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**2007 Government and Industry
Pipeline R&D Forum
Report**

New Orleans, Louisiana

February 7-8, 2007

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Executive Summary

Eleven government and industry organizations working through a steering committee, organized, planned and executed this forum. The forum brought together over 240 representatives from State, Federal, and international government offices together with domestic and international natural gas and hazardous liquid pipeline operators, along with several research providers and technology vendors. The forum's goals included identifying key challenges facing industry and government, sharing information on current research efforts, and identifying research that can help to meet the challenges. The organizing committee included presentations recognizing emerging technology success stories and federal government approaches to technology transfer of research during the forum.

The forum was successful in identifying key challenges facing industry and government and in noting many high-level challenges. The following challenges were identified:

1. Maintaining the safety, security and reliability of an aging pipeline infrastructure
2. Managing significant forecasted increases in energy demand forecasts
3. Fostering development of new technologies and strengthening industry consensus standards
4. Increasing R&D funding and leveraging R&D resources while improving R&D performance
5. Improving an effective technology transfer program through stakeholder communication
6. Protecting the environment while transporting new fuels to meet national energy needs

The forum opened with a keynote address on perspectives on energy pipelines by the DOT/PHMSA Administrator, Vice Admiral Thomas J. Barrett. Admiral Barrett focused on our successful enterprise approach to addressing pipeline safety research and development in the face of many new challenges. Some key challenges Admiral Barrett identified were global warming, transporting energy from new sources such as biofuels, existing aging infrastructure, strengthening distribution integrity management and the implications of transporting new fuels through an aging existing infrastructure.

Speakers representing the Pipeline and Hazardous Materials Safety Administration (PHMSA) and high level industry leaders representing hazardous liquid and natural gas

transmission and natural gas distribution trade organizations including the In-Line Inspection Association identified the following key technical challenges facing their organizations: *strengthening standards and risk management tools for use by operators and regulators, locating underground utilities, developing and applying effective encroachment enforcement techniques, determining real corrosion/crack growth rates, building consensus standards for confirmatory direct assessment practices, developing new tools for rapid detection of SCC, confirming and testing new tools for detecting and sizing defects, understanding causes and effects of damage from weather related pipeline movement, developing alternative repair methods, and assessing risks of using existing infrastructure to transport.*

Past forums, research workshops and conferences have identified several R&D opportunities to address pipeline challenges. Unfortunately, many previous government-developed technologies were not transferred to the marketplace because they lacked industry champions. When designing the 2007 forum, the steering committee incorporated an agenda item on key challenges facing industry which resulted in discussions on how to coordinate R&D more effectively in a government/industry partnership. Participants at the Forum discussed the need to face increasing environmental challenges as well as issues arising from interchangeability of products being transported and gas quality. Additional issues identified included the use of declining R&D funds, aging workforces/ infrastructure and approaches to effectively communicate new initiatives and their progress with the public. Steering committee members and their organizations expect to use this report as a common basis for discussions with their constituents on actions needed to support collaborative research and development for energy pipeline infrastructure.

Next, each of the three industry segment discussed their views on current issues. Included below are brief summaries of these three discussions.

1. Generating Innovation: Are we investing enough?

Sponsored by American Gas Association and Interstate Natural Gas Association of America (INGAA) Foundations, this discussion focused on a recent study comparing

R&D funding for the natural gas industry with similar industries. Findings showed that federal agencies' funding levels have decreased drastically over the past decade. This trend has resulted in elimination of long-term basic research for natural gas and emphasis on near-term-focused collaborative industry programs. Additionally, overall funding has decreased. Finally, the current R&D environment places a premium on coordination and communication between funders.

2. The Value of Government/ Industry Collaboration

This discussion by Pipeline Research Council International, Inc. (PRCI) focused on identifying the key industry organizations and government agencies supporting research for pipelines. PRCI addressed methods to broaden the knowledge base and awareness of issues, challenges, and needs to influence regulatory policy and decisions based on sound technical information. PRCI emphasized the need to use available industry/government funds wisely producing the greatest impact. Some continuing challenges addressed were aligning the process and schedules of industry and government procurements, securing research funding for high-risk but high-impact and high-value programs, and identifying which federal agency should be the catalyst to stimulate funding of long-term R&D initiatives.

3. Research and Development Success Stories

Forum participants next addressed successful commercialization of three new technology tools for the pipeline industry. The first tool was a remote methane leak detector which was a key technology used during the recovery operations after Hurricanes Katrina and Rita. Next, details on the live CCTV pipeline inspection tool were described as a pioneering technology for today's robotics programs. The final item discussed was how R&D influenced critical consensus standards needed to support operating natural gas pipelines in the U.S. at 80% SMYS.

