

**Interagency Research and Development
Five-Year Program Plan
For Pipeline Safety and Integrity**

Annual Update Report
Fiscal Year 2007

**Department of Transportation,
Department of Energy, and
Department of Commerce's
National Institute of Standards and Technology**

December 17, 2007

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List of Acronyms

BAA	Broad Agency Announcements
COR	Contracting Officer's Representative
COTR	Contracting Officer's Technical Representative
DHS	Department of Homeland Security
DOC	Department of Commerce
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
EPA	Environmental Protection Agency
FY	Fiscal Year
GAO	Government Accountability Office
LNG	Liquefied natural gas
MIS	Management Information System
MMS	Minerals Management Service
NETL	National Energy Technology Laboratory
NIST	National Institute of Standards and Technology
NPC	National Petroleum Council
NTSB	National Transportation Safety Board
OMB	Office of Management and Budget
OPS	Office of Pipeline Safety
OTRC	Offshore Technology Research Center
PART	Performance Assessment Rating Tool
PHMSA	Pipeline and Hazardous Materials Safety Administration
PSDOCC	Pipeline Standards-Developing Organization Coordination Council
PSIA-2002	Pipeline Safety Improvement Act of 2002
R&D	Research and Development
RITA	Research and Innovative Technology Administration
SBIR	Small Business and Innovative Research
SDO	Standards Developing Organizations
TSA	Transportation Security Administration
USDA	US Department of Agriculture
WREN	Washington Research Evaluation Network

Interagency Research and Development Five-Year Program Plan For Pipeline Safety and Integrity Annual Update Report – Fiscal Year 2007

As required by law, the U.S. Department of Transportation, after coordination with the U.S. Department of Energy and the National Institute of Standards and Technology, submits this annual update report of the five-year pipeline safety research and development program plan.

This annual update report to the Congress describes the progress made during Fiscal Year 2007 toward implementing joint activities identified in the initial program plan.

Executive Summary

The Pipeline Safety Improvement Act of 2002 (PSIA-2002) mandates that the U.S. Department of Transportation (DOT), the U.S. Department of Energy (DOE) and the National Institute of Standards and Technology (NIST) in the U.S. Department of Commerce (DOC) “shall carry out a program of research, development, demonstration and standardization to ensure the integrity of pipeline facilities.” A fundamental component of this program was the five-year program plan to guide and integrate research and development (R&D) activities of these agencies. While not formally required to participate, the U.S. Department of the Interior’s (DOI) Minerals Management Service (MMS) contributed to the development of the initial plan and has been part of the interagency group since its inception. These agencies are identified as the participating agencies.

This annual update report to the Congress describes the results of collaboration among the participating agencies during Fiscal Year (FY) 2007. The report updates the progress resulting from working together to achieve shared objectives. As a result of better collaboration, the agencies are jointly clarifying R&D focus areas as well as identifying alternative technology development opportunities, preventing inadvertent duplication of effort, and improving communications among the participating agencies. The collaboration described in this update report has led to better integration of reported agency activities, including determining stakeholder perspective on critical issues and identifying promising technologies and areas deserving the highest priority for R&D funding. Agreement on these areas of collaboration is improving the effectiveness of our collective investment in R&D. A summary of FY 2007 collaboration is provided below. Further details illustrating collaborative success are found in the body of the report.

Appropriation changes for the DOE Infrastructure Reliability Program led to the closure of this program and transfer of responsibility for future collaboration research from DOE to the other participating agencies. Since FY 2006, the DOE program made no new research awards and formally closed many active projects. Except for quarterly interagency coordination meetings, DOE participation in all pipeline research activities was terminated.

In FY 2007, DOE, DOC and DOT increased their focus on alternative fuels. Each has played a different role and focused on a different part of the production and transportation of biofuels, including: transport of feedstocks to bio-refineries, the production process of biofuels and the

transportation of biofuel mixtures to end users. Much of the effort during FY 2007 has led to roadmaps for new programs which will commence in FY 2008. Recent collaboration on biofuels illustrates success in addressing the fundamental goals of the five-year plan, including removing duplication and helping meet Administration targets such as “20-in-10.” Building on past success, this collaboration will be employed to promote cooperation among the participating agencies and additional Federal agencies such as the U.S. Department of Agriculture (USDA) and the U.S. Environmental Protection Agency (EPA).

Results of the coordinated R&D are noteworthy. Since FY 2002, the DOT program has produced 10 patent applications, commercialized 6 technology improvements, impacted the revision of 3 consensus standards with 12 more out for revision, submitted 27 public conference papers and released 27 final reports to the public. These reports have documented important program results focusing on key pipeline safety needs, including: better diagnostic tools, approaches to testing unpiggable pipes, stronger materials, improved pipeline locating and mapping technologies, means to prevent outside force damage, and leak detection technologies. The DOT program made 111 project awards since 2002 with \$37 million in funding and with \$46 million of industry co-funding.

All interagency information relevant to PSIA-2002 is kept current and publicly available at <http://primis.phmsa.dot.gov/rd/psia.htm>.

A summary of FY 2007 collaboration efforts is provided below. Further details illustrating collaborative success are set forth in the body of the report.

Identifying the right priorities

- Two interagency coordination meetings.
- One R&D forum to advance Pipeline Damage Prevention, Detection and Characterization, Defect Remediation and Repair and New Fuels Transportation.
- Three government/industry technical workshops to advance the Transportation of Hydrogen via Pipeline, the Readiness and Recovery of the Offshore Infrastructure from Hurricanes, and the Design and Repair of Steel Catenary Risers.

Finding the best research contractors

- The DOT and DOI programs have both solicited research and collaborated on the reviews of submitted proposals. During FY 2007, DOE, DOC and DOI participated in one research solicitation for the DOT program. In addition, the DOC participated in the reviews of the DOT Small Business Innovative Research (SBIR) Program solicitation.
- The DOT and DOI awarded 24 new pipeline research projects (20 DOT and four DOI) with 21 jointly funded by the pipeline industry. The DOT and DOI awarded over \$6 million in new research with industry co-funding of over \$12 million. The DOE program made no new awards because of the program closure during FY 2006. The DOE program did obligate \$400,000 on an active robotic research project, an expansion of scope to an existing/active project awarded in FY 2003, using FY 2005 carryover monies.

