



November 2010

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Pigging Industry News

the newsletter of the Pigging Products & Services Association

Jim Cordell, Founder of PPSA **1935—2010** *by Chris Kershaw*

Jim Cordell was born in 1935 in Loughton, North East London. As a young boy, he watched the Battle of Britain unfold over London and this experience instilled in him a passion for aircraft and flight, so when his time came to do National Service, he joined the RAF as an aircraft plotter.

On leaving the forces he became a mechanical engineering draughtsman, working in a number of positions covering nuclear power station and aircraft design and he eventually became a Chartered Engineer. Jim once told me, tongue in cheek, that he was extremely proud of having the dubious honour of single-handedly designing the stainless steel toilet bowl for the Hawker Siddeley Trident airliner, without which the plane would probably never have flown!

He started in the pipeline industry in 1967 as UK marketing manager for TD Williamson, having been interviewed by Hershel Vanzant who became a lifelong friend. Initially he worked at the UK office but was later promoted to the Brussels office where he became marketing manager for Europe, Africa and the Middle East.

I first met Jim in 1980 at a pipeline services conference where we were both speakers, and although we immediately hit it off, little did we realise that a friendship had started which would last for 30 years. I quickly came to know and respect Jim and found that above all else he was totally honest, extremely kind, and always dedicated himself completely to the job in hand, although he had an extremely low tolerance for bureaucracy. He earned great respect from everyone he worked with and met, and lived his life to the full in a wonderfully jovial manner no matter how bad things were and had absolutely no problem in laughing at himself which

happened frequently.

In 1984 Jim left TDW to set up his own consultancy business called On-Stream Systems Ltd. Jim carried out consultancy work for most of the major oil companies and many pipeline service contractors, but his big break came in 1996 when he became a full time consultant to Statoil in Norway, working with Arne Vingerhagen on the design of specialist pigs for non standard offshore pipelines. The last and most notable project, and one which I had the privilege to work with Jim on, was the development of a 28 to 42 inch dual diameter pig, the success of which surpassed all expectations and pushed dual diameter pigging technology forward by a giant leap.

By the late eighties Jim had come to the conclusion that the pigging industry needed an international association to promote the knowledge of pigging and its related products and services by providing a channel of communication between the members themselves, and with users and other interested parties. Thus PPSA was formed, initially with 19 members but over the years this has increased to over 90. Jim can be justly proud of his efforts.

In 1998 Jim joined up with Hershel Vanzant to write the Pipeline Pigging Handbook which was, and still is in my opinion, the most authoritative book on pigging with well over a thousand copies sold worldwide and Jim and Hershel used to get together annually to update it.

Jim decided to retire completely in 2000 in order to spend more time with his wife Sheila and his family.

Jim died after a six month battle with lung cancer on 15 August 2010. He was the nicest, most decent person you could wish to meet. He was a true friend. I shall miss him greatly. ●

SmartScan™ clears a path for pipelines in the USA

The challenges facing 'unpiggable' pipelines are often associated with reduced bore valves, miter bends or changes in diameter. **PII Pipeline Solutions** identified this as an opportunity to combine its pipeline inspection experience with the requirement of pipeline operating companies to develop technologies to inspect these challenging pipelines.

One example of this co-operation arose in early 2007, when El Paso Pipeline Group (El Paso) contracted PII to conduct metal-loss inspections of 13 natural gas pipelines located in the United States.

The segments ranged in length from 30 to 89 miles (48-142 km), with at least two diameters in each segment. Many of them contained full-bore tees and 1.5D back-to-back bends. Although the lines had been in service for several decades, none had been inspected. El Paso had a requirement to complete inspections mandated under US Department of Transportation regulation CFR 49 Part 192 for High Consequence Areas (HCA) and also for internal requirements.

The project timeline required GE to design, build and test a fully functional, multi-diameter SmartScan tool within eight months.

GE developed its SmartScan inspection tool using the well-

proven MFL (Magnetic Flux Leakage) principle. The tool is configured with extremely short and compact magnetizing modules compared with conventional ILI tools.