Six Technical Track Sessions were then used to allow participants to explore the key challenges and research gaps identified on the first day. The general audience broke out into these sessions where they heard many examples from government and industry leaders on continuing research efforts, to identify gaps in ongoing R&D, prioritized remaining research gap, and provide important scope details on what the top three priorities should address. These details comprised a basic road map on the top three needs for each technical track topic. The following is a brief summary drawn from the track session report-outs.

1. Data Mining/Threat Assessment

This session focused on the technical issues and R&D needs related to (a) data types; (b) data collection, analysis and sharing; and (c) the use of data to prioritize threats, identify integrity challenges and prioritize threat assessment. Common themes among presenters included the need to move the pipeline industry toward a common course for the most effective and efficient systems for managing information, growing data overload issues, reporting inconsistencies, and the need for threat assessment for outside forces.

2. Excavation Damage Prevention

This session focused on the technical issues and needs for locating pipelines and other below ground utilities before digging. Enforcement of the One Call process was identified as the number one issue that needs to be addressed. Additionally, using global positioning system coordinates, monitoring encroachment, preventing damage while digging/boring, and continuing to evolve keyhole technologies were proposed as technical needs that research could address.

3. Direct Assessment (DA)

This session focused on technical issues and R&D needs for detecting, measuring and assessing the severity of defects that may arise during installation (girth weld defects, rock dents) or during operation (corrosion, SCC, impact damage). The current status of in-pipe and out-of-pipe inspection tools was reviewed. The capabilities of assessment methods for crack-like, metal-loss and deformation defects were examined. The applicability of current guidance, codes and standards was considered. A gap analysis revealed several general issues, including

- How to improve and quantify the accuracy and reliability of inspection tools
- Inadequate knowledge of where, and how fast, time-dependent damage occurs
- How to establish effective codes and validate/qualify procedures.

4. Defect Detection/ Characterization

This session focused on the technical issues and R&D needs for detecting/locating defects or leaks (internally or externally); developing consensus standards (i.e., API 1162); and determining from data collected “How big is the problem?”; sharing technology advancements in robotic camera technology for inside pipe castings; and identifying the need for defective coating detection technologies. Another gap in technology related to validation of the capabilities of long-range guided ultrasonics for in flaw discrimination.

5. Defect Remediation/ Repair/ Mitigation

This session focused on the technical issues and R&D needs for maintaining safe pipelines, repairing damaged pipelines and removing future threats. Discussions occurred on proactive damage prevention technologies centered on prevention

mitigation technologies as well as on keyhole technologies, advanced repair methods for plastic pipe and offshore pipelines repair because of severe weather damage.

6. New Fuels Transportation

This session focused on the technical issues and R&D needs from the impact of LNG on pipeline distribution systems, safety/security of LNG facilities, and the impact of ethanol or methanol blends on pipeline systems. Discussions occurred on the effects of gas interchangeability on LDC components, including continuing research to identify the impact of varying gas compositions on components based on ASTM standards and the general understanding of new fuels. This track session made special note that operators must be confident their facilities can perform safely, reliably, and cost-effectively when delivering mixtures of fuels. Last a discussion on the observation that little or no consideration is being given to assessing risks and developing implementation tactics to deal with the existing installed appliance population regarding gas composition.

Extra details are in the Appendix or posted at the following webpage:

http://primis.phmsa.dot.gov/rd/mtg_020707.htm.

Background

Forum Objectives, Approach, Organization and Sponsorship

What was the forum designed to achieve?

Our nation, and indeed the world, is strongly dependent on pipelines to deliver the energy needed to continue economic well being and to promote economic growth. As the current pipeline infrastructure continues to age and as increasing energy demand calls for new fuel mixtures and new pipelines, we must redouble our efforts to assure pipeline safety, integrity and reliability. Research and development represent critical items in increasing that assurance.

The objective of the forum was to allow government and industry pipeline stakeholders to develop a consensus on the technical gaps and challenges for future R&D. It addressed both short- and long-term research objectives for liquid/gas and transmission/distribution pipelines, covering onshore, offshore and extreme weather environments. Added discussion included outlining details of the final research goals and developing road maps identifying roadblocks or barriers preventing the technology use, technology demonstrations, technology transfer and commercialization. Specifically, the forum was designed to:

1. Develop a consensus agenda of technical gaps & challenges for future R&D;
2. Identify both short and long term research objectives for liquid/gas transmission and gas distribution pipelines;
3. Conduct basic road mapping on identified technical gaps so solicited research is addressing the needs effectively; and

4. Provide details of the ultimate research goals so appropriate end users are factored into project scopes.

How did the forum approach attainment of its objectives?

To achieve the stated objectives the forum explored the challenges facing the pipeline industry, shared information on recently completed and continuing tasks to address these challenges, and identified potential gaps or overlaps in the set of projects currently underway or in planning. The intended result was to inform the attendees and to identify various resources available to sponsors of research and development in defining their priorities. Other results considered important were sharing progress on related projects to gain knowledge of similar research efforts within the pipeline community. The agenda included extra time in all sessions for open discussions to define pipeline types, working environments, and performance needs and expected targets or time frames to complete the research. Each track session reported on methods to quantify benefits, improve planning activities, and address various demonstration options to maximize the potential for commercialization for the marketplace. Then, each track session considered how best to integrate standard organizations into research efforts to ensure high-quality outputs.