Assuring good contractor performance

- DOT is using automated email alerts and electronic milestone tracking as some of the oversight controls to address good contractor performance. This is an example of our continuing pursuit of organizational excellence. These measures implemented for the DOT program assure researcher awareness of contract obligations and communicate any required actions to project and program managers.

Assuring high quality outputs

- The DOT program conducted its second formal peer review panel, part of assuring compliance with Office of Management and Budget (OMB) mandates on Data Quality and Peer Reviews¹. These peer review panels are convened annually and address relevance, quality, and performance of awarded research. Additional information is available at http://primis.phmsa.dot.gov/rd/peer_review_07.htm.

Providing outputs to end users

- The DOT program did not hold any formal or organized technology demonstrations during FY 2007. Demonstrations are included in some project scopes and many were held during FY 2007. These demonstrations are not formal in nature and are part of the normal field work necessary to raise the technology readiness level to a point where formal, broadly communicated events are held.
- In FY 2007, the DOT program conducted a data call involving all affected Standards Developing Organizations (SDO) to ascertain the impact of its research on standards. Early results show a strong impact on safety standards. Full results will be tabulated on the DOT program website in FY 2008. In addition, the DOT program and the Pipeline Standards-Developing Organizations Coordinating Council (PSDOCC) entered into an agreement in January 2006. The goal is to enhance cooperation and coordination and specifically to facilitate more effective and efficient integration of pipeline safety R&D results into the development and revision of voluntary national consensus technical standards.
- DOT maintains an R&D web site containing results from completed R&D programs that are accessible to interested pipeline operators and public stakeholders. This web site received significant use as evidenced by 430,715 hits during FY 2007.

Appendices of this report contain the following summary tables and figures:

- Matrix of New Project Awards for FY 2006 (Table A.1)
- List of FY 2007 Collaborative Activities and Milestones for the Participating Agencies (Table A.2)

¹ Information Quality Act (Pub. Law No. 106-554-515(a)) & Paperwork Reduction Act (44 U.S.C. § 3501 *et seq.*)

- Systematic Evaluation Process utilized by the Pipeline and Hazardous Materials Safety Administration in support of Reportable Research Performance Measures (Figure A.1)
- List of FY 2008 Collaborative Activities and Milestones for the Participating Agencies (Table A.3)

1.0 GOAL OF THE INTERAGENCY PROGRAM

As stated in the PSIA-2002, the goal of the five-year R&D program plan is to guide activities needed to carry out a program of research, development, demonstration and standardization to ensure the integrity of pipeline facilities. Attainment of this goal involves recognizing legitimate differences among the priorities of individual agencies and harmonizing these priorities to ensure complete coverage of critical developmental needs and opportunities.

2.0 OBJECTIVES OF THE INTERAGENCY R&D PROGRAM

The participating agencies believe that attainment of this goal requires joint pursuit of the following objectives:

1. *Identify Safety & Integrity Issues* - Understand stakeholder perspectives on the issues that must be resolved to ensure integrity of current and future pipeline facilities.
2. *Identify Opportunities to Resolve Issues* - Identify a broad spectrum of opportunities for resolving these issues through research, development, demonstration and standardization activities.
3. *Identify Gaps Between Needs and Available Technologies* - Understand the gaps between existing technologies and those needed to resolve the key issues.
4. *Solicit and Select Projects* - Collaborate to solicit topics and select and manage the projects needed to fill identified gaps.
5. *Promote Continuity in Technology Development* - Confirm proof-of-concept and promote continuity of technology development from the concept stage through demonstration and validation.
6. *Evaluate Project and Program Results* - Evaluate the results of program activities using jointly designed performance measures and jointly managed evaluation processes.
7. *Increase Accessibility of R&D Results to Users (Promote Application)* - Support increased accessibility of R&D results to users.
8. *Seek Promising Technologies from Outside Sources* - Collaborate with other agencies and stakeholder organizations in recognition, development and demonstration of promising new technologies.

3.0 MANAGEMENT PLAN

3.1 Areas of Responsibility

The PSIA-2002 enumerated ten R&D program elements as the focus of the agencies participating in the pipeline safety and integrity R&D program.

Table 1. Summary of PSIA-2002 R&D Program Elements

Program Elements	
1.	Materials inspection
2.	Pipe anomaly detection
3.	Internal inspection and leak detection technologies
4.	Methods of analyzing content of pipeline throughput
5.	Pipeline security
6.	Risk assessment methodology
7.	Communication, control, and information systems surety
8.	Fire safety of pipelines
9.	Improved excavation, construction, and repair technologies
10.	Other appropriate elements
	a. Materials analysis and development
	b. Standardization activities

- Department of Energy, National Energy Technology Laboratory, part of DOE’s national laboratory system, is owned and operated by the Department of Energy and supports DOE’s mission to advance the national, economic, and energy security of the United States.
- Department of Commerce, National Institute of Standards and Technology is promoting U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.
- Department of Transportation, Pipeline and Hazardous Materials Safety Administration is sponsoring research and development projects focused on providing near-term solutions that will increase the safety, cleanliness, and reliability of the Nation's pipeline system.
- Department of the Interior, Minerals Management Service supports research associated with operational safety and pollution prevention as well as oil spill response and cleanup capabilities.

3.2 Management Processes to Achieve Objectives (How have we worked together?)

The objectives of the interagency pipeline safety and integrity R&D program are listed in Section 2.0. The areas of collaboration designed to achieve these objectives are discussed in this section.

The participating agencies are committing to periodically examine areas of collaboration and to document that program objectives are met. Successful attainment of these interagency objectives

is assured through collaboration in identifying research priorities and by making research outputs available to end users. As described below, each agency plays an active role throughout the life cycle of research in the following areas of collaboration:

- Identifying the right priorities
- Finding the best research contractors
- Assuring good contractor performance
- Assuring high quality outputs
- Applying outputs to end users

3.2.1 Identifying the Right Priorities

The following sections explain how the participating agencies identify and validate R&D needs and sequence their implementation. Each agency uses the common set of priorities for strategic planning to promote attainment of PSIA-2002 directives. The participating agencies pursue the eight program objectives through the activities described in this section.

