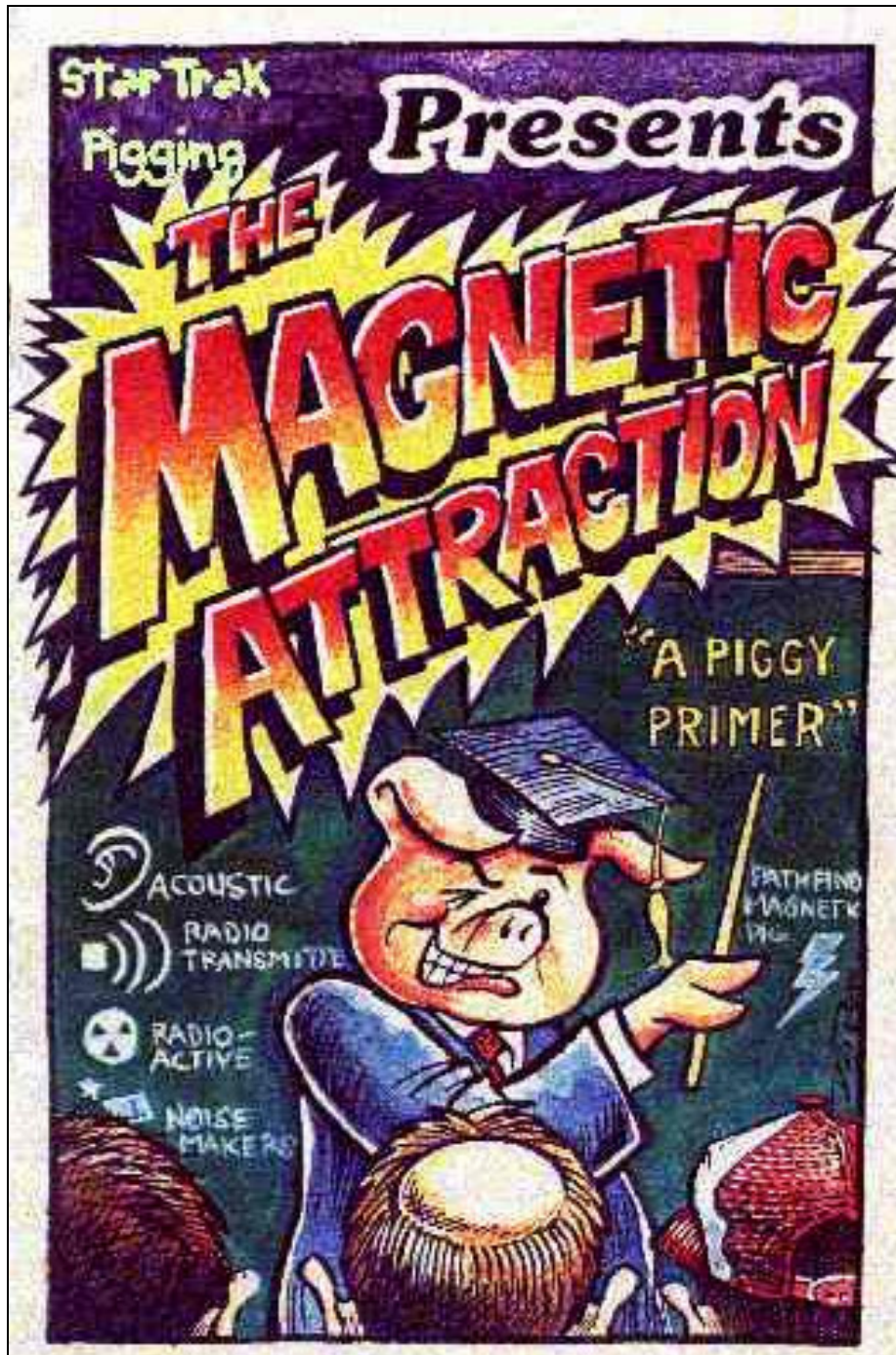


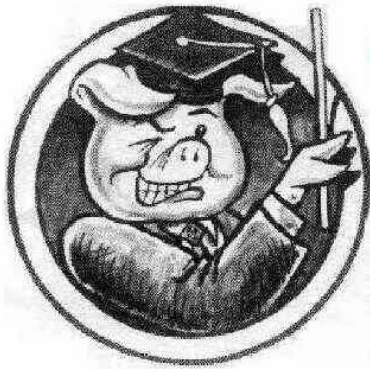
StarTrak Pigging Technologies



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Introduction



StarTrak Pigging
Presents








Pipeline Pigs are dispatched through pipelines to perform various functions:

