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2005 Government and Industry Pipeline R&D Forum Proceedings

2005 Government and Industry Pipeline R&D Forum

Houston, Texas

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Proceedings

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Executive Summary

A steering committee comprised of thirteen government and industry organizations organized, planned and executed this forum. The forum brought together over 185 representatives from State, Federal and foreign government offices along with domestic and foreign natural gas and hazardous liquid pipeline operators. 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 forum was successful in identifying key challenges facing industry and government. Many high level or overall challenges were noted. These were identified as the following set of challenges:

1. Maintaining the safety, security and reliability of an aging pipeline infrastructure.
2. Managing significant energy demand forecasts.
3. Protecting the environment while addressing national energy needs.
4. Fostering the development of new technologies and strengthening industry consensus standards.
5. Leveraging R&D resources while improving R&D performance.
6. Conducting an effective program of technology transfer and communication with stakeholders.

The Office of Pipeline Safety (OPS), National Institute for Standards and Technology (NIST), Minerals Management Service (MMS), Interstate Natural Gas Association of America, American Gas Association, Association for Oil Pipelines, and the In Line Inspection Association identified the following as a few of the key technical challenges facing their organizations: *ageing pipelines and facilities, ability to interpret and classify internal inspection data, knowledge of interaction between anomalies and pipe features, knowledge of impact on pipe integrity by environmental factors, monitoring encroachment activity, affordable and effective leak detection, increasing infrastructure capacity, fatigue life prediction, gas quality and inter-changeability, continuously changing public expectations, limiting emissions, and permitting to expand the infrastructure.*

An interagency overview provided a summary of coordination, collaboration and co-funding occurring between the Department of Transportation, Department of Energy, Department of Commerce, and Department of the Interior on pipeline research. The Pipeline Safety Improvement Act of 2002 brought this government group together and provided a means to jointly report to Congress on their pipeline research activities. This relationship seems to have reduced duplication of efforts, identified joint initiatives and leveraged agency resources.

A summary presentation identified the efforts of a recently formed government and industry steering committee. The committee, comprised of government agencies, industry trade associations and research organizations, is addressing the role of the energy pipeline infrastructure and how research supports its use. Steering committee members and their organizations will use the report as a common ground for discussions with key decision makers on actions required to support collaborative research and development for energy pipeline infrastructure.

During a luncheon presentation, audience members were informed why research is important to the Consolidated Edison Company of New York. Several examples were given which identified the benefits of research and how it must be employed to maintain and expand upon the infrastructure. Specific projects were showcased and demonstrated how challenges can be mitigated and technology can be commercialized through research.

In past forums and at other research workshops and conferences, several R&D opportunities are usually identified which can address industry and government challenges. Unfortunately, many of these funded R&D opportunities are ill planned, missing a champion and results are not transferred to the market. When designing the 2005 forum, the steering committee factored in Brainstorming Sessions generating new discussions on how to identify and measure the benefits from research, improve our research effort planning, demonstrate technology and deploy it to the market, certify that research outputs are of high quality, and integrate standard organizations into funded research.

Five Brainstorming Sessions were organized and designed into the agenda. The general audience broke out into these sessions, heard many examples from government and industry leaders and was provided time for open discussion with the topic. A brief summary is included below and was drawn from the report-outs given.

1. Benefits from Research

This session focused on identifying and measuring the benefits from conducting research. Industry and government leaders opened lines of discussions including: identifying who sets project goals, which stakeholder group benefits apply to, and when is it possible to measure benefits.

2. Road Mapping

This session focused on designing projects for ultimate outcomes and validated how road mapping facilitates successful application of project results. Industry and government leaders opened lines of discussions including: joint planning with appropriate stakeholders, defining times frames and goals, pledging a commitment to follow the road map, factoring in funding schedules from various sources, and how to handle out of box ideas.

3. Technology Demonstrations & Transfer

This session focused on improving ways to transfer research results to end users and how technology demonstrations should be used to benchmark technology applicability. Industry and government leaders opened lines of discussions including: intellectual property issues, regulations that do not reflect new technologies, tracking successes and failures, and jointly developing demonstration protocols.

4. Peer Reviews

This session focused validation that funded research will be of high quality. Industry and government leaders opened lines of discussions including: why quality outputs are important, pre and post award components of peer reviews, what the government requirements are, and using these reviews to tie in road mapping and knowledge transfer goals.

5. Standards Development

This session focused on improving ways to transfer research results which apply to consensus standards. Industry and government leaders opened lines of discussions including: creating a fast tracked process, including stakeholders early in the process, diligence of keeping stakeholders involved during the process, and reviewing past success and failures.

The forum expanded upon the key challenges and research gaps identified on the first day through six Technical Track Sessions. The general audience broke out into these sessions, were informed of ongoing research efforts, prioritized remaining research gaps and provided important scope details on what the top five priorities should address. A brief summary is included below and was drawn from the report-outs given.