Interagency Coordination Meetings

This past year the participating agencies held quarterly coordination meetings to promote collaboration on the PSIA-2002 group activities. These meetings provided opportunities to assess progress on projects and overall program effectiveness. In addition the meetings supported: review of developing issues and their priorities; identification of gaps between high priority safety, integrity and reliability issues and the R&D designed to support their resolution; identification of promising technologies; review of measures of performance; update and integration of plans for future solicitations; and update project portfolios.

The first interagency coordination meeting in FY 2007 was held on April 11, 2007. The meeting was attended by representatives from each participating agency. Subsequent meetings were held on July 10 and October 11, 2007, and were also attended by representatives from each participating agency. These meetings promote healthy discussions and the identification of further collaboration opportunities in the many areas described in Section 2.0.

Collaboratively Organized Public Events

Forums, workshops, and conferences are jointly organized by the participating agencies and in 2007, involved a spectrum of industry stakeholders. They served to identify priorities, eliminate redundancy, and disseminate research output to end users.

2006 Offshore Hurricane Readiness and Recovery Conference

This event was held in New Orleans, LA, on November 1 and 2, 2006, to understand the significance of and lessons learned with the 2004 and 2005 hurricane seasons in the Gulf of Mexico. The offshore Gulf of Mexico region supplies nearly 30 percent of domestic oil and 25 percent of domestic natural gas production. The tremendous impacts that Hurricanes Ivan (2004)

and Katrina and Rita (2005) had on offshore Gulf of Mexico State and Federal Oil and Gas operations underlines the importance of holding this Hurricane Readiness and Recovery Conference. The Conference was co-sponsored by the American Petroleum Institute, the MMS, and other industry stakeholders to provide a forum to discuss the challenges and lessons learned regarding design and operating practices, technology, and regulations/standards in order to identify any needs and opportunities for improvements. This event was a follow-up to the same event held in 2005 in Houston, TX, to provide a platform for public discussion on how to better design and prepare offshore oil and gas facilities to withstand future events and to better coordinate and expedite repairs afterwards to improve oil and gas supply recovery time.

Proceedings and further information is available at <http://api-ec.api.org/meetings/proceedings/hurricane-conf-proc.cfm>.

Joint Government and Industry Pipeline R&D Forum

The R&D Forum is held on a periodic basis to review and recommend updates for the national pipeline research agenda. The objective of the forum is to allow government and industry pipeline stakeholders to develop a consensus on the technical gaps and challenges for future R&D. The Forum addressed both short and long-term research objectives for liquid and gas transmission and distribution pipelines, covering onshore, offshore and Arctic environments. In addition, details about ultimate research goals, technology demonstrations and transfer, and commercialization are discussed. Feedback received from this event directly contributed to planning guidance for program and project level direction. Pipeline stakeholders utilize identified gaps and challenges as input to determining which topics represent the highest priorities and to support research solicitations such as Broad Agency Announcements (BAA). This provides transparency on programmatic decisions to stakeholders and removes perceptions of a narrow or expert driven model. During FY 2007, a forum was held in New Orleans, LA on February 7 and 8. The two-day event included approximately 250 representatives from Federal, State and international government agencies, public representatives, research funding organizations, standards organizations, and pipeline operators from the U.S. and overseas.

All forum outputs are viewable at <http://primis.phmsa.dot.gov/rd/workshops.htm>.

Repair of Risers Using Composite Materials

This event was held in Houston, TX, on March 29, 2007, to share the results of an MMS sponsored research project at the Offshore Technology Research Center (OTRC). The sponsored work focused on developing guidelines to assist regulators, operators, and manufacturers in using composite technology to repair steel risers and tubulars. For the past decade, the use of composite materials in repairing offshore systems has been of interest to operators and regulators. Risers are one of the most critical elements of the offshore production and pipeline system due to their role in delivering sub-sea oil and gas resources to surface (sea-level) production and transportation facilities. Risers are inherently susceptible to damage and degradation due to the harsh environment and challenges of the offshore oil and gas industry. While risers have been repaired using composite materials, there is little guidance other than manufacture recommendations that specifically address the impact of using this technology on

mechanical integrity requirements. For this reason, the MMS sponsored a research study through the OTRC to assess existing composite repair technology and held a one-day workshop on the subject.

Proceedings and further information is available at https://triton.infosys.tamus.edu/portal/page?_pageid=37,2931&_dad=portal&_schema=PORTAL&id=100263.

Deepwater Riser Design, Fatigue Life, and Standards Workshop

A one-day workshop was held in Houston, TX, on April 20, 2007, on behalf of the MMS on standards affecting deepwater riser design and fatigue life. This FY 2007 MMS-funded initiative is evaluating the fatigue life of pipeline risers on floating structures and reviewing fatigue modeling processes used by the offshore industry. These efforts will lead to recommended revision or replacement of current design standards, modeling practices and best practices applied to deepwater steel catenary risers.

NIST Workshop on Materials Test Procedures for Hydrogen Pipelines

An event was held in Boulder, CO, on August 21-22, 2007, to develop a roadmap for materials, test procedures, mechanical properties data and standards for future hydrogen pipelines. Forty-six (46) representatives from NIST, DOT, DOE and relevant consensus standard organizations met and identified challenges for the existing pipeline infrastructure in a hydrogen economy. The workshop agenda included six keynote presentations to provide some background and suggest some issues, three working groups (materials, test techniques, and standards) to refine and rank the research needs, and summary presentations to the whole group (to compare results and comment on any overlaps or omissions). The workshop results are published by NIST as NISTIR 6649.

Proceedings and further information is available at http://www.boulder.nist.gov/div853/Pipeline_Workshop/.

