

Advanced platform for pig tracking

Geoff Wilkinson and Chris Loadman, Propipe, UK, define a new generation of pig tracking technology.

Now, more than ever, pipeline operators are demanding safe and cost-effective approaches to pipeline maintenance. Pigging operations, in the form of routine cleaning or intelligent pigging for integrity management, require reliable pig tracking data to maximise efficiency. Dependable, accurate, and timely pig tracking data minimises impact to normal operations, as well as minimising the time between any inspection runs and subsequent maintenance on potential defects.

Traditional approach

Pipeline pigs are routinely launched and run through pipelines to separate batches, clean and inspect the pipe. There are several reasons why it is critical to always know pig location during the run. Pigs have a risk of getting stuck and preventing flow; stations and valves often require adjustments to allow the pig to pass; and inspection runs need reference markers deployed along the pipeline as the pig passes.

Pig tracking onshore is usually performed by a team of technicians who are responsible for intercepting the pig throughout the run. Pig passage is determined through use of specialist receiving equipment and typically through use of an electromagnetic (EM) transmitter fitted to the pig.

In recent years there have been relatively few advances in the communication of pig tracking information to the pipeline operators. Propipe has advanced this technology by providing a system that is designed to enable live remote tracking of pigs over the internet, real-time streaming access to pre-deployed equipment, and online management of all pig tracking data.

Above ground markers (AGM)

Historically, AGMs have been used as the workhorse product for detection of pigs at pre-determined survey locations above onshore pipelines. Traditional AGM products can detect the passage of pigs with permanent magnetic signatures and electromagnetic transmitters. Pig passages are recorded to internal memory and time stamped, and this data can later be recovered and combined with inspection data to provide accurate positioning of inspection tools to precisely locate any pipeline defects. Tracking pig location in real-time has typically relied on handheld receiver products and geophones deployed by field technicians local to the AGM box. Recovering AGM data, managing true and false passage information, and fusing this data with survey information requires logistical and operational overhead that can be expensive and slow.

Next generation AGM

Propipe's APEX and accompanying web-based software portal allows pigs to be tracked anywhere in the world where the user has an internet connection and web-browser. Pig tracking reports are built in real-time as live sensor data, real-time passage information and even geophone audio can be streamed to users instantly. The need to download and organise data after a pig run is eliminated through this unique system, which drastically reduces the overhead of managing

data from pig runs, this leads to faster and more efficient pigging operations.

The APEX is built on a solid foundation of custom hardware and low power electronics. APEX is designed in an all-weather waterproof housing with folding electromagnetic antenna, which makes it easy to travel with, while at the same time provides optimal detection performance.

Detection of pigs

APEX can simultaneously detect pigs with attached permanent magnets and emissions from up to three different EM transmitter frequencies at the same time, making it useable in the most difficult electromagnetic environments and with multiple pigs. With all pig detection equipment, receivers can be subjected to harsh environments with EM interference that could otherwise be considered a pig passage. To combat this, APEX integrates a combination of temporal and statistical signal processing methods to accurately detect pigs and reject false alarms. In addition, an extremely low noise geophone input is provided with built in variable gain amplifier, so passive detection of pigs through acoustic means is also possible with this AGM. Geophone audio and waveforms can be transmitted in real-time over the internet. Data can then be sent to the end user over several flexible communication channels including cellular, satellite, Bluetooth and WiFi. All data is recorded raw to internal memory and is time stamped with GPS hardware synchronised time.

Web based platform

To allow for complete remote pig tracking, a dedicated platform (PigView) has been developed to handle and manage all information related to the pigging runs. PigView Web software provides the user with an interface for configuring APEX AGMs, collecting real-time data from APEX devices, storing, and managing historical pig tracking data records as well as managing live real-time pig runs over the internet. Each user has all APEX data and pig run records stored in their own cloud-based database.

PigView Web allows the user to track real-time pig location online. Users can import pipeline survey data (Figure 2), configure SMS and email notifications, and group all pig passage information from deployed AGMs with surveyed locations so that pig tracking reports are produced instantly at the completion of a run. Users and clients can be notified in real-time of pig launch, pig receipt, pig passage information and even updates on pig speed.

In addition, a real-time data stream and analysis window is part of the PigView Web package. By enabling a streaming session to a deployed AGM (Figure 3) the user can track a pig over the internet as though they were located on site with a handheld receiver and geophone. Real-time graphs of the raw electromagnetic signal, raw geophone waveforms, processed signal strength, and a spectrogram display of received electromagnetic power vs frequency vs time are given. Real-time geophone audio is also provided and streamed into the web browser, enabling the remote user to listen to the acoustics of a passing pig.



Figure 1. Propipe APEX.

