

R&D and Innovation for PG&E Gas Operations

François Rongere
CEC R&D Workshop, July 16th, 2015



■ Mission Statement

R&D and Innovation detects, adapts, qualifies and implements innovative solutions in the Gas Operations business to improve its performance measured in public and work safety, customer satisfaction, cost effectiveness, environmental impact, regulatory compliance, and communication.

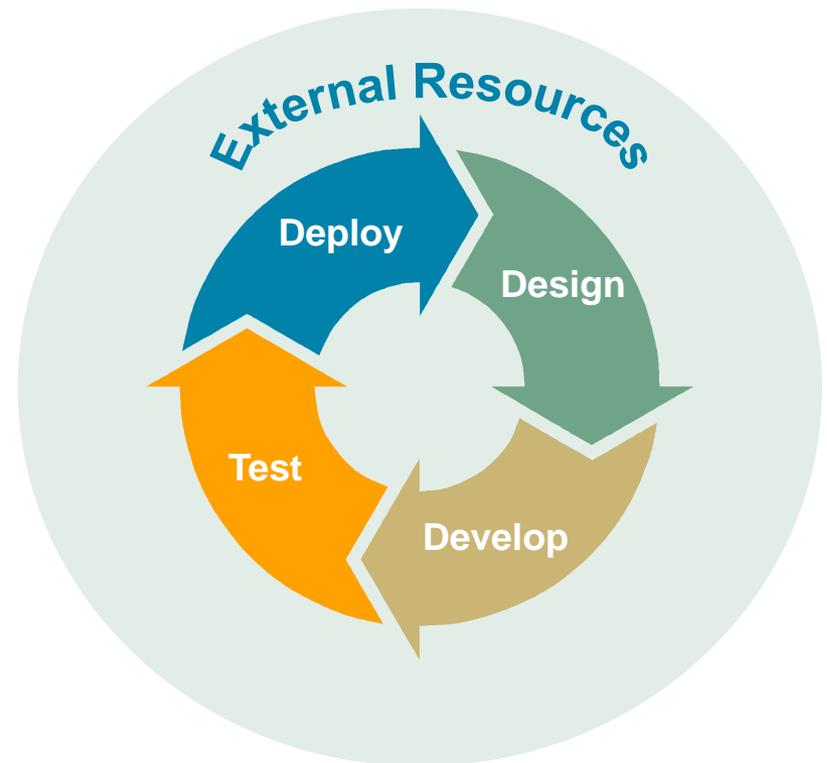
François
Rongere

Ben Wu

Rosemary
Rentschler

Gerry Bong

Sam Kim
Associate
Engineer in
Rotation



R&D and Innovation Connection

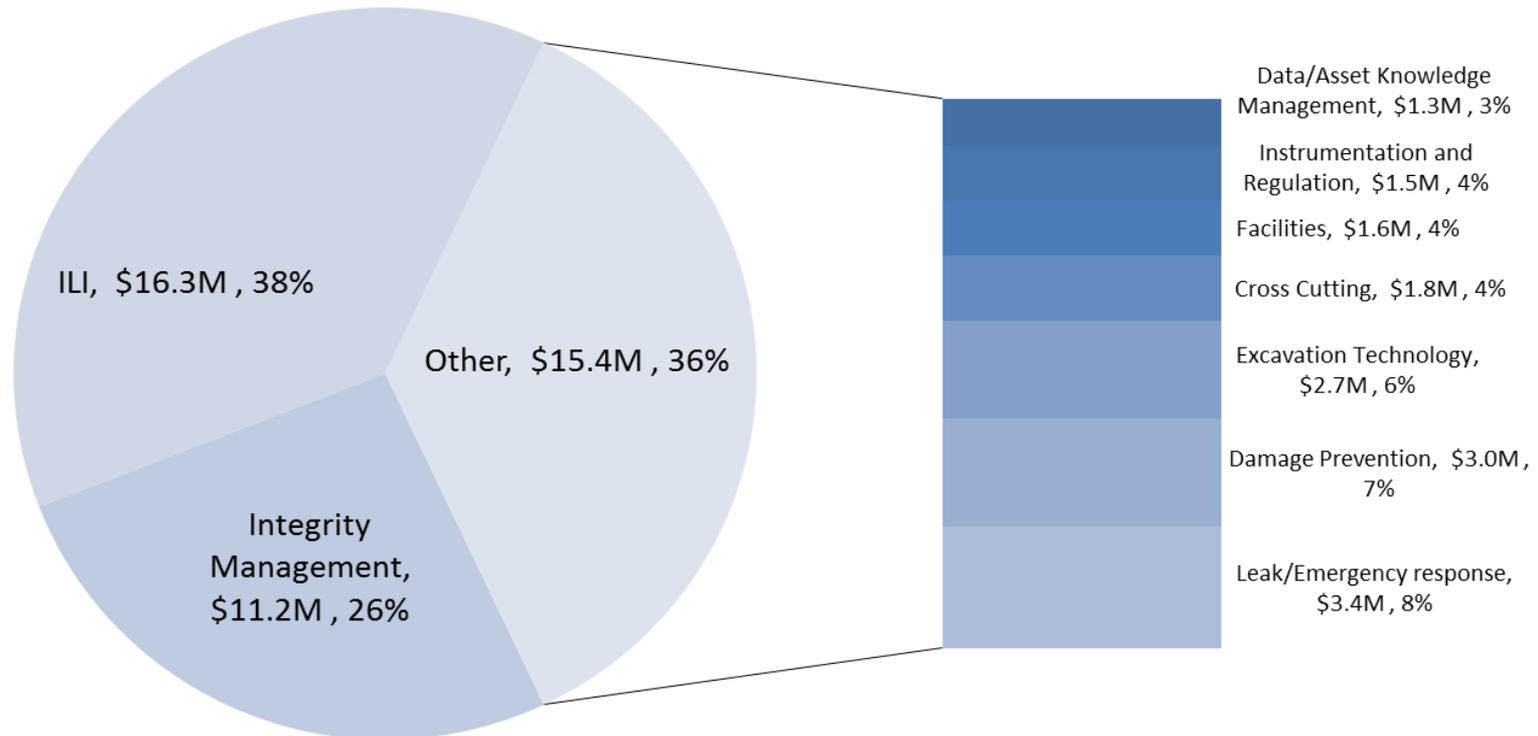




R&D and Innovation Portfolio

- 137 active projects, 6 in evaluation, 57 completed (as of June 30th, 2015)

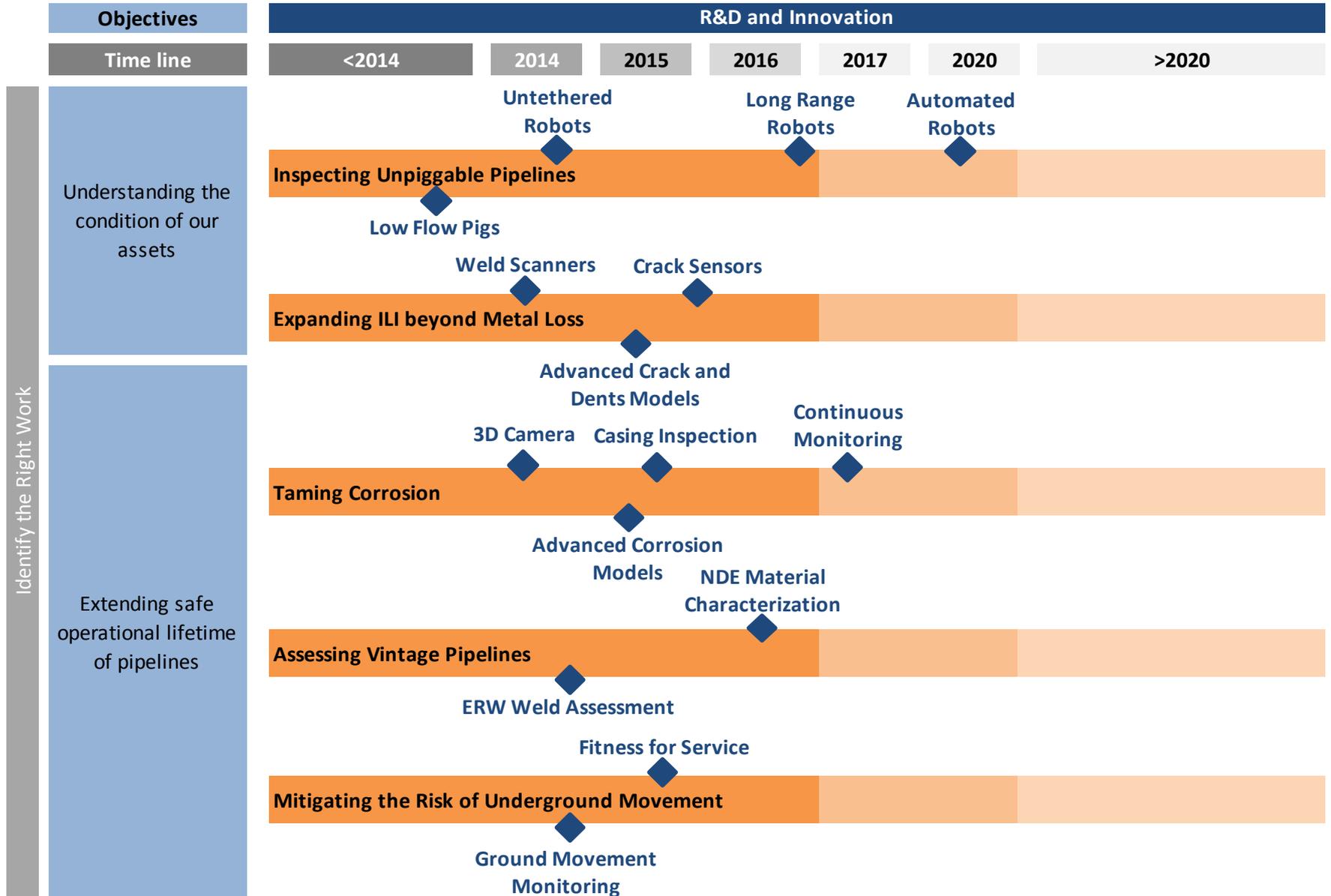
Current R&D and Innovation Portfolio
leveraging collaborative R&D



