



# RAPID+ System for Natural Gas Pipeline Integrity Management

California Energy Commission  
Staff Workshop July 16<sup>th</sup> 2015





# Acellent Technologies Inc. and SHM systems

- Headquartered in Sunnyvale, CA; spin-off from Stanford University;
- Global leader providing customized Structural Health Management solutions to a wide variety of industries.
  - Damage/crack detection, Corrosion monitoring,
  - Impact detection/monitoring,
  - Structural state sensing & Prognostics
- Certified in AS9100:2004 Aerospace Standards and ISO9001:2008
- Full-scale manufacturing & development facility; Worldwide system sales

## Core components of SHM system



## Active (damage detection) and Passive (impact damage) solutions

	Sensors	Hardware	Software
<b>Hot Spot Monitoring</b>		ScanSentry	ScanGenie mini SMART Patch
<b>Large Area Damage Detection</b>		ScanGenie II ScanGenie mini	SHM Composite
<b>Corrosion monitoring</b>		ScanPad	
<b>Impact Monitoring</b>		IMGenie II	AIM



## Background

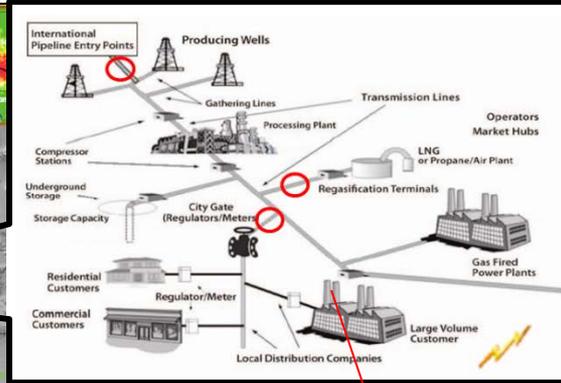
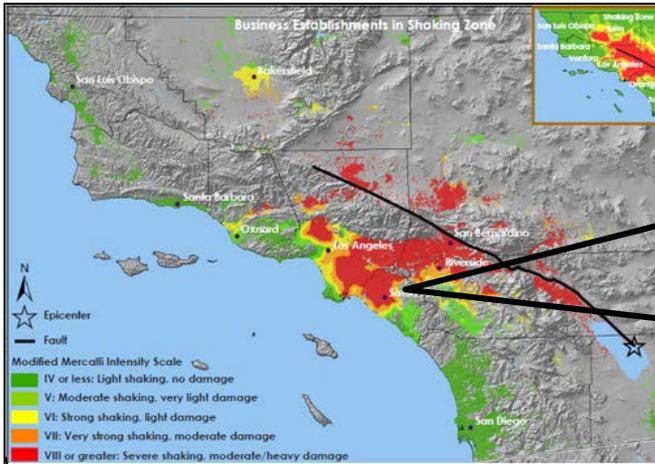
- Acellent Technologies, Inc. based in Sunnyvale CA, has developed a Real-time Pipeline Integrity Detection (RAPID) system in order to improve gas pipeline integrity management
- Under a previous CEC program (PIR-12-013), Acellent successfully performed research and development work to mature the RAPID system for damage monitoring in natural gas pipelines.
- In this program, the RAPID system has been enhanced into the RAPID+ system to provide early detection of incidental or intentional encroachment events that threaten the gas pipeline network in the ground and support the near field measurement of the severity of damage caused by the encroachment events.



# PIR-12-013 program: **RAPID** System for Gas Pipeline

**Real-time Active Pipeline Integrity Detection**

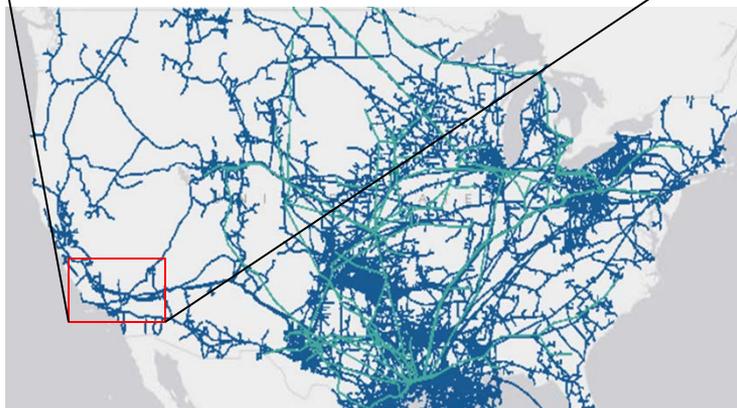
USGS Earthquake Hazard Map (usgs.gov)