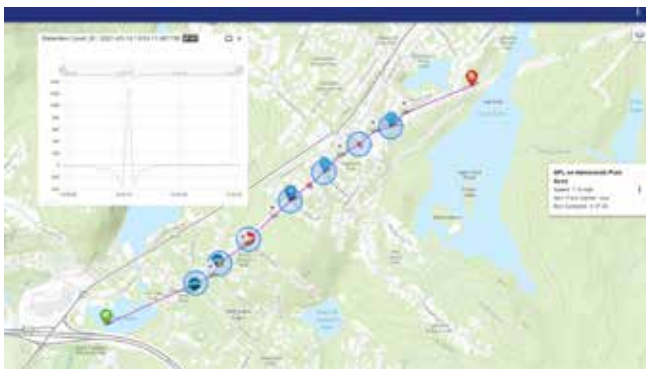


Figure 2. PigView Web – a typical pipeline run.

Reliable detection

In a recent application in the UK, the value of the multi-sensor detection system within the APEX system was truly realised. Upon launching a cleaning pig, the operator confessed to not installing the EM transmitter within the pig, meaning that only tracking by magnets and geophone would be possible. As the majority of the pipeline was buried in depths greater than 2 m, the geophone would be the primary method for detection. With traditional tracking this would have meant that the teams would need to be deployed to listen locally for pig passages. APEX, however, provides the facility to stream this audio live through the web based software, meaning fully autonomous pig tracking could still be performed.

Enhanced safety

As discussed previously, the conventional method of pig tracking is to set up tracking locations and move down the pipeline with the pig. This can be quite a difficult process for the team and will often present difficult and dangerous situations.

Length of pig run

Recent projects have had pigging runs spanning over a several days. Meaning that both day/night shift crews are required to track the pig. Long hours and working in the dark present safety challenges.

Pig speed

For some pipelines, speed control of the pig is unpredictable or subject to change. Therefore, sometimes resulting in the tracking team having to 'chase the pig' in order to catch up – which can lead to safety incidents.

Tracking location

Onshore pipelines can traverse remote locations, leading to these sites being more difficult to access and reducing the time the pig tracking team has to get into position (Figure 4).

Utilising the APEX system, the risks outlined above can be significantly reduced by tracking the pig remotely. The pig tracking technicians are only on site when the pigging run is 'offline' to deploy the equipment, therefore minimising risk associated with 'pig chasing' and also 24 hour working.

Reduced costs

Using traditional pig tracking methods that utilise teams of technicians can be expensive and can introduce risk. During remote tracking runs that utilise APEX, a technician is only required to deploy and collect the equipment. The management of the pig run itself is performed online by a single user. All of this results in a reduction of:

- Manpower and therefore cost.
- Vehicles required to transport technicians.
- Environmental footprint.

When using remote tracking methods, the cost savings are not only reflected in reduced technician hours, but also

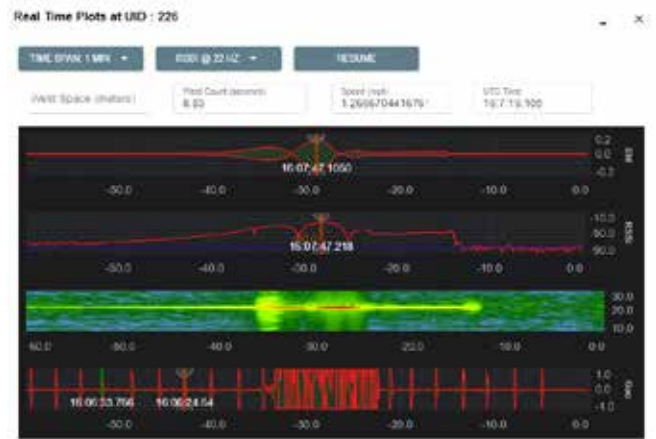


Figure 3. PigView, Web data streaming and analysis view of a 22 Hz pig passage



Figure 4. APEX deployed at a remote location.

in terms of reduced costs relating to reducing travel, etc. It also eliminates the need for long field shifts and night shifts, making it the safe alternative to traditional tracking. While many pipeline companies still use traditional methods, best-in-class integrity programmes are now leveraging remote pig tracking to reduce cost and increase safety.

Internet based pig tracking

The use of Propipe's APEX internet based pig tracking system has been proven to reduce the costs and risks associated with deployment of pig tracking teams on projects. Furthermore, the live streaming of data has resulted in more accurate and reliable tracking of pigs. When considering projects with long pigging runs or multiple pigging runs concurrently, then the system provides a significant advantage. There may be occasions when traditional methods can still be employed but the future of pig tracking is certainly internet based and APEX is leading the way. 