1. To clean the inner wall of the pipeline.
2. To swab the line free of liquids.
3. To fill the line during testing stages.
4. To internally gauge the line geometrically.
5. To inspect the line for internal corrosion.
6. For product separation - in multi-product lines.
7. Miscellaneous operations utilizing connection with on line maintenance programs.

Pigs may take the form of two, three, or four urethane cups which are mounted on a mandrel. Multi-section mandrels - for inspection purposes, poly pigs, cast urethane pigs, or spherical pigs.

Anytime that a pig is introduced into a pipeline, there are uncertainties as to its whereabouts. Many of the problems associated with pipeline operations, or maintenance may be attributed to pigging operations. When a pig becomes lost, or jammed, the major problem is the location of the pig with a high degree of accuracy.

During the last decade, there have been many companies who have produced devices which are intended to assist in tracking pigs in both land and marine operations. These devices take various forms:

- a. Acoustical 
- b. Radio transmitters 
- c. Radioactive material 
- d. Noise makers 
- e. Magnetic 

Each of these devices will work given the correct circumstances.

The Acoustic Device



Usually called a "pinger" as this emits interrupted acoustic signals. It has many benefits in offshore pipelines for defining the pig's passage through a general area. Its success has been limited for the following reasons:

- * Unit is battery operated, and therefore has a limited operational life.
- * Poor position accuracy. Acoustics echo in all directions, and is therefore very difficult to pinpoint.
- * Requires a liquid interface and therefore cannot be utilized in a dry line i.e. gas pipeline.
- * Cannot be utilized in land lines.
- * Large physical size.
- * Hazardous environment, vibration / shock
- * Must use correct frequencies.

The amount of overburden over the pipeline will prevent the passage of audio signals.

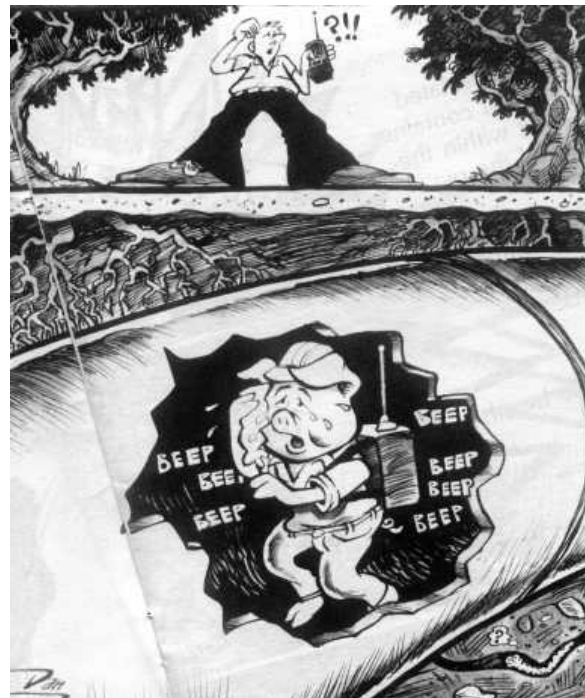
The Radio Transmitter

A battery operated unit which is attached to the pig.

In order to penetrate the pipe wall, which is a natural screen against radio signals, the chosen frequency has to be extremely low. The resultant signal through the pipe wall is minute, and in consequence the receiving unit has to be ultra sensitive.

