

Peer Review Report



Pipeline & Hazardous Materials Safety Administration

Pipeline Safety Research & Development Program

**Peer Reviews Conducted
May 1, May 6 & May 14, 2008**

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EXECUTIVE SUMMARY

The Pipeline and Hazardous Materials Safety Administration's (PHMSA) Pipeline Safety Research and Development (R&D) Program held its first structured peer review of active research projects in February 2006 and the most recent peer review in May 2008. Mandates by the Office of Management and Budget (OMB) and the Office of the Secretary of Transportation (OST) govern these reviews and are keeping PHMSA "Green" with research data quality. Conducting peer reviews via teleconference and the Internet is saving time and resources. It is also working well with panelists, researchers, Contracting Officers' Technical Representatives and project co-sponsors. Most impressively, the PHMSA approach facilitates attendance from all U.S. time zones, Canada and Europe.

The peer review continues to build on an already strong and systematic evaluation process developed by PHMSA's Pipeline Safety R&D Program and certified by the Government Accountability Office. The peer review panel consisted of nine government and industry experts. Two of the nine panelists are active Government representatives from the National Institute of Standards and Technology and the Minerals Management Service. The remaining seven panelists are retired Government and retired and active industry personnel who play vital roles as peers for the American Petroleum Institute, the American Society of Mechanical Engineers, the National Association of Corrosion Engineers and other standards developing organizations.

Twenty-nine active research projects were peer reviewed by expert panelists using 21 evaluation criteria. These criteria were grouped within the following six evaluation categories:

1. Is the project still relevant to the PHMSA mission?
2. Is the project well designed?
3. Is the project still well managed?
4. What is the approach taken for transferring results to end users?
5. Is the project well coordinated with other closely related programs?
6. Is the project producing high quality results?

The rating scale possibilities were "Ineffective," "Moderately Effective," "Effective," or "Very Effective." During the May 2008 review, the average program rating was "Very Effective" for each of the above six evaluation categories. For this year, 28 projects were rated "Very Effective" with only one project ranked as "Effective." The average sub-criteria scoring were also rated very high and underpin these findings. This marks the third annual peer review where the majority of peered projects and the overall program rating were very effective. Additional details are available in Section 7 and Tables 3 and 4 of this report.

PHMSA is very satisfied with the process performed to conduct these reviews, as well as the findings and recommendations provided by the panelists. PHMSA accepts the findings and recommendations summarized in the report. The official PHMSA response memorandum is found in Appendix A.

These reviews are held annually for active research projects and usually occur in the second quarter of each fiscal year.

1.0 Introduction

The purpose of this document is to report findings from the research peer reviews held May 1, May 6 and May 14, 2008 for PHMSA's Pipeline Safety Research and Development Program. The findings and recommendations in this report derive from the scoring and comments collected from the peer review panelists.

Department of Transportation (DOT) Operating Agencies (OA) are required to develop and execute a systematic process for peer reviews and for all influential and highly influential information that the OA plans to disseminate in the foreseeable future.

Through the Information Quality Act¹, Congress directed the Office of Management and Budget (OMB) to "provide policy and procedural guidance to Federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information, (including statistical information) disseminated by Federal agencies." A resulting OMB Bulletin, titled "Final Information Quality Bulletin for Peer Review," was issued prescribing required procedures for Federal programs.

The Office of the Secretary of Transportation (OST) produced procedures governing modal implementation of this OMB Bulletin. These procedures, as well as the OMB Bulletin, serve as the basis and justification for the PHMSA Pipeline Safety R&D Program peer reviews.

The purpose of these peer reviews is to uncover technical problems, keep projects on target or aligned with stakeholder needs and to give technical guidance with technically competent and independent, objective experts.

2.0 Research Program Background

PHMSA regulates safety in the design, construction, operation and maintenance, and spill response planning for over 2.3 million miles of natural gas and hazardous materials pipelines. It is focused on the continual reduction in the number of incidents on natural and other gas and hazardous liquid pipelines resulting in death, injury, or significant property damage, and also aims to reduce spills that can cause harm to the environment.

The vision of the PHMSA Pipeline Safety R&D Program is to support the pipeline safety mission of PHMSA, which is "to ensure the safe, reliable, and environmentally sound operation of America's energy transportation pipelines." The mission of the PHMSA Pipeline Safety R&D Program is "to sponsor research and development projects focused on providing near-term solutions that will improve the safety, reduce environmental impact, and enhance the reliability of the Nation's pipeline transportation system."

PHMSA has regulatory responsibility for the safety of natural gas and hazardous liquid pipelines. Over the past several years, PHMSA has strengthened its role in assuring the safety of the Nation's pipeline system in numerous ways, including promulgating new regulations on integrity

¹ Pub. Law. No. 106-554-515(a)

management.^{2,3,4} These new regulations, together with the new inspection processes being used by regulators to evaluate operator compliance, rely on operator access to new technologies that support improved safety and integrity performance and on regulator access to information on the appropriate use and limitations of these technologies. To address the need for new integrity-related technologies and information on the validity of these technologies, Congress expanded the support for the PHMSA Pipeline Safety R&D Program in 2002.⁵ As authorized by Congress, PHMSA is sponsoring research and development projects focused on providing near-term solutions that will increase the safe, reliable, and environmentally sound operation of America's energy transmission and distribution pipelines.

The R&D program contributes directly to the PHMSA mission by pursuing three program objectives:

1. Fostering the development of new technologies that can be used by operators to improve safety performance and to more effectively address regulatory requirements.
2. Strengthening regulatory requirements and related national consensus standards.
3. Promoting and improving the state of knowledge for pipeline safety officials so industry and regulatory managers and PHMSA pipeline safety field inspectors can make better decisions with safety issues and resource allocation.

The R&D Program is organized around eight R&D program elements. Each program element has associated safety issues, technology needs or gaps, and R&D opportunities. Ongoing and future planned projects are linked to at least one of these program elements. The program elements reflect the responsibilities of DOT in the Five-Year Interagency R&D Program Plan⁶ and guidance from pipeline experts and stakeholder groups.

Program goals are associated with each program element. The goals define the desired outcomes for the R&D projects. Each goal bears a direct relationship to longer-term enhancement of pipeline safety. Table 1 identifies these program elements and the improvements desired.

² "Pipeline Integrity Management in High Consequence Areas for Hazardous Liquid Operators" (49 CFR Part 195); Rules effective May 29, 2001, and February 15, 2002. <<http://primis.phmsa.dot.gov/iim/ruletextamended.htm>>

³ "Pipeline Safety: Pipeline Integrity Management in High Consequence Areas (Gas Transmission Pipelines)"; Final Rule. December 15, 2003. <<http://primis.phmsa.dot.gov/gasimp/docs/GasTransmissionIMRule.pdf>>

⁴ "Pipeline Integrity Management in High Consequence Areas (Gas Transmission Pipelines)". Final Rule (as amended), May 26, 2004. <http://primis.phmsa.dot.gov/gasimp/docs/FinalRuleAmended_gas_full.pdf>

⁵ Pipeline Safety Improvement Act of 2002 <http://ops.dot.gov/Pub_Law/107_cong_public_laws.pdf>