How was the forum organized?

PHMSA assembled a diverse steering committee with representation from many government and industry stakeholders to design and host a successful forum. This provided equal opportunity for representation and stakeholder involvement to discuss critical technical topics and to fulfill the forum objective. The steering committee had representation from the following:

DOT/PHMSA
DOI/MMS
American Gas Association
American Public Gas Association
American Petroleum Institute
Association of Oil Pipe Lines
Interstate Natural Gas Association of America
National Association of Pipeline Safety Representatives
Northeast Gas Association/NYSEARCH
Operations Technology Development
Pipeline Research Council International

How was the forum sponsored?

The Department of Transportation, Pipeline & Hazardous Materials Safety Administration's Office of Pipeline Safety provided the administrative funding to hold the forum.

The sponsors of breaks were American Gas Association, Association of Oil Pipe Lines, American Public Gas Association Research Foundation, American Petroleum Institute, Operations Technology Development, Northeast Gas Association, and In-line Inspection Association. These breaks provided opportunities to discuss topics identified during planned discussions, to explore various other issues with other participants, and to refresh before re-entering the forum.

GE Energy was contracted and provided facilitators to aid the Technical Track Session Chairs. This gave greater leverage to the session chairs and helped them be more efficient and successful.

Forum Overview

The Government Industry Pipeline R&D Forum was held in New Orleans, Louisiana on February 7-8, 2007. The 2-day event included roughly 240 representatives from Federal, State, and international government agencies; public representatives; research funding organizations; standards organizations; researchers; and pipeline operators from the U.S. and overseas. A list of attendees is in the Appendix.

The Forum's goals included identifying key challenges facing industry and government, sharing information on current research efforts, and identifying research that can help to meet the challenges. Participating organizations expect to use the forum results to help guide and focus their independent programs. All presentation material is posted publicly and available at: http://primis.phmsa.dot.gov/rd/mtg_020707.htm

Opening Session

The forum moderator opened the forum and welcomed all participants to New Orleans. Next, PHMSA presented a high level perspective on energy pipelines.

Key Challenges

High level industry perspectives on current and future key challenges were given and set the stage for expanded discussion through the remaining forum agenda. These perspectives represented the various pipeline types and the association representing the in-line inspection companies.

Liquid Transmission: Speaker: Tim Felt President and CEO, Explorer Pipeline Company
Gas Transmission: Speaker: Walter Ferguson Sr. Vice President, Operations, CenterPoint Energy
Gas Distribution: Speaker: Peter Terranova Vice President of Operations, UGI Utilities, Inc.
ILIA: Speaker: Garrett Wilkie President, In Line Inspection Association

Presentations from Industry Leaders

In each of these industry presentations, participants heard details from industry leaders about their experience and knowledge of the subject. Below is a listing of each presenter on the agenda for this session.

Discussion 1: Generating Innovation: Are we investing enough? Speaker: Robert Howard Vice-President Pacific Gas & Electric Corporation
Discussion 2: The Value of Government/Industry Collaboration Speaker: George W. Tenley, Jr. President Pipeline Research Council International
Discussion 3: Research and Development Success Stories The Remote Methane Leak Detector Speaker: Claude Trahan, Compliance Supervisor, Atmos Energy Live CCTV Pipeline Inspection Speaker: George Ragula, Distribution Technology Manager, PSE&G U.S. Natural Gas Pipelines Operating at 80% SMYS Speaker: David Johnson, Technical Consultant, Panhandle Energy (SUG)

Technical Track Sessions

Six concurrent technical track sessions were used to structure discussion of the key challenges facing industry and government, ongoing research activities, and additional R&D needs and details in the following areas:

1. Data Mining/Threat Assessment
2. Excavation Damage Prevention
3. Direct Assessment
4. Defect Detection/Characterization
5. Defect Remediation/Repair/Mitigation
6. New Fuels Transportation

Each technical session began with a review of the challenges identified in the opening session and those identified in the registration survey for that track. Participants then identified additional challenges specifically related to the track session's topic. Below are the identified top challenges. Additional information from each technical track session can be found in the Appendix.