Following the Boulder workshop, a subgroup of DOE's Hydrogen Pipeline Working Group met to discuss testing methods. This Group made a list of relevant tests and prioritized the gaps in R&D. They agreed to conduct a series of tests in which every laboratory conducts similar tests on identical samples of material to evaluate differences in laboratory practices, equipment, etc. This required making a decision on a sample design, an alloy to use for the samples, selection of test methods, and assignment of a laboratory responsible for sample fabrication. Following completion of testing, DOE and NIST will be conducting inter-laboratory comparisons on hydrogen test methods over the next nine months.

3.2.2 Finding the Best Research Contractors

The following sections explain how the participating agencies collaborate to find the best research contractors to address identified priorities. The participating agencies pursue many of

the eight interagency objectives through the activities described in this section. Resulting awards represent the best researchers who propose the most promising technologies for research and development. These activities support attainment of the following interagency objectives:

- Solicit and Select Projects;
- Promote Continuity in Technology Development;
- Increase Accessibility of R&D Results to Users; and
- Seek Promising Technologies from Outside Sources

Joint Interagency R&D Solicitations

The idea of consolidating research solicitations has been discussed at interagency coordination meetings. The participating agencies developed a process or framework for joint research solicitations but many impediments identified and reported in FY 2004 Annual Update Report continue preventing joint solicitations as an option.

Please find the elaborated process and framework for joint solicitations at the following address http://primis.phmsa.dot.gov/rd/PSIA_2002_FY_2004_Section_12_Update_Report.pdf.

The participating agencies will continue seeking ways to remove these barriers. In the interim, the agencies continue participating in joint reviews of individual agency solicitations. This practice is succeeding in promoting the efficiency objectives described in PSIA-2002 and the Interagency Research and Development Five-Year Program Plan. The DOT and DOI programs fund new pipeline research.

Interagency Review of R&D Solicitations

The participating agencies are collaborating on merit review panels during research solicitations. Broad representation in each agency's solicitation review process continues providing assurance that programs are not duplicative and that the best researcher is selected for award.

During FY 2007, both the DOT and DOI programs solicited new research and collaborated on the reviews of submitted proposals. During FY 2007, DOC and DOI participated on two research solicitations for the DOT program. The first one addressed improving weld design in high strength steel pipe, developing construction practices for welding high strength steel pipe, weld inspection, assessments, repair and maintenance methods for high strength steel pipe, and improving joint integrity and assessment for nonmetallic materials. The second addressed topics for excavation damage prevention technologies, direct assessment methods for transmission and or distribution pipelines, defect detection/characterization, defect remediation/repair/mitigation, and new fuels transportation.

In the DOI program, MMS issued three independent solicitations in FY 2007 covering safety and oil spill research. Two of the solicitations included topics for pipeline research including 1) develop pre-hurricane pipeline riser inspection and monitoring programs to determine in-situ conditions, 2) assess risk and develop modeling for a sudden gas release due to a gas pipeline rupture, and 3) assess smart-pigging options for low pressure, low volume gas pipelines.

In addition, DOC assisted in reviewing SBIR grants submitted to the DOT. The DOT program participates in the Department's SBIR program to encourage the initiative of the private sector and to use small business as effectively as possible in meeting specific Federal research and development objectives.

Cost Sharing R&D with the Pipeline Industry

In the DOT program, cost sharing by proposing organizations is required. This practice is contributing to the goal of finding the best research contractors, as well as significantly expanding the pool of available research funds. The approach is working and reflected in the willingness of other funding organizations to contribute to project management.

Required cost sharing is 50 percent for the DOT program. Research addressing proof of concept sometimes is more risky than research well on its way to commercialization. Therefore, cost sharing is more for development/deployment research as seen with DOT. Cost sharing is formalized through a contractual requirement with the researcher.

During FY 2007, 24 new pipeline research projects were awarded. Over \$6 million in research awards were made by the participating agencies with industry co-funding of over \$12 million. The DOE program made no new pipeline R&D awards. The DOE program did obligate \$400,000 on an active robotic research project with FY 2005 carryover monies. This was not a new start but an expansion of scope to an exiting/active project awarded in FY 2003.

3.2.3 Assuring Good Contractor Performance

Each of the participating agencies establishes good contractor performance differently while addressing many of the interagency objectives described in this section. These efforts work toward the following interagency objectives:

- Identify Opportunities to Resolve Issues;
- Promote Continuity in Technology Development;
- Evaluate Project and Program Results; and
- Increase Accessibility of R&D Results to Users

The following sections explain how the participating agencies assure and maintain good contractor performance.

Contracting Officer's Representatives/Contracting Officer's Technical Representatives

Within DOT and DOI, Contracting Officer's Representatives (COR)/Contracting Officer's Technical Representatives (COTR) are trained, certified, and assigned to each project in accordance with the Federal Acquisition Regulations. In DOT the COTRs are selected based on their familiarity with the technology being developed (or its application). They provide the day-to-day coordination and technical direction required to keep the research focused on the program

goals. Only DOT has current research contracts and interagency agreements with NIST designed to address the technical areas specified in PSIA-2002.

Management Information System

A Management Information System (MIS) is utilized by the DOT program to ensure pipeline safety research contractors are performing well. The MIS electronically monitors and tracks contractor performance as the project moves toward completion. DOT program staff provides the necessary oversight for using the system in assuring specific contractual milestones are met and that accounting procedures are systematically followed as prescribed in the contract. System controls improve and maintain program and project quality, efficiency, accounting, and accountability.

3.2.4 Assuring High Quality Outputs

The following section explains how the participating agencies assure and maintain high quality outputs. Each of the participating agencies manages project quality differently while addressing all interagency objectives except “Solicit & Select Projects” with activities described in this section.

Project Peer Reviews

The participating agencies establish the quality of project outcomes in different ways and through a combination of actions. Joint assurance of quality is a goal addressed through R&D forums, workshops and conferences that the participating agencies organize and jointly conduct with industry stakeholders. Research projects are vetted at public events with diverse sets of peers. These measures ensure that the engineering and science are based on sound fundamentals and aimed at the appropriate end users. The issue of project quality is addressed at multi-agency events discussed in Section 3.2.1. When appropriate, interagency coordination meetings also serve as opportunities for peer discussion of awarded projects.