1. Damage Prevention

This session focused on the technical issues and R&D needs for damage prevention of pipelines. The workshop participants identified needed and high value research and development including: right of way encroachment monitoring, locating existing damage, mapping the location of pipelines, avoidance sensors on digging and boring equipment, and lowering the cost of such technologies.

2. Direct Assessment

This session focused on the technical issues and R&D needs for direct assessment of pipelines. The workshop participants identified needed and high value research and development including: identifying, develop and demonstrate tools and techniques to fill the gaps and expand the applicability of ECDA & SCCDA, characterizing the accuracy and range of applicability of ICDA methods, characterizing which models apply to what situations, and characterizing the impact of uncertainties in ICDA application.

3. Inspection/ Repair/ Leak Detection

This session focused on the technical issues and R&D needs for inspection, repair, and leak detection of pipelines. The workshop participants identified needed and high value research and development including: identifying technologies to support repair decisions, developing guidance on material selection for repairs, expanding the capabilities of robotic inspection for unpiggables, in-ditch inspection for SCC characterization, maximizing data acquisition, qualitative screening and ranking of mechanical damage, inspect pipes of various steel grades and non-metallics, assessing the significance of the small leak problem, managing perceptions, real-time monitoring and detection of small leaks, and pinpointing the location of leaks.

4. Design/ Construction/ Materials/ Welding

This session focused on the technical issues and R&D needs for design, construction, materials and welding of pipelines. The workshop participants identified needed and high value research and development including: a comprehensive set of design tools for strain based design, predicting loads on pipelines during large scale movements, predicting long-term performance of materials, and updating code and standards with the state of technology.

5. Facilities/ Compression/ LNG

This session focused on the technical issues and R&D needs for facilities, compression, and LNG. The workshop participants identified needed and high value research and development including: intelligent meters, real-time/high-speed sensor and data fusion, managing gas quality, reducing operations and maintenance costs, complying with emission standards, characterizing effects of LNG blended gas on end use equipment, measuring shipboard volumes of LNG, refining safety zone modeling, and supporting dialog with the public.

6. Environmental Risk Assessment and Impact

This session focused on the technical issues and R&D needs for environmental risk assessment and impact. The workshop participants identified needed and high value research and development including: reducing pollutants & particulates, developing models to estimate working area footprints for various situations, comparing various medias with current ones used during commissioning, and articulating industry roles and benefits as it relates to quality of life.

Detailed information can be found in the Appendix and from the following webpage

http://primis.phmsa.dot.gov/rd/mtg_032305.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 sustain economic well being and to promote economic growth. As the current pipeline infrastructure continues to age and as increasing energy demand necessitates new pipelines, we must redouble our efforts to assure pipeline safety, integrity and reliability. Research and development represents a critical component in increasing that level of assurance.

The objective of the forum was to allow government and industry pipeline stakeholders to develop a consensus on the technical gaps & challenges for future R&D. It addressed both short and long term research objectives for liquid and gas and transmission and distribution pipelines, covering onshore, offshore and Arctic environments. In addition, details of the ultimate research goals, technology demonstrations, and transfer and commercialization were discussed.

How did the forum approach assist attainment of its objectives?

To achieve its objectives, the forum was structured to explore the challenges facing the pipeline industry, to share information on recently completed and ongoing activity to address these challenges, and to identify potential gaps and overlaps in the set of projects currently underway or in planning. The result was intended to be an information resource to help the various sponsors of research and development in defining their priorities and in selecting related projects by developing a clearer picture of the ongoing and planned efforts of other sponsors. In addition, new discussions were factored in to the agenda on how to identify and measure the benefits from research, improve our research effort planning, demonstrate technology and deploy it to the market, certify that research outputs are of high quality, and integrate standard organizations into funded research.

How was the forum organized?

To design and host a successful forum, a diverse steering committee was formed with representation from many government and industry stakeholders. This provided equal representation and stakeholder involvement of critical technical topics and implemented the forum objective. The steering committee had representation from the following:

DOT/PHMSA/OPS
DOE/NETL
DOC/NIST
DOI/MMS
American Gas Association
Association of Oil Pipe Lines

American Public Gas Association
American Petroleum Institute
Gas Technology Institute
Interstate Natural Gas Association of America
NACE International
Northeast Gas Association
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.

Breaks were sponsored by the American Gas Association, the Association of Oil Pipe Lines, the American Public Gas Association Research Foundation, and the Interstate Natural Gas Association of America. Breaks were also sponsored individually from the Gas Technology Institute and Electricore, Inc. These breaks provided ample opportunities to discuss topics identified from the agenda, network various other issues and a time to refresh before re-entering the forum.

A luncheon was hosted by NYSEARCH/Northeast Gas Association to expand upon the theme of that day of the benefits and role of research. Consolidated Edison Company of New York supplied an excellent speaker who enlightened the audience with some of their successes.

The Pipeline Research Council International hosted an evening reception and brought an end to a very fruitful first day. This event provided additional opportunities to discuss topics identified from the forum, network various other issues and time to wind down and refresh before the next one and a half days.