⁶ Five Year Interagency R&D Program Plan <<http://primis.phmsa.dot.gov/rd/psia.htm>>

| Table 1. Program Elements of PHMSA Pipeline Safety R&D Program | | |
|---|--|---|
| | Program Element | Program Element Goal |
| 1. | Damage Prevention | Reduce the number of incidents and accidents resulting from excavation damage and outside force |
| 2. | Pipeline Assessment and Leak Detection | Identify and locate critical pipeline defects using inline inspection, direct assessment, and leak detection |
| 3. | Defect Characterization and Mitigation | Improve the capability to characterize the severity of defects in pipeline systems and to mitigate them before they lead to incidents or accidents |
| 4. | Improved Design, Construction, and Materials | Improve the integrity of pipeline facilities through enhanced materials, and techniques for design and construction |
| 5. | Systems for Pipeline Mapping and Information Management | Enhance the ability to prevent and respond to incidents and accidents through management of information related to pipeline location (mapping) and threats definition |
| 6. | Enhanced Operation Controls and Human Factors Management | Improve the safety of pipeline operations through enhanced controls and human factors management |
| 7. | Risk Management & Communications | Reduce the probability of incidents and accidents, and mitigating the consequences of hazards to pipelines |
| 8. | Safety Issues for Emerging Technologies | Identify and assess emerging pipeline system technologies for opportunities to enhance their safety |

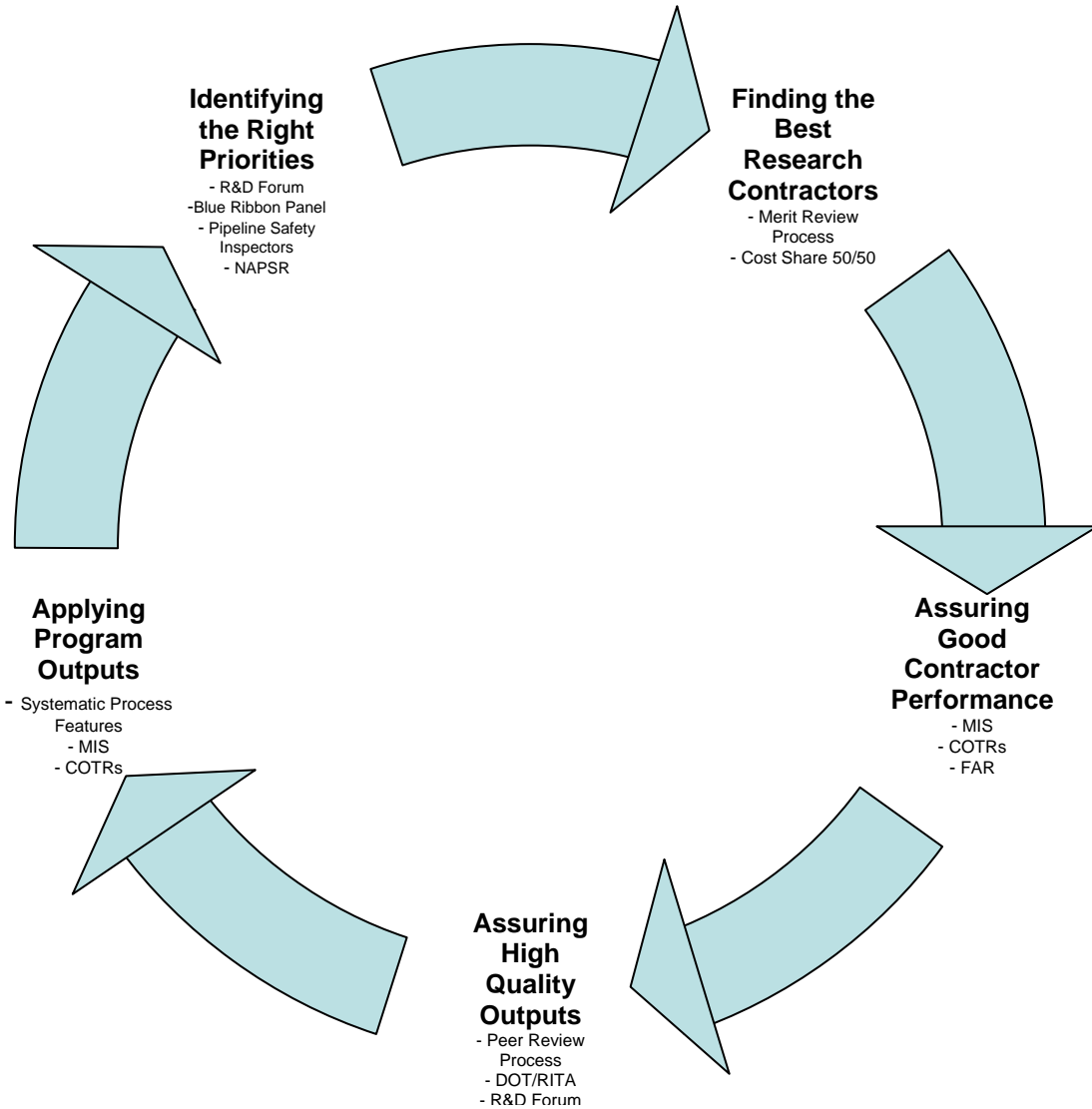
More information on the program strategy is outlined in the R&D Program Strategic Plan and on the program website at <http://primis.phmsa.dot.gov/rd/>

Research Program Quality

While the program addresses strategy, a systematic evaluation process has been designed and implemented for raising and validating program quality. The process contains five steps and follows research projects from their inception to their resulting implementation. Each step of this systematic process ensures that project outcomes will be of high quality, relevant to PHMSA’s mission, and applied to the appropriate end users.

Figure 1 identifies the steps in the systematic evaluation process and how it follows the lifecycle of research projects. Please visit <http://primis.phmsa.dot.gov/rd/evaluation.htm> for more information on this process.

Figure 1. Systematic Evaluation Process



The quality of the research projects is first established while identifying the right priorities. This pre-solicitation input at joint Government and industry R&D forums and other meetings collaboratively identifies the right priority and structures projects to meet end user technical needs. This allows government and industry pipeline stakeholders to develop a consensus on the technical gaps and challenges for future R&D. It also reduces duplication of programs, leverages funds, broadens synergies and factors ongoing research efforts with other agencies and private organizations.

Appropriate priority and good project design are refined while finding the best research contractors. A merit review panel comprising of representatives from Federal and State agencies, industry operators, and trade organizations uses strong evaluation criteria to review research white papers and proposals. In addition, a 50 percent cost share between the Government and industry is required, which forces researchers to organize with credible groups increasing the credibility and applicability of the proposed work.

PHMSA uses its Management Information System (MIS) to assure awarded projects are performing well. The MIS electronically monitors and tracks contractor performance as the project moves toward completion. This system provides the necessary oversight so specific contractual milestones and contract accounting are systematically followed as prescribed in the award documents. The system design improves and maintains program quality, efficiency, accounting and accountability. Additional oversight is provided by Contracting Officers' Technical Representatives (COTRs) who are trained, certified, and designated to each project in accordance with the Federal Acquisition Regulations.

The peer review is designed to further improve quality and keep research projects on track to meet their ultimate goal(s). If the first three steps of the systematic evaluation process are applied correctly and efficiently, PHMSA pipeline safety research projects have a higher probability of being successful.

3.0 Peer Review Panelists

Peer review panelists are chosen based on three criteria: expertise, balance, and independence. Specifics for choosing panelists are derived from the OMB Bulletin and panelists can range from academics to active and or retired pipeline personnel from operators, regulators and industry trade organizations.

The peer review panel consisted of nine Government and industry experts. Two of the nine panelists are active Government representatives from the National Institute of Standards and Technology and the Minerals Management Service. The remaining seven panelists are retired government and retired and active industry personnel who play vital roles as peers for the American Petroleum Institute, the American Society of Mechanical Engineers, the National Association of Corrosion Engineers and other standards developing organizations. Table 2 identifies the panelists.