Peer review panels, papers, and expert reviews are some of the more formal systematic methods the participating agencies use to assure project quality. These are some of the options provided in OMB guidance when implementing statutory requirements on Data Quality and Peer Reviews.¹ The DOT program held its first formal panel peer review in February 2006. Annual peer reviews meet the OMB requirements and address relevance, quality, and performance of awarded research. The FY 2007 review was held on March 27-29. The DOT program posts peer review reporting at http://primis.phmsa.dot.gov/rd/annual_peer_review.htm and is transparent to the public.

Within NIST, expert and panel peer reviews are performed yearly through the National Research Council procedures. Projects awarded by DOT to NIST fall under this process for addressing scientific quality.

¹ Information Quality Act (Pub. Law. No. 106-554-515(a)) & Paperwork Reduction Act (44 U.S.C. § 3501 et seq.)

Technology demonstrations are specifically designed to ensure research projects develop technologies that work under field conditions. Agencies use demonstrations to validate the engineering approaches utilized during the research for ultimate use in the field. Several research projects awarded by the participating agencies require demonstrations as part of project scopes. Section 3.2.5 provides more information on these demonstrations.

Pipeline R&D Forums described in Section 3.2.1 also provide a level of peer review. Many ongoing research projects are presented during working group sessions. These working groups are comprised of a wide variety of peers where feedback can drive scope changes and enhance quality.

Finally, the COR/COTR provides another level of peer review. A COR/COTR is required to review all project deliverables for technical adequacy and to work with researchers so that final outputs are of high quality. The DOT program matches technical backgrounds of regional inspectors with the scopes of new projects. This process of COR/COTR assignment further increases project quality while strengthening internal knowledge.

3.2.5 Applying Outputs to End Users

Each participating agency establishes quality differently while addressing all interagency objectives except “Solicit & Select Projects” with the activities described in this section. Several of the eight interagency objectives are handled collaboratively. The following section explains how the participating agencies apply research results to end users.

Technology Demonstrations

The purpose of these technology demonstrations is to provide realistic test beds and to support technology transfer for several related government funded research efforts. Demonstrations are carried out consistent with a detailed demonstration test plan - having strong input from both an industry advisory board and the demonstration test participants.

Various aspects of technology demonstrations are discussed at the interagency coordination meetings. The participating agencies identify commonalities in technology currently being developed in their individual portfolios. When common technologies reach a point of comparison, a technology demonstration is planned and supported by the participating agencies.

The DOT program funded two formal technology demonstrations during FY 2006 but none in FY 2007. The DOT program does hold informal demonstrations throughout the work scope of projects. These informal demonstrations increase the readiness level of technology to a point where formal demonstrations are planned and multiple government and pipeline stakeholders are involved. Agencies conduct these events on a periodic, not annual, basis. For information on these collaborative technology demonstrations, please view the following pipeline research websites:

DOE's National Energy Technology Laboratory
<http://www.netl.doe.gov/scngo>

DOT PHMSA's Office of Pipeline Safety (OPS)
<http://primis.phmsa.dot.gov/rd/techdemo.htm>

R&D Forums

Pipeline R&D Forums described in Section 3.2.1 provide another opportunity to bring developers and end users of the research into one setting. Many ongoing research projects are presented within the working group sessions. A variety of end users attend these working groups and provide feedback that drive scope changes and improve research applicability toward a given challenge.

Memorandum of Agreements with End Users

The Pipeline Standards-Developing Organizations Coordinating Council (PSDOCC) and DOT's PHMSA entered into an agreement in January 2006 to enhance cooperation and coordination. Specifically, the agreement facilitates a more effective and efficient integration of pipeline safety R&D results into the development and revision of voluntary consensus technical standards. The DOT program measures program outputs and impacts. A critical element in impacting pipeline safety is the incorporation of the results from research projects in standards that reach end users. In FY 2007, the DOT program conducted a data call with all affected SDO to ascertain the impact of its research addressing standards. These findings will be reported on the DOT program website in FY 2008. Please find this agreement at http://primis.phmsa.dot.gov/rd/PHMSA_PSDOCC_MOA.pdf.

4.0 OTHER COLLABORATIVE INITIATIVES

4.1 Interagency Hand-Off of R&D Project Responsibility

The participating agencies have discussed a formal process for interagency hand-off of R&D project responsibility (e.g., from proof of concept to demonstration). The most effective practice identified to date is for one soliciting agency to add a related technical topic to its next solicitation and to notify the researcher managing the subject R&D project of this opportunity. Candidate projects are then reviewed by a merit review committee and new awards made as appropriate.

4.2 R&D Performance Measurement

The participating agencies conduct ongoing discussions on how to improve R&D performance measurement and to comply with requirements of the Government Performance and Results Act and the OMB Program Assessment Rating Tool (PART). Because of differences in agency

missions, different research focus areas, and types of research funded (basic/development), the structure for performance measures must be derived from each agency's own mission directives. Program strategy and performance must be derived from an agency's mission statement and translated into agency specific Strategic and Performance Plans. The PART directs the focus on individual research programs but requires interagency involvement through external reviews. Interagency quarterly coordination meetings facilitate external reviews and contribute to improved performance.

The participating agencies periodically attend the Washington Research Evaluation Network's (WREN) sponsored events. WREN serves as a forum for the R&D evaluation community to explore new approaches to improve the management and the performance measurement of science and technology organizations. Participation at WREN events provides critical insight for the participating agencies to comply with the directives of PART. Please visit <http://www.science.doe.gov/sc-5/wren/index.html> for more information on the WREN and the types of events that have been held.

4.2.1 Update on Pipeline Safety R&D Program and Research Performance Measurement

In September 2005, the PHMSA Pipeline Safety R&D Program favorably addressed both of the Government Accountability Office (GAO) recommendations issued in June 2003. The GAO Final Report # GAO-03-746 recommended that the PHMSA Pipeline Safety R&D Program develop a systematic process for evaluating program outcomes using identified best practices and for including this information in its reports to Congress.

