

NEW APPROACH TO PIPELINE DETECTION



Luigi Kassir and Josh Pendleton, Skipper NDT, discuss the drawbacks of manual methods for detecting and locating abandoned pipelines and wells, providing a new solution system that combines several sensors to acquire precise magnetic data.

The US is home to over 2 million decommissioned or abandoned oil and gas wells, alongside thousands of miles of decommissioned or abandoned pipelines. Among these assets, some are classified as 'orphaned' due to a lack of identifiable owners.

These assets present a significant risk of emitting gases that contribute to safety and environmental hazards. According to the United States Environmental Protection Agency (EPA), decommissioned, abandoned, and orphaned wells release an estimated

7 - 20 million metric tpy of CO₂ equivalent.¹

Compounding the issue, these decommissioned or abandoned assets often lack comprehensive records, posing challenges for midstream operators in verifying, mitigating, and avoiding them during other construction activities in affected areas.

The challenge

The primary challenge for operators, in ensuring the safe retirement of decommissioned wells and pipelines, is the verification or establishment of their locations. This challenge is

compounded by the fact that historical records for these assets are frequently incomplete or inaccurate, and the areas they occupy are often vast, remote, and challenging to access.

Traditionally, the detection and locating of abandoned wells have relied on manual methods, such as electromagnetic pipe locators. However, these methods are associated with several drawbacks:

- Field operator safety concerns: many wells are situated in difficult-to-access areas, posing potential safety hazards for field operators.

- High cost: given the extensive surface areas that need to be covered, deploying field operators to survey the area is time-consuming and may require significant logistical planning and resources.

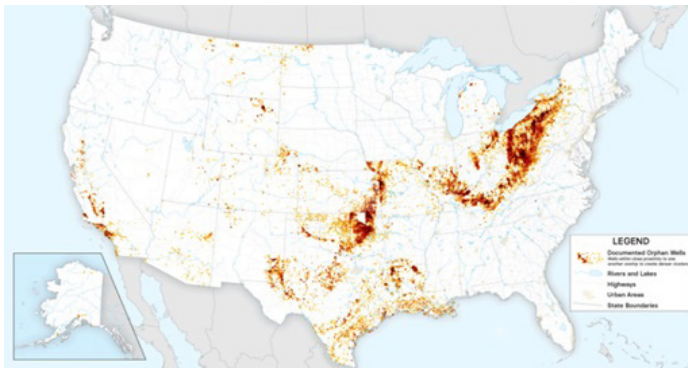


Figure 1. Map showing documented orphaned wells.



Figure 2. Skipper NDT Argos payload on a commercial drone.

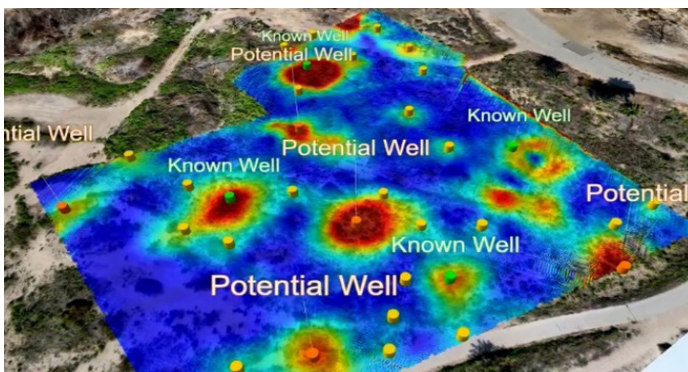


Figure 3. 3D rendering of the inspected site with a photogrammetry layer.

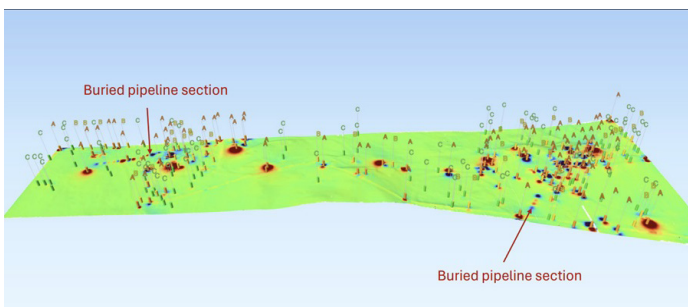


Figure 4. 3D rendering of the inspection area with decommissioned pipelines and wells.

