STARTRAK PIGGING TECHNOLOGIES, INC

"PATHFINDER MAGNETIC MODULAR PIGGING SYSTEMS"

30" "Pathfinder" used to commission the All American Pipeline

Accuracy & Safety

StarTrak's Commitment

StarTrak Pipeline Technologies, Inc
27233 West Highway Blvd
Katy, Texas. 77494. USA

Phone (281) 599 7557 Fax (281) 578 9181 Web Site:
www.starpig.com. e-mail: startrak@starpig.com

StarTrak "Pathfinder" Modular Pigging Technologies

Introduction:

In 1970 the Magnetic Pigging System was developed and patented by Ernest D Casey then in the United Kingdom when working in conjunction with South West Gas.
Since that time the system has been used to detect dents, obstructions caused by others pigs, commissioning of major pipeline systems both on land and offshore, also detection of small leaks.

"Pathfinder" Magnetic Pigging System- its basic form:
Consists of three basic elements:

- Magnetic Modular Pig sizes 2" – 42" (larger if necessary)
- Magnetometer – pig passage Indicators.
- Flux-gate Gradiometer

Magnetic Modular Pig:
This is a pipeline pig, designed to saturate (magnetically) the wall of the pipe through which it is traveling. In order to obtain maximum field strength, the magnetic circuit is designed to include modules (StarTrak design) inserted into pole plates. This, dependant on the pipeline size, the pigs may be located to a depth of 45 ft/15 meters (overburden)

The "Pathfinder" pig may be utilized for the following applications:

- Cleaning – initial construction - routine maintenance
- Commissioning process to monitor progress of the interface
- Locating of obstructions Land or marine.
- Monitoring Inline Inspection Tools
- Batch separation
- Leak detection

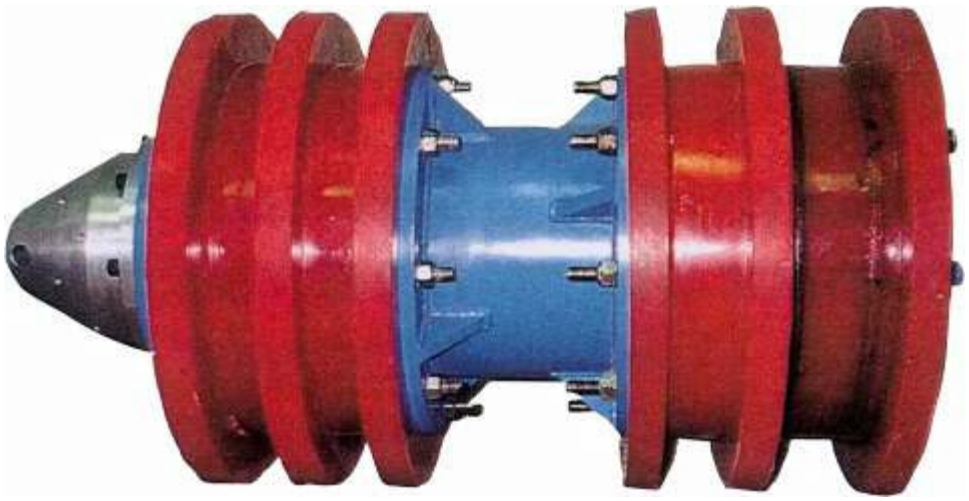


Illustration of StarTrak "Pathfinder" Jetstream pig. Modular Magnetic circuit is shown between the final two discs

Magnetometer – Pig Passage Indicator:
In order to maintain control of the pig's progress during operations, station pig passage indicators are positioned at strategic locations along the route of the pipeline. It is customary to erect these stations at places of easy access such as pipeline road crossings, and waterway crossings.

The units are designed to signal the passage of a pig traveling at speeds between 1" per one minute to 100 miles per hour. There are several types of units, which have been developed for both StarTrak's service operations also for sales to Pipeline Companies.

On Land Operations:

StarTark "Port-a-Sig:

- Port-a-Sig units for launch and receive traps or above ground pipe/valve stations. Units signal by high intensity beacon also included elapsed timer and event counter.
  This unit can be used in as a manual type mode, whereby it will remain signaling until physically de-activated
  Manual mode operates the elapsed minute timer.
  Auto re-set mode may be used for operations where multiple pigs are in the line at the same time, the system will reset automatically with a 10 second delay. Auto mode operates the event monitoring counter.