The R&D program supports the PHMSA mission to ensure the safe, reliable, and environmentally sound operation of the Nation's pipeline transportation infrastructure. PHMSA achieves its mission by promulgating regulations, inspecting operators for compliance with these regulations, and taking enforcement action as appropriate. The R&D Program contributes directly to achieving the PHMSA mission through pursuing the following three program objectives:

1. Fostering 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. Improving the state of knowledge of pipeline safety officials so industry and regulatory leaders and PHMSA pipeline safety field inspectors can use this knowledge to better understand safety issues and to make better resource allocation decisions leading to improved safety performance.

Actions taken since the release of the GAO recommendation have improved the quality, efficiency, accounting, and accountability of the program.

Table 2 illustrates performance measures reported by the PHMSA Pipeline Safety R&D Program within the hierarchy of goals, objectives, impacts, and process features. These measures capture

program activities from October 2002 to the end of FY 2007. The systematic evaluation process established by PHMSA is supporting this structure shown in Appendix A.3.

Table 2. Hierarchy of R&D Program Measures and Processes Features Flowing from the PHMSA Pipeline Safety R&D Program Mission and R&D Program Goals

PHMSA Pipeline Safety R&D Program Mission	To ensure the safe, reliable & environmentally sound operation of the Nation's pipeline transportation system.					
Research Program Goals	<p><i>"To drive improvements in"</i></p> <ul style="list-style-type: none"> • Pipeline Damage Prevention and Leak Detection • Pipeline Operations, Controls, and Monitoring • Material Performance and Other Pipeline Safety Improvements 					
Research Program Objectives	Fostering Development of New Technologies		Strengthening Regulatory Requirements and Consensus Standards		Promoting Knowledge for Decision Makers	
Desired Impact Performance Measures	Number of projects contributing to these objectives	42	Number of projects addressing PHMSA regulations	40	Number of projects contributing to these objectives	80
	Number of projects demonstrating new technologies	23	Number of projects contributing to new or revised industry standards	51	Number of final reports publicly available	27
	Number of projects filing for U.S. Patents	10	Number of projects addressing National Transportation Safety Board (NTSB) recommendations	7	Number of conference papers presented	27
Process Features	Categorizing projects for mission relevance		Categorizing projects for mission relevance		Categorizing projects for mission relevance	
	Technology transfer process		Consensus standard integration process		Peer review process for qualifying output quality	
	Peer review process for qualifying output quality		PHMSA regulatory program integration process		Monitoring projects for contractual performance	
	Monitoring projects for contractual performance		Peer review process for qualifying output quality		Contractual requirement for submitting conference papers	
	Contractual requirement for notifying PHMSA of U.S. patents		Monitoring projects for contractual performance			
Fast Facts:						
<ol style="list-style-type: none"> 1. The data is reflecting the first project award on October 1, 2002 until the end of FY 2007. 2. Total number of research awards: 111 3. Current number of completed projects: 58 4. Total funding distribution for 111 projects: \$37,173,926 (PHMSA) \$46,435,172 (Industry co-Funding) 5. Contributing to new or revised standards or regulations is determined when research applicants submit their proposals. Each applicant characterizes what their project deliverable will impact and this information is tracked once a project is awarded. 						

5.0 COMMUNICATION OF R&D RESULTS

Several mechanisms are employed by the participating agencies in making potential users aware of newly-developed technologies. These individual efforts will continue into the future. In addition, several mechanisms will be explored to increase the consistency and quality of the processes used to communicate R&D results. The primary means of communicating R&D results among the agencies, stakeholders, and industry are discussed below.

Government/Industry Pipeline R&D Forum – As previously described, this is a mechanism to bring together government agencies, industry, and pipeline R&D funding organizations to identify the key challenges facing industry and government, current research efforts, and potential research that can help to meet these challenges.

Interagency Program Presentation – This informational presentation is utilized to consistently describe interagency R&D program focus and status. The main objective is to provide an informative, joint pipeline R&D program presentation describing the collaboration, coordination, and project co-funding activities resulting from the passage of the PSIA-2002. The presentation is updated periodically by PHMSA with input from the participating agencies and presented at various public events such as our R&D Forum. It is available to the public via the joint PSIA-2002 Interagency Group website.

More specifically, this presentation identifies and describes the following:

- The requirements of PSIA-2002 on affected Federal R&D Programs
- Introduction and background information on each agency's pipeline R&D program
- Current agency project funding levels
- Current agency project co-funding among programs
- Technology demonstrations
- Future joint activities

PSIA-2002 Interagency Group Website - For the participating agencies, PHMSA has established a joint website to describe and document the interagency group activities and milestones. Please visit our joint PSIA-2002 Interagency Group website at the following address:

<http://primis.phmsa.dot.gov/rd/psia.htm>

6.0 ALTERNATIVE FUELS AND SECURITY R&D AMONG THE PARTICIPATING AGENCIES

Alternative Fuels

In FY 2007, DOE, DOC and DOT increased their focus on alternative fuels. Each played different roles and emphasized different parts of the production and transportation of feedstocks to bio-refineries, the production process of biofuels or the transportation of alternative fuels to end users. Much of the effort seen during this FY will appear as roadmaps and new programs in FY 2008. A synergy of efforts supports the fundamental component of the 5 year plan and is the

group's goal to remove duplication and help meet administration targets such as "20-in-10." In addition, this collaboration will be employed between the participating agencies and new Federal agencies such as the USDA and the EPA.

Alternative Energy Supply and Pipeline Transportation from Offshore Deepwater LNG Receiving Terminals

By 2025, the National Petroleum Council (NPC) estimates that as much as 25 percent of all U.S. natural gas supplies will be supplied by liquefied natural gas (LNG). LNG is touted as a key resource needed to prevent disruption to U.S. energy supplies and economic growth over the next decade. The DOT and DOI, working in conjunction with the US Coast Guard, are doing their part to provide transportation of domestic and foreign-supplied LNG from newly constructed deepwater terminals to shore. Research and technical assessment are underway to study the challenges and impacts of gas handling and transport via existing and new pipelines connecting the offshore Gulf of Mexico and Pacific coast regions to shore. During FY 2006 and FY 2007, 16 applications were received for construction of new deepwater LNG ports, with six applications approved, five granted licenses, one port now operational, and a second expected to commence operations this month (December 2007).