Identified Future Research Gaps

Data Mining/Threat Assessment:

- Interchange Standards and tools between operators and regulators
- Advanced Risk Management tools and technologies

- Best Practices for Enterprise Integration

Excavation Damage Prevention:

- Improvements to technologies to quickly locate underground facilities
- Study effective methods of enforcement
- Early warning encroachment technology
- Intergrating accurate location techniques on excavation equipment

Direct Assessment:

- Determining realistic corrosion/crack growth rates
- Develop consensus standards for confirmatory Direct Assessment with Guided Ultrasonic Testing Technologies
- Develop tools to rapidly detect presence of SCC on site
- Develop and validate testing database on new LRGW-UT technology tools

Defect Detection/Characterization:

- Develop tools for defect sizing from inside & outside the pipe
- Develop validation and qualification standards for defect sizing and assessment
- Develop tools for assessment of mechanical damage severity

Defect Remediation/Repair/Mitigation:

- Develop new alternative repair methods for difficult access areas
- Study off-shore pipe movement during extreme weather conditions
- Study defect repair techniques/technologies from other industries

New Fuels Transportation

- Develop standardized process for identification materials for construction of pipeline and compatibility with new fuels
- Study alternate fuel compatibility risks with existing and new pipeline materials
- Conduct real-time monitoring of fuel components to generate a Data Warehouse containing fuel information

Presentations within the Technical Track Sessions

Following the identification of challenges, participants heard detailed presentations from industry leaders on the R&D work they were conducting. Below is a listing of the presenters for each track session. These presentations are available from the following web site: http://primis.phmsa.dot.gov/rd/mtg_020707.htm.

Session 1: Data Mining/Threat Assessment Chair: <i>Chad Zamarin, Colonial Pipeline</i> Facilitators: <i>Mick Collins, GE</i> <i>Jerry Rau, Panhandle Energy</i> <i>Sheila Wilson, PODS Association</i>	Chad Zamarin, Colonial Pipeline Chris Ziolkowski, GTI David Nemeth, Panhandle Energy Roger Little & Piyali Talukdar, DOT/PHMSA Steve Biagiotti, Structural Integrity Associates, Inc	Ed Weigele, GE Craig Wilder, BP Cheryl Trench, Allegro
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<p>Session 2: Excavation Damage Prevention Chair: Burt Williams, City of Mesa Co-Chair: Maureen Droessler Facilitator: Paul Wood, Cycla Corporation</p>	<p>Blaine Keener, DOT/PHMSA Manuel Terranova, GE Mark Andraka, Peco Energy Corporation Kiran Kothari, GTI</p>
<p>Session 3: Direct Assessment Chair: Chris Bullock, CenterPoint Energy Co-Chair: Keith Leewis, P-PIC Facilitator: Rudy Reid, GE</p>	<p>James Merritt, DOT/PHMSA Daniel Ersoy, GTI Drew Hevle, Enbridge Bob Fassett, PG&E</p> <p>Oliver Moghissi, CC Technology Gary Matocha, Spectra Energy Trevor Place, Enbridge Andrew Pulsifer, CenterPoint Energy</p>
<p>Session 4: Defect Detection/Characterization Chair: Daphne D'zurko, Northeast Gas Association Co-Chair: David Batte, PRCI Facilitator: Mauricio Palomino, GE</p>	<p>Robert Smith, DOT/PHMSA Jerry Rau, Panhandle Energy Daphne D'zurko, NGA/NYSEARCH Bob Francini, Kiefner & Associates Tom Bubenik, CC Technologies Peter Mudge, TWI Plant Integrity Larry Weigel, Structural Integrity</p> <p>Gary Burkhardt, SwRI Scott Ironside, Enbridge Dave Batte, PRCI Albert Teitsma, GTI Terry Boss, INGAA Garrett Wilkie, ILI Association Thomas Picciott, National Grid</p>
<p>Session 5: Defect Remediation/Repair/Mitigation Chair: Dave McNeill, Enbridge Co-Chair: Gary Vervake, Spectra Energy Facilitator: Val Bernardi, GE</p>	<p>Elizabeth Komiskey, DOT/PHMSA Manny Gagliano, DOI/MMS Gary Vervake, Spectra Energy Andrew Hammerschmidt, GTI</p>
<p>Session 6: New Fuels Transportation Chair: Joe Vitelli, Key Span Energy Co-Chair: Glyn Hazelden, GTI Facilitator: Emily Turner, GE</p>	<p>George Vradis, NGA/NYSEARCH Bob Wilson, Key Span Energy Yong Yi Wang, Engineering Mechanics Corporation of Columbus Glyn Hazelden, GTI Kevin Bodenhamer, Enterprise Products Company</p>

Following the presentations, participants identified priorities for R&D, and provided the required details to solicit effective research projects. A full list of the research opportunities identified in each track, can be found in the Appendix.

Draft Technology Transfer Plan

PHMSA staff presented the PHMSA Pipeline Safety Research and Development (R&D) Technology Transfer Plan to the main body at the R&D forum. PHMSA staff recognizes the challenges and understands that successful completion of R&D projects is not enough to meet PHMSA's mission. Carrying out an effective and rapid placement of new technologies into use is the objective of the plan. PHMSA's plan of partnering with pipeline stakeholders to measure and report on technology transfer efforts offers several parallel paths, not a single path to ensure success. Success with these endeavours needs diligence throughout the R&D project life and needs early involvement with targeted end users to ensure the technology pull towards commercialization. PHMSA identified several critical steps to lessen end user risk and shorten the time to commercialization while conducting demonstrations to benchmark the applicability of technology advances.