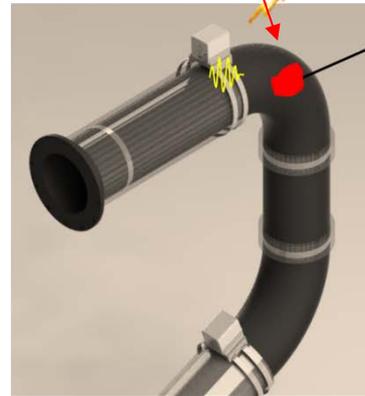
Verizon CDMA Network



Remote Monitoring



Natural gas pipeline network  
[www.greenovateboston.org](http://www.greenovateboston.org)



Pipe leakage detected



24/7 Relentless Monitoring  
Tracking Severity of Leakage

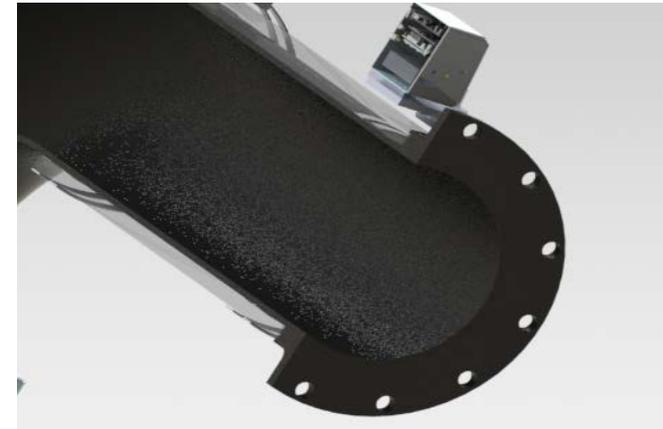
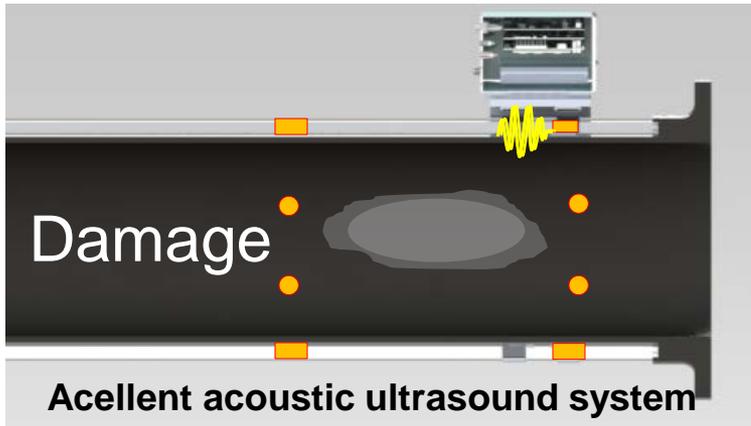


### Social Economic Benefits:

- Utility facility safety
- Economic Growth from sustainable energy



# RAPID System Operating Principle



Lamb wave-based acoustic sensor network

Historical Data



Continuous Scanning



Monitor Damage Growth Rate





## Straight pipe installation



## Bend Pipe Installation



Posted on July 14, 2014

## PG&E Testing New Monitoring Technology for Gas Pipelines

By Debbie Felix

**SAN RAMON** – At its Applied Technology Services facilities, PG&E recently coordinated a demonstration of new technology the company has been testing for its natural gas pipeline system. Developed by Silicon Valley-based Acellent Technologies Inc., the Real-time Active Pipeline Integrity Detection (RAPID) sensor system was designed to remotely monitor the structural health of pipelines by identifying potential concerns such as corrosion, cracks or other damage.

Tiny sensors embedded between strips of flexible film, which are wrapped around the outside of steel pipes, could one day provide PG&E with real-time, detailed information about the condition of its pipelines, especially in locations that are particularly susceptible to damage. By sending and receiving ultrasonic waves through the thickness of the pipeline steel to a data acquisition box installed on the pipe, PG&E's gas operations' engineers will get an advance warning when the condition of a pipe changes.