Security

Since September 11, 2001, greater awareness exists for security-related issues affecting transportation of natural gas and hazardous liquids. Pipeline research and development is an effective tool to investigate solutions to any recognized security gaps and challenges. These solutions may range from providing the knowledge required to make appropriate policy decisions to developing the technology needed to protect hard assets. With the post September 11, 2001, reorganization of Federal agency structures and missions, the Transportation Security Administration (TSA) and/or the Department of Homeland Security (DHS) are designated to address overall security research and specifically, pipeline security research. The participating agencies have addressed some technical topics involving technologies for encroachment monitoring and third party damage prevention relative to pipeline security.

7.0 COLLABORATIVE RESEARCH

A major success of participating agencies' is collaboration on merit review panels during research solicitations. Representation on each other's research solicitation is reducing duplication and recommending the best researchers for project awards.

For FY 2007, the participating agencies identified many opportunities for leveraging resources without duplicating efforts. This section categorizes and describes funding for interagency co-funded research. Table A.1 itemizes all new awards for FY 2007 where some are co-funded between the participating agencies.

1. *DOT & DOI Research Project Co-Funding* – FY 2007 marked the eighth consecutive year DOT and DOI reviewed offshore pipeline research proposals and coordinated offshore activities. On some offshore pipelines, DOT and DOI have mutual jurisdiction. The FY 2007 marked new research awards by DOI but no new co-funding by DOT. This joint focus is addressing our energy needs while reducing energy congestion and promoting safety and environmental protection.
2. *DOT & DOC Research Project Co-Funding* – In FY 2007, DOT indirectly expanded FY 2006 program of research and standardization activities with NIST. DOT awarded two new projects to research vendors who subcontracted portions of the work scope to NIST. The DOT program has worked since 2002 to educate funding organizations about NIST qualifications and capabilities. FY 2007 marked the first time these groups partnered contractually with NIST to respond to DOT solicitations. NIST is focusing on pipeline materials, inspection processes, and measures of materials performance and reliability. This program directly supports DOT efforts to maintain and ensure the integrity of natural gas and hazardous liquid pipelines.

This program is improving prediction of corrosion rates in steel pipelines, strengthening related consensus standards and may support lengthened assessment intervals. In addition, material testing directly supporting a strain based design standard is underway and vital for using high strength steels (as proposed for the Alaskan Natural Gas Pipeline).

3. *DOT & DOE Research Project Co-Funding* – In addition to co-funding technology demonstrations and collaborating on other events, DOT and DOE have coordinated hand-offs of R&D project responsibility, but have not co-funded research projects. The DOE program has addressed proof of concept research being long-term in nature. The DOT program awards research which is passed proof of concept, short-term in duration and near commercialization.

Appropriation change for the DOE Infrastructure Program led to the transfer of research responsibility to the other participating agencies. They continue discussing ways to address future research project hand-offs. Three project hand-offs were reported in FY 2004 report but none occurred during FY 2006 and FY 2007 reporting period. This was the result of the DOE program's cessation of new research starts in FY 2006.

Appendices

A.1. Current R&D Activities

The matrix below (Table A.1) shows new project starts categorized by the areas on which these activities are focused for FY 2007. The matrix also displays the amount of funding from the government (Agency Funding) along with the funding levels of the projects provided by industry (Co-Funding).

Specific project information can be found at the following R&D Program websites:

Department of Transportation (DOT)

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

Department of Energy (DOE)

<http://www.netl.doe.gov/scngo/>

Department of Commerce (DOC)

<http://www.metallurgy.nist.gov>
<http://www.boulder.nist.gov/div853/>

Department of the Interior (DOI)

<http://www.mms.gov/tarprojectcategories/pipeline.htm>

Table A.1. Matrix of New Project Awards for FY 2007^{1,2,3,4,5}

R&D Topic (Department)	Number of New Projects	Funding (\$)	Co-Funding (\$) (industry cost share)
Coating Integrity/Reducing Corrosion (DOT)	9	\$1,532,539	\$2,113,408
Improved Plastic Joint Inspection (DOT)	2	\$525,000	\$757,795
Improved Pipeline Materials/Welding (DOT)	9	\$4,075,595	\$8,063,681
Improved Integrity Management (DOI)	1	\$135,780	\$0
Hurricane & Geo-hazard Assessment (DOI)	2	\$170,191	\$1,608,221
Improved Design Solutions (DOI)	1	\$159,450	\$0
Robotic Inspection Technology	0	\$400,000	\$0
Totals:	24	\$6,998,555	\$12,543,105

1. Table only illustrates new project awards for Fiscal 2007.
2. Table does not indicate if future funding for these projects will be proposed.
3. Co-Funding was not required on some awards.
4. DOE & DOC had no new pipeline R&D starts in Fiscal 2007.
5. DOE obligated \$400k of FY2005 carryover monies and modified an active contract.

A.2. FY 2007 Collaborative Activities and Milestones for the Participating Agencies

During FY 2007, the participating agencies have collaborated on and coordinated several activities. These activities and associated milestones are itemized in Table A-2.

Table A.2. List of FY 2007 Collaborative Activities and Milestones for the Participating Agencies