Up to now, solutions for inspecting pipelines with diameter changes were to adapt an existing MFL single-diameter tool to inspect the nominal diameter and traverse through the other diameter(s) or break up the segment into multiple segments of single diameter pipeline. The limitation of this approach is largely due to the existing MFL technology and magnetizers designed for these tools. If the variation in bore is large, the data collected in the extreme diameter(s) is usually compromised. Ultrasonic wall measurement in-line inspection tools have performed better in these situations but costly tool modifications are often required and were not applicable in El Paso's gas pipeline network.

Although several pipeline inspection companies do have multi-diameter inspection tools, there were no tools on the market that could traverse and inspect these 24" through 31" pipelines. El Paso required that all diameters be inspected within the segment, preferably, within one run. Some of the pipelines contained full-bore offtakes, 1.5D bends and to further complicate the issue, there were lines with true 31" OD. The tool had to meet the following criteria:

- Complete metal-loss (MFL) inspection

- Detection specification: 10% wt in general corrosion and 20% wt in pitting corrosion (speed and wall thickness dependent)
- Depth sizing accuracy: 80% ±15% wt
- Multi-diameter inspection capable of 24" through 31"
- Full-bore offtake passing
- 1.5D back-to-back bends

One of the greatest challenges for in-line inspection of an unpiggable pipeline is assuring the line is clean enough to allow the inspection tool to pass undamaged and to collect quality inspection data. Some of these pipelines were built over 40 years ago and there was potential for excessive wear and/or damage to sensors that have to be kept in close contact with the pipe wall to do their job. Early runs with the SmartScan tool showed such damage and the feedback was used by GE to refine the sensor design and improve running life.

A solution for cleaning the proposed lines had to be devised prior to running the inspection tool in the pipeline. In parallel with the design, building and testing of the in-line inspection tool, GE also worked on a cleaning solution.

GE recommended that the lines be chemically cleaned, followed by running a multi-diameter cleaning pig to determine if the line was clean enough for inspection.

El Paso needed to complete at least two inspections by December 17, 2007 in order to meet internal and



Industry news

DOT requirements. They required the tool be ready to launch by November 7. The tool was designed by March, built by August and tested in October. It was launched on 7th November 2007.

In order to confirm the passage of the tool through specific pipeline features, a mock pipeline was set up. The tool was pumped through it utilizing water as the medium. The features in the line included obstacles such as offtakes, 1.5D back-to-back bends, minimum ID spools and a section to confirm that the tool would drive in the 31" pipe.

The mechanical proving tests were conducted in the same line layout as the pump through test, with additional obstacle features added, including a valve void of 9.75", 60 degree step of 1" and full-bore offtake of 31". The tool was pulled by winch and each test was conducted at speeds of 1, 3 and 5 m/s.

To develop the defect sizing algorithms, a series of manufactured defects were put into 24", 26", 28", 30" and 31" diameter pipes. The tool was pulled through the pipes at various speeds to determine the effect of velocity on the sizing algorithms. The results from these runs were used to build a statistical sizing model for the tool in the various diameters and wall thicknesses of pipe.

The tested tool was ready for its first inspection on time on November 7, 2007. The GE crews



Multi-diameter cleaning brushes

inspected three pipelines prior to the end of 2007, allowing El Paso to meet DOT inspection requirements for HCA mileage and company goals for total mileage.

Early in 2008, the tool was returned to Cramlington, UK to modify the metal-loss sensors to improve their robustness and wear characteristics. Since the completion of the sensor modification El Paso and GE have completed 16 additional inspections with the SmartScan tool within lines that would have otherwise been considered 'unpiggable'. ●

Baker Hughes' CPCM Tool successful

In July 2010, Baker Hughes' Pipeline Management Group was contracted to perform an in-line cathodic protection (CP) current inspection for a major pipeline operator in the Eastern United States. The line was a 43 mile, 12 inch refined products pipeline constructed primarily of 0.219 inch wall thickness, X-60, electric resistance welded pipe. The predominate coating on this

pipeline was polyethylene tape. CP for this line was reported to be provided by six rectifiers and a bond.

Baker Hughes' cathodic protection current measurement (CPCMTM) tool was launched on July 13, and received on July 14, with one hundred percent of the pipeline's length successfully inspected.