Each panelist provided a short biography describing their work history and qualifications of technical knowledge. These biographies are in Appendix B.

| Table 2. Peer Review Panelists | | |
|---------------------------------------|----------------------------|--|
| | Name | Affiliation |
| 1 | Tom Siewert | Department of Commerce, National Institute of Standards and Technology |
| 2 | Michael Else | Department of the Interior, Minerals Management Service |
| 3 | Richard Fields | Department of Commerce, National Institute of Standards and Technology (retired) |
| 4 | Joe C. Bowles, Jr., P.E. | Past President of National Association of Corrosion Engineers (retired) |
| 5 | L. James Moore, P.E. | BP U.S. Pipelines and Logistics |
| 6 | Philip D. Flenner, PE, CWI | Flenner Engineering Services, LLC |
| 7 | Mario Macia | ExxonMobil Upstream Research Company |
| 8 | Jerry Rau | Panhandle Energy |
| 9 | Steven E. Powell | Oklahoma Natural Gas |

4.0 Panelist Charge

The Peer Review Panelist charge, initially developed in December 2005 and revised annually, is provided to each panelist prior to the review. It contains specific instructions regarding what is expected in terms of their review. This charge is important for the following reasons:

1. It focuses the review by presenting specific questions and concerns that PHMSA expects the peer reviewers to address.
2. It invites general comments on the entire work product. The specific and general comments should focus mostly on the scientific and technical studies that have been applied in a sound manner.

The charge is a separate document not attached to this report. It is publicly available for each year's review at http://primis.phmsa.dot.gov/rd/annual_peer_review.htm and may be revised after researcher and panelist post-review feedback.

5.0 Scope of the Peer Review

During the annual peer review of projects, the members of the panel see focused, high-level presentations from researchers addressing 21 evaluation criteria within six specific evaluation categories. Presentations are no more than 30 minutes with five minutes of panelist questions and five minutes of possible written public questions. An underlying R&D Program objective is not to compare one project to another, but to provide the best assessment of each project's performance addressing the specific criteria. A scorecard for rating performance on the specific

categories is provided. Each category has equal rating from one to five. The scorecard included the following questions in six performance categories:

1. Is the project still relevant to the PHMSA mission?
 - Is the project still relevant for enhancing pipeline safety or protecting the environment?
 - Does the project support rulemaking, statutory requirements, inspection activities, or stakeholder recommendations?
 - Does the project address a technology gap or consensus standard or general knowledge?
2. Is the project well designed?
 - Does the project have clear objectives?
 - Does the project have clear milestones?
 - Are the deliverables well defined?
 - Are the capabilities of the project team appropriate to the work?
 - Has the project a well designed plan for transferring results to end users?
3. Is the project still well managed?
 - Does the project have an up-to-date work plan?
 - Is the project making progress toward the scope and the PHMSA goals?
 - Is the project being managed on budget and schedule?
4. What is the approach taken for transferring results to end users?
 - How much end user involvement is incorporated into the work scope?
 - Have efforts been made to protect the intellectual property in a manner that allows for the greatest public impact?
 - For results that may include marketable products and technologies, are commercialization plans established?
5. Is the project well coordinated with other closely related programs?
 - Does the project build on, or make use of, related or prior work?
 - Has consideration been given to possible future work?
 - Is the project coordinated with related projects or programs in PHMSA, industry, or other government agencies?
6. Is the project producing high quality results?
 - Are the intended results supported by the work performed during the project?
 - Are the intended results consistent with scientific knowledge and/or engineering principles?
 - Are the intended results appropriate for the resources expended?
 - Are the intended results presented in such a manner as to be useful for identified end users?

These criteria will provide a numeric rating, which will be converted and illustrated as "Ineffective," "Moderately Effective," "Effective," or "Very Effective." This rating conversion is illustrated in Table 3.

| Table 3. Peer Review Rating Conversion | |
|---|-----------|
| Rating Scale | |
| Very Effective | 3.9 - 5.0 |
| Effective | 2.6 - 3.8 |
| Moderately Effective | 1.3 - 2.5 |
| Ineffective | 0.0 - 1.2 |

6.0 Associated Research

Specific research project subject matter will vary from one annual peer review to another. Generally, subject matter falls within the eight program elements shown in Table 1. Technical issues usually address metallurgical, structural, technological, and risk-based subjects commonly seen in the pipeline industry.

The research peered during the May 2008 review varied among welding, coating, technological, and general knowledge focused projects. Specific technical subjects addressed corrosion, welding, fracture mechanics and material property issues. Projects focusing on technology included several new tools for external and internal pipeline inspection. Research for general knowledge involved projects addressing risk assessment for natural gas distribution pipelines, and human factors, fatigue and control room design.

A short description of each peer reviewed project is found in Appendix C.

7.0 Peer Review Findings

During the May reviews, 29 research projects were peer reviewed by nine expert panelists using 21 different evaluation criteria. The rating scale possibilities were "Ineffective," "Moderately Effective," "Effective," or "Very Effective." The average program rating was "Very Effective" for each of the six evaluation categories. For this year, 28 peered projects were rated "Very Effective" with only one project ranked as "Effective." The average sub-criteria scoring were also rated very high and underpin these findings. This marks the third annual peer review where the majority of peered projects and the overall program rating were very effective. Table 4 itemizes the project ranking order, where projects of the same score have an equal ranking.

At the time of the reviews, the majority of these projects were approximately 75 percent complete. The panelists made several recommendations in the course of the review. These recommendations were categorized into "Strong" and "Weak" points and were associated with each project. Having these high ratings precluded the need for itemization of recommendations on specific research projects. None of these comments identified critical actions required to salvage a project from failing, but recommended actions to further improve upon good performance.

Table 5 itemizes the strong and weak points collected from the nine panelists. These points were consistent among several panelists and are reflected in the scoring of multiple evaluation categories. Specific recommendations will be disseminated to researchers and COTRs so individual decisions on scope changes can be determined.

| Table 4. Summary of Total Average Score & Rating for the Review Categories and Sub-Criteria | | |
|--|--------------|-----------------------|
| Review Categories and Sub-Criteria | Score | Rating |
| 1. Is the project still relevant to the PHMSA mission? | 4.7 | Very Effective |
| 1.1. Is the project still relevant for enhancing pipeline safety or protecting the environment? | 4.8 | Very Effective |
| 1.2. Does the project support rulemaking, statutory requirements, inspection activities, or stakeholder recommendations? | 4.6 | Very Effective |
| 1.3. Does the project address a technology gap, and consensus standard or general knowledge? | 4.7 | Very Effective |
| 2. Is the project well designed? | 4.6 | Very Effective |
| 2.1. Does the project have clear objectives? | 4.6 | Very Effective |
| 2.2. Does the project have clear milestones? | 4.7 | Very Effective |
| 2.3. Are the deliverables well defined? | 4.6 | Very Effective |
| 2.4. Are the capabilities of the project team appropriate to the work? | 4.8 | Very Effective |
| 2.5. Has the project a well designed plan for transferring results to end users? | 4.5 | Very Effective |
| 3. Is the project still well managed? | 4.4 | Very Effective |
| 3.1. Does the project have an up-to-date work plan? | 4.4 | Very Effective |
| 3.2. Is the project making progress toward the scope and the PHMSA goals? | 4.6 | Very Effective |
| 3.3. Is the project being managed on budget and schedule? | 4.2 | Very Effective |
| 4. What is the approach taken for transferring results to end users? | 4.6 | Very Effective |
| 4.1. How much end user involvement is incorporated into the work scope? | 4.7 | Very Effective |
| 4.2. Have efforts been made to protect the intellectual property in a manner that allows for the greatest public impact? | 4.6 | Very Effective |
| 4.3. For results that may include marketable products and technologies, are commercialization plans established? | 4.5 | Very Effective |
| 5. Is the project well coordinated with other closely related programs? | 4.5 | Very Effective |
| 5.1. Does the project build on, or make use of, related or prior work? | 4.7 | Very Effective |
| 5.2. Has consideration been given to possible future work? | 4.3 | Very Effective |
| 5.3. Is the project coordinated with related projects or programs in PHMSA, industry, or other government agencies? | 4.5 | Very Effective |
| 6. Is the project producing high quality results? | 4.5 | Very Effective |
| 6.1. Are the intended results supported by the work performed during the project? | 4.5 | Very Effective |
| 6.2. Are the intended results consistent with scientific knowledge and/or engineering principles? | 4.6 | Very Effective |
| 6.3. Are the intended results appropriate for the resources expended? | 4.5 | Very Effective |
| 6.4. Are the intended results presented in such a manner as to be useful for identified end users? | 4.5 | Very Effective |
| Total Average Scoring and Rating: | 4.5 | Very Effective |