The draft technology transfer is posted at:

<http://primis.phmsa.dot.gov/rd/mtgs/020707/DraftTechnologyTransferPlan.pdf>

Follow up Actions

In the interest of designing future forums to be as useful as possible, feedback from participants was solicited on useful changes (additions, deletions or restructuring) and

will be incorporated in future designs. Details of the feedback can be found at the following web site: http://primis.phmsa.dot.gov/rd/mtg_020707.htm .

Acknowledgements

Highest Appreciation

This forum would not have been possible without the time, direction and support of the steering committee members. The added touch that the sponsoring organizations provided was greatly appreciated and positively received by the attendees.

Special Thanks

Special thanks should be noted to Christina Sames who organized the submission of the non-government sponsorship. Special thanks to General Electric (GE) Corporation for supplying “Black Belt” facilitators used in the technical track sessions. Special thanks to Paul Wood & Piyali Talukdar for their facilitation within the technical track sessions. Last, a special thanks to the city of New Orleans for hosting the event and best wishes for a speedy economic recovery.

Thank You

Thank you to everyone who traveled, attended, and participated in this forum. Your efforts have set a national pipeline research agenda for the near future.

Appendices

Technical Track Sessions Challenges and R&D Opportunities

1. Data Mining/ Threat Assessment:

Challenges

1. Data mining/threat assessment is dependent on (and limited by) the fundamental data management foundations and integration abilities.
2. Historically, data management development lagged behind new technology introduction. Recognition that the data management component must be considered in other areas of R&D.
3. Data quality and complexity is growing and growing and growing.
4. Consensus that in many areas, data already exist that is not fully utilized, that technology to bring data together already exists, and that effective technology transfer should be attainable.

Research Opportunities

1. Interchange standards and tools between operators and regulators
2. Advanced risk management tools and technologies
3. Best Practices for Enterprise Integration
4. Data Model for transmission and distribution
5. Spatial Accuracy Coordinate Transform/ Translation. Software standards aimed at legacy GIS
6. Temporal Connectivity Persistence (Historical data, maintain the data set with current pipe) in either direction, or look at how the pipeline has changed over time.
7. Tools to decentralize data integration from field data collection of threat to ensure data get all the way into the corporate database.
8. Integration of traditional paper oriented data,
9. Data Quality- Tools to maintain/ correct the data, quality, (Extract, Transform, Load)
10. Association of Critical data with applications that use this data
11. Collection and comparison of ILI data to understand repeatability of data on re-inspection with different inspection tools.
12. Ground penetrating radar to determine depth of pipe
13. Internal data on facilities to be improved radiography and location of small pipe within facilities
14. Use automation to monitor aircraft photography for changes in Right of Way (ROW)
15. Spend more time analyzing data then gathering and correcting data
16. One call sheets- Ability to mine data to look for trends, predictive models
17. Standards and protocols for comparing field inspection results with ILI data for multiple threats. Feedback into the ILI technology

18. Legacy data- Global involvement is leading this industry. Same faces. Tools to collect new data or convert old data. 90% of the time is used getting the less important data.
19. Data management best practices. How can we come up with strategies that can enhance company specific data challenges?
20. Ability to automate the reporting and the receipt of the report by PHMSA.
21. Understanding the core technology capabilities, available public data. What data, accuracy can be leveraged by the pipeline company.
22. Reporting tools to pull data into meaningful formats, dashboard concepts? Have data presented in a meaningful format. Development of a standard output for reporting, mining data.
23. Normalizing leakage history for trend analysis

2. Excavation Damage Prevention

Challenges

- Strengthening education and enforcement will have a major impact
- Limited knowledge on offshore damage prevention. This is where the greatest risk is associated with pipelines in shallow water.
- Study the results and implications from current ongoing work before future procurements

Research Opportunities

1. Improvements to technologies to quickly/ accurately/cheaply locate underground facilities
2. Effectiveness of enforcement – a social research issue
3. Technology to provide early warning of the presence of excavators
4. Technology to integrate accurate information on pipe location into operation of excavation equipment.
5. Strengthen the completeness and usability of damage data from DIRT as well operator data bases
6. Off-shore damage prevention
7. Develop excavation methods that don't damage underground utilities
8. Understand the effectiveness of candidate approaches to education- social science research
9. Use of available technology to detect underground utilities and shutdown excavation equipment
10. Demonstrate cost effective/timely coupling between one call and excavation permitting
11. Means to strengthen the effectiveness of use of location information during excavations
12. Means to more effectively engage other stakeholders, including underground utility owners, in local damage prevention efforts.