The main difficulties with this device are:

- * Unit is battery operated therefore has a limited operational life.
- * Very limited range.
- * Impossible to operate in high electrical interference areas.
- * Requires continuous monitoring / leap frogging.
- * No remote signaling facilities.

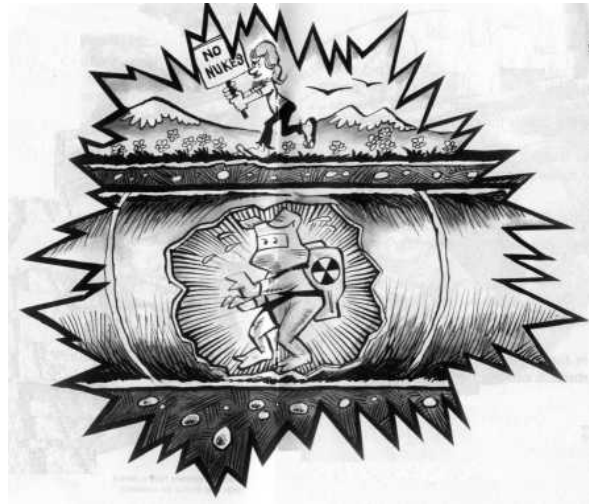


Radioactive Materials

Radioactive Materials are encapsulated in a small container housed within the body of the pig.

This method is not recommended for the following reasons:

- Possible health hazard.
- Possible contamination of the pipeline.
- Requires a high level of material to be effective, handling difficulties.
- Does not allow for remote monitoring, or systemization.
- Not acceptable in most countries in the world.



Noise Makers



Probably the earliest form of pig tracking. This requires either a cam type device or a metal chain which makes a noise as the pig travels through the pipeline.

This method cannot be recommended for the following reasons:

- * The device is primitive, and not conducive with modern engineering practices.
- * In order to detect its passage, it requires labor to lay with an ear to the ground or vent post to listen for the pig
- * In the event that the pig does become stuck, it cannot be located.

The StarTrak Pigging Magnetic Pig System

The system consists of four elements:

1. Pipeline Magnetic Pig
2. Station Magnetometer or Static.
3. Flux gate Gradiometer - Search Instrument.
4. Port-a-Sig

Magnetic Pig:

The pig is designed as a magnetic circuit with a field strength sufficient to saturate the wall of the pipe through which it is traveling.

The pig normally comprises of a steel body which houses the magnetic section, four urethane cups, urethane spacers, a nose plate designed to take shock, and a rear locking plate.

The Magnetic circuit may take the form of the entire pig body, as in small size pigs or a collar in larger diameter pigs. The collar is made up of two mild steel discs with independent magnetic modules around the center-line of the circle.

The magnetic circuit may be used in conjunction with cast urethane pigs, poly pigs, or spherical pigs.



Call us we're always ready

Station Magnetometers: The station or static magnetometers are remote field passage indicators which allow the operator to track the pig through sections of line. These units not only indicate the pig's arrival at that point, but indicate also the time of the event. An output from the unit can also give a relay closure, thus providing for any number of ancillary devices, i.e. radio telemetry, sonda-alert (audio alarm), or input into the clients' SCADA network. Normally, indication is facilitated by high intensity strobing beacon which can be seen from long distances especially from the air, and at night. The station indicators may take the form of either portable or permanent installations, or in marine applications, be sub sea or buoy mounted. Add to this Satellite communications and this unit will give our clients all the flexibility they need.

Flux Gate Gradiometer: This instrument provides a very essential part of the total system, it is used to locate the whereabouts of a pig should it become lost in a line. The gradiometer may take the form of a portable hand held unit, a "fish" for offshore location of pipelines or magnetic pigs, or be used in conjunction with an R.O.V. or with an airborne vehicle . The Flux Gate Gradiometer is designed to sense magnetic fields which exist around all magnetic objects. These steady magnetic fields penetrate soil and water, and so indicate the presence of magnetic objects which may be buried, or hidden from view. Two flux gate sensors are contained within a sensor tube with a spacing of typically of one half meter and are aligned mechanically to within two seconds. The sensor tube can either be detached, or mounted directly to an electronics housing which also consists of a display. The difference in the magnetic field between the two sensors is presented on the display which may take the form of either a meter movement, or a digital display, and also can be used to drive a remote display or recorder. The device lends itself to interfacing with various computers.