TOTAL: \$44M for \$3.7M PG&E funding

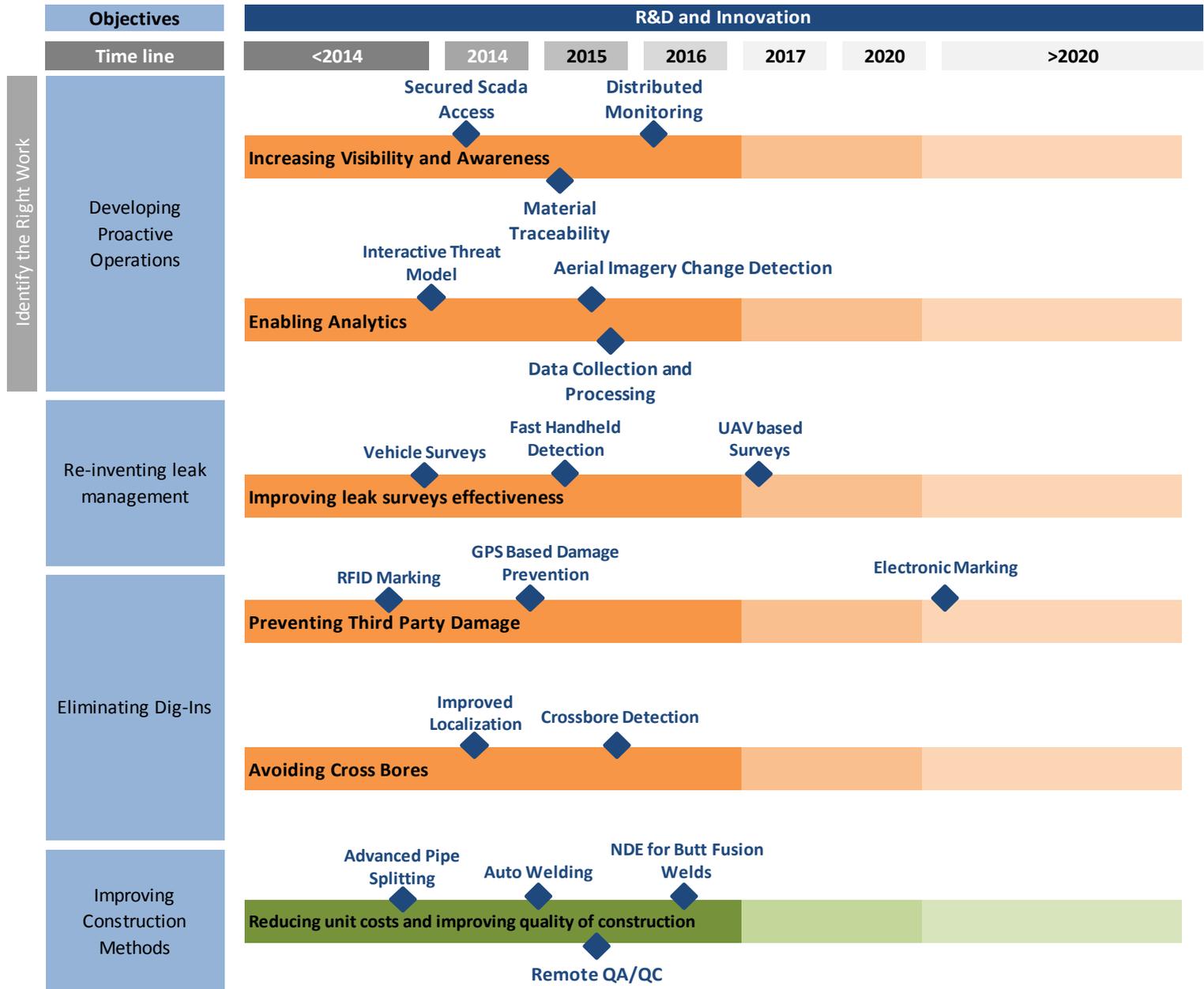


R&D and Innovation Road Map





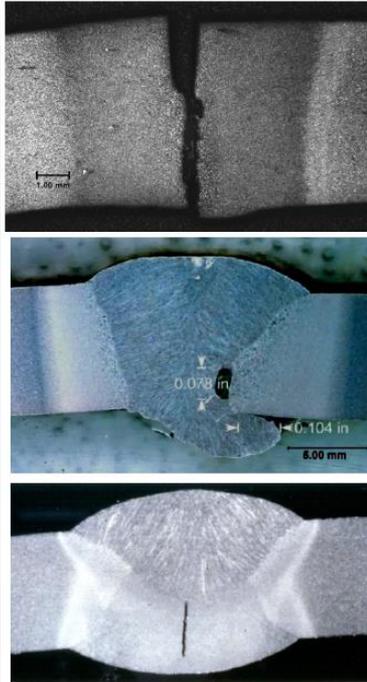
R&D and Innovation Road Map





Understanding the Condition of Our Assets

Critical Crack Size for In Line Inspection Specification



Axially-oriented manufacturing defects in long seams (ERW, SSAW, DSAW)

- NDE technologies for crack inspection are emerging for ILI platforms, but critical crack size parameters have not been established
- The project defined minimum reassessment interval as a function of flaw size and expected crack growth mechanisms and crack growth rates
- A calculation tool has been developed
- Results can be used to establish performance criteria for NDE tools on ILI platforms that would provide assurance of integrity comparable to hydrotesting