| Table 4. Summary Ranking & Rating of Individually Reviewed Research Projects | | | | | |
|---|--------------------|---|---|---------------|----------------|
| Rank | Project ID | Project Title | Contractor | Rating | Score |
| 1 | DTPH56-06-T-000002 | Define, Optimize and Validate Detection and Sizing Capabilities of Phased-Array Ultrasonics to Inspect Electrofusion Joints in Polyethylene Pipes | Edison Welding Institute | 4.9 | Very Effective |
| 1 | DTPH56-06-T-000001 | Demonstration of ECDA Applicability and Reliability for Demanding Situations | Gas Technology Institute | 4.9 | Very Effective |
| 1 | DTPH56-06-T-000015 | Pipeline Integrity Management for Ground Movement Hazards | Pipeline Research Council International | 4.9 | Very Effective |
| 1 | DTPH56-06-T-000019 | Augmenting MFL Tools with Sensors That Assess Coating Condition | Battelle Memorial Institute | 4.9 | Very Effective |
| 1 | DTPH56-06-T-000020 | Phase Sensitive Methods to Detect Cathodic Disbondment | Gas Technology Institute | 4.9 | Very Effective |
| 2 | DTPH56-06-T-000017 | Improved In-field Welding and Coating Protocols | Gas Technology Institute | 4.8 | Very Effective |
| 2 | DTPH56-07-T-000002 | Advanced Technologies and Methodology for Automated Ultrasonic Testing Systems Quantification | Edison Welding Institute | 4.8 | Very Effective |
| 3 | DTPH56-05-T-0003 | Corrosion Assessment Guidance for Higher Strength Pipelines | Electricore, Inc. | 4.7 | Very Effective |
| 3 | DTPH56-06-T-000003 | Characterization of Stress Corrosion Cracking Using Laser Ultrasonics | Intelligent Optical Systems, Inc. | 4.7 | Very Effective |
| 3 | DTPH56-06-T-000014 | Validation and Documentation of Tensile Strain Limit Design Models for Pipelines | Pipeline Research Council International | 4.7 | Very Effective |
| 3 | DTPH56-06-T-000016 | Investigate Fundamentals and Performance Improvements of Current In-Line Inspection Technologies for Mechanical Damage Detection | Pipeline Research Council International | 4.7 | Very Effective |
| 3 | DTPH56-07-T-000005 | Development of Optimized Welding Solutions for X100 Linepipe Steel | Electricore, Inc. | 4.7 | Very Effective |
| 4 | DTPH56-05-T-0001 | Understanding Magnetic Flux Leakage (MFL) Signals from Mechanical Damage in Pipelines | Electricore, Inc. | 4.6 | Very Effective |
| 4 | DTPH56-06-T-000013 | Guidelines for the Identification of SCC Sites and the Estimation of Re-Inspection Intervals for SCCDA | Pipeline Research Council International | 4.6 | Very Effective |
| 4 | DTPH56-06-T-000014 | Second Generation Models for Strain-Based Design | Pipeline Research Council International | 4.6 | Very Effective |
| 4 | DTPH56-07-T-000005 | Update of Weld Design, Testing, and Assessment Procedures for High Strength Pipelines | Electricore, Inc. | 4.6 | Very Effective |

| | | | | | |
|----|--------------------|---|---|-----|----------------|
| 5 | DTPH56-06-T-000004 | Plastic Pipe Failure, Risk, and Threat Analysis | Gas Technology Institute | 4.5 | Very Effective |
| 5 | DTPH56-06-T-000016 | Development of Dual Field MFL Inspection Technology to Detect Mechanical Damage | Pipeline Research Council International | 4.5 | Very Effective |
| 5 | DTPH56-07-T-000004 | Development of HAZ Hardness Limits for In-Service Welding | CC Technologies, Inc. | 4.5 | Very Effective |
| 5 | DTPH56-07-T-000003 | Hybrid Laser/GMAW of High Strength Steel Gas Transmission Pipelines | Edison Welding Institute | 4.5 | Very Effective |
| 5 | DTPH56-07-T-000010 | Butt Fusion Joint Integrity and Evaluation of NDE Technologies | Northeast Gas Association/NYSEARCH | 4.5 | Very Effective |
| 5 | DTPH56-07-T-000009 | In-Situ Hydrogen Analysis in Weldments: Novel NDE for Weld Inspection | Colorado School of Mines | 4.5 | Very Effective |
| 6 | DTPH56-07-T-000007 | Hybrid Laser Arc Welding (HLAW) System Development for Pipeline Construction | BMT Fleet Technology Limited | 4.4 | Very Effective |
| 7 | DTPH56-06-T-000021 | Method for Qualification of Coatings Applied to Wet Surfaces | CC Technologies, Inc. | 4.3 | Very Effective |
| 7 | DTPH56-07-T-000001 | Improving Joint Integrity and Assessment for Non-Metallic Materials | Gas Technology Institute | 4.3 | Very Effective |
| 7 | DTPH56-07-T-000006 | Validation of Assessment Methods for Production Scale Girth Welding of High Strength Pipelines with Multiple Pipe Sources | Electricore, Inc. | 4.3 | Very Effective |
| 8 | DTPH56-06-T-000022 | External Pipeline Coating Integrity | Texas Engineering Experiment Station | 4.2 | Very Effective |
| 9 | DTPH56-06-T-000023 | Effect of Surface Preparation on Residual Stress in Multi-layer and Other Pipeline Coatings | NOVA Research & Technology Centre | 4.0 | Very Effective |
| 10 | DTPH56-07-T-000008 | Automated Laser Ultrasonic Testing (ALUT) Of Hybrid Laser Arc Welds For Pipeline Construction | Intelligent Optical Systems | 3.8 | Effective |

| Table 5. Summary of Strong and Weak Point Recommendations | |
|--|--|
| Strong Points | Weak Points |
| <ul style="list-style-type: none"> • Close technical support and coordination with most industry end users | <ul style="list-style-type: none"> • Improve researcher documentation of coordination with standards developing organizations and expand literature searches for other relevant efforts |
| <ul style="list-style-type: none"> • Technology demonstrations are applied with most project scopes | <ul style="list-style-type: none"> • Better tailor results targeting standards into the format of that standard developing organization |
| <ul style="list-style-type: none"> • High relevance to the mission of the PHMSA’s Office of Pipeline Safety | <ul style="list-style-type: none"> • Several contractors have ambitious schedules and have problems adhering to them with multiple factors causing delays |
| <ul style="list-style-type: none"> • Project are mostly well designed | <ul style="list-style-type: none"> • PHMSA should provide more guidance on commercial planning to contractors developing technology |
| <ul style="list-style-type: none"> • Projects are mostly well managed | <ul style="list-style-type: none"> • Improve the clarity of researcher intellectual property plans for technology development projects |
| <ul style="list-style-type: none"> • Technology transfer is working well on some projects | <ul style="list-style-type: none"> • Technology demonstrations need to be part of all projects developing technology |
| <ul style="list-style-type: none"> • Projects are producing high quality results | <ul style="list-style-type: none"> • Improve validation of models through field trials |
| <ul style="list-style-type: none"> • Project impacts addressing several industry challenges | <ul style="list-style-type: none"> • Improve coordination with other related projects within PHMSA and other related programs |
| | <ul style="list-style-type: none"> • Improve contractor efficiency and rigor with literature searches – Can improvements here save time and further remove duplication? |