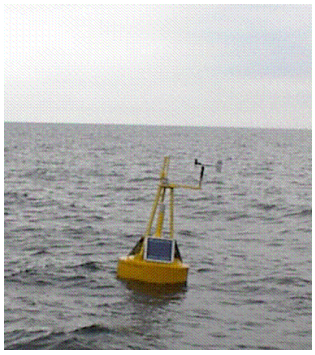
Station Pig Passage Indicators (Statics)

Monitoring "Pathfinder" Pig.
Lake Lugano, Switzerland

- The Static remote unit provides pig passage signaling for remote areas used as a service tool during operations.
  Its function is similar to that of Port-a-Sig,
- The station or static magnetometers allow the operators to monitor "Pathfinder" pigs through sections of pipeline.
  These units not only indicate the pig's arrival at that point, the unit also indicates the time of the event, either to one-minute interval or 1/10th of a second, as required.
- An output from the unit may provide a relay closure, thus providing for any number of ancillary devices, i.e. radio telemetry, satellite communication, son-alert or input directly into clients' SCADA network. Normally, indication is facilitated by high intensity strobe beacon, which can be seen from long distances especially from the air, and at night

Offshore Operations:

- Offshore pig passage stations are designed for housing in a buoy. The sensor package is designed for installation in close proximity to the pipe, transmission is conducted by means of a cable from sub-surface to surface approximately 400-ft.



Passage alert is achieved by high intensity beacon on the surface buoy, also by means of Low Earth Orbit Satellite data communication link.
Pig signaling in deeper waters than 400-ft can be achieved by means of acoustic telemetry, which in turn is converted to a radio frequency and transmitted on a 150 MHz signal to the nearest orbiting satellite. Subsequently data is downloaded to an Earth Station and fed via Internet link to Pipeline Control Center.

Deep "C" magnetic pig monitoring system has been designed as a permanent offshore unit for use in loop systems. StarTrak has sold units for deployment off-shore West Africa in 2,500-ft waters. These units have been in operation for at least six years without a known defect, to our knowledge. Both power and signaling is conducted by an umbilical cable. The cable supplies power to a Pipe Line End Manifold (PLEM) for several units in order to control the operation of valves during routine pigging operations. Designed using dual magnetic sensors for wide range of pig speeds and long life.

Satellite Monitoring Systems:
Routine pigging and inspection operations normally require technicians to leap-frog from road crossing to next road crossing in order to monitor the pig's progress and control the operational flow especially for gas pipelines.

- During pipeline inspection programs it is vital that the pigs passage is monitored at strategic points (GPS) together with exact time. This method assists the Inspection Company during the final reporting. Any internal defects such as line intrusions or corrosion pitting defect information that is recorded, during the pigging operation, has to be accurately located on the system survey plan. Inaccuracies can be extremely costly.

- StarTrak's monitoring system captures information relating to the station identification (GPS) also ensures accurate event time to $1/10^{th}$ of a second atomic clock time. Data is transmitted on a radio link to the nearest orbiting satellite, downloaded to an Earth Station, relayed through fiber optic cable to Satellite Control where it is switched to the client's secured Internet facility for near real time display.

The electronics, include a CPU, satellite communicator and power supply, located in a stainless steel housing. The unit is mounted on an aluminum post 3" x 60" that also includes a 10wt solar panel and whip antenna. Ultra-bright LEDs provide on site indication of pig's passage

Installing Monitoring Station.
African Jungle Location.

The power supply utilized in the unit is 12vdc, located in a vented compartment inside of the stainless steel housing. The magnetic sensor is contained in a small PVC package sited at the base of the tube. Suffice to say that erection of the station monitor is extremely easy and demands very little of one's time.
After the unit has been positioned, it is necessary to

a) Program the unit for it's GPS coordinate
b) Transmit a test signal.

The system is programmed by use of a PDA with Blue Tooth technology. The PDA also commands the station to transmit the test and records the incoming reply, thus providing certification that the station is operating successfully.

In order to ensure positive activation of the magnetic pig, the system analyzes the magnetic field of the pig and provides positive activation at the crossover of the magnetic field. At the time of the event, data is transmitted to the satellite indicating the station identification, time to 1/10th atomic clock time and any other items of information, which had been programmed.
Data is received, through the client's Internet facility, and directed to a Back-Office facility where information is analyzed and displayed on a monitor. The Back-Office can determine speed of the pig through each section, provide anticipated ETA at subsequent stations. Utilizing a StarTrak ESRI component (patents pending) the client can watch the pig traveling on the monitor offering flow and pressure data to determine location of pig in the event that it becomes obstructed. Each field monitor is capable of recording 100 events that can be down loaded remotely, as required.
The system described is a valuable asset to both inspection companies and pipeline operating companies especially those, whose operations involve commissioning of new systems and in remote areas or foreign territories.

ORBCOMM is a satellite service provider offering high value, Two-way data and messaging communications. Since 1995, with the launch of two low-Earth orbit (LEO) satellites, ORBCOMM has processed over one million messages providing information for sensor monitoring, environmental conditions and two-way data communications on land and sea. Now fully operational since November 1998, with a constellation of over 30 satellites..

All of StarTrak Pigging systems are manufactured in house with the highest grade of materials, therefore dependability during operations.

StarTrak Pipeline Technologies
27233 West Highway Blvd
Katy, Texas. 77494. USA

Phone (281) 599 7557 Fax (281) 578 9181
Web Site: www.starpig.com
e-mail: startrak@starpig.com