2013

Design

Develop

Test

Deploy

2015

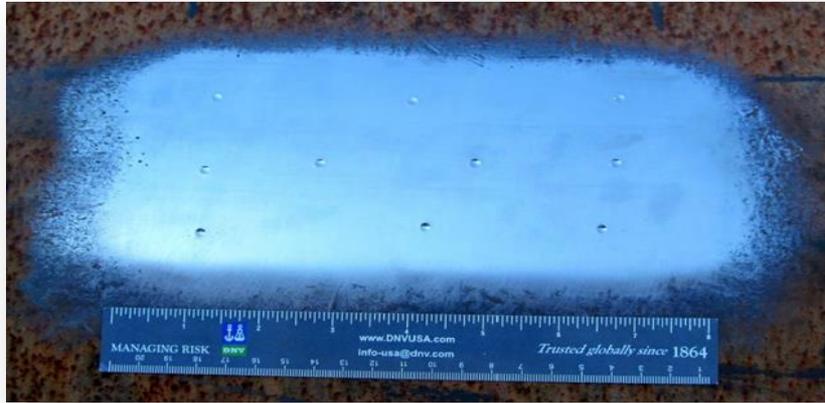




Extending the Safe Operation Life of our Pipelines



JIP: Using Hardness to Estimate Yield Strength



Telebrineller



Leeb Ball Rebound



Ultrasonic Contact Impedance (UCI)

- Joint Industry Project with 15 operators, led by DNV, to investigate the use of hardness testing to estimate yield strength of steel pipelines (API 5L, Grade B through X52)
- Results can help with determination and validation of MAOP and avoid pressure reductions.
- Common in-the-field hardness testers (Telebrineller, UCI, and Leeb Ball Rebound) evaluated against metallurgical characterization and tensile testing to validate approach.
- All instruments provided conservative estimates of YS compared to actual YS.



