
The Need for a U.S. Pipeline Safety Test Facility

**A Technology Study Provided by the Fiber Optic Sensing
Association**

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www.fiberopticsensing.org

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Introduction

As new pipeline technologies improve the monitoring and operation of oil and gas gathering, transmission and distribution businesses, thorough evaluation and appropriate validation of promising new innovations will encourage their timely adoption in the marketplace. The Fiber Optic Sensing Association (FOSA), in view of the need for such evaluations, offers this concept paper envisioning a modern pipeline safety test facility in the United States.

FOSA is a non-profit organization created in Washington D.C., in 2017, with the mission of educating industry, government and the public on the benefits of fiber optic sensing. One of FOSA’s primary areas of interest is improving pipeline safety through advanced external leak detection and intrusion detection technology.

In recent years, conversations at pipeline industry meetings and conferences have often turned to the need for accurate and reliable testing of new safety technologies for numerous purposes, including leak detection, intrusion detection (e.g., digging), shutoff valves, improved pigging, etc. Although pipeline operators already engage in significant testing, the ability to do so under real-world conditions is limited.

As an organization of technology companies working with pipeline operators around the world, FOSA believes the pipeline industry and the public would benefit from a facility providing testing opportunities under real-world conditions. Such a facility would help pipeline operators validate valuable new technologies and advance further technology development, which will in turn result in fewer and less severe pipeline incidents.

There is ample precedent within the U.S. transportation industry for such a facility: the Federal Transit Administration, Federal Aviation Administration, Federal Rail Administration, Federal Highway Administration, and National Highway Traffic Safety Administration each supports at least one test center aimed at improving safety in specific sectors. (See Figure 1)

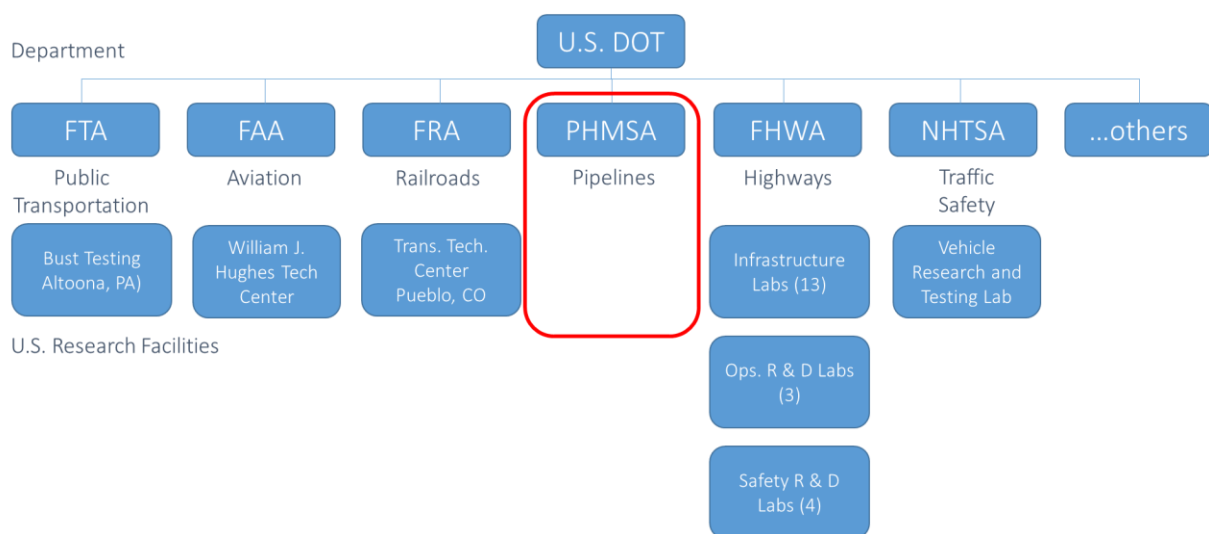


Figure 1

Pipeline Safety Facility Industry Survey

Because of our strong belief that the pipeline sector needs its own safety test facility, FOSA recently set out to determine if other organizations in the pipeline sector agreed. Using a questionnaire developed by the FOSA Technology Committee, we held conversations with a number of influential pipeline industry representatives to determine the user requirements of such a facility and the likely level of support for it, if it were to exist.

The results were telling. A mix of organizations, including some of the world’s largest pipeline operators, responded to the questionnaire. Their responses were overwhelmingly positive for the creation of a substantial test facility for full flow gas and oil pipelines that can generate controlled and environmentally benign leaks for testing and validating technology performance under real-world conditions.