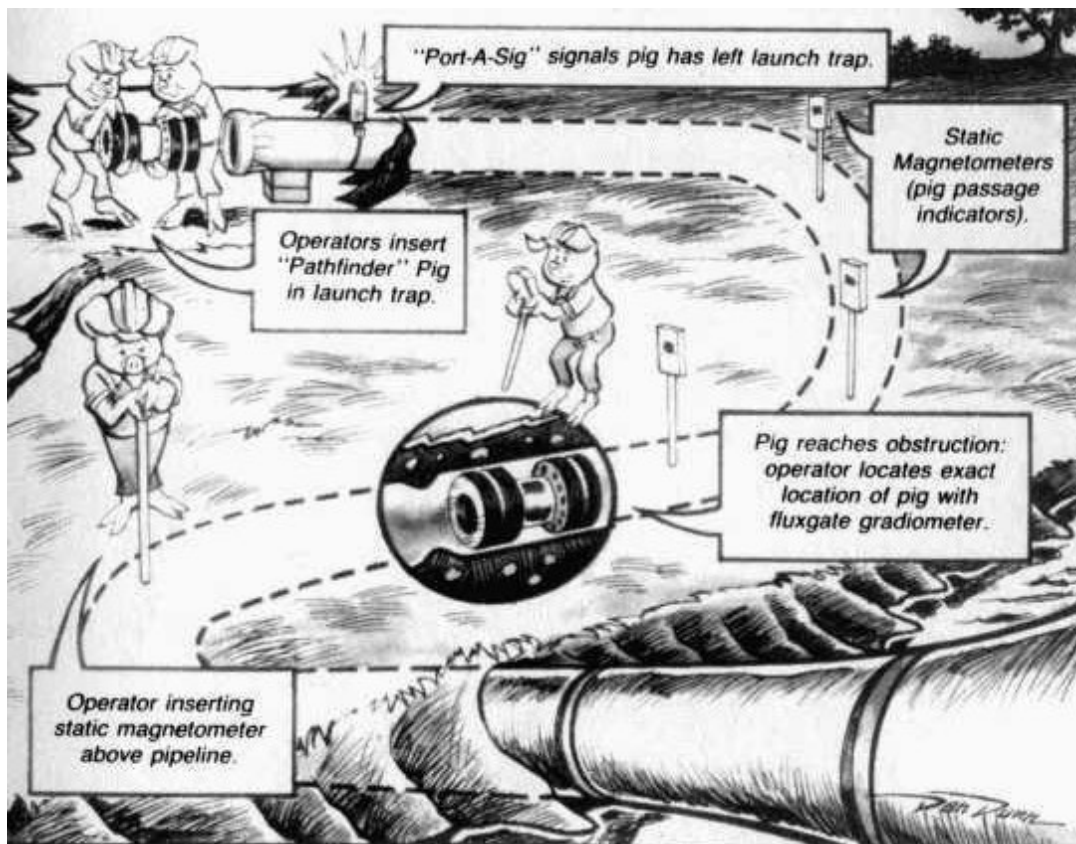
Port-a-Sig: Launch and receive alert. This instrument complements the system as it was designed to be used with or without the other station devices and is sold as a pig alert device which will respond to the arrival or departure of a pig containing a small magnetic collar or spacer. The unit, as its name suggests is completely portable, and can be used on any line size. It has the unique feature of being intrusive free, and not prone to corrosion either internally or externally as are other signaling devices. This instrument not only signals the arrival or departure of a pig, but can count the number of pigs and times. A manual mode will ensure that the unit continues to be activated, recording the times of the event, until it is physically turned off. In the auto re-set mode the unit will re-set itself normally 20 seconds to await the arrival of further pigs. Port-A-Sig signals, by high intensity strobing beacon and also provide a relay closure for integration into automatic systems i.e., opening /closing valves. The unit is powered by 12 volts and can be used with lithium batteries or solar power.