8.0 PHMSA Official Response to Panelists Findings and Recommendations

Being the third structured peer review of its pipeline safety R&D program, PHMSA is satisfied with the process for conducting these reviews as well as the findings and recommendations provided by the peer review panelists. PHMSA accepts these findings and recommendations summarized in the report. The panel indicated no immediate actions to safeguard peer reviewed research projects from achieving contractual milestones. However, a number of good recommendations targeting some of the lower scoring projects will be discussed with project managers and project co-sponsors. The official PHMSA response memorandum can be found in Appendix A.

PHMSA will continue refining the annual peer review process by incorporating feedback submitted by the researchers and peer review panelists. Since none of the reviewed projects were rated “Ineffective” or “Moderately Effective”, no immediate project modifications are warranted. Specific recommendations from panelists will be disseminated to researchers and COTRs. The researchers, COTRs and research co-sponsors will decide whether any scope changes are warranted.

A number of initiatives are planned to provide further guidance on commercialization of technology projects and better coordination with projects strengthening standards. These program initiatives will bring transparency to the panel’s recommendations. PHMSA can still make improvements even with high annual ratings.

In addition, the guidance and presentation template provided to the researchers will be revised. This will improve the manner in which questions are answered, support effective reviews by the panelists, and raise project and program quality.

APPENDIX A

PHMSA Acceptance Memo

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APPENDIX B

Peer Review Panelist Bios

Tom Siewert

Education:

| | | | |
|-------|--------------------------|-------------------------|------|
| B.S. | Applied Math and Physics | Univ. of Wis.- Milw. | 1969 |
| M.S. | Materials Science | Univ. of Wis.- Madison | 1973 |
| Ph.D. | Metallurgy | Univ. of Wis. - Madison | 1976 |

Experience:

Government: Leader of structural materials, welding, and then process sensing and modeling groups at NIST since 1984. Publications in the areas of joining, cryogenic properties, nondestructive evaluation, and mechanical properties. Leadership in conference and workshop organization committees, Active in various societies.

Industry: Supervisory Research Engineer, then Manager of Research and Development, Alloy Rods (welding filler metal developer) 1976 to 1984.

Academic: Active with a number of Universities

Teaching short courses in Materials, Welding, and NDE for OSHA inspectors (OSHA Training Institute), about 20 one-day courses since 1989.

Adjunct Professor and Research Scientist in the Metallurgical and Materials Engineering Department, Colorado School of Mines

Professional Society Memberships:

- American Society for Metals
- American Society for Testing and Materials
- American Welding Society
- International Institute of Welding
- Welding Journal Reviewer

Active Committee Work:

- American Society for Testing and Materials
 - A01 Steel
 - E28 Mechanical Testing
 - E07 Nondestructive Evaluation
- American Welding Society
 - American Council of the IIW
 - International Standards Activities Committee
 - Government Affairs Activity Committee

Richard Fields

Relevant Experience:

R. J. Fields has conducted metallurgical research and participated in mechanical test standards development activities for nearly 40 years. He is currently the US representative on the Ductility Subcommittee of ISO, Chairman of the ASTM Subcommittee on Ductility and Formability, and an active member of the ASTM Fire Resistive Steel Task Group and the National Materials Advisory Board's Committee on Corrosion Prevention Standards for Ductile Iron Pipe. He received a Bronze Medal from the Bureau of Standards for his research on fracture and crack arrest in high strength steels and a Silver Medal from the Department of Commerce for research on mechanical properties and modeling. From 2002 until 2004, he was the principal technical investigator on metallurgical aspects of the congressionally mandated investigation of the collapse of the World Trade Center Towers. He has performed research and written numerous papers relevant to the prediction of fracture behavior in pipeline steels. In particular, he was principal author on NIST Report 89-4136 written at the request of Senators Bond and Danforth entitled "An Assessment of the Performance and Reliability of Older ERW Pipelines". He was appointed by Secretary of Transportation E. Dole to the Office of Pipeline Safety's Hazardous Liquid Pipeline Safety Committee and served for six years, three of these as secretary. He is now part of a research team that is developing experimental and analytical methods to assess the high rate fracture and crack arrest behavior of high strength pipeline steels.

Education:

Undergraduate degrees in Chemistry and Metallurgical Engineering were awarded to R. J. Fields in 1971 by the University of Pennsylvania in Philadelphia. He received a Masters in Engineering and Applied Physics from Harvard University in 1973 and a PhD in Engineering Materials from Cambridge University in 1977 in England.

Work History:

From 1977 until 2004, R. J. Fields worked at the National Bureau of Standards/National Institute of Standards and Technology (NIST). He retired in May of 2004, and now works for KT Consulting on a contract with NIST. Highlights of his career include 6 years as a Supervisory Metallurgist managing the Time Dependent Failure Group in NBS's Fracture and Deformation Division. This group ran the metallographic facilities as well as carrying out mechanical testing research programs for the US Navy, the Federal Railroad Administration, the National Transportation Safety Board, and the Nuclear Regulatory Commission. More recently, R. J. Fields was Group Leader for the Materials Performance Group in NIST's Metallurgy Division. Part of this group of 11 professionals runs the US National Hardness Standardization Facility, certifying primary hardness standards. As the supervisor of the Materials Performance Group, he started a program on sheet metal forming with the auto industry. This is now the largest program in the Division. He also started a program on modeling bullets and armor for the National Institute of Justice and a program on fire resistant structural steels. He has an extensive list of publications, patents, and awards available on request.

Professional Society Membership:

R. J. Fields is a member of ASTM International and the American Academy of Mechanics.

Joe C. Bowles, Jr.,P.E.

Forty-nine years experience in all aspects of pipeline corrosion control (external-underground/submerged, internal, and atmospheric). Served as Manager of Corrosion Control for major pipeline company with more than 19,900 miles of pipeline, onshore and off-shore, 96 compressor stations, off-shore platforms and meter stations. Established and supervised the operations, maintenance, budget, construction, design, and monitoring for nine subsidiaries.

Served as President of NACE International for the 1996-97 term and as a Director for eleven years. Received the NACE International Distinguished Service Award in 1990, and the NACE International Technical Achievement Award in 1992. A member of nine Technical Practices Committees.

A Registered Professional Engineer in Corrosion Engineering, in state of California, and a certified Corrosion Specialist with NACE International.

Participated as a member of Pipeline Research Committee (Corrosion Supervisory Committee), and Gas Research Committee, (Biocorrosion Task Group).

Authored and presented numerous papers on pipeline corrosion control.

Michael (Mik) Else

Organization: US DOI, Minerals Management Service

Job Title: Safety Research Engineer

Job Responsibilities: As the lead engineer for the MMS Safety and Technology Research Program, headquartered outside Washington, D.C., Mik coordinates the selection, funding, and management of MMS's safety and technology research for a wide range of offshore Oil & Gas development activities.