Facilitators were provided by GE Energy to assist both the Brainstorming and 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 Houston, Texas on March 22 - 24, 2005. The 2.5 day event included approximately 185 representatives from Federal, State and international government agencies, public representatives, research funding organizations, standards organizations, and pipeline operators from the U.S. and overseas. A list of attendees can be found 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. It was envisioned that the results of the Forum could be used by the participating organizations to help guide and focus their independent programs.

Opening Session

The opening session focused on high level key challenges facing government and industry and with some overview of existing R&D programs.

Brainstorming Sessions

Five concurrent and consecutive brainstorming sessions structured discussions around how to integrate these ideas into research programs and how can we (government & industry) systematically conduct them in the following areas:

1. Benefits from Research
2. Road Mapping
3. Technology Demonstrations & Transfer
4. Peer Reviews
5. Standards Development

Detailed report-outs can be found at http://primis.phmsa.dot.gov/rd/mtg_032305.htm and provide a summary of the discussions.

Presentations from Industry & Government Leaders

In each of the brainstorming sessions, participants heard detailed presentations from industry and government leaders about their experience and knowledge of the subject. Below is a listing of each presenter that was on the agenda for every brainstorming session. These presentations are available on the web site listed above.

Session 1: Benefits from Research Chair: George W. Tenley, Jr. President Pipeline Research Council International	George W. Tenley, Jr. – Pipeline Research Council International Jeff Wiese – DOT/PHMSA/OPS David L. Johnson – Panhandle Energy Bob Barbeauld – Colonial Pipeline Co.
Session 2: Road Mapping *Chair: Rodney J. Anderson* *Technology Manager* *DOE/NETL*	Jim Merritt – DOT/PHMSA/OPS Paul Beckendorf – Gas Technology Institute Gerald Paulus – City of Mesa Utilities
Session 3: Technology Demonstrations & Transfer *Chair: Jean-Louis Staudenmann* *Advanced Technology Program Manager* *DOC/NIST*	Rita Freeman-Kelly – DOT/PHMSA/OPS Lee Bowes - DOC/NIST/ATP
Session 4: Peer Reviews *Chair: Steve Gauthier* *Executive Director* *Gas Technology Institute*	Steve Gauthier - Gas Technology Institute Carol Handwerker– DOC/NIST Robert Smith – DOT/PHMSA/OPS Daphne D'Zurko - Northeast Gas Association/NYSEARCH Tom Kevorkian - Pipeline Research Council International Ron Snedic – Operations Technology Development
Session 5: Standards Development *Chair: Drew Hevle* *Principal Engineer* *El Paso Corporation for NACE International*	Linda Goldberg – NACE International Daron Moore – American Society of Mechanical Engineers Andrea Johnson – American Petroleum Institute Richard Ricker – DOC/NIST Jeff Wiese – DOT/PHMSA/OPS

Technical Track Sessions

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

1. Damage Prevention
2. Direct Assessment
3. Inspection/Repair/Leak Detection
4. Design/Construction/Materials/Welding
5. Facilities/Compression/LNG
6. Environmental Risk Assessment & Impact

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 a few if these identified challenges. A full list can be found in the Appendix.

Summary Challenges

Damage Prevention:

- Locating pipelines in urban areas
- Monitoring right of way encroachments
- Locating damage before failure
- Reducing digging/boring equipment contact to pipe

Direct Assessment:

- Expanding the applicability of DA
- Improving the range and accuracy of tools for difficult to inspect areas
- Characterizing which DA models apply to what situations
- Characterizing the impact of DA model uncertainties

Inspection/Repair/Leak Detection:

- Deploying affordable and accurate leak detection
- Internal inspection for unpiggable pipelines and non-metallic pipes
- Maximizing data acquisition
- Deciding when and how to repair pipelines

Design/Construction/Materials/Welding:

- Designing for high strain service
- Predicting loads on pipelines

- Reducing conservatism in codes or standards
- Predicting long-term materials performance

Facilities/Compression/LNG:

- Refining safety zones and supporting public dialogue
- Managing gas quality
- Metering technologies
- Storage options
- Emissions compliance

Environmental Risk Assessment & Impact

- Criteria pollutants & particulates
- Permit streamlining
- Lowering waste generation
- Information sharing/communication

Presentations of Ongoing R&D

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 the track session. These presentations are available from the following web site: http://primis.phmsa.dot.gov/rd/mtg_032305.htm .