Based on information gleaned from this questionnaire, FOSA has developed this concept paper to help visualize a pipeline safety test facility.

Information Learned from Key Stakeholders

FOSA’s questionnaire was designed for a targeted audience of North American pipeline operators and companies that serve them. “Quality over quantity” was the goal – i.e., preferring a small number of highly knowledgeable people over a large group of less knowledgeable people. The total number of respondents in the first distribution round was 29, of which 11 (38%) represented pipeline operators, including some of the largest operators in North America.

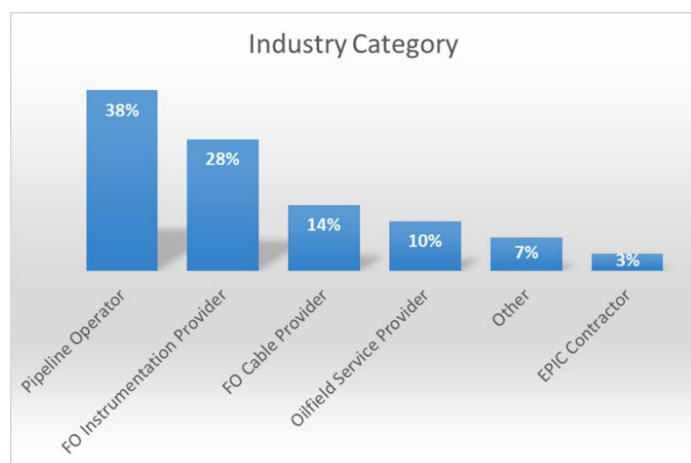
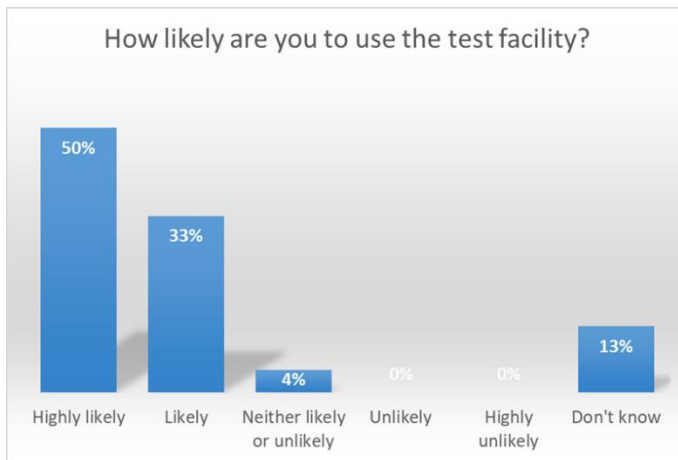


Figure 2

The second largest category was providers of fiber optic instrumentation, which encompassed 28% of respondents. Fiber optic cable providers, oilfield service providers, and testing organizations made up the remainder.

The questionnaire contained 18 questions regarding respondents’ views on a pipeline safety test facility and the capabilities they would want in such a facility. The full results of the survey are available at www.fiberopticsensing.org. We discuss four of the key results below.

Would You Use It?



One of the most important purposes of the questionnaire was to ask the threshold question, “Would you use it?” The response was very positive: 83 % of respondents indicated they were likely or highly likely to use such a facility if it existed. 13 % said they didn’t know. No respondents indicated they were unlikely to use it.

Figure 3

Buried or Surface?

One of the main drivers for an independent test site is the complexity of testing for leaks on buried pipelines. It was evident from the questionnaire that a significant proportion of the respondents were interested in a test facility for the case of buried pipelines.

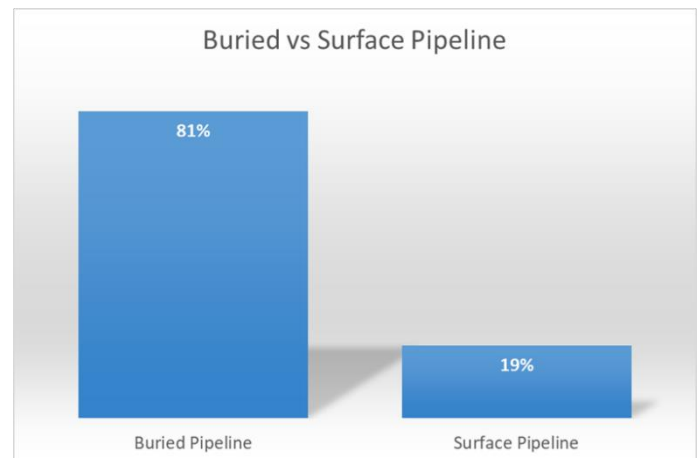


Figure 4

What Conditions/Activities Should the Facility Test?