The CPCM tool data indicated five rectifiers protecting this line, while the client's records indicated six rectifiers. One of the rectifiers was found to be flowing current to the pipeline through the negative drain. This is reverse flow from what is normally expected. The rectifier in question protects a parallel line as well as the target line. The current loops through the negative drain cable from one line to the other. Two mainline valves exhibited very high current densities. It has not been determined if this was due to coating issues at the valves or shorts through motor operated valve electrical conduits. Even though the pipeline exhibited low current density, it appeared to be receiving current at all points. Average current density was found to be 0.026mA/ft². The pipeline was being protected with 18.62 amps of current. Nine areas (each under 100 ft.) had much higher current densities ranging from 6.46 mA/ft² to 76.95 mA/ft². Recoating these nine areas (411 ft. of pipe) would result in a reduction of 13 amps or 70% of the 18.62 amps presently being used to protect the line. Overall, current density of the pipeline would drop from 0.026mA/ft² to 0.008mA/ft².

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A second CPCM inspection was conducted on this pipeline on July 14 as part of a Pipeline Research Council International project. The operator had modified the CP system for this inspection in an effort to check the ability of the tool to detect changes. The location and nature of the CP system modifications was not communicated to Baker Hughes; however, data analysis revealed the location and nature of the CP system modifications that were made for the test. Once again, the tool run was a success. The first change was found at a bond to a foreign pipeline. In the first run, this bond was draining 7.35 amps from the target pipeline. In the second run, this bond had been removed, revealing a second bond to a parallel pipeline. The effects

of breaking this bond were far reaching. This bond was protecting approximately 50% of the pipeline during the first run, and once this bond was broken, fourteen distinct areas of current discharge (negative current density) were found. Surprisingly, the most serious discharge area was located approximately three miles upstream of the bond location and measured 2.67mA/ft². This area was 151 ft. in length and was discharging 1.35 amps from the pipeline to the soil. Overall, the fourteen segments exhibiting negative current density were discharging a total of 13.58 amps of current from the pipeline to the soil. These are serious conditions that, if left unmitigated, would have a negative impact on the integrity of this pipeline. The pipeline was returned to normal

operations immediately following this test inspection. The other temporary change to the CP system that was discovered by the CPCM tool was the addition of a 1.35 amp bond to another pipeline. This bond acted as a current source with current flowing from the target pipeline to the foreign pipeline through the bond connection.

The most significant difference noted between the two inspections was the 7.35 amp bond to the foreign pipeline. This bond impacts approximately 50% of the entire 43 mile pipeline and is critical to the protection of this pipeline. The elimination of this bond not only caused significant interference, but also changed the current flow patterns on a significant portion of the line. ●

TDW Offshore Services AS and BV offer comprehensive pipeline support

TDW Offshore Services AS (TDW) joined forces with Offshore Independents BV to offer integrated solutions for companies keen to retain a full range of pipeline services and emergency pipeline repair systems from a single source.

They saw there was a gap in the market for an organization that offers pipeline recertification and project management services, in addition to core inspection, repair and maintenance services, and expertise in emergency pipeline

repair systems. "Together we offer a truly comprehensive range of special services to the world's pipeline industry," said Dirk Rook, Commercial Director of Offshore Independents. "TDW has an excellent reputation globally for its pipeline pressure isolation

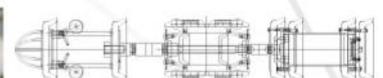
technology. TDW's products and services are the perfect complement to our range of pipeline recertification, project management and engineering services. This gives us the opportunity to better assist our clients as they strive to prepare for the unexpected," he added. ●

PPSA's Annual Seminar in Aberdeen— Meeting the Challenges of Pipeline Pigging

PPSA's One Day Annual Seminar is on Wednesday 17th November 2010 at the Marcliffe Hotel. The day will include presentations of technical papers and an exhibition. There will also be a Question and Answer Forum with the chance to have your questions answered by a Panel of Experts. Questions can be asked on the day or may be submitted beforehand anonymously at www.ppsa-online/anonymousquestions. If you would like more details about the seminar see our website at <http://ppsa-online.com/seminar10.php> or contact the Secretary at ppsa@ppsa-online.com.