Session 1: Damage Prevention ***Chair:*** *Jim Walton* *Co-Chair* *Common Ground Alliance R&D Committee*	Steve Rieger – DOT/PHMSA/OPS Allen Peterson - Northeast Gas Association/NYSEARCH
Session 2: Direct Assessment ***Chair:*** *Daphne D'Zurko* *Vice President RD&D* *Northeast Gas Association/NYSEARCH*	Daphne D'Zurko - Northeast Gas Association/NYSEARCH Daniel Ersoy - Gas Technology Institute Harvey Haines - Pipeline Research Council International Garry Matocha – Duke Energy Robert Smith – DOT/PHMSA/OPS
Session 3: Inspection/Repair/Leak Detection ***Chair:*** *Jerry Rau* *Chair, Corrosion & Inspection Technical Committee* *Pipeline Research Council International*	Jerry Rau - Pipeline Research Council International Rita Freeman-Kelly – DOT/PHMSA/OPS Chris Buckingham – Southwest Research Institute Al Teitsma – Gas Technology Institute Carl Popelar – Consultant Walter Kresic – Enbridge Marina Smith - Pipeline Research Council International
Session 4: Design/Construction/Materials/Welding ***Chair:*** *Marie Quintana, P.E.* *Manager* *Lincoln Electric Company*	Individual speaker information is not available
Session 5: Facilities/Compression/LNG ***Chair:*** *Mike Whelan* *Program Director* *Pipeline Research Council International*	Allison Berkowitz – NiSource Inc. Bill Couch - Pipeline Research Council International Angela Floyd – Panhandle Energy Charles Helm - DOT/PHMSA/OPS Ed Bowles - Southwest Research Institute Jeryl Mohn - Panhandle Energy Eric Thomas – GMRC Jasmine Urisk – Canadian Energy Partnership Mike Whelan - Pipeline Research Council International Jim Witte – El Paso Pipeline Group
Session 6: Environmental Risk Assessment & Impact ***Chair:*** *Debbie Ristig (gas)*	Jerry Englehardt - Kinder Morgan Bill Kendrick – Cross Country Pipeline

Sr. Director, Compliance and Support Services *CenterPoint Energy* ***Chair:*** *Jerry Englehardt (liquid)* *Kinder Morgan*	

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

Summary R&D Opportunities

Damage Prevention:

- Develop (Real-time 24/7) monitoring of right of way encroachments
- Improve upon technologies to locate existing damage
- Develop (Real-time 24/7) monitoring to detect any contact to the pipe
- Improve avoidance sensors on digging/boring equipment
- Develop improved technologies to locate buried pipelines

Direct Assessment:

- Identify, develop and demonstrate tools and techniques to fill the gaps and expand the applicability of ECDA
- Characterize the accuracy and range of applicability of ICDA methods
- Characterize which models apply to what situations
- Identify and develop practical approaches to: characterize the impact of uncertainties in ICDA application; to reduce uncertainties in ICDA application; to pinpoint locations and optimize length of excavation.
- Identify, develop and demonstrate tools and techniques to fill the gaps, expand the applicability and improve the ability to detect SCC

Inspection/Repair/Leak Detection:

- Develop affordable and accurate leak detection
- Develop and validate internal inspection for unpiggable pipelines and non-metallic pipes
- Identify approaches to maximize data acquisition
- Develop process to decide when and how to repair pipelines

Design/Construction/Materials/Welding:

- Develop a comprehensive set of design tools for strain based design
- Develop methodologies for predicting loads on pipelines with regard to large scale movements.
- Improve predictive tools for pipeline loading under large scale movement and adverse environmental conditions

- More effective short term testing methods to predict long term performance – wear and penetration, coating soil interactions, etc.

Facilities/Compression/LNG:

- Characterize LNG blended gas effects on end use equipment
- Develop improved methods used to measure shipboard volumes
- Improve incident models to further refine safety zones
- Improved measurement technologies for custody transfer accuracy & bias
- Develop appropriate standards to match gas measurement activities
- Develop cost-effective emissions monitoring
- Develop ultra-low NOx retrofit equipment for reciprocating engines
- Improve dispatch models for overall system efficiency and throughput increases
- Develop technologies to save fuel and increased capacity

Environmental Risk Assessment & Impact

- Develop technologies and equipment to reduce pollutants & particulates
- Develop model to estimate footprint or working areas for various situations
- Compare various medias with current ones used during commissioning
- Develop methods to aggressively articulate industry role and benefits as it relates to quality of life

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_032305.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

To the Key Challenge, Luncheon and other Agenda speakers. To the Chairs of the Brainstorming & Technical Track Sessions. Special thanks should be noted to Christina Sames who organized the submission of the non-government sponsorship. Special thanks to Scott Thetford for supplying “Black Belt” facilitators used in the brainstorming and technical track sessions. Special thanks to Paul Wood for his facilitation within a brainstorming and technical track session. Special thanks to Richard Sanders for taking many well representative photographs during the forum.

Thank You

To everyone who traveled, attended and participated in this forum. Your efforts have set a national pipeline research agenda.

Appendices

Technical Track Sessions
Challenges and R&D Opportunities

Damage Prevention

Challenges

1. Locating pipelines in urban areas.
2. Monitoring right of way encroachments.
3. Locating damage before failure.
4. Reducing digging/boring equipment contact to pipe.
5. Crosscutting technology and knowledge from other industries and applying to prevent damage.
6. Benchmarking developed technologies on real pipelines.
7. Increasing awareness and buy-in by excavators and municipalities.
8. Increasing awareness of contractor and pipeline owner's presence in the field.
9. Increasing local awareness of pipeline position in high consequence areas.
10. Developing affordable monitoring technology.
11. Coordinating excavation procedures with one-call centers.
12. Discouraging all unauthorized digging.
13. Communicate to the public the importance of One Call.
14. Capitalizing on synergies from the entire infrastructure and develop a common message across transmission, distribution, liquids, etc.
15. Mitigating hurricane damage on offshore pipelines.
16. Tracking the loop current in the Gulf of Mexico
17. Considering pipeline issues in current land use planning practices.