Years with current organization: 17

Years working in the oil/gas industry or in related fields: 25

Academic Degree: BS Petroleum Engineering, May 1983, Montana College of Mineral Science and Technology.

Summary of other information that may be important for the audience: MMS is the steward of 1.76 billion acres of offshore Federal Waters consisting of areas off Alaska, the Pacific and Atlantic coast, and the Gulf of Mexico. MMS is responsible for management of energy and minerals exploration and development activities in these areas as well as protection of marine and coastal environments as they relate to energy and minerals development. In addition,

MMS funds research for environmental sciences, alternative energy, and oil spill response including oversight of the MMS Ohmsett Test Facility in Leonardo, NJ, the world's largest of its type.

Philip D. Flenner, P.E., CWI
Flenner Engineering Services, LLC

Mr. Flenner graduated with a Bachelor of Welding Engineering and a Master of Science in Welding Engineering in 1972 from The Ohio State University. He joined Consumers Power Co. (now Consumers Energy Co.) in Michigan and progressed through various positions until he took early retirement in 2001, when he started consulting on a full time basis. His responsibilities at Consumers included the development of the welding program for both fossil and nuclear stations, the training and qualification of company welders, field services for welding repairs, welding engineering, auditing, nuclear licensing, and dry fuel storage. He is or has been very active during his career in both the American Welding Society and the American Society of Mechanical Engineers. In the AWS, he was active in the Continuing Education Committee and taught several Welding Inspection Courses. In the ASME, he holds several Chair or Vice Chair positions for the B31.1 (29 years), B31 (26 years), and Section IX (24 years) Committees. He has taught ASME sponsored national B31.1 and B31.3 courses for 22 years. He is currently an independent consultant specializing in the welding area and in Codes and Standards issues.

Jerry F. Rau

EDUCATION & CERTIFICATIONS

Bachelor of Science-Mechanical Engineering (BSME) Marquette University (1974)

National Association of Corrosion Engineers, American Society of Mechanical Engineers

SUMMARY OF EXPERIENCE

- * Over 35 years of experience in energy related businesses, primarily oil and gas production and natural gas transmission.
- * Specialist in many areas of corrosion control including: cathodic protection, chemical inhibitors, coatings and materials selection (including CRA materials).
- * Has been heavily involved in development of corrosion control and integrity management industry standards and have directed research activities for the pipeline industry
- * Extensive experience both onshore and offshore in the corrosion control disciplines for both structural reliability and failure avoidance
- * Has developed and implemented threat assessment and risk management programs
- * Has authored papers and made numerous presentations to industry association on corrosion control and integrity management

- * Currently manage a multi disciplinary engineering staff of pipeline experts in codes compliance, corrosion control, pipeline technical services and data analysis / integration

L. James Moore, P.E.

Forty years experience in engineering and engineering management including corrosion, materials, and mechanical engineering.

Began career as a corrosion engineer for Sun Pipe line Company and served in various corrosion engineering and leadership positions in Harco Technologies Corporation. Have worked for Amoco/BP in a variety of engineering and leadership positions since 1989.

Currently managing the Facilities Engineering team in the BP U.S. Pipelines and Logistics (USPL) business which operates approximately 9000 miles of onshore and offshore pipelines and 70 products terminals in the “lower 48” U.S.A. Have served as Advisor for Corrosion and Integrity Management for the BP Exploration and Production business segment.

Education / Professional / External Activities:

BS Engineering Administration (Electrical Engineering), University of Delaware, Newark, Delaware

Registered Professional Engineer - Texas, Ohio, New Jersey
Registered Professional Engineer in Corrosion Engineering - California

NACE International

Certified Corrosion Specialist
Distinguished Service Award – 2003

Currently serving as Chair of Technical Coordination Committee (2007-2009) with over 35 years service in various NACE technical committees. Recently completed term as a member of NACE Board of Directors as Chair of the Conferences and Expositions Activity Committee (2005-2008) and have chaired the Certifications Committee (2001-2003) and Instructor and Peer Quality Committee (2003-2005). While serving on the Board of Directors, conceived and championed a Pipeline Council to deepen the engagement of the pipeline industry in NACE technical, education, and certification activities.

American Petroleum Institute

Member of the Storage Tank Task Force.

Steve Powell

For over twenty five years, Steven E. Powell has been developing new products and assuring quality in pipeline technology. While at Central Plastics Company, he worked on many fittings, including the emergence of electrofusion. He was recruited to assure quality at McElroy Manufacturing, a company recognized worldwide for their heat fusion equipment for polyolefin pipelines. He was also instrumental in Research and Development of both destructive and non-destructive evaluation of pipe joints. Today, Steve manages the distribution operations for Oklahoma Natural Gas, a subdivision of ONEOK.

Currently, Steven E. Powell is serving as Chair Elect for the ONEOK Distribution Companies, Materials Specification Committee. For many years, he has actively represented ONEOK Distribution Companies as the Chairman of the Research Identification and Advisory Subcommittee through the Plastic Materials Committee of the American Gas Association.

Mario L. Macia

Mario Macia has 12 years of work experience at ExxonMobil Upstream Research Company and currently working in the Pipeline Technology section.

Assignments have included research in the areas of metallurgy, welding, fracture mechanics and pipeline design. Research projects experiences include the evaluation of 13Cr stainless steels for flowline applications, the development of X120 pipeline steels and girth welding technology, reliability based design for arctic pipelines, development of methods to evaluate pipeline strain capacity and development of welding technology for pipelines with strain based designs. In addition to research activities, he has provided support to ExxonMobil affiliates on materials engineering issues, including assignment to the Mackenzie Gas Project team to support development and qualification of materials for a strain based pipeline design.

He holds degrees in Materials Science and Engineering including a Bachelor of Science from Rice University and a PhD from the Georgia Institute of Technology. He is an active member of the API Task Group on Linepipe and a voting member of API SC5 for linepipe related standards.

APPENDIX C

Peer Review Project Summaries

Additional summaries and publicly available reports are available at:

<http://primis.phmsa.dot.gov/matrix/>

Demonstration of ECDA Applicability and Reliability for Demanding Situations

Gas Technology Institute

The objective is to identify and demonstrate External Corrosion Direct Assessment (ECDA) technologies for demanding pipeline situations (cased and non-cased crossings, pipe with shielded coatings, segments with stray currents or interferences from other pipelines). The deliverable will be a published procedure (best practice) for ECDA that allows the identification of ECDA techniques for each situation. The results will be fed into industry standards and recommended practices (*e.g.*, ASME and NACE) to assure the fastest possible implementation.

Hybrid Laser/GMAW of High Strength Steel Gas Transmission Pipelines

Edison Welding Institute

The project aims to develop innovative hybrid Yb-Fiber Laser and Gas Metal Arc Welding (GMAW) processes and technologies for pipeline girth welding and to demonstrate the system under field conditions. Internal diameter root pass welding with GMAW will be the baseline with external hybrid root pass welding techniques developed for variations of laser power and root face thickness. This combination has the greatest potential to meet existing pipeline integrity requirements and facilitate the use of new and existing Yb-Fiber Laser GMAW hot and fill pass techniques. Advanced automation will be used to improve and develop root and fill pass processes, and for attainment of mechanical property requirements.

Corrosion Assessment Guidance for Higher Strength Pipelines

Electricore, Inc.

