

A High-flying Alternative to Walking the Line

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More than 2,000 years ago, natural gas was sent across Tibet via bamboo pipes. How did they maintain the integrity of that system? By walking the line. For as long as there have been natural gas pipelines, inspectors have had no choice but to walk the line to detect leaks and ensure public safety. Now the endless walk is over.

ITT Industries has introduced a breakthrough airborne technology that makes it possible to inspect pipelines up to 100 times faster and provides 30 times more right-of-way (ROW) coverage than traditional methods. The Airborne Natural Gas Emission Lidar (ANGEL) Service detects and quantifies leaks with a high degree of accuracy. It also surveys, maps and images pipeline corridors and surrounding areas then delivers detailed GIS-ready datasets and reports. And it does it all, day or night – more than 1,000 miles a day.

Because it's airborne, the ANGEL Service doesn't have to deal with obstacles that often slow down ground crews. Issues such as difficult terrain, property access, inclement weather and insufficient field staff are a thing of the past. The ANGEL Service also can be used in known dangerous areas without having to put people in harms way. Perhaps best of all, the ANGEL Service is a cost-effective, end-to-end, out-sourced service. By subscribing to the ANGEL Service, natural gas providers not only obtain necessary information required to meet today's enhanced regulatory compliance, but also detailed information that will benefit various departments within their company including pipeline integrity management (PIM); geomatics (GIS); environment, health and safety (EHS); and operations and maintenance (O&M).

While the technologies used by the ANGEL Service (differential absorption LIDAR, aerial mapping and surveying, and differential global positioning system (GPS) to name just a few) may be new to some in the natural gas industry, they have been in use for

many years in different applications ranging from cartography to environmental monitoring. ITT is knowledgeable in these technologies, as they have been developing innovative remote sensing technologies for defense, intelligence and aerospace applications for more than 50 years. ITT remote sensing technology is used everyday in weather and imaging satellites, space telescopes and GPS systems to collect information and images of earth and space.

ANGEL Service operations

When a company subscribes to the ANGEL Service, they're buying a turnkey service from a Fortune 500 company that is a worldwide leader in the remote sensing sciences. ITT handles every detail of the logistics, including all aircraft operations, data collection and processing, and report generation.

The ANGEL Service provides an instrumented leak survey using a remote sensing system built on differential absorption lidar (DIAL), an extremely sensitive gas detection and quantification technology. Installed aboard a Cessna Grand Caravan 208B aircraft, the ANGEL system collects up to 180,000 laser measurements per minute while flying at 1,500ft above the ground at 120 mph. That means it's sensitive, thorough, efficient and accurate. The ANGEL system scans the pipeline corridor,

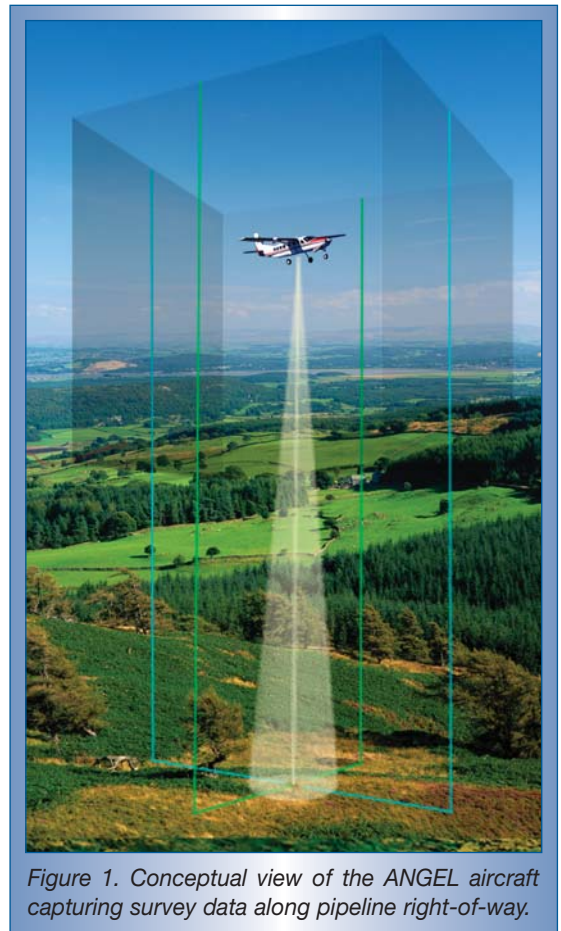


Figure 1. Conceptual view of the ANGEL aircraft capturing survey data along pipeline right-of-way.

remotely sensing ethane and methane emissions. It then precisely images and maps the plume's physical size and ground location allowing the client to fully understand the situation before responding.