3. Direct Assessment

Challenges

- Assessing Difficult Situations
- Consensus Standards and Procedures development
- DG/WG Validation for Unique Situations
- Detection of internal Corrosion Flaws
- Integration of Different DA Methods for synergies
- Determination of number of dig requirements
- Consistency of Survey Practices, Results, Methods

Research Opportunities:

1. New and improved tool development in support of DA
2. Determine the true risk associated with difficult to assess situations
3. Understanding and interpreting data results
4. Approval of GWUT for assessment in other technologies
5. Construction Practices
6. Tools for real time detection of corrosion environment conditions
7. Corrosion Growth Rate determination
8. Flow model improvements
9. Feasibility Assessment Guidance
10. Validation of System Analysis Approach
11. Identification of monitoring tool placement
12. Rapid detection tool for presence of SCC in the ditch

4. Defect Detection/Characterization

Challenges

- Discriminating mechanical damage features
- Extending the performance of guided wave ultrasonic testing
- Inspection through coatings, scale
- Understanding the site-selectivity of SCC, corrosion
- Field testing and demonstration – building confidence in inspection tool performance

Research Opportunities:

1. Develop in-the-field rapid detection of SCC
2. ILI for SCC in gas pipelines
3. Quantified probability of detection
4. Develop tools for corrosion and SCC growth monitoring
5. Field-relevant growth rates for corrosion, MIC, SCC

6. Understand crack interaction, coalescence
7. Better correlation between material toughness (K_c) and Charpy energy
8. Understand how coatings degrade/disbond and lead to start of corrosion/SCC
9. Interpretation of MFL signals from mechanical damage features
10. Influence of mechanical damage features on failure pressure, remaining life

5. Defect Remediation/Repair/Mitigation

Challenges

- Refining safety zones and supporting public dialogue
- Managing gas quality
- Metering technologies
- Storage options
- Emissions compliance
- Alternatives to Hydrotesting
- Self healing pipes
- Development of Strain Criteria to deal with pipelines repaired.

Research Opportunities

1. Reliabilities of tools for high strength steel/ limitations of repairs
2. Restoring capacity through HCA (Operate at lower pressure, reinforcing linings, restore design factors)
3. Develop less expensive ways of making repairs.
4. Study how effective hydro testing is towards crack remediation
5. Determine how effective CP is in mitigating SCC

6. New Fuels Transportation

Challenges

- Developing the next generation of alternative fuel blends that are compatible with existing and new materials in the construction of pipelines.

Research Opportunities

1. Develop standards for the content of gas and hazardous liquids for compatibility with existing and new materials for pipelines.
2. Catalog gas transmission infrastructure materials and establish compatibility with alternate supplies
3. Update AGA bulletin 36, establish enterprise wide interchangeability assessment processes and criteria consistent with other global evaluation methodologies

4. Assess existing pipeline infrastructure for supply blending opportunities, supply reliability & contingency
5. Comprehensive national study to assess the nations pipeline infrastructure – long term/short term retrofit or build options
6. Review pipeline integrity and management standards to ensure alternate fuels are compatible with existing standards and practices.
7. Examine the need for additional fuel conditioning to maximize alternate fuel supply
8. Study the environmental issues inside the pipe.

Forum Participants

1.	Bertges, Bill	
2.	Lidiak, Peter	API
3.	Fingerhut, Martin	APPLUS RTD
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49.	Pearson, David	Colonial Pipeline Company
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54.	Wilson, David M.	ConocoPhillips Pipe Line Company
55.	Ecock, Edward	Consolidated Edison Co.
56.	Mahboob, Ijaz	Contracting & Technical Services, Inc.
57.	Singer, Marc	Corrosion Center - Ohio University
58.	Kroon, David	Corrpro Companies, Inc.
59.	Zellers, Gary	Corrpro Companies, Inc.
60.	Compton, Butch	Crosstex Energy
61.	Torbin, Robert	Cutting Edge Solutions LLC
62.	Wood, Paul	Cycla Corp/PHMSA
63.	Alvarado, Alex	DOI/MMS
64.	Kovacs, Stephen	DOI/MMS
65.	Keener, Blaine	DOT / PHMSA / OPS
66.	Komiskey, Elizabeth	DOT-PHMSA
67.	Smith, Robert	DOT/PHMSA
68.	Merritt, James	DOT/PHMSA
69.	Steffan, Andrew	Dresser Piping Specialties, Dresser, Inc.
70.	Jezerinac, Dan	Dresser, NGS
71.	Bodenhamer, Kevin	EPCO, Inc.
72.	Mohr, William	EWI
73.	Khurana, Shuchi	EWI Inc.
74.	Boring, Matt	Edison Welding Institute
75.	Kratzenberg, Robert H.	Edison Welding Institute (EWI)
76.	Xu, Junde	Edison Welding Institute, Inc.
77.	Wood, Ian	Electricore Inc.
78.	Hevle, Andrew	Enbridge Energy
79.	Place, Trevor	Enbridge Inc.
80.	McNeill, David	Enbridge Pipelines