Because a significant proportion of pipeline leaks and catastrophic impairments are caused by third party activities, it was no surprise that respondents indicated detection of third party intrusion (TPI) as their top activity of interest for testing. The next highest areas of interest were typical pipeline activities - pigging operations, horizontally directional drilled sections of installation and other dynamic conditions such as pipeline startup/shutdown and normal operation of valves.

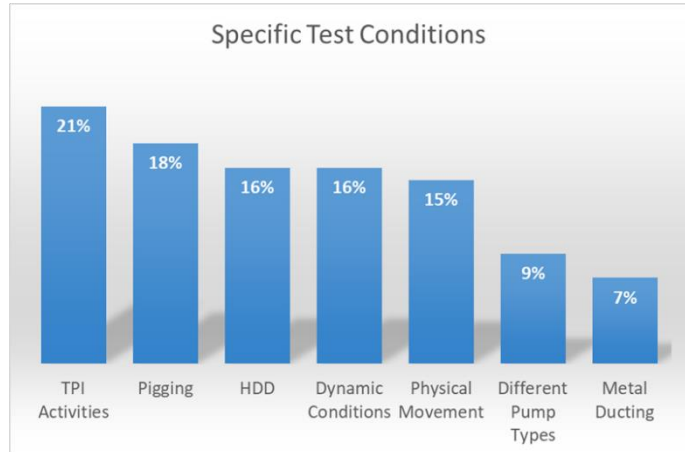


Figure 5

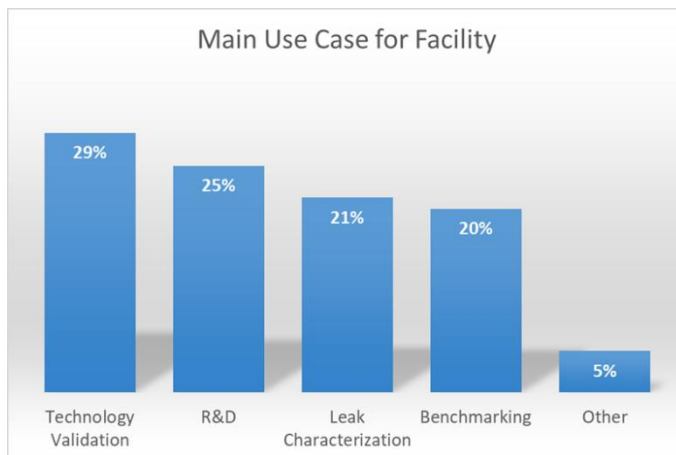


Figure 6

Main Use of Facility

In addition to the conditions and activities of interest for testing, we asked respondents to prioritize the general categories of use they would want in a pipeline test facility. Three main uses emerged – technology validation, research and development, and leak characterization.

Respondents' Additional Comments

Through written and oral comments, respondents also suggested the need for:

- Testing of retrofit technologies and techniques;
- Noisy testing environments to ensure real-world environmental conditions for the test facility – for example traffic, water crossings, temperature variations, etc.
- Comparison and benchmarking of external leak detection systems against internal mass balance systems;
- Interfacing of leak detection technologies with DCS/SCADA, etc.