Research Opportunities

1. Develop (Real-time 24/7) monitoring of right of way encroachments.
2. Improve upon technologies to locate existing damage.
3. Develop (Real-time 24/7) monitoring to detect any contact to the pipe.
4. Improve avoidance sensors on digging/boring equipment.
5. Develop improved technologies to locate buried pipelines.
6. Studying how human factors issues have led to 3rd party incidents involving human actions.
7. Better excavation procedures need to be developed.

Direct Assessment

Challenges

1. Expanding the applicability of DA.
2. Improving the range and accuracy of tools for difficult to inspect areas.
3. Characterizing which DA models apply to what situations.

4. Characterizing the impact of DA model uncertainties.
5. Admitting that better knowledge of the SCC phenomenon is required before a SCC DA standard is developed.
6. Improving the quality and qualifications of contractors performing DA and the analyzing of collected data.
7. Developing more specific criteria about how to analyze and interpret the inspection data.
8. Applying DA methods consistently.
9. Identifying when and where DA methods should and should not be applied.
10. Improving confidence in DA methods.
11. Reducing the number of and cost of re-inspections.
12. Differentiating between DA methods and integrity management.
13. Better understanding of difficult situations for ECDA, ICDA.

Research Opportunities

1. Identify, develop and demonstrate tools and techniques to fill the gaps and expand the applicability of ECDA.
2. Characterize the accuracy and range of applicability of ICDA methods.
3. Characterize which models apply to what situations.
4. Identify and develop practical approaches to: characterize the impact of uncertainties in ICDA application; to reduce uncertainties in ICDA application; to pinpoint locations and optimize length of excavation.
5. Identify, develop and demonstrate tools and techniques to fill the gaps, expand the applicability and improve the ability to detect SCC.
6. Investigating bio sensors or fluidized micro-chips for detection of internal corrosion.
7. Research to benchmark DA approaches at multiple crossing pipes, cased crossings, shielding coatings, and shielding soils.

Inspection/Repair/Leak detection

Challenges

1. Deploying affordable and accurate leak detection.
2. Internal inspection for unpiggable pipelines and non-metallic pipes.
3. Maximizing data acquisition.
4. Deciding when and how to repair pipelines.
5. Understanding the capabilities/limitations of current and future inspection tools.
6. Relating technologies to the IMP rules and the “threats” outlined within.
7. Improving inspection data accuracy and consistency.
8. Developing SCC In-Line Inspection for natural gas pipelines.
9. Accurate detection, sizing and sentencing of welding flaws in girth welds in order to avoid unnecessary (expensive) repair.
10. Improving power efficiencies of ILI for non-piggable pipelines.
11. Categorized corrosion determination for determining the criticality of a repair.
12. Improving launch methods of ILI for non-piggable pipelines.

13. For regulators to handle increased volume of ILI logs from new Gas IMP.
14. Qualifying of NDT and ILI personnel.
15. Developing ILI crack detection capability for gas pipelines.
16. Validating anomaly sizing reliability of inspection tools using confirmation excavations for integrity assessment.
17. Developing more scientific criteria for analyzing misc. damage to pipe (creases, bends, dents), so that they can be quantitatively analyzed and determined to be safe (or not).
18. Developing alternative assessment methods and criteria to ACCEPT anomalies that are discovered during ILI that might fail the existing prescriptive rule requirements that demand repair.
19 Improving the accuracy of SCADA and leak detection equipment.
20. Validating offshore leak detection methods.
21. Validating deepwater repair methods.
22. Obtaining unbiased facts on the capabilities and limitations for various inspection tools.
23. Adapting ILI to unpiggable transmission lines and distribution systems.
24. Consistency of evaluating anomalies in the field and of tools that can identify SCC.
25. Quantifying geometry and other aspects of damage assessment in the ditch.
26. Improving Computer Pressure Modeling.
27. Early detection of small leaks.
28. Efficiently and systematically estimating the value of inspection for a particular application.
29. Improving government and industry coordination on inspection research.
30. Predicting sites where localized corrosion and/or stress corrosion cracking will take place.

Research Opportunities

Leak Detection

1. Assessment of significance of small leak problem.
    a. Manage perceptions
    b. New technologies for real-time monitoring and detection of small leaks
    c. For LDCs, develop hand-helds and methods for pinpointing location and migration patterns
    d. For liquids, develop fly-over devices, and assess needs for new technologies vs. analytical model developments
    e. Technologies for use in deepwater offshore operations

Sensor Technology

1. Develop improved understanding of performance characteristics of existing technologies → examine emerging technologies to improve results.
    For unpiggables,
        a. Improved power and communications and/or lighter sensors
        b. Integration of platform and sensor package design
        c. Guidelines for cleaning
2. In-ditch methods for SCC characterization.

