Pathfinder Pigs:
The history of magnetic pigging technology dates back to 1970 when Ernest Casey, working on British Gas Pipelines, developed and patented a process for monitoring and locating lost/obstructed pigs. Since that time there has been major advances in electronics, magnetic and communications technologies. StarTrak has taken every advantage of these new and exciting developments.

StarTrak’s “Pathfinder” modular magnetic pigs are designed to saturate the wall of the pipeline through which they are traveling. Pig size range from 3” to 48”, which cover most aspects of operational pipeline systems. In order to achieve the required field strength necessary to provide detection of pigs that may be obstructed, specially designed magnetic modules are inserted into pole plates thus causing the magnetic flux to be guided to the wall of the pipe. System patented by Ernest & Ian D Casey.

All pigs are constructed to provide the strength necessary for varying operating conditions for oil & gas pipeline system, on and off shore. Pigs are detectable to a depth of 15 meters, 10 meters for 4”-6” pigs.

All “Pathfinder” pigs utilize a high grade of urethane cup or disc also urethane spacers that save on maintenance and in addition provide a shock absorbing effect. Pigs are equipped with optional by-pass facilities and may also be utilized with brushes or blades.

In addition to the unique magnetic detectability features, “Pathfinder” pigs also collect magnetic debris during their operations.
The Jet Stream Pig:
The Jet Stream Pig system is used to remove Wax encrusted on the inside wall of a pipeline. It accomplishes wax removal by using a train of Hydrochloric acid in front of the pig and Anhydrous Ammonia behind the pig, and a further slug of Xylene at the rear of the train to pacify any corrosive effects and prevent crystallization. Except for the Jet Stream pig separating the Hydrochloric acid and Anhydrous Ammonia the rest of the train is contained by batching pigs.

When the pig's travel is impeded by a wax build-up, the pressure across the pig increases, a valve inside the pig will open allowing the anhydrous ammonia to be jetted, through holes in the nose cone, into the acid at the wall of the pipe.

The resultant thermal reaction of the mixing of the two chemicals, melts the wax, and the flow keeps any particles of wax in suspension. The residual of the chemicals at the end of the run will be Nitrogen and Brine which can easily be disposed.

Video and Inspection Pig
The system revolves around a video inspection pig suitable for travelling through pipelines from 10" and greater in diameter. The System provides a continuous video inspection operating at 30 frames per second producing the necessary clarity required to analyze the internal surface of the pipeline through which it is travelling.

SYSTEM USES:
- Inspection for internal metal loss-Corrosion
- Verification of the On-Line Inspection results
- Inspection of internal pipe prior to Internally coating operations
- Inspection of Internal coating
- Internal inspection of newly constructed pipelines
- Riser inspection

SYSTEM FEATURES:
- Video Resolution Full Color at 525 lines
- Precision at 30 frames per second
- Design to traverse 3 x diameter bends
- Self contained recording system
- Internal timing frequency 1/10th of a second
- Distance traveled recorded in footage or meters
- Self contained lighting capabilities
- Instantaneous download to VHS or Hi 8 tape
- 3D reporting capabilities
Magnetic Pigs Passage Indicators:
StarTrak manufactures two basic magnetic pig passage indicators known under their trade names “Port-a-Sig” and “Sky 1500”

“Port-a-Sig”®
This unit is designed especially for above ground pipeline systems including launch and receive traps. The unit features:

- Manual and auto re-set magnetic pig alerts
- Elapsed time of event
- Event counting
- Alarm by High Intensity Beacon and/or audio alarm
- Manufactured from high grade T6061 aluminum with protection against weather conditions makes it ideal for both land and offshore operations.
- System features both reliability, and well-proven operations by major oil & gas pipeline companies.

“Sky 1500”®
This is the latest pig passage indicator designed and manufactured by StarTrak Pigging Technologies. In order to accommodate the requirements of operators and contractors under varying conditions, the unit is provided in it’s basic form with options to be ordered as required. Unit designed for pig passage indication at remote stations.

Unit features:
- High Intensity –Ultra Bright LED display warning of pig’s passage.
- Monitors both magnetic and transmitter pigs.
- Designed for all weather conditions
- Accommodates all pig speeds 6” per minute to 100 mph
- Unbreakable Polly Carbonate window.
- Rechargeable Batteries with charger also cigar lighter connector.

Options:
- Low Earth Orbit Satellite Communicator and ST Software Package
- Bluery Long Range Communicator c/w PDA and ST Software Package
- Auto re-set programming for time reset
- System memory for 100 activation for down loading into PDA/ Master computer
  Provides atomic clock time to 1/10th second, also station location (GPS)
“Watchdog” ® The Intelligent Pipeline Marker:
Unit as shown in Appendix “C” is designed to carry out three distinct functions:
- Transmit by Low Earth Orbit Satellite network the passage of a pig equipped with a magnetic circuit or transmitter device.
- Transmit weekly, monthly reports of pipe/soil potentials or by command as required.
- Provide alarm in the event that the pipe is damaged through third party digging or terrorist attacks.

The “Watchdog” unit includes whip antenna, rechargeable battery pack, solar charging panel and ST software package – Back Office.
**Flux-Gate Gradiometer:**
This is a hand held unit specially designed to locate “Pathfinder” Magnetic Pigs. The instrument consists of a flux-gate sensor tube, which is attached to the Electronics Head, which includes re-chargeable battery pack, video and audio alarm facility.