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48" Gas Magnetic Flux Leakage Inspection Tool

T.D. Williamson, Inc. (TDW) has developed a 48-inch Gas Magnetic Flux Leakage (GMFL) inspection tool in Salt Lake City.

The tool, which has already had a field run on a 48-inch natural gas transmission line in Canada, reveals the versatility of the services that TDW offers to its customers. TDW can provide cleaning pigs and inline inspection (ILI) services using its 48-inch Kaliper®360 tool for identifying physical anomalies and geometry in a pipeline and using its 48-inch GMFL tool for identifying corrosion features and pipe wall loss. TDW also offers hot tapping and plugging services to assist with the repair of identified anomalies.

The GMFL tool is designed to fill a niche in the ILI market. Gas pipe-

line MFL tools do not enjoy the advantages that liquid product tools do. In a liquid line, the product provides lubrication, reducing friction between the inspection tool and pipe wall. This makes it possible to maintain a steady speed as the tool traverses the pipe. In a gas environment, however, friction rises, causing the magnetic inspection tool to "stick" to the pipe wall. It is difficult to maintain a steady tool speed because variations in gas pressure cause the tool to stall and surge as it moves within the line.

The GMFL tool addresses this with three strategies. First, each magnetizer "floats" individually so that magnetic forces are consistent whether in a thick or thin wall, or a tight bend. By reducing tool drag, floating magnetizers enable more consistent velocities. Second, the traditional MFL tool has coarse steel brushes that magnetize the pipe wall (so sensors can read

magnetic loss levels). These are replaced in a GMFL tool with smooth, flat wear skid plates that glide more easily. Finally, the tool's design allows for as much as 25% bore reduction and is constructed of lighter weight materials, making it approximately half the weight of other 48-inch tools. All this means that the GMFL tool offers a greater ability to negotiate breadth reductions which, along with reduced drag, allows for more consistent velocities and, therefore, more accurate inspection.

An additional feature of TDW's ILI services is the ability to remove foreign liquid from a gas pipeline. Over time, liquid sometimes collects in pools at low levels. These reduce the throughput of the line to below its optimum capacity. TDW has addressed this by providing custom engineered cleaning pigs with special urethane cups and discs designed to shoot out liquid. ●

Automatic Multiple Pig Launching System

Pipeline Engineering (PE) has successfully completed a series of pigging runs for one of its US based clients using a new method of operational pigging. This has been achieved by utilising PE's patented Automatic Multiple Pig Launching System (AMPL).

The client, a major gas operator, was until the introduction of AMPL, carrying out a daily pigging run which required a significant investment in both time and resources. The client was drawn by the multiple launch

functionality of AMPL and the resulting reduction in trap interventions. The client believed this would lead to safety and the environment improvements, as well as significant cost reductions.

PE was asked to develop an AMPL based solution that could be used to deploy 10" pigs in a 27 mile long, wet gas gathering system. Initially this involved undertaking a thorough evaluation of the line taking into consideration pipeline flow rates, pressure, temperature and relevant pipeline geometry. As a result PE set in place a series of development trials at its testing facility in the UK. Following these

trials the project team proposed a six pig AMPL system, complete with a custom designed launch cassette which could be retrofitted to the existing launcher. Using PE's AMPL technology enabled the full series of six pigs to be launched as required, without having to access the line until all of the pigs had been run, when the cassette could then be re-loaded.

This procedure reduced the current frequency of trap interventions by a factor of six. To support the independent launching of the AMPL pigs, the client has fully automated the launching and receiving sites, which included add-



ing valve actuators, controlled by a SCADA system, operated remotely from a base 80 miles from the launching site. Personnel are no longer required at either the launch or the receive sites on a daily basis. The first series of runs were carried out with full support from PE's

USA based service team. This included onsite training for the client's operating team. The team will continue to support the client, but future pigging runs will be carried out by the clients own personnel.