3. Methods for inspecting cased pipes.
4. Assess needs for new technologies.
    a. Inspection of non-metallics
5. Considerations for small diameter pipelines.
6. Methods/techniques to maximize data acquisition.
7. Development of geometry tools to traverse multi-diameter pipes.

Mechanical Damage

1. Enhance methods of inspection and assessment for qualitative screening and ranking.
2. Develop tools and methods of inspection and assessment for quantitative life predictions and prioritization of severity damage.
3. Identify methods to locate and repair damage in difficult to inspect areas.
4. Develop proper definitions for cracks and other damages.
5. Design tools to inspect pipes of various steel grades and non-metallics

Repair

1. When to Repair.
    a. Identify technologies needed to support repair decisions
    b. Investigate how to mine existing datasets with goal of providing improved industry guidance
    c. Need to transfer technologies to industry to influence standards and regulatory activities
2. How to Repair.
    a. Guidance on proper selection of composite and other repair techniques
        - Tracking database
        - State of industry report
    b. Consider drivers for selection of repair technologies

Design/Construction/Materials/Welding

Challenges

1. Designing for high strain service.
2. Predicting loads on pipelines.
3. Reducing conservatism in codes or standards.
4. Predicting long-term materials performance.
5. Improving techniques for cost-effective supplemental facility construction
6. Developing new techniques for performance based design and maintenance.
7. Improving better field welding of high-strength (X-80 and above) steel pipe.
8. Updating consensus standards addressing high strength steel issues.
9. Predicting performance of new high strength materials; e.g., corrosion and fatigue effects on high yield/tensile materials.
10. Completing a standard for reliability based and strain based pipeline design, construction and operation.
11. Identifying flaw tolerance of girth welds (with respect avoidance of failure) in high

strength steels.
12. Minimizing pipeline weight for deepwater installations.
13. Developing safer construction practices.
14. Cutting construction costs and streamlining permits.

Research Opportunities

1. To develop a comprehensive set of design tools for strain based design.
2. To develop methodologies for predicting loads on pipelines with regard to large scale movements.
3. Improve predictive tools for pipeline loading under large scale movement and adverse environmental conditions.
4. More effective short term testing methods to predict long term performance – wear and penetration, coating soil interactions, etc.

Facilities/Compression/LNG

Challenges

1. Refining safety zones and supporting public dialogue.
2. Managing gas quality.
3. Improving metering technologies.
4. Expanding storage options.
5. Emissions compliance.
6. LNG gas interchangeability.
7. Overcoming co-mingling of BTU quality issues for LNG gas with mainline transmission gas.
8. Managing liquid fallout.
9. Identifying safety zones and the potential for catastrophic events.
10. Leveraging clean air compliance with interchangeability issues.
11. Managing changing EPA requirements.
12. Developing highly reliable compressor drive technology.

Research Opportunities

1. Characterize LNG blended gas effects on end use equipment.
2. Develop improved methods used to measure shipboard volumes.
3. Improve incident models to further refine safety zones.
4. Improved measurement technologies for custody transfer accuracy & bias.
5. Develop appropriate standards to match gas measurement activities.
6. Develop cost-effective emissions monitoring.
7. Develop ultra-low NOx retrofit equipment for reciprocating engines.
8. Improve dispatch models for overall system efficiency and throughput increases.
9. Develop technologies to save fuel and increased capacity.

Environmental Risk Assessment & Impact

Challenges

1. Managing pollutants & particulates.
2. Permit streamlining.
3. Lowering waste generation.
4. Information sharing/communication.
5. Coordinating national and state GHG inventory protocols.
6. Developing reasonable permitting needs with proper hearings and reasonable exchange of opinions.
7. Improving consistency of activities for assessment & impact during construction and repair, including the development of better practices.
8. Managing habitat fragmentation and disposal of hydrotest waters.
9. Improved communications between operators, regulators and public.
10. Minimizing greenhouse gasses.
11. Developing practical air emission standards.
12. Improving public perception & knowledge, permitting lead time, regulatory consistency.

Research Opportunities

1. Develop technologies and equipment to reduce pollutants & particulates.
2. Develop model to estimate footprint or working areas for various situations.
3. Compare various medias with current ones used during commissioning.
4. Develop methods to aggressively articulate industry role and benefits as it relates to quality of life.
5. Develop new tools, standards and best practices to control and manage emissions.