Operations:

On Land:

Prior to the operation, alignment sheets should be studied in order to choose the best practical location of the static magnetometers. Where possible, areas of accessibility are the obvious location to site the stations. However, vulnerable places such as road crossings, bends, rivers, and railroad tracks should be addressed. The static magnetometers are normally spaced at intervals of typically one mile or convenient locations. From alignment sheets one can obtain the exact linear location of stations. Dependent on whether the propellant is a liquid, gas, or air, it should be possible to work out an estimated time for the pig's arrival at each location.

The installation of the static magnetometers is a very simple operation. The line is located using a pipe locator or gradiometer, and a depth measurement noted. A small 2" hole is augured just off the line of pipe, as it is not necessary to make direct contact with the pipe. The sensor tube is installed normally 2-4 ft. above the line, and made firm, then the static head is attached and the unit turned to the on position.



It must be noted that in areas where the line is buried deeply it is not practical to use the static magnetometers, and these areas should be monitored by the Gradiometer.

When all static magnetometers have been positioned, the pig may be launched. It will first pass the Port-a-Sig which is sited at the pipe directly before it enters the ground. This ensures a satisfactory launch. The Port-a-Sig will immediately respond by signaling the passage of the pig.

The operator will then keep constant recordings of line pressure at both ends of the line. As the pig passes each static, indication will be given allowing the ETA of the pig's arrival at the next station to be updated.

In the event that the pig becomes stuck, the first indication will be an increase in pressure at the launch trap and a decrease in pressure at the receiving trap. By timing the operation accurately, and correlating this against known speed of the pig, it is possible to calculate the location of the obstruction to within 100 ft.

At this point, an operator using a flux gate gradiometer will go to the area, locate the line, and conduct the search for the pig. The Gradiometer will respond both on the visual display and by its in-built audio system. By excavation, the defect usually becomes apparent and can be corrected.

Offshore:

Marine operations more skill on the part of the operator both during setup procedures, and positive location of the defective area. The operation is basically the same for offshore as it is on land.

The line should be buoyed at strategic locations, and the marine magnetometer sensors installed with weights.

In order to obtain valuable information on how the pig is running, it is advisable to set up two points near to the launch. This will provide a key as to how the pig is traveling which may be used to assist in the event the pig gets jammed.

In the event the pig does stick, a diver equipped with a marine gradiometer can be used to determine the exact location of the pig. In deeper water, an R.O.V. mounted with gradiometer can be used to locate the pig.

StarTrak Pigging Technology Inc.

Pipeline Systems & Service in Katy Texas. U.S.A.

We specialize in a unique brand of services to the World-Wide Pipeline Industry. The uniqueness of StarTrak stems from its in-house development of equipment, the specialist training of employees, the quality control of work and the sheer desire to provide clients with a higher standard of workmanship than any of the competition.

StarTrak has provided services and engineering consulting throughout many parts of the world for both land and marine pipeline facilities.

As a result of the extensive field services combined with research and development, which has been carried out by StarTrak' s engineering staff, the company is able to present a line of products which will bring a new technical dimension to the industry.

Services:

- * Location - Profiling - Computerized mapping of all buried pipeline and utility networks on land and offshore
- * River Crossing Surveys - Full Profile - Electronic Utilizing StarTrak "One-Pass" system
- * Detectable Pigging Operations - Land and Marine. StarTrak "Pathfinder" magnetic pigging system
- * Detection of pipeline intrusions and leaks.
- * Pipeline Wrapping Evaluation - Computerized System Location of areas with poor wrapping
- * Pipeline Engineering Efficiency Studies

Products:

- Urethane Scraper Cups
- Pipeline Pigs - Cleaning - Gauging - Detection Equipment
- Electromagnetic Location Instruments - Magnetic Sensing Equipment - Flux gate Gradiometer
- Permanent Pig Monitoring Systems
- Port-a-Sig Non intrusive Pig Monitoring Units

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