Additionally the use of solid bodied AMPL pigs, as opposed to the previous foam pigs,

resulted in a significant increase in the effectiveness of cleaning with far greater amounts of debris being removed per run. It is anticipated that this may lead to a reduction in pigging frequency required over time. ●



At site: launcher fully loaded with 6 AMPL pigs

Integrated Magnetics components for Pigs

New associate member **Integrated Magnetics (IM)** has been providing custom built components for Magnetic Flux Leakage inspection equipment for over a decade. Established 55 years ago, IM is a vertically integrated magnetics supplier, supplying permanent magnet materials, complex magnetic assemblies and custom engineered electrical machines for critical applications. IM's engineering group provides magnetic design services based on 2-D and 3-D finite element analysis modeling and engineers or builds-to-order motors, alternators, resolvers, actuators and other electro-mechanical devices – often for use in harsh conditions, with temperature, pressure, shock, and other challenging environmental operating conditions.

For the oil and gas services sector, apart from MFL components, IM produces components or finished products for down-hole applications such as NMR, magnetic valves, alternators, and magnetic couplings. IM also serves the semiconductor, medical, aerospace, and research and development markets.

IM operates its own ISO 9000 registered plants in California, Mexico and China – providing cost and lead-time optimized production solutions for its clients. Production facilities include extensive precision CNC machining, grinding, EDM, coil winding, assembly, class 1000 clean rooms, and inspection and test. ●

Inspection of Dual-Diameter Pipelines

Recent high profile pipeline failures have focused increased regulatory scrutiny on the integrity assessment and management of aging pipeline assets throughout the world. Many older pipelines, including those in heavily populated areas, have geometries such as small radius bends and diameter changes which have traditionally classified them as unpiggable. The InVista™ tool from **Quest Integrity Group** inspects such pipelines and provides 100% overlapping data coverage of lines that were not navigable by other pigs.

With a large collapse factor, the

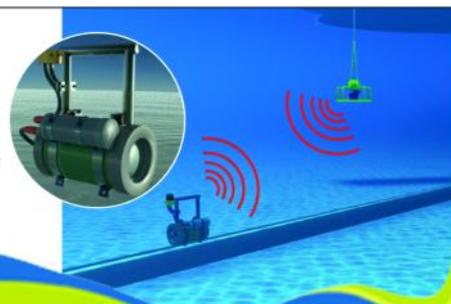
ability to navigate 1D bends, and configurations that are easily customizable to the specifics of an individual pipeline, the InVista tool has shown its value in recent inspections. Inspections of both 6"/8" and 8"/10" dual diameter pipelines have demonstrated that the tool is not just able to navigate, but also to gather a full dataset in pipelines with multiple diameters. By collecting the complete set of data in a single run, the tool decreases the operational costs associated with an in-line inspection. In addition, the high fidelity ultrasonic dataset generated by InVista can be rapidly assessed using the company's LifeQuest Pipeline software so that a full level 2 fitness-for-service assessment is delivered as part of the final inspection report. ●

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A-Hak develops Push Pull System for Piglet

In its continuous effort to further expand the applications of the world-patented Piglet® inspection system, **A. Hak Industrial Services** has developed a push-pull system which allows for high-performance ultrasonic inspection of branch lines with minimum impact on the operational availability of the pipeline system.

A specialized pushrod was developed to obtain exceptionally long push lengths and minimum bend passing capabilities of 1.5D, as well as a motorized pusher-

puller mechanism to control the inspection velocity and required circumferential and axial coverage.

The compact, light weight, modular design of the piglet® in combination with a push rod's ability to provide the required propulsion, power supply and data transfer allows user-friendly, high performance ultrasonic inspection of branch pipelines with all ultrasonic measurements presented online.

An advanced data acquisition system stores all data, which results in one of the most accurate and detailed ultrasonic analyses of the

inspected pipes available in the industry.

The system is already successfully in use and had a world launch in Brazil at the CDUT in Rio de Janeiro. Lots of clients witnessed its first spectacular run. ●



The push-pull UT inspection system

ROSEN completes second of 5-year contract with National Grid Gas UK

National Grid Gas UK, is the owner and operator of Great Britain's high pressure natural gas pipeline network and four lower pressure distribution networks.

The pipeline inspection services contract was awarded to **ROSEN Europe** in January 2008 with operations commencing in April. ROSEN successfully completed a record number of 66 National Grid pipeline inspections between April and December 2008. The inspections were undertaken with ROSEN's state-of-the-art inspection tools for metal loss, extended geometry and XYZ mapping. In addition, new Magnetic Flux Leakage (MFL) and extended geometry tools were designed especially for low-

pressure and low-flow conditions in pipeline sizes up to 18".