81.	Ironside, Scott	Enbridge Pipelines Inc.
82.	Jacob, Alan	Energy Solutions International
83.	Hinson, Leon	Energy Gas Operations
84.	Waddell, Kevin	Enventure Global Technology
85.	Felt, Timothy	Explorer Pipeline Company
86.	Avioli, Michael Joseph	FBS, Inc.
87.	Rose, Joseph	FBS, Inc.
88.	Fay, Jim	GasOperations
89.	Quick, Eric	GE - PII Pipeline Solutions
90.	Stimson, James	GE - PII Pipeline Solutions
91.	Palomino, Mauricio	GE - PII Pipeline Solutions
92.	Turner, Emily	GE - PII Pipeline Solutions
93.	Collins, Mick	GE - PII Pipeline Solutions
94.	Wiegele, Edward	GE - PII Pipeline Solutions
95.	Hazelden, Glyn	Gas Technology Institute
96.	Maupin, Julie	Gas Technology Institute
97.	Hammerschmidt, Andy	Gas Technology Institute
98.	Kothari, Kiran	Gas Technology Institute
99.	Ersoy, Daniel	Gas Technology Institute
100.	Mamoun, Michael/M	Gas Technology Institute
101.	Teitsma, Albert	Gas Technology Institute
102.	Ziolkowski, Christopher	Gas Technology Institute
103.	Bernardi, Valeriano	General Electric - Oil and Gas - PII
104.	Grissom, Michael	Genscape, Inc.
105.	Irvani, Hadi	GeoFields
106.	Water, Gary	GeoFields, Inc.
107.	Spickler, Fred	Global Information Systems
108.	Tiratsoo, John	Global Pipeline Monthly
109.	Wang, Henry	Gulf South Pipeline Company
110.	Maraia, Frank	Gulf South Pipeline Company, LP
111.	Midgley, Graham	Heath Consultants Incorporated
112.	Rutherford, Jim	Heath Consultants Incorporated
113.	Mandich, Ivan	ICM, U.S. Engineering, LLC
114.	Stearns, Steven	ITT - Space Systems Division, ANGEL Service
115.	Brake, Daniel	ITT Corporation - ANGEL Service
116.	Stearns, Steve	ITT Industries Space Systems Division
117.	Zhao, George	Intelligent Automation, Inc.
118.	Boss, Terry	Interstate Natural Gas Association of America
119.	Goldfine, Neil	JENTEK Sensors, Inc.
120.	Skinner, John	JP Kenny
121.	Kendrick, Andy	Kendrick Consulting LLC
122.	Kushner, Todd	Kendrick Consulting LLC
123.	Vitelli, Joseph	KeySpan Energy Delivery

124.	Haines, Harvey	Kiefner & Associates
125.	Francini, Robert B	Kiefner and Associates, Inc.
126.	Drenthen, Jan G.	Krohne
127.	Farmer, Joseph C.	Lawrence Livermore National Laboratory
128.	Atkins, Molly	Longhorn Pipeline
129.	Schaunaman, Larry	Longhorn Pipeline
130.	Mergist, James	Louisiana Department of Natural Resources
131.	Batte, David	MACAW Engineering
132.	Pikas, Joseph	MATCOR
133.	Massin, Heidi	Massin Consulting Services, LLC
134.	McElroy, Robert	McElroy Consulting, LLC
135.	Watkins, Wes	Michael Baker Jr., Inc.
136.	Mayernik, Christine	Michael Baker, Jr., Inc.
137.	Miesner, Tom	Miesner, LLC
138.	Else, Mik	Minerals Management Service
139.	Gagliano, Manny	Minerals Management Service
140.	Goldberg, Linda	NACE International
141.	Johnson, Cliff	NACE International
142.	McColskey, David	NIST
143.	Meegoda, Jay N.	NJIT
144.	D'Zurko, Daphne	NYSEARCH
145.	Fabiano, Angelo	NYSEARCH
146.	Vradis, George	NYSEARCH
147.	Janega, George	NYSEARCH
148.	Peterson, Allen	NYSEG
149.	Jeglic, Franci	National Energy Board
150.	Murray, Alan	National Energy Board
151.	Swiech, Craig	National Fuel Gas
152.	Picciott, Thomas	National Grid / Nysearch
153.	Brush, Ron	New Century Software, Inc.
154.	Smith, Greg	New Century Software, Inc.
155.	McNamara, John	New Mexico State University
156.	Nichols, Kris	Nicor Gas
157.	Capizzi, James N.	Nonlinear Ion Dynamics, LLC
158.	Nesic, Srdjan	Ohio University, Institute for Corrosion and Multiphase Flow
159.	Leewis, Keith	P-PIC
160.	Srivastava, Vipul	PARSONS Corporation
161.	Topek, Philip	PDA
162.	Talukdar, Piyali	PHMSA/PHP-10
163.	White, Gary R.	PI Confluence, Inc
164.	Wilson, Sheila	PODS Association
165.	Brooks, Paul	Pacific Gas & Electric Company
166.	Howard, Robert T.	Pacific Gas & Electric Company
167.	Fassett, Robert	Pacific Gas & Electric Company
168.	Rau, Jerry F.	Panhandle Energy