- Low efficiency: the manual nature of detection, coupled with the limitations of available tools, results in a lack of guarantee in identifying all targets effectively.

The solution

Skipper NDT offers a new technology, the Argos sensor system (Figure 2), that represents a paradigm shift to the efficiency of abandoned well and pipeline detection.

The Argos system combines several sensors to acquire precise magnetic data, free from interferences. Amongst these selected components are:

- Fluxgate magnetometers.
- Real-time global navigation satellite system (GNSS).
- Tactical grade inertial measurement unit (IMU).
- Remote sensors for measuring the distance between the payload and the ground (for depth of cover assessment).
- A proprietary electronic card for data acquisition, digitisation, and synchronisation.

Among these sensors, fluxgate magnetometers play a crucial role. They can measure all three components of the magnetic field at a sample frequency of 1000 Hz. Compared to scalar magnetometers, fluxgate magnetometers have lighter and more durable sensors, and their sampling frequency is ten to a hundred times higher, making them better suited for UAS constraints.

An important advantage of fluxgate sensors is their ability to capture the 3D components of the magnetic field. Using this feature Skipper NDT has developed a proprietary protocol enabling to compensate any bias of the sensor allowing to increase the native resolution of the sensors 25 times.

By leveraging state-of-the-art hardware and software advancements, Skipper NDT's Argos sensor stands as a fully automated magnetic-based technology, enabling the precise identification of abandoned wells and pipelines with a remarkable level of confidence and accuracy. The technology effectiveness has been demonstrated through rigorous field testing and validation across numerous abandoned well and pipeline detection missions conducted for leading operators in North America.

The notable advantages of our technology include:

- Remote operation: field operators can conduct scans remotely, eliminating the need to physically navigate challenging or inaccessible terrains, thus ensuring their safety.
- Swift coverage of large areas: through the drone vector, rapid access to complex landscapes, including mountainous regions is possible, enabling coverage of up to 20 acres per day. This capability significantly reduces time and resource expenditure.
- Real-time preliminary processing: the system enables quick preliminary processing of magnetic data directly in the field, facilitating operational responsiveness. Within just 15 minutes

after a drone flight, analysts can provide field crews with actionable insights.

- Consistent data quality: automated data acquisition and processing ensure reliable and repeatable results, enhancing the overall dependability of the solution. The proprietary data processing algorithms allow to distinguish wells and pipelines magnetic signatures from other sources of background noise.
- Comprehensive geospatial positioning: Skipper NDT's technology offers enhanced geospatial positioning by integrating additional data layers, such as photogrammetry or suspected well locations. This feature not only confirms and precisely locates the position of wells or pipelines.

The results

The Skipper NDT technology has undergone extensive field testing and validation through numerous missions focused on detecting abandoned wells and pipelines across 12 distinct sites in California. During the fall of 2023, the system successfully identified over 30 potential wells (Figures 3 and 4). Utilising in-situ preliminary responses during operations, the solution provided real-time guidance for excavation work on the same day.


Skipper NDT's advanced solution is designed to streamline inspection and excavation tasks, resulting in remarkable efficiency gains. By enabling both tasks to be completed within the same day, Skipper NDT's technology reduces mitigation response time by over a month.

The comprehensive integrated results delivered by the technology empower clients to:

- Validate existing records with confidence.
- Rectify any misalignments between recorded locations and actual positions in the field.
- Identify previously undiscovered wells, prompting further investigation.
- Strategically plan upcoming inspection and mitigation projects.
- Provide regulators with assurance regarding the accuracy, completeness, and currency of company records.

Looking to the future

Experience a transformative approach to decommissioned/abandoned well and pipeline detection with Skipper NDT's cutting-edge technology. We're not merely addressing an urgent environmental concern; we're revolutionising the landscape of buried asset detection with unparalleled efficiency, safety, and precision.

Gone are the days of manual, labour-intensive methods. The future is automated, streamlined, and dependable with Skipper NDT. 

References

1. <https://www.edf.org/orphanwellmap>