The project objective is to extend present guidance for assessing corrosion metal loss defects to material grades from X70 to X100 by the following: 1. Improve an operator's ability to determine the severity of damage from localized corrosion and its reduction on pipeline operating pressures; 2. Develop comprehensive and consistent methods for locating and assessing corrosion in the field; 3. Create better tools and procedures for assessing, managing, and mitigating external force and mechanical damage threats; 4. Provide a sound basis for establishing the interval between successive integrity management assessment; and 5. Address and improve the prevention of pipeline failure due to third party damage.

Validation and Documentation of Tensile Strain Limit Design Models for Pipelines *Pipeline Research Council International*

The project objective covers the following goals: 1. Obtain high quality experimental data on the most important parameters for the tensile strain capacity of pressurized pipes; 2. Using the experimental data, and building on previous work, determine the accuracy of existing models (FEA and other engineering models) to predict full-scale results, make initial modifications to improve model accuracy and identify requirements for next generation model developments; 3. Prepare initial recommended procedures, for design and material testing, for establishing project-specific, tensile strain limits for pipelines designed using strain based design methods; and 4. Develop next generation tensile strain limit models and strain-based design procedures.

Second Generation Models for Strain-Based Design *Pipeline Research Council International*

Pipelines that are subjected to large ground movements, such as those resulting from frost heave, thaw subsidence, or seismic actions, can only be economically designed using strain-based design (SBD) methods. There is an urgent need to properly address the lack of physical test data, which would allow for further verification and development of tensile strain capacity models, and consequently, documented procedures for establishing tensile strain capacity limits. Objectives: 1. Obtain high quality test data to identify the dominant parameters governing the tensile strain capacity of pressurized pipes; 2. building on previous work, apply test data to assess the accuracy of existing numerical and engineering models, modify the models to improve accuracy and identify requirements for second generation model development; 3. prepare a state-of-the-art guidance document to establish tensile strain limits based on existing SBD models; and 4. develop second generation tensile strain limit models and SBD procedures.

Guidelines for the Identification of SCC Sites and the Estimation of Re-Inspection Intervals for SCCDA *Pipeline Research Council International*

The objective is to develop a set of quantitative guidelines for predicting where and when SCC might be an integrity threat for gas and liquid hydrocarbon pipelines. These guidelines would complement other methodologies, such as the NACE RP0204, ASME B31.8S, and the CEPA Recommended Practices. These guidelines are aimed at improving the industry's ability to locate SCC in the field where the in-ditch protocols detailed in NACE RP0204 would be followed. In addition, the quantitative nature of the proposed guidelines would allow more-informed estimation of the re-inspection interval for repeat Direct Assessment procedures.

Investigate Fundamentals and Performance Improvements of Current In-Line Inspection Technologies for Mechanical Damage Detection
Pipeline Research Council International

The objective of the project is to evaluate existing in-line inspection tools for detecting, discriminating, and characterizing mechanical damage. The main benefit is to help industry manage the threat of delayed mechanical damage and document the relative value of existing technology versus additional technology, such as the proposed dual field technique, in characterizing mechanical damage and discriminating defects from benign anomalies.

Development of Dual Field MFL Inspection Technology to Detect Mechanical Damage
Pipeline Research Council International

The objective of the project is to establish the capability of dual magnetic field MFL technology to detect mechanical damage and discriminate between critical and benign anomalies. This project will entail building a dual magnetization MFL tool and testing in an operating pipeline.

Characterization of Stress Corrosion Cracking Using Laser Ultrasonics
Intelligent Optical Systems, Inc.

The objective of the proposed effort is to apply the proven technologies of laser ultrasonics and finite difference simulation toward the development of a tool that can provide the ability to map the SCC colonies accurately and provide spatially precise 3-dimensional data, and to develop an application that can do so in an efficient manner in the field.

Improving Joint Integrity and Assessment for Non-metallic Materials
Gas Technology Institute

The objective of this project is to develop nondestructive ultrasonic methods for inspecting nonmetallic fusion joints, in particular polyethylene (PE) joints. PE is the predominant pipe used in gas distribution systems. Visual inspection of PE joints works in most cases, but does not guarantee integrity. The industry project, "Ultrasonic Inspection of Fusion Welds on PE Mains," sponsored by the Operations Technology Development, is developing an affordable, easy-to-use (go/no-go) prototype for inspecting butt fusion joints. This project expands that effort to include development of the method to all types of fusion joints, sockets, tees, elbows, etc. for both heat fusion joints and electro-fusion joints. One approach scans an array of two or three sensors around the joint. Data fusion then combines the information from all scans and accepts or rejects the joint. A second approach places as many sensors as needed around the joint in a fixed array and pulses them one at a time. Synthetic aperture focusing software for technology behind side-looking radar combines all the received signals into a sharp image that is used to accept or reject the joint.

Plastic Pipe Failure, Risk, and Threat Analysis
Gas Technology Institute

The objective of the research is to determine the failure risks and threats to plastic gas pipes by conducting failure analyses including a root-cause analysis to identify defects that lead to failure initiation and growth and prioritizing the risks and threats using risk assessment techniques and to identify an inspection technology to mitigate plastic pipe failures, risks and threats.

Define, Optimize and Validate Detection and Sizing Capabilities of Phased-Array Ultrasonics to Inspect Electrofusion Joints in Polyethylene Pipes

Edison Welding Institute, Inc.

The objective is to define the detection and sizing capabilities of current state-of-the-art phased-array technique for non-destructive inspection of electrofusion and saddle lap-joints in polyethylene gas distribution pipelines. Additional tasks include the development of an optimized phased-array procedure and determination of the performance of the technique and proposed improvements

Butt Fusion Joint Integrity and Evaluation of NDE Technologies

Northeast Gas Association /NYSEARCH

The objective of the program is to improve and/or validate the existing butt fusion process by developing novel analytical solutions and new test approaches that will help ensure the safe long-term performance of polyethylene (PE) butt fusion joints. The new test approaches are designed to address overall joint integrity related to long-term destructive testing and evaluate the latest innovations in Non-Destructive Examination (NDE) techniques.

Method for Qualification of Coatings Applied to Wet Surfaces

CC Technologies Inc.

The objective is to develop a test methodology which addresses the application of rehabilitation and repair coatings on wet surfaces is proposed. The method will encompass the extremes of wet surface coating application, namely a continuously wet and cold surface.

Phase Sensitive Methods to Detect Cathodic Disbondment

Gas Technology Institute

The objective is to develop a phase sensitive technology that could detect coating disbondment on steel pipe from above ground, thus locating potential corrosion failure points. The system would consist of two components, a stationary signal generator that is attached to a test point and a detector that is carried along the pipeline. Sinusoidal or pulse excitation signals may be used. A

wireless link between the generator and the detector provides accurate synchronization. An abrupt change of signal phase is expected at the disbondment.

Augmenting MFL Tools with Sensors That Assess Coating Condition

Battelle Memorial Institute

The objective is to develop new sensors and instrumentation that could work with currently available MFL in-line inspection tools to detect external coating disbondment. Much like the bore diameter sensor and inertial guidance systems that are being added to MFL tools, these sensors would not add substantial cost or complexity to a normal MFL survey. Moreover, coating assessment during in-line inspection will help pipeline owners assess the general health of the coating protecting their pipeline system.

Pipeline Integrity Management for Ground Movement Hazards

Pipeline Research Council International

The project objective will address large scale ground movement events related to landslides, long term slope movement and ground subsidence. The objective of the proposed effort will develop recommendations on engineering practices with respect to the assessment of these large scale ground movement geohazards, and guidance to define appropriate and sufficient pipeline design and operational measures for the mitigation of large scale ground displacement effects on buried pipelines.