169.	Johnson, David	Panhandle Energy
170.	Nemeth, David	Panhandle Energy
171.	McQuilling, David	Panhandle Energy
172.	Finlayson, Richard	Physical Acoustics Corporation (PAC)
173.	Ramachandran, RAM	Pipe Line Trust & St Charles Parish La
174.	Thetford, Scott	Pipeline Research Council International, Inc.
175.	Tenley, George	Pipeline Research Council International, Inc.
176.	Weimer, Carl M.	Pipeline Safety Trust
177.	Winnie, Harold	Pipeline and Hazardous Materials Safety Administration
178.	Vierk, Glen	Pipeline and Hazardous Materials Safety Administration
179.	Boros, Stephen	Plastics Pipe Institute
180.	Chang, Benjamin T. A.	PolyLab
181.	Jones, Philip	Profile Technologies, Inc.
182.	Focia, Ronald	Profile Technologies, Inc.
183.	Randazzo, Bert	Project Consulting Services, Inc.
184.	Templet, Dwayne	Project Consulting Services, Inc.
185.	Mars, Rex	Project Consulting Services, Inc.
186.	Vogt, Gary	Project Consulting Services, Inc.
187.	Ragula, George	Public Service Electric & Gas Co.
188.	Webster, Andrew	Quality Connector Systems
189.	Avery, Lee	Quality Connector Systems
190.	Papenfuss, Stefan	Quest Integrity Pipeline Resources
191.	Anderson, Ted	Quest Reliability LLC
192.	Saeed, Rick	Questar Gas Company
193.	Foley, Chris	RCP
194.	Rubinshteyn, Alexander Isaac	ROSEN USA
195.	Mallia, Joseph	Rochester Gas and Electric
196.	Rincon, Jose	SEPCo
197.	Gruenberg, Michael	Southwest Gas Corporation
198.	Miller, Scott D	Saudi Aramco
199.	Wrzyszczyński, Mark	Shell
200.	Lemonier, David	Shell Exploration and Production Company
201.	Broussard, Gweneyette	Shell Pipeline Company LP
202.	Sitterly, Brian	Shell Pipeline Company LP
203.	Bethel, Kyle	Smart Pipe Company LP
204.	Stringfellow, William	Smart Pipe Company LP
205.	Charboneau, Kenneth	Smart Pipe Company LP
206.	Catha, Steve	Smart Pipe Company,LP
207.	Perry, Laurie	Southern California Gas Company
208.	Newton, Edward	Southern California Gas Company
209.	Chadburn, William A.	Southwest Gas Corporation
210.	Gustilo, Paul	Southwest Gas Corporation

211.	Burkhardt, Gary	Southwest Research Institute
212.	Song, Frank	Southwest Research Institute
213.	Bowles, Edgar B.	Southwest Research Institute
214.	Oh, Daniel	Southwest Sciences, Inc.
215.	Matocha, Garry	Spectra Energy
216.	Vervake, Gary	Spectra Energy
217.	Scrivner, Ron	Stress Engineering Services
218.	Weigel, Larry	Structural Integrity Associates
219.	Lebsack, Scott	Structural Integrity Associates
220.	Biagiotti, Steve	Structural Integrity Associates
221.	Weigel, Larry	Structural Integrity Associates
222.	Van Arsdale, Gloria	T.D. Williamson, Inc.
223.	Mudge, Peter	TWI
224.	Baker, Floyd Allen	TWI USA
225.	Summa, Joseph	Technical Toolboxes, Inc.
226.	Demirovic, Nedzad	Technical Toolboxes, Inc.
227.	Olson, Leslie	Texas Transportation Institute
228.	Roop, Stephen	Texas Transportation Institute
229.	Chittick, David	TransCanada Pipelines
230.	Worthingham, Robert	TransCanada Pipelines
231.	Allouche, Erez	Trenchless Technology Center/Louisiana Tech University
232.	Mason, Chris	Williams Gas Pipeline
233.	Linn, Craig	Williams Gas Pipeline
234.	Birken, Ralf	Witten Technologies Inc.
235.	Droessler, Maureen	Operations Technology Development
236.	Olson, Leslie	Texas Transportation Institute
237.	Rizkalla, Moness	via+
238.	Holohan, Vincent	Washington Gas
239.	Macintosh, Scott	Witten Technologies, Inc
240.	Gremillion, Jack	www.valvesafety.com