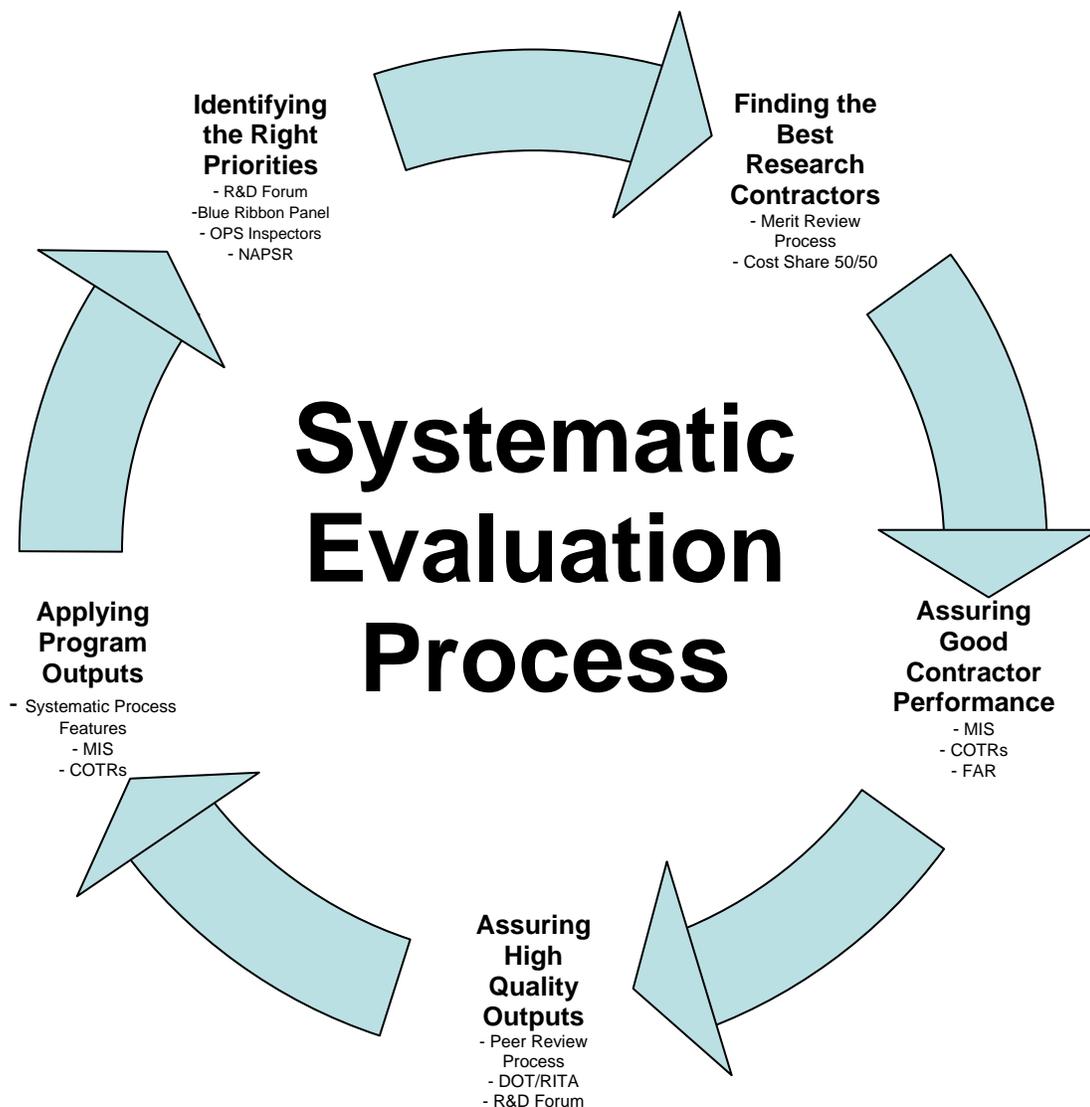
FY 2007 Collaborative Activities and Milestones	DOT	DOE	NIST	DOI
Joint Review of DOT/PHMSA Research Solicitation Submissions – October – December 2006	X		X	X
2006 Offshore Hurricane Readiness and Recovery Conference – November 1, 2006				X
Government/Industry Pipeline R&D Forum - February 7-8, 2007	X		X	X
Repair of Risers Using Composite Materials – March 29, 2007	X			X
Interagency Coordination Meeting – April 11, 2007	X	X	X	X
Banff/Pipeline Integrity Workshop – April 1-5, 2007	X		X	
Deepwater Riser Design, Fatigue Life, and Standards Workshop, April 20, 2007				X
Joint Review of DOI/MMS Research Solicitation Submissions – May, 2007	X			X
DOE Hydrogen Program Review – September 24-25, 2007	X	X	X	
Interagency Coordination Meeting – July 10, 2007	X	X	X	X
Joint Review of DOT/PHMSA Research Solicitation Submissions – June 2007 – TBA	X		X	X
NIST Workshop on Materials Test Procedures for Hydrogen Pipelines – August 21-22, 2007	X	X	X	
DOE Pipeline Working Group Testing Methods Subgroup Meeting – August 22, 2007	X	X	X	

A.3. PHMSA Pipeline Safety R&D Program Systematic Evaluation Process in Support of Research Performance Measurement

This high level representation of the PHMSA Pipeline Safety R&D Program systematic evaluation process is addressing activities described in the PHMSA Pipeline Safety R&D Program Performance Plan. Each step of this systematic process ensures that project outcomes will be of high quality, relevant to the mission of PHMSA and applied to the appropriate end users. It also provides many of the process measures required for quantitative reporting of the program performance.

Continuously working with stakeholders will undoubtedly lead to additional reportable measures and the processes to underpin them. Refining the PHMSA Pipeline Safety R&D Program management and performance reporting will occur over time and improve program and project quality and effectiveness. Additional information about this management process is available upon request.

Figure A.1. Systematic Evaluation Process



A.4. Identification of Future Interagency Group Activities and Milestones for FY 2008

These known future activities and milestones for FY 2008 are itemized in Table A-3. Additional items are likely.

Table A.3. FY 2008 Collaborative Activities and Milestones

FY 2008 Collaborative Activities and Milestones	DOT	DOE	NIST	DOI
Interagency Coordination Meeting – October 11, 2007	X		X	X
Joint Review of DOI/MMS Research Solicitation Submissions – October, 2007	X			X
Ethanol Research RoadMap Workshop – October 25-26, 2007	X		X	
NACE International – National Corrosion Conference – March 16-20, 2008	TBA	TBA	TBA	TBA
Interagency Coordination Meeting – January 2008	TBA	TBA	TBA	TBA
Interagency Coordination Meeting – May 2008	TBA	TBA	TBA	TBA
Interagency Coordination Meeting – August 2008	TBA	TBA	TBA	TBA
International Pipeline Conference – September 29 – October 3, 2008	TBA	TBA	TBA	TBA

A.5. Working Members of FY 2007 Participating Agencies

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