Recent increases in production and proved reserves of tight oil and unconventional natural gas in the U.S. and other countries have renewed interest in technologies that enable the safe and environmentally responsible use of these resources. SRI has developed technologies over many decades to help the world meet its energy needs cleanly, safely, and cost-effectively.

SRI draws on scientific knowledge and expertise from multiple R&D groups to develop new applications for natural gas, ways to improve the safety of oil and gas infrastructure, and technologies to monitor the environment and mitigate potential disasters.

Enabling New Applications for Natural Gas

Converting natural gas and coal to liquid fuels
SRI has developed a low-carbon-footprint method to make liquid transportation fuels from natural gas and coal. Our process uses natural gas instead of water to provide the hydrogen needed to convert coal to syngas, a mixture of carbon monoxide and hydrogen. The syngas is converted into methanol, which can then be processed efficiently to make transportation fuels. The result: a cost-effective route to liquid fuels without net water consumption or coal-associated CO₂ emissions.

Natural gas storage for vehicular applications
SRI is developing low-pressure natural gas storage tanks for light-duty vehicles. Our approach uses a porous carbon material with a high surface area for gas adsorption to store the natural gas. The conformable material is strong enough to eliminate the need for a costly external tank.

Protecting Oil and Gas Infrastructure

Minimizing the consequences of pipeline failures
SRI applies its knowledge of blast-resistant materials and computational modeling to studies that aim to understand and minimize the impact of high-pressure gas releases, fires, and explosions. Our test facilities support

Solutions to help the world meet energy needs cleanly, safely, and cost-effectively.

instrumentation for measuring key parameters (e.g., gas flow rate, cloud diffusion, flame temperature, high-speed flame visualization data, thermal radiation effects) associated with rupture-induced pipeline failures.

Understanding why pipes fail
SRI’s Fracture Surface Topography Analysis (FRSTA) technique can reconstruct the growth history of a crack after catastrophic failure. SRI creates a 3D map of the crack surface and analyzes the information to reconstruct the history of crack formation over the pipe’s

SRI can quickly convert GIS or sensor data into meaningful information and present it in easy-to-use formats.
entire service life. By linking information on crack propagation to service life records, SRI can determine why a pipe failed and make recommendations to improve the way a pipeline is designed, inspected, and maintained.

**Remote monitoring**

SRI is at the forefront of developing aerial sensing technologies and analysis techniques to recognize activities of interest. Combined with image georegistration, 2D or 3D change detection, visibility analysis, and navigation tools, these techniques enable next-generation approaches to monitoring remote operations and identifying areas of concern, such as encroachment on pipeline right-of-ways.

**Data visualization**

SRI’s Geovisualization Center rapidly transforms raw Geographic Information System (GIS) or sensor data into intuitive and meaningful visual representations. Data visualization can be an important tool for analyzing the potential environmental impact of planned pipeline expansions or for emergency response planning.

**Cybersecurity**

SRI’s Infrastructure Security program researches, develops, and supports activities to improve the security of energy infrastructure. SRI supports the U.S. Department of Homeland Security’s LOGIIC (Linking the Oil and Gas Industry to Improve Cybersecurity) consortium.

SRI participated in what is believed to be the largest natural gas pipeline release and fire test using a 40-mile auxiliary section connected to the main TransCanada gas pipeline. The data SRI collected are used by the gas industry to improve their consequence analysis of natural gas pipeline incidents.

*FRASTA creates topographic maps of conjugate fracture surfaces to reconstruct details of the fracture process.*
Training and education

SRI developed the National Training and Education Resource (NTER), www.nterlearning.org, an open-source, Web-based training platform that includes a 3-D enabled learning management system to create courses, train personnel, evaluate progress, and track results. The 3-D content enables interactive training and performance-based assessment. Developed under sponsorship of the Department of Energy to support national training needs for the Weatherization Assistance Program, the platform was designed to address a wide variety of content areas and is well suited to meeting training challenges in many industries, including operations or emergency response training for the oil and gas industry.

Environmental Monitoring and Cleanup

In situ underwater hydrocarbon sensors for offshore monitoring

SRI has developed two techniques that can be used on unmanned or manned underwater vehicles to detect hydrocarbons such as methane. One technique uses membrane introduction mass spectrometry to detect and quantify light hydrocarbons and dissolved gases at trace levels, and the second uses a short-}

Project Profiles

SRI works with commercial clients to develop solutions to their challenges. Here we include profiles that showcase projects for the oil and gas industry.

Corrosion detection: SRI developed a technique based on electrochemical impedance spectroscopy (EIS) to detect increased corrosion on buried gas and oil pipelines to prevent leaks or failure. In field tests, SRI demonstrated the use of real-time impedance measurements and data processing on a buried gas transmission line to detect simulated defects up to 10 km from the measurement station.

Inspection robots: SRI’s robotics team developed a pipeline inspection robot based on a technology platform called MAGPIPE. This agile robot navigated difficult pipeline obstacles such as bends, valves, or vertical rises. While conventional pipeline inspection gauges (pigs) travel passively with the flow within a pipe, MAGPIPE used magnetic wheels and on-board power and control to stop, turn, move upstream, and investigate anomalies.

Methane detection: SRI developed mobile remote sensing technology for gas leak detection using a semiconductor (diode) laser to detect trace amounts of methane, a major constituent of natural gas. In field experiments conducted from a moving vehicle, the prototype demonstrated the ability to detect simulated gas pipeline leaks.

Pipe liners: SRI technology was used to develop liners to extend the lifetime of pipes, including pipes used in downhole applications or to transport raw oil and gas straight from the well. Liners based on SRI’s aliphatic polyketone-based engineering polymer have high barrier properties to water, hydrogen sulfide, carbon dioxide, and oxygen. By reducing friction, liners can reduce pressure drop in a pipeline, which in turn reduces pumping costs.

SRI’s Magnetically Attached General Purpose Inspection Engine (MAGPIPE) inspection robot navigates twists and turns in gas pipelines.
wavelength fluorescence laser to identify oil and tar on the sea floor.

Cleaning contaminated water or soil
SRI has developed several methods to treat and decontaminate wastewater and soil. Advanced hydrothermal oxidation destroys organic hazardous wastes in water using sodium carbonate. The technique is used commercially to destroy polychlorinated biphenyl compounds. SRI has also demonstrated a hot-water extraction technique to remove organic contaminants from soil.

Advanced vehicles for underwater monitoring
SRI’s remotely operated vehicle (ROV) and autonomous underwater vehicle (AUV) can serve as mobile platforms to monitor hydrocarbons underwater, collect data, or inspect pipelines.

Carbon capture
Although natural-gas-fired power plants emit far less carbon dioxide than conventional coal-fired power plants, the emissions are still significant. SRI is developing techniques to recover carbon dioxide from the dilute streams associated with natural-gas-fired power plants.

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About SRI International
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