Leeb Ball Rebound

1999

2014

Design >> Develop >> Test >> Deploy

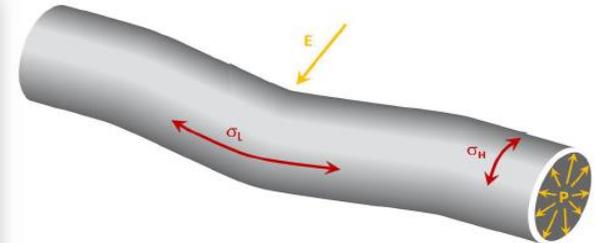


Joint Industry Project on Ground Movements

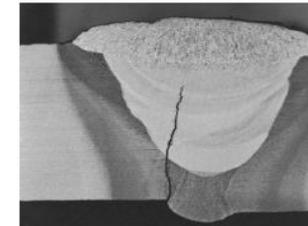
- Industry project started in April 2012 focused on development of Fitness for Service (FFS) assessments and best practice document for management of ground movement hazards
- Consortium of several oil and gas pipeline operators
- Study led by Center for Reliable Energy Systems (CRES)
 - Girth weld failures on vintage pipelines
 - Additional stresses exerted on pipelines (ground movement, residual stresses, construction activities, soil creep, heavy rainfall, etc.)
 - Characterization of pre-existing flaws on girth welds from welding (lack of penetration, hydrogen embrittlement, high-low misalignment, cracking, etc.)



Pipe Movement
→ Strain (ϵ) & Stress (σ_L)



Bending Strain & Stress
+
Girth Weld Features



2012

Design

Develop

Test

Deploy

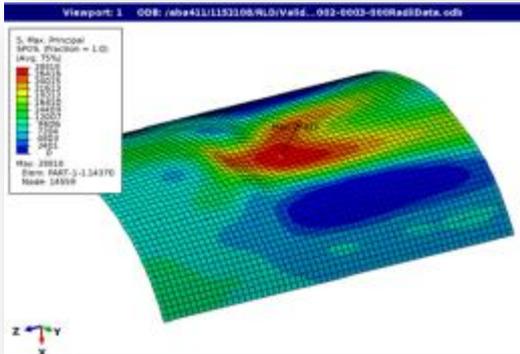
2015



CIP – Dent Validation

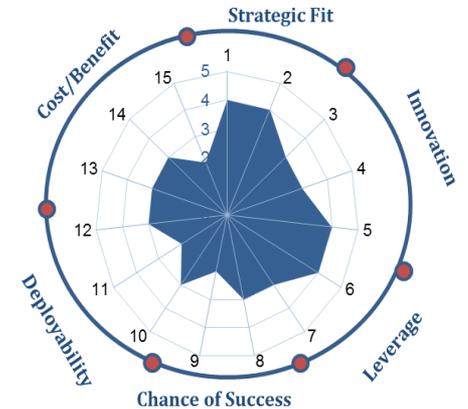


Full-scale Indenter at Stress Engineering Services



Stress Contour Plots from Finite Element Analysis of Sample Dent

- Collaborative Industry Project (CIP) funded by several oil and gas operators, led by Stress Engineering Services
- Objective is to perform dent severity analysis using ILI caliper sensor data
- Will build upon the Fitness For Service evaluation per API 579 and add full-scale pressure testing on a re-created sample, and repair solution if needed
- PG&E’s focus will be on unconstrained dents on 12” and 18” diameter pipelines
- Project to be completed by 1Q 2015





Developing Proactive Operations



Interactive Threat Model

	EC	IC	SCC	MFR	CON	EQ	IO	TPD	WROF
EC			0.017	0.148	0.017			0.013	
IC				0.052	0.019				
SCC									
MFR									
CON						0.208			
EQ	0.059								
IO	0.055					0.125			
TPD			0.089		0.009	0.012	0.006		0.098
WROF					0.096	0.158			