Forum Participants

Name	Organization
Bowes, Lee	Advanced Technology Program, NIST
McQueen, Mark	Advantica
Ward, Clive	Advantica
White, Gary	AECsoftUSA, Inc.
Sames, Christina	AGA
Kabous, Julie	American Gas Association
Johnston, Peter	Arizona Public Service
Smith, Dan	B.P.Pipeline
Putman, Bill	Baker Hughes Pipeline Management Group
Kolb, Paula	Baker Hughes PMG
Nestleroth, J. Bruce	Battelle
Kakoschke, Dale	BJ Pipeline Inspection Services
Leedham, Robert	Bj Pipeline Inspection Services
Tiku, Sanjay	BMT Fleet Technology Ltd.
Platt, Jr., John Paul	BP
Sanderson, Norman	BP
Alkire, John	BP America
Lensing, Chad	BP America
Owen, Les	BP America, Inc.
Nyholt, John	BP North America
O'Connell, Joe	BP Pipelines North America
Stachura, Christopher	bp Pipelines, N.A.
Abes, Jake	Canadian Energy Pipeline Association
Papavinasam, Sankara	CANMET Materials Technology Laboratory
REVIE, R. WINSTON	CANMET Materials Technology Laboratory
Moghissi, Oliver	CC Technologies
Schmdit, John T.	CC Technologies, Inc.
Ristig, Debbie	CenterPoint Energy Pipeline Services
Paulus, Gerald	City of Mesa
Clowney, Sam	Clean Air strategy Consultant
Barbeauld, Robert	Colonial Pipeline Company
Scott, William D.	Colonial Pipeline Company
MISHRA, BRAJENDRA	COLORADO SCHOOL OF MINES
Kipp, Robert	Common Ground Aliance
Hotze, Richard K.	Compressor Engineering Corporation
McCartney, Mary Jane	Consolidated Edison Company of New York, Inc
Powell, Daniel	Corrpro Companies, Inc.
Johnson, David L	CrossCountry Energy

Wood, Paul	Cycla Corporation
McLaren, Chris	DOT Office of Pipeline Safety
Willke, Ted	DOT/Office of Pipeline Safety
Jacobi, John A	DOT/OPS
Smith, Robert/William	DOT/OPS
Helm, Charlie	DOT/OPS Southwest Region
Rallis, Anthony	DOT/OPS Southwest Region
Winnie, Harold	DOT/Office of Pipeline Safety
Rieger, Steven N.	DOT/OPS
Fischer, Steven	DOT/Office of Pipeline Safety
Coy, Byron	DOT/PHMSA
Freeman-Kelly, Rita	DOT/OPS
Rieger, Steven N.	DOT/OPS
Wiese, Jeff	DOT/OPS
Sanders, Richard	DOT/PHMSA / OPS / T&Q
Cuentas, Carla	DOT/PHMSA/Office of Contracts and Procurement
Merritt, James	DOT/PHMSA/OPS
Nanney, Steve	DOT/OPS
Lewis, Matt	Dresser, Inc.
Matocha, Garry	Duke Energy Gas Transmission
Vervake, Gary	Duke Energy Gas Transmission
CORNELIUS, BOB	EAGLE INFORMATION MAPPING
THORLEIFSON, TRACY	EAGLE INFORMATION MAPPING
Kratzenberg, Robert H.	Edison Welding Institute
Fiji, George	El Paso
Cordaway, John	El Paso Corporation
Hevle, Andrew	El Paso Corporation
Johnson II, Winston A.	El Paso Corportion
Barfield, Jon	El Paso Pipeline Group
Barry, Sue	El Paso Pipeline Group
Couch, William	El Paso Pipeline Group
Moore, Daron	El Paso Pipeline Group
Whitney, Chris	El Paso Pipeline Group
Witte, James	El Paso Pipeline Group
Cohen, Mark	Electricore, Inc.
Dunning, James	Electricore, Inc.
Meyer, Art	Enbridge
Barlow, Rick	Enbridge Pipelines Inc.
Ironside, Scott	Enbridge Pipelines Inc.
Irving, Stephen	Enbridge Pipelines Inc.
Kresic, Walter	Enbridge Pipelines Inc.
McNeill, David	Enbridge Pipelines Inc.

Wang, Yong-Yi	Engineering Mechanics Corporation of Columbus
Fletcher, Chad	Enginuity, LLC
Holtzman, Barry	Equistar Chemicals
Ames, Nate D.	EWI
Rose, Carol	Explorer Pipeline Company
Torbin, Robert	Foster-Miller, Inc.
Short, Marsha	Gas Machinery Research Council
Beckendorf, Paul	Gas Technology Institute
Ersoy, Daniel	Gas Technology Institute
Gauthier, Steven W.	Gas Technology Institute
Teitsma, Albert	Gas Technology Institute
Thetford, Scott	GE
Colucci, Anthony	GE - Global Research Center
Logan, Thomas	GE Energy
Wint, David	GE Energy - PII North America
Walker, James	GE Energy Integrity Services
Aggarwal, Rajiv	Granherne-KBR
Snedic, Ron	GTI (Gas Technology Institute)
Mims, Douglas	Gulf Interstate Engineering
Nicholson, Dan L.	Gulf Interstate Engineering
Rutherford, Jim	Heath Consultants Incorporated
Wehnert, Paul	Heath Consultants Incorporated
Beal, Lisa	Interstate Natural Gas Association of America (INGAA)
Jamoussi, Anouar	itRobotics
Stanley, Roderic	itRobotics
Ghorbel, Fathi H.	itRobotics Inc.
Walton, Jim	JW's Pipeline Integrity Services, LLC
Lamison, Craig	KBR -- Granherne
Falk, Michael D.	Kern River Gas Transmission
Haines, Harvey	Kiefner & Associates, Inc.
Mitchell, Jesse L.	Kiefner & Associates, Inc.
Engelhardt, Jerry	Kinder Morgan Energy Partners
Vaughn, Randy	Kinder Morgan, Inc
Davis, J. D.	Kinder Morgan, Inc. Gas Pipeline Group
Lebsack, Scott	Lebsack & Associates
Nicholson, Peter	Lincoln Electric
Harris, O. B.	Longhorn Pipeline, LP
Marr, Jim	Marr Associates Integrated Pipeline Solutions
Marshall, Bill	Mears Pipeline Integrity Services
Miesner, Thomas	Miesner, LLC

