SAP GEO.e interface. The top window, titled "Display Functional Location: Master Data", shows details for a functional location: "GT. IN. LB. T300" with a description of "Bay Area Test Line Inital Line 300". Below this, a map view shows a street grid with a blue line representing the functional location. A context menu is open over the map, listing actions such as "Create Notification", "Create Work Order", and "Show all Work Orders".

The bottom window, titled "Display Functional Location: List of Orders", shows a table of orders:

MAT	Order	Description	Mn.wk.ctr	Notification	User	Status	Type
9BA	30990297	LINE LB. T300 CONSTRUCTION	SNCARLOS M G			UNSE	N060
IIA	41597622	LINE T300, 0 - 2000	SNCARLOS M G	105580178		PREC	N180
IIA	41597623	LINE T300, 2000 - 4000	SNCARLOS M G	105580179		UNSC	N180
IIA	41597624	LINE T300, 4,000 TO END	SNCARLOS M G	105580180		UNSC	N180
BXI	41597625	STANDARD VALVE MAINTENANCE	SNCARLOS M G			UNSC	N180
BXI	41597626	STANDARD VALVE MAINTENANCE	SNCARLOS M G			UNSC	N180
BXP	41597627	CHECK TEST LEAD	SNCARLOS M G	105580181		UNSE	N080

# To-Be Application Architecture Gas





# Technology Heat Map

	GIS Intrepid	EAM SAP LAM	MWM Ventyx	CMS Documentum	IM IRAS	Engr SynerGEE	SCADA PI	Spatial BI SAP DW
As-Built Recording	● X	X		X				
Preventative Maintenance	● X	X	X	X				X
Corrective Maintenance	● X	X	X	X				
Engineering Planning	● X	X	X			X		
Mark & Locate	● X	X	X	X				
Integrity Management	● X	X	X	X	X		X	X
OPS Awareness	● X	X	X			X	X	X

# Questions?