Advanced Technologies and Methodology for Automated Ultrasonic Testing Systems Quantification

Edison Welding Institute

The overall objective of the program is to reduce the uncertainty of Automated Ultrasonic Testing (AUT) detection and sizing accuracy with the goal of dramatically improving the predicted reliability of pipelines in the early design stage. This will be accomplished by the following manner: 1. Develop a methodology for quantification of AUT systems; 2. Advance and quantify AUT systems image-capture capabilities; 3. Quantify the performance of multiple AUT systems and establish a guidance document; and 4. Implement the quantification methodology in field tests and guidance document in Reliability Based Design and Assessment (RBDA) standards. The deliverables for this program will include a methodology to quantify imaging capabilities and AUT systems, probability of detection (POD) and sizing accuracy curves for multiple representative systems, guidance for AUT capabilities and ECA/strain-based design approach applicability, and technical justification for modifications of the current requirements for AUT quantification trails demanded by the global practices of majors companies and codes.

Improved In-field Welding and Coating Protocols
Gas Technology Institute

The objective is to reduce premature coating failures of in-field welded and coated pipeline sections/appurtenances. The project team will survey/summarize current in-field welding/coating practices and interactions and develop protocols to improve welding-coating coordination. The team will weld and coat test sections using the existing and improved protocols and validate improvements with accelerated corrosion/coating tests. A set of clear/concise recommendations will be submitted for incorporation into consensus guides and recommended practices.

Validation of Assessment Methods for Production Scale Girth Welding of High Strength Pipelines with Multiple Pipe Sources
Electricore, Inc.

The goals of the proposed project are: 1. To test a large set of girth welds produced under realistic conditions by a state of the art high productivity GMAW system; 2. To demonstrate the effect of material variability between pipes, between heats and between pipe manufacturers; and 3. To validate current and proposed new weld defect assessment methods against the performance of a large set of welds made under field production conditions.

External Pipeline Coating Integrity
Texas Engineering Experiment Station

The project objective is to systematically investigate the root-cause for coating disbondment and to optimize material properties and coating thicknesses for coating integrity via the following specific steps: 1. Study of effect of surface preparation, cleanliness, anchor profile on initial coating adhesion and adhesion degradation rate; 2. Measurements, analysis, and modeling of the built-in residual stresses of multi-layer coatings and; 3. Prediction of coating disbondment and Recommendation of approaches for preparation of a new generation of multi-layer pipeline coatings.

Effect of Surface Preparation on Residual Stress in Multi-layer and Other Pipeline Coatings
NOVA Research & Technology Centre

The project objective is to improve the performance of multi-layer coatings through an understanding of the factors that affect the level of residual stress in the coating and the consequences for coating disbondment. This improved understanding is expected to 1. Lead to the identification of improved methodologies for surface preparation and coating application, 2. Enable the evaluation of construction or in-service damage on the long-term integrity of the pipeline and, consequently, 3. Result in a greater acceptance by the North American pipeline industry for the use of these inherently safer, advanced coating systems.

Hybrid Laser Arc Welding (HLAW) System Development for Pipeline Construction
BMT Fleet Technology Limited

The objective of this program is to take lessons learned from the lab and input from industry sponsors to develop, test, and validate a "field ready" Hybrid Laser Arc Welding (HLAW) system for full circumferential girth welding of large diameter (NPS30 and above) high strength pipelines.

Automated Laser Ultrasonic Testing (ALUT) Of Hybrid Laser Arc Welds For Pipeline Construction

Intelligent Optical Systems

Girth welds in new pipeline construction have stringent inspection requirements to ensure pipeline safety. Current automated ultrasonic inspection testing systems are complex and are limited to post process application. Laser ultrasonics is a noncontact technique that can perform ultrasonic measurements on hot, moving surfaces. The goal of this project is to apply laser ultrasonics for monitoring the integrity of girth welds in real time, using a measurement sensor that is mounted in tandem with the weld head. This project is consolidated with a parallel project on the development of hybrid laser arc welding for girth weld production.

Development of HAZ Hardness Limits for In-Service Welding

CC Technologies, Inc.

The objective of the proposed project is to develop heat-affected zone hardness acceptance criteria that can be used to evaluate welds during the qualification of procedures for welding onto in-service pipelines. Welds made onto in-service pipelines are particularly susceptible to hydrogen cracking. During qualification of welding procedures, limits are often imposed on heat-affected zone hardness (*e.g.*, 350 HV max.) as a way to avoid cracking. The hardness level below which hydrogen cracking does not occur is not a fixed value, but varies as a function of several parameters. The results of previous work resulted in the development of hardness evaluation criteria that can be used to quantify the trade-offs that can be made between HAZ hardness, hydrogen level, and the chemical composition of the materials being welded for welds made onto in-service pipelines. Further development and validation is required prior to the widespread use of these criteria, particularly for microalloyed materials used for modern high-strength pipelines. The use of these criteria will reduce the cost and increase the reliability of pipeline modifications and repairs.

Update of Weld Design, Testing, and Assessment Procedures for High Strength Pipelines

Electricore, Inc.

The objectives of this work are to fill critical gaps and provide guidelines on the effective use of high strength linepipes, from design and testing to weld integrity assessment procedures. The planned work builds up the extensive research and development efforts completed by the project

team members. Several key deliverables are: 1. A recommended format for the specifications of high strength linepipes; 2. Relevant testing procedures and protocols for the assessment of strength and toughness that are consistent with the design, construction, and maintenance requirements of high strength pipelines; 3. inclusion of weld strength mismatch requirements for different design conditions; and 4. Updated ECA (Engineering Critical Assessment) procedures for the construction and maintenance of high strength pipelines.

Development of Optimized Welding Solutions for X100 Linepipe Steel
Electricore, Inc.

The objectives of the proposed work are to establish the range of viable welding options for X100 line pipe, define essential variables to provide for welding process control that ensures reliable and consistent mechanical performance, validate the new essential variables methodology for relevant field welding conditions, and verify weldment performance through a combination of small and large scale tests. Full implementation will be achieved through changes to applicable codes and standards.

Understanding Magnetic Flux Leakage (MFL) Signals from Mechanical Damage in Pipelines
Electricore, Inc.

The objective of the project is to provide understanding, identification, and characterization of the MFL signals arising from the geometric and residual stress components to enhance the reliability of employing MFL tools for mechanical damage detection.

In-Situ Hydrogen Analysis in Weldments: Novel NDE for Weld Inspection
Colorado School of Mines

In this program, the Colorado School of Mines and the National Institute of Standards and Technology - Boulder will collaborate in the development of non-destructive technology for weld inspection, assessment, and repair in high strength pipeline steels and their weldments. Advanced sensors will allow the pipe integrity to be frequently or continuously monitored to assure pipeline safety and environmental protection. The research would be further advanced by the characterization of hydrogen in pipeline steel weldments. The characterization of hydrogen content and behavior in high strength steel weldments is timely and important with the introduction of new higher strength steels (*e.g.* X100, which have higher susceptibility to hydrogen damage) in the pipeline industry.

APPENDIX D

The Peer Review Coordinator (PRC) organizes, coordinates, monitors, and facilitates the annual panel peer review. The PRC is the main contact for panelists and the researchers involved with a peer review and for public inquiries. The PRC for the May 2008 peer reviews was Mr. Robert Smith of PHMSA.

Robert Smith

R&D Manager

Department of Transportation

Pipeline & Hazardous Materials Safety Administration

Office of Pipeline Safety, Room E22-321

1200 New Jersey Avenue S.E. (East Bldg.)

Washington D.C. 20590

P(202) 366-3814

F(202) 493-2311

Email robert.w.smith@dot.gov