Gordon, Joe	Minerals Management Service
Edgar, David	Mustang Engineering, L.P.
Jew, Dany	Mustang Engineering, L.P.
Goldberg, Linda	NACE International
Johnson, Cliff	NACE International, The Corrosion Society
Jeglic, Franci	National Energy Board
Ricker, Richard	National Institute of Standards and Technology
Peterson, Allen	New York State Electric & Gas Corporation
Picciott, Thomas	Niagara Mohawk/National Grid
Berkowitz, Allison Beth	Nisource
Gayle, Frank	NIST
Handwerker, Carol	NIST
D'Zurko, Daphne	NYSEARCH/Northeast Gas Association
O'Brien, Martin	Ophir Corporation
Spaeth, Lisa	Ophir Corporation
Lawrence, Larry	Oregon Steel Mills
West, Mike	Pacific Gas and Electric
Floyd, Angela	Panhandle Energy
Mohn, Jeryl	Panhandle Energy
Rau, Jerry	Panhandle Energy
Warner, Christopher	PGE
Kevorkian, Tom	Pipeline Research Council International
Whelan, Michael	Pipeline Research Council International
Smith, Marina	Pipeline Research Council International, Inc.
Tenley, Jr., George W.	Pipeline Research Council International, Inc.
Popelar, Carl H	Popelar Mechanics
Hereth, Mark	P-PIC
Leewis, Keith	P-PIC
Zurcher, John	P-PIC
Ragula, George	Public Service Electric & Gas Co.
Zobell, Randy	Questar Pipeline Company for INGAA
Byrd, W. R. (Bill)	RCP Inc.
Brown, Bryce W	ROSEN
Wassink, Casper	RTD quality services
Fingerhut, Martin	RTD Quality Services USA LP
Tomar, Munendra	RTD Quality Services USA LP
Raghu, Damodaran	Shell Global Solutions US
Stringfellow, William D	Smart Pipe
Catha, Steve	Smart Pipe Company
Kanninen, Melvin F.	Smart Pipe Company
Bethel, Kyle	Smartpipe Company LP
Mandich, PE.MA., Ivan C.	Smartpipe Company LP

Ekelund, Aron	Smartpipe Compnay LP
Thomas, Eric	Southern Natural Gas
Bass, Robert L.	Southwest Research Institute
Bowles, Edgar	Southwest Research Institute
Buckingham, John Christopher (Chris)	Southwest Research Institute
Crouch, Al	Southwest Research Institute
Kelner, Eric	Southwest Research Institute
Sridhar, Narasi	Southwest Research Institute
Meier, Craig	Sunland Construction, Inc.
Williamson, Dick	T.D. Williamson, Inc.
Summa, Vincent	TechCorr
Cherry, Darrell	Texas Gas Association
Haycraft, Roger	Texas Gas Transmission, LLC
Quintana, Marie Annette	The Lincoln Electric Company
Chittick, David	TransCanada
Taylor, Kenneth G.	TransCanada PipeLines
Horsley, David	TransCanada PipeLines Limited
Chesniak, Don	Tuboscope Pipeline Services
Moreno, Pam	Tuboscope Pipeline Services
Pisarski, Henryk	TWI Ltd
Driscoll, Dan	U.S. Department of Energy, NETL
Royer, Michael	U.S. Environmental Protection Agency
Terranova, Peter	UGI Utilities, Inc for AGA
Anderson, Rodney	US Department of Energy/National Energy Technology Lab
Ethridge, Andy	Wellstream International Ltd
Scrivner, Ron	WGP Transco
Eckert, Randall	Williams Gas Pipeline
Ford, Gregory	Williams Gas Pipeline
Linn, Craig	Williams Gas Pipeline
Mathis, James	Williams Gas Pipeline
Robertson, Joseph	WIlliams Gas Pipeline
Wait, Charles	Williams Gas Pipeline
Whitfield, Mary Beth	Williams Gas Pipeline
Meehan, Sean	Williams Gas Pipeline - Transco