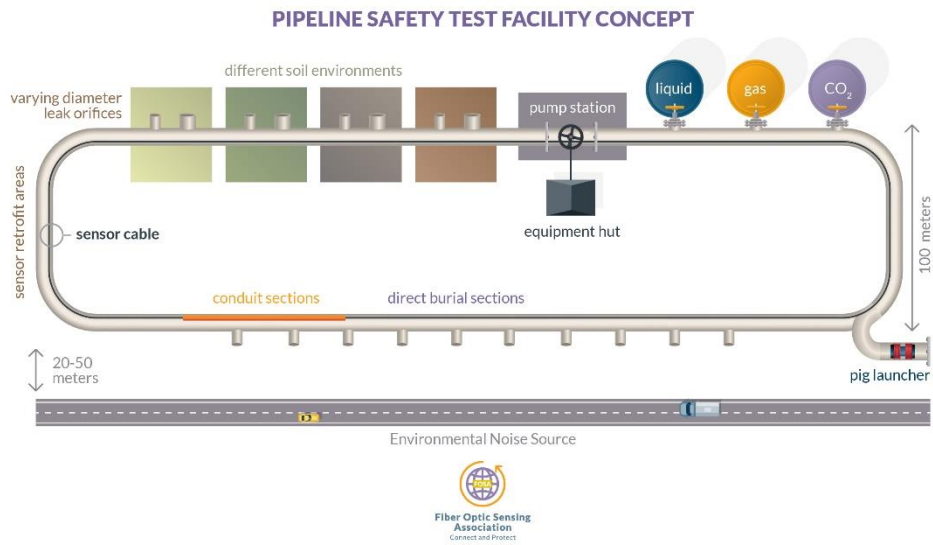


Figure 7

A Facility Meeting the Criteria Expressed by Industry Experts

The illustration at Figure 7 represents FOSA’s concept of a facility that meets the criteria expressed by industry experts participating in the questionnaire. Specifically, FOSA envisions a buried flow-loop pipeline with dimensions approximating 1,000 meters x 100 meters (~2.5 kilometers circumference) with the following features and characteristics.

Test Facility Features and Characteristics

Pipeline Material	Steel	Reflecting typical transmission pipelines.
Pipeline Diameter	8” - 16”	Diameter reflecting typical usage.
Pipeline Phase	Mixed	Mixed phase-capable to make facility useful to largest number of users.
Flow Loop Length	Circumference approx. 2.5km	Exact length depends on number of soil types, conditions, etc, to be considered – each test portion needs 50-100m of pipeline.
Flow Loop Pressure	Up to 1500psi	Reflecting typical full-sized bore conditions of transmission pipelines

Leak Sizes	Varying from pinholes to > ~ 1% of flow.	Leak orifices from 0.1mm to 2.5mm to replicate leak spectrum from “seepers” to larger incidents.
Liquid Phase Leak Product	Water	Majority of questionnaire respondents said water is adequate leak product for liquid phase leak detection testing.
Gas Phase Leak Product	Air/CO2	Majority of questionnaire respondents said air or CO ₂ is adequate leak product for gas phase leak detection testing.
Buried or Surface	Buried	Majority of questionnaire respondents preferred buried over surface pipeline for testing purposes.
Temperature Change	~5°C	Able to generate a 5°C or greater change in ambient soil conditions to test technology’s ability to measure temperature change.
Quiet vs. Noisy Environment	Varied	Should provide for both “quiet” testing, involving minimal disturbance of the test area, and “noisy” testing involving controlled disturbances from road traffic, pedestrian traffic, excavation, flowing water, etc.
Burial Conditions	Varied	Should encompass a range of burial environments reflecting different soil types and conditions – e.g., sandy vs. loamy soil, tightly vs. loosely packed, dry vs. marshy, etc.
Fiber Optic Cable	Multiple	Should allow placement of multiple cables and cable ducts in various positions and distances from the pipeline to test optimal placement under varying circumstances. Should allow occasional removal and replacement of cables and ducts.
Pumping Station	Typical	As needed for typical transmission pipeline.
Entry Port for Internal Devices	As needed	Allowing insertion of PIGs and other internal devices.
Utilities	Typical	Appropriate for facility size and function.
Testing Activities/Conditions	Various	Third party intrusion, leak detection, retrofitting existing pipelines with external leak detection technologies, pigging, HDD, dynamic conditions, pump dynamics,

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		ducting, technology comparison and benchmarking, technology integration.
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Summary

FOSA believes there is a significant need for a pipeline safety test facility in the United States, and that such a facility would provide clear benefits. It would help validate existing safety technologies and accelerate the advancement of new technologies. With better technology, operators would reduce incidents and mitigate costs, fines and negative public relations. Regulators would gain greater knowledge of the capabilities offered by new technologies, assisting in their ability to help the industry operate more safely. And - most importantly - the public would face fewer and less severe pipeline incidents. Pipelines are statistically proven to be the safest mode of hydrocarbon transportation, yet when incidents occur they can be catastrophic to the public and the environment. An opportunity to improve the safety and efficiency of such a vital piece of American infrastructure should be seized.

Recommendations: We encourage the U.S. federal government to fund an engineering study to determine the specifications and cost to build and operate a facility of the type discussed above. We encourage the pipeline sector and related parties to support such an effort through provision of information and expertise. FOSA pledges to provide technological information useful to such effort. We look forward to working with all interested parties toward this important goal.