The system is designed to detect distortions, either greater than or less than, in the Earth’s normal magnetic field. By this technology, a pipe inserted in the earth’s field will cause a displacement of the field. Therefore, a magnetic pig that causes magnetic saturation, is easily detected to a depth of 15 meters. This instrument may be used to locate pipelines, electric cables or monitor the pig’s passage at remote stations. It comes complete with a carrying case and additional battery pack.

**ESRI Geographic Pigging System:**
This system originally designed to monitor pigging operations, has many features that include actually viewing the progress of pigging operations minute by minute at Pipeline Control Center (PLC) It indicated the extent of by-pass (interface) provides line pressures, temperature, rectifier voltage and current also pipe/soil potentials.

The system is designed as GIS to be utilized for all aspects of pipeline monitoring including pipe history and as built pipe lengths including pups and valves.

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**Condensate Slug Detection & Measurement System**
StarTrak Pigging designed a slug measurement system at the request of an offshore operator. In the 1980’s. The system was not adopted due to an acquisition of the company concerned. This system can be also based on satellite communication technology. The data downloaded into a Back Office facility, which will provide a measurement of the incoming slug and the operator’s ability to control the system.
“Deep C” Pig Passage Indicator:
These units are normally sited at the Pipe Line End Manifold (PLEM) in order that valves can be activated after positive confirmation that a pig has passed.

In order that the “Deep C” system can be deployed to a depth of 10,000-ft below the surface, the housing is constructed of either Titanium or Super Duplex material. Each unit is equipped with facilities to incorporate ODI connections.

“Deep C” is the trade name of StarTrak’s sub-surface pigging system. The units are designed to activate at the passage of Pathfinder Pigs from speeds of 6” per minute to 100 miles per hour. Th electronics package includes twin-sensing systems, a micro processor programmed to allow auto reset facilities from 1 second to 60 minutes. Allowance is made and caters for unit sensitivity. These functions are normally programmed in the factory prior to Factory Acceptance Test (FAT)

Offshore Pig Monitoring:
Utilizing StarTrak’s “Pathfinder” Pigs for offshore operations, these can be monitored at strategic stations along the route of the pipeline either on a permanent basis or during operations or Inspections with MFL tools.

In water depths of 400-ft (140 meters) or less the sensors attached to or near the pipe, are connected by cable to a surface buoy, which contains an electronics package, battery pack, solar panels and satellite communication system.

In greater water depths communications from sub-surface to surface may be achieved utilizing acoustic technology. This is a unit, which is known as StarTrak “SoniSig”.
On activation the acoustic system will emit a train of data relating to time and location. Data is then transmitted to a buoy location, processed for onward transmission to control centers by satellite communication networks where information is displayed on the client’s monitors.

In the event that a pig becomes obstructed its position can be easily located utilizing a StarTrak Marine Flux-gate Gradiometer.
**Cathodic Protection Rectifier Monitor:**
At the request of a major oil & gas pipeline company, StarTrak designed a system to monitor pipeline Cathodic Protection Rectifiers for:
- Incoming Voltage
- Voltage to the Pipeline
- Current Consumption
- Pipe to soil potential

Data is processed on a continuous basis in order to provide alarms in the event of failure or for excessive voltage being applied to the pipe under protection.

The system utilizes Low Earth Orbit Satellite Communications to transmit data to control centers. StarTrak Back office software is utilized to process the incoming data.

These units are extremely cost effective and may be utilized anywhere in the world. In the USA it is claimed that the monthly cost of monitoring each rectifier manually is $150.00, this function can be carried out for $12.00 per unit per month regardless of times it is interrogated.

**Valve and Check Valve Monitoring:**
Due to constant leaks in a Californian pipeline and the failure of automatic closure of system check valves, the Californian Fire Marshall required periodic testing of check valves to ensure adequate closure in the event of a leak or pipeline rupture.

StarTrak Pigging was commissioned to develop facilities to ensure complete closure of check valves.

The sensor monitored the metallic clapper or in the event that the clapper was manufactured of a non-metallic material, a small magnet could be adhered to the clapper face. The sensor would indicate open or close of the check valve but it would not respond until absolute closure of the system.
**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 on sensor monitoring, environmental conditions and two-way data communications on land and sea. Now fully operational since November 1998, with a constellation of 28 satellites.

The integrated solution:
- cost efficient
- captures all pipeline operational data
- two-way communication with Pipeline Control (PLC)
- cost effective alternative to SCADA
- can use clients existing formats for easy integration
- low construction and implementation costs
- reduces operating expenses
- fixed or portable
- can be implemented to clients specifications
- remote metering
- secure
- remote E-mail access

**Satellite (LEO) -** PLC Photo or Art by permission of ORBCOMM

**ORBCOMM LEO** satellite network and **StarTrak Pigging Technologies** have teamed to provide an innovative solution for remote monitoring and data communications for the International Pipeline Industry.

The **ORBCOMM LEO** satellites, orbiting at approximately 500 miles above the earth to provide two-way global communications available to exploration, production and pipeline companies. Orbcomm now has a constellation of 28 satellites in low-Earth orbit and 14 gateway earth stations installed or under construction on five continents.
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