EC	External Corrosion
IC	Internal Corrosion
SCC	Stress Crack Corrosion
MFR	Manufacturing Defect
CON	Construction Defect
EQ	Equipment Defect
IO	Incorrect Operations
TPD	Third Party Damage
WROF	Weather Related Outside Forces

- Currently PG&E's model assigns a relative score for each threat for each segment of the Transmission system.
- To represent that threats may interact and increase risk, a model based on failure data has been developed by Kiefner with NYSEARCH
- Easy to integrate into existing risk model.
- Set of coefficients that represent the increased of likelihood of failure (LOF) due to threat interactions





Re-inventing Leak Management



Handheld Methane Detector

- The handheld methane detector utilizes the same laser based technology that NASA has installed on its planetary rovers to detect methane on Mars.
- The tool has superior sensitivity (parts per billion) compared to other commercial handheld detectors. It is also lightweight (150g).
- When completed, the tool is expected to reduce time taken to locate leak in association with vehicle based survey.



Using the handheld methane detector to pinpoint simulated leaks at Livermore training center (December 2014)

<http://www.pgecurrents.com/2014/11/04/video-pge-adapts-mars-rover-technology-for-gas-leak-detection-tool/>



Prototype of handheld methane detector (December 2014)





Stationary Methane Laser Sensor



Installed Remote Methane Leak Detector at PG&E
Livermore Training Center (February 2013)

- Continuously monitors pipelines and provides rapid warning of leaks.
- System consists of sensor, weather station, camera and computer station.
- Testing of the system co-funded with the California Energy Commission:
 - Demonstration of sensor efficacy
 - Evaluation of sensor response to leaks in typical operating scenarios and weather conditions
 - Elimination of false alarms
- Project is completed. Results were presented at the 2014 AGA Spring Conference.

2013

2014 ▼

Design

Develop

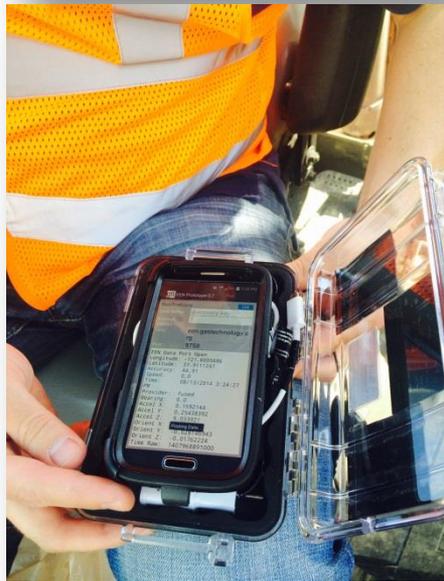
Test

Deploy



Eliminating Dig-ins

GPS based Damage Prevention



- Supplements 811 calls to provide additional protection
- Uses GPS location of construction equipment and movement patterns
- Sends alerts to field operators, and utility control room when equipment digs close to underground assets
- Solution expected to be cheaper and more effective than ultra-sonic and fiber optic detection systems
- First field tests performed at PG&E in August 2014 showed the system's ability to detect digging activities.
- Next steps include industrialization and extension to farming activities.





GDF SUEZ

RFID to mark plastic pipes and assure material traceability



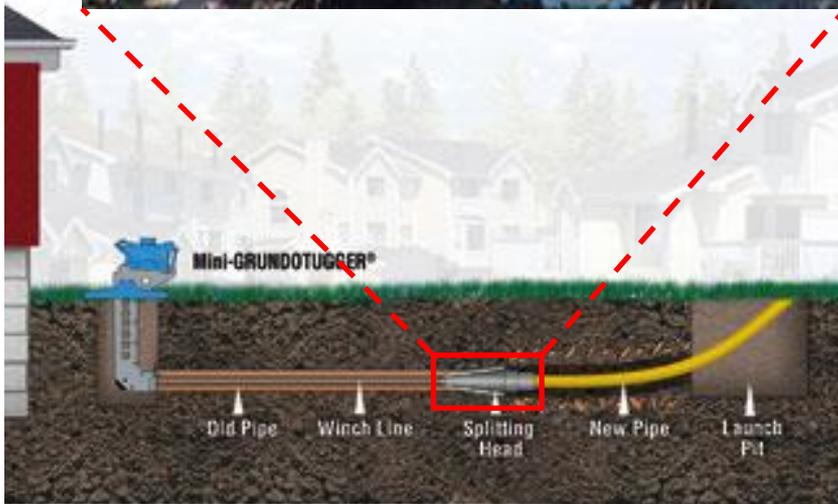
- RFID is used to precisely locate the pipe with active antenna.
- Precision is x-y: 1", z:4" down to 5'.
- Additional information about the pipe is recorded in the RFID following ASTM standard to assure material traceability.
- Developed in Europe. First field tests performed at PG&E in June 2014.
- Pipe embedded version is in development.