To ensure targeting accuracy and pipeline coverage, the ANGEL system features a computer-guided laser pointing and tracking sub-system. It scans a 100-ft wide ground track along the pipeline ROW. This wide coverage area increases the likelihood of

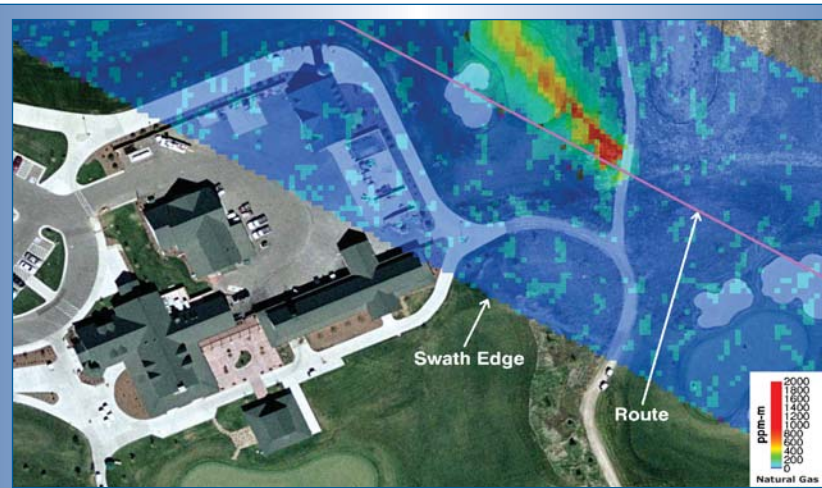


Figure 2. Ten-time enlargement of natural gas plume. ITT ANGEL system has detected emissions of natural gas. The plume is integrated with color imagery and GIS coordinated to provide the precise location.

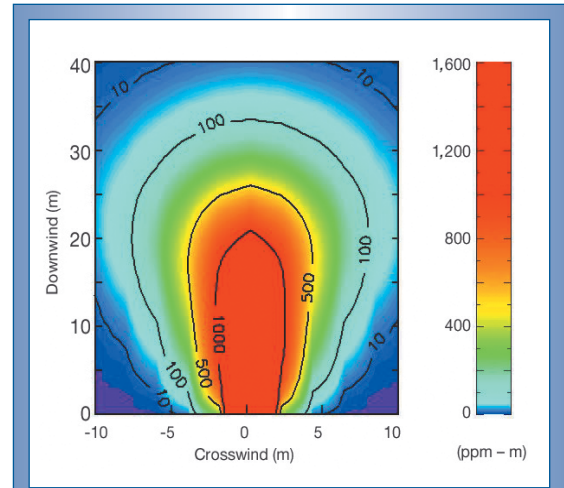


Figure 3. The ANGEL system detects, quantifies, images and maps gas concentrations of methane and ethane gas.

detecting leaks, even those that might have migrated away from the pipe.

At the same time, the ANGEL system captures color high-resolution orthorectified digital imagery of the entire ROW and surrounding areas. These GIS datasets can be overlaid with maps and other database information. Information can be extracted from this imagery such as high consequence area identification and third-party encroachment. It can also be seamlessly integrated into a client's existing digital geomatics and integrity management systems.

Unparalleled high-level output

After the flight, the ANGEL ground team processes and analyzes the datasets providing unparalleled high-level output and reports.

ITT provides certified findings in the form of written reports plus GIS vector layers, orthorectified color imagery and a video log of the flight. These detailed reports offer ITT's clients a range of capabilities.

These reports make it possible to respond quickly and effectively when leaks occur or pipeline integrity has been compromised. In addition, the data contained in reports provides an overview of pipeline ROW condition that makes it easier to plan maintenance.

If a client is researching the purchase or sale of a transmission system, the ANGEL

Service can produce better-informed decisions during due diligence. Records can be archived and accessed as needed. Using digital maps and databases, viewers in remote locations can call up an accurate model, a virtual "big picture" of the pipeline's status. Finally, the digital record of the ROW makes it possible to fly identical missions to compare past data with the current status of the pipeline.

With 100 times the speed and 30 times the ROW coverage compared with traditional methods, the ANGEL Service is a leap forward for leak survey. The addition of current mapping imagery and videography makes for a complete service that will address the growing needs of many diverse departments within a company.

Factor in the ability to accurately collect a range of valuable data, minimize transmission downtime and ensure public safety, do it all cost effectively via an end-to-end turnkey service from ITT, and it's no wonder the ANGEL Service is gaining wide acceptance in the industry. ♦

Acknowledgements

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For more information on the ANGEL Service, or to schedule a site visit, contact: Dan Brake, 800 Lee Road, PO Box 60488, Rochester, N.Y. 14606-0488. Tel: (585) 269-5121. E-mail: daniel.brake@itt.com, Web site: www.ssd.itt.com/angel

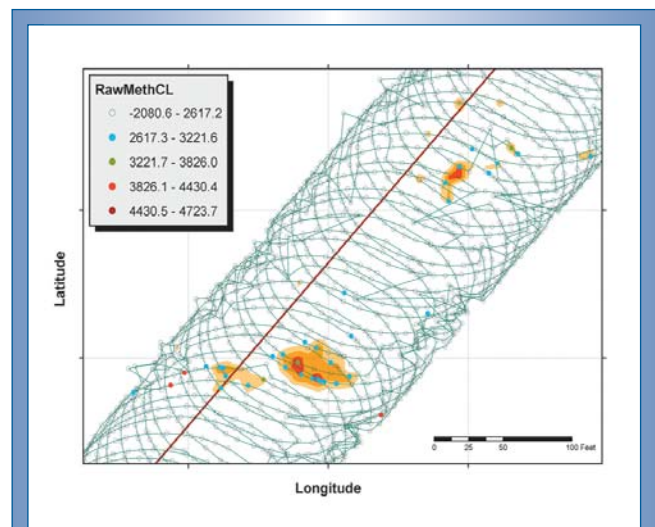


Figure 4. The conical scan display shows points color-coded to reflect the measured concentration wavelength values for methane and ethane.