To service the contract ROSEN opened an operational base in Newcastle upon Tyne, UK. It became fully operational in January 2009 and supports not only National Grid but all other UK and Ireland inspection works including tool maintenance and data analysis.

In addition ROSEN performed dent strain analysis using data from the extended geometry tool. In 2009, mobile Electro-Magnetic Acoustic Transducer technology was used for valve pit inspections, and transverse MFL technology inspections were added for specific pipelines.

On-site work for 2010 commenced in the first quarter of the year – a period that is usually outside the historical inspection window. A further 50+ pipelines are planned for 2010. ●

B.G. Technical completes commissioning of West African Gas Pipeline Laterals

B.G. Technical Ltd (BGT) completed the pre-commissioning of the west African gas pipeline system. This 520km, 20" diameter offshore gas pipeline runs along part of the west African coastline, delivering gas from Nigeria to other countries in the region. The project completion enables gas supply from Nigeria to consumers in Benin Republic, Togo and Ghana. BGT's work included hydrotesting, pigging, drying and inerting of the 8", 20km lateral from offshore to Cotonou RM station and 10", 9.8km pipeline from RM station to CEB. Testing, drying and nitrogen packing of 8", 18.6km lateral from offshore to Lome RM station and similar works in 18", 17km laterals

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from offshore to Tema RM station in Ghana.

To meet tight completion targets, BGT mobilized full spread of equipment and personnel from Nigeria onto a specially fitted divers' vessel. BGT's nitrogen membrane unit delivering nitrogen at slightly better than 98% purity, was a key element in the success of the project.

BGT used special pigs designed and manufactured to specifications in Nigeria by sister company Pipeline Products and Accessories. ●

Visit the PPSA Website

To find out more about PPSA members and the services they offer visit the PPSA website at <http://www.ppsa-online.com>

Attend PPSA's Annual One Day Seminar

and learn about the latest developments in Pipeline Pigging

Aberdeen, UK
17th November 2010

Contact: Diane Cordell
pps@pps-online.com

Self Propelled Caliper

To meet the difficult challenge of pipeline exploration and inspection, Uwe Dietrich, founder and CEO of **Analytic Pipe** and his team designed an innovative self-propelled caliper (SPC) tool (patent pending). Its self-propelled, multi-function robotics are designed specifically to inspect newly built pipelines, and the entire concept is based upon an independent drive module which pulls the measurement unit through the pipeline. It is suitable for pipe-line diameters from 30 inches.

In order to test the tool's capabilities, the company set up a 38m test loop. This had a 6m straight section, 3.5m 3D bend and an obstacle of a 10% circumferential reduction of inner diameter. The results of comprehensive test runs and other research in this facility have led to the following conclusions for the SPC tool.

They had a high degree of confidence that the device would function correctly when it encountered similar conditions in actual pipelines. Conclusively and consistently the tests showed that the SPC tool works very well under a wide range of situations. An analysis of the results indicated that the physical forces acting upon the device considerably increased when

passing through successive 3D bends. As a result, the power consumption also increased. Telemetric data clearly demonstrated a quadrupling of the forces upon the tool, which was seen to withstand them very well. During a 12 km continuous test, the SPC was exposed to extensive physical strain, increasing with each bend. After four passes in the 38m test loop the force and electric current quadrupled in strength.

Over a continuous distance of 12km in automatic mode, the SPC cumulatively passed 320 loops, 1280 bends, and 320 gaps. This meant the device was exposed to increased physical force for one third of the total distance.

Under normal circumstances, in a straight pipeline for example, it can be concluded that that the SPC can run double the distance of the 12km loop. This is due to the fact that not having to navigate through bends in the line would save battery capacity.

In conclusion, a 12km run in the test loop can be compared to a 24km run in a straight pipe. Since the work conditions of the device are four times harder in a 3-D bend, it has been shown that the device and its components are highly reliable under normal circumstances. ●



PIPELINE PIGGING AND MAINTENANCE EQUIPMENT

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