Improving Construction Methods

Polyethylene Pipe Splitting Tool Development



Mini-GRUNDOTUGGER from TT Technologies

- Pipe splitting technique involves splitting vintage Aldyl-A pipe and inserting new PE pipe in existing path
- Methodology is “trenchless” and lower in cost compared to excavation
- The project will focus on the development of standard pipe splitting tools and procedures.
- Project completion by Q4 2015.



Composite Repair on Polyethylene Pipe

- OTD-led project to evaluate composite repair for mechanically damaged polyethylene pipes.
- Currently, damaged pipes require gas shutoff, bypass of the damaged area, cut-out, and replacement. This solution will allow for repairs of small leaks without shutting off service.
- Testing will include mechanical property testing of Pipe Wrap, lap shear strength with polyethylene, and sample repair testing including burst testing, hydrostatic pressure testing, and impact testing.
- Study is expected to be completed by Q3 2015



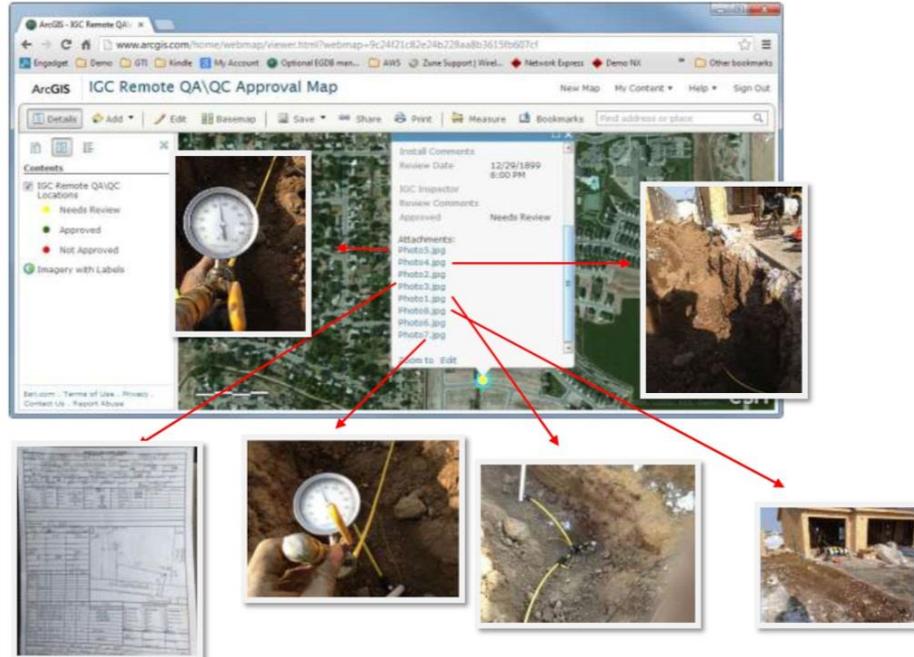
Composite repair trial on polyethylene pipe.



Hydrostatic pressure test on repaired sample; failure outside of repair area.



Remote QA/QC Process



Examples of Information captured in the field and automatically loaded within the GIS.

- Development of a remote QA/QC application to monitor the quality of field work in real-time by capturing pictures along the process.
- Remote monitoring of operations will effectively increase quality control of work by ensuring proper photo-documentation.
- Three pilot projects will be conducted with participating operators.
- Expected completion date is Q3 2015.





R&D and Innovation for Gas Operations at PG&E

- Collaborate with Others
- Build a Project Portfolio focused on Major Risks
- Use a rigorous Project Selection Process
- Develop Internal Network of Expert Leads
- Foster Innovation
- Drive Deployment



Thank you!



François Xavier Rongere

Tel: (925) 244-3070

Cel: (415) 517-0946

E-mail: fxrg@pge.com