"The RAPID technology could one day transmit an alert in real-time to our engineers when it detects damage to a pipeline", said François Rongere, PG&E's research & development and innovation manager in gas operations. "This assures a faster response and repair time."

At the demonstration in San Ramon, two simulated corrosion cells of varying sizes and depths were installed on a test pipe using a plasma cutter. During the demonstration, Acellent's RAPID system located, measured and identified the depth of the corrosion cells. As a next step, PG&E will verify the accuracy of RAPID's findings using a laser scanner.



A data acquisition box sits atop a test pipe wrapped with sensors and covered with protective fiberglass (yellow bands) as part of new technology to remotely monitor pipeline health.



## RAPID System Future Plan

- Continued collaboration with utility companies on monitoring system in underground environment showing the reliability and sensitivity of detection system
- A more practical production and technology strategy will be developed based on revision plan of devices and enclosures with UL.
- Technology transfer and implementation with the natural gas pipeline industry



# Vision of PIR-14-015 Result

## Acellent Encroachment Detection System

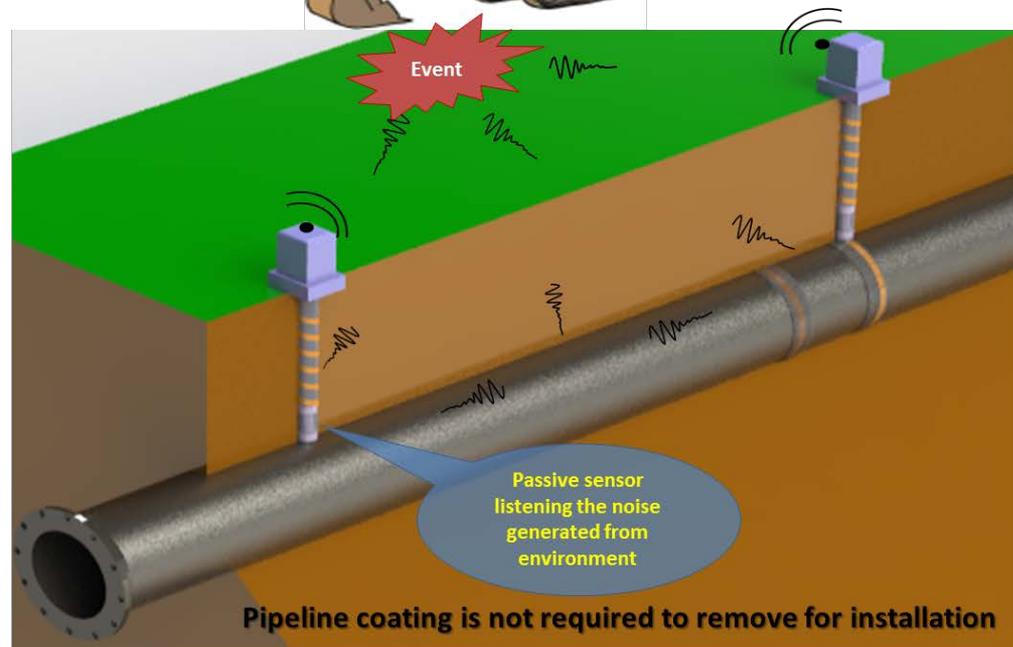


Acoustic sensors receive the noise created by environment abnormal activity

Underground sensors near the pipeline can map out the location and distance from the pipeline

Installation is easy and not required to remove existing pipeline protection/coating materials

Passive sensing and wireless communication enable mass- distribution to a large service area





## On-going Project Goals Y2016-2017

- Integrate and deploy the RAPID+ technology to the field.
- Evaluate the effectiveness of the deployed system and address any improvements direction for technology transfer to real applications
- Evaluate cost-benefits by applying advanced technologies for pipeline safety.
- Form an effective working force of critical committee members to direct the technology transfer and commercialization endeavors.



## Concluding Remarks

- RAPID technology can help to ensure the safety of natural gas pipelines based on 24x7 continuous monitoring.
- Technology provides better state awareness to the end user and supporting a real-time security monitoring, and schedule based inspections. “Reduce costs tremendously!”
- Acellent will conduct to demonstrate the system reliability in actual field environments and develop plans for implementation and deployment.



Thank you!

- Questions & Answers