November, 2009

Pigging Industry News
the newsletter of the Pigging Products & Services Association

The President's Letter
by Lloyd Pirtle

I WANT TO take this opportunity to thank the Association and the membership for the opportunity and honour to serve as President of PPSA. Many great volunteers have served prior to my involvement in the Association, and served the Association well. I hope that I can fill the shoes vacated before me and, with the help of the directors and other officers, do my part to uphold the standards and reputation of the Association and the industry. Also, on behalf of the Association, special thanks goes to Gill Hornby for her hard work and dedication to make our Association survive in the midst of very challenging economic times.

Jim Cordell, Founder of PPSA, has been invited to be the introductory speaker at the Pigging Products & Services Association's seminar this year, which is being held at The Marcliffe Hotel in Aberdeen on 18th November (*see page 8*). He is looking forward to coming to the seminar and interested in hearing about industry developments since his retirement. We look forward to hearing from Jim in November. Chris Kershaw, our first President, will also attend the seminar, as will Gary Smith, who was first Vice President and subsequently twice President of PPSA.

We want to thank Joe Caldwell for his contribution to PPSA over the years in the role of Technical Adviser on US legislation. David E Bull of Sugar Land, Texas, has now has taken over this responsibility. David co-founded ViaData, and is publisher of WinDOT, The Pipeline Safety Encyclopedia (a primary reference source for US Federal and State pipeline safety regulations). You can find more details about David on our web site under Members – Individual. David has just updated the paragraph in our *Introduction to Pipeline Pigging* on the subject of legislation; the book is currently being reprinted.

2010 marks the 5th annual PPSA golf tournament. Each year, this function is more successful than the previous year, and PPSA's management intends to make 2010 a special outing to celebrate the 5th Anniversary of the tournament. Sponsorships are available for members to make a special contribution to our 20th year as an Association.

The Annual General Meeting for all PPSA members will be held at the Marriott Westchase Hotel, Houston on Tuesday, 16th February, prior to the opening of the Pipeline Pigging and Integrity Management Conference and Exhibition. Please plan to attend this meeting as it is your chance to voice opinions and help shape the future of the organization.

Finally, sometimes we forget how important industry associations can be to the success of member service companies, industry operators, and to the individuals who serve on boards or committees of these associations. 2010 marks the 20th anniversary of PPSA. Next year, we are "Celebrating 20 Years serving the pipeline industry". Please see the newly-updated PPSA web site for additional details regarding the history of the Association and the people who have served the industry well. ●

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Industry news

Weatherford certified by DNV

DURING June, **Weatherford International Ltd's** Pipeline & Specialty Services' Western Hemisphere facilities in Lafayette, Louisiana, and Macae, Brazil, completed recertification audits, the results of which were accepted by **Det Norske Veritas** (DNV) who has issued certification to both of these facilities. The ISO 9001:2008 certificate issued by DNV will have Lafayette as the hub, and will list Macae as an additional site. The company plans that its Houston facility will be added to the current certification by the end of the year. ●

Brush excellence

COTTAM BRUSH has been presented with an STEP Business Award 2009 for 'Excellence in customer service'. The company also achieved runner-up in the 'Manufacturer of the year' category. "Although this is a great result, it will not take away our determination to improve. This passion for excellence in customer service has been with the company for over 150 years and is one of the keys to its continued success", sales manager Kathy Bevan commented.

Although the company's manufacturing methods have changed considerably over the years in line with improving technology, the main underlying principle remains the same: to supply its customers with what they want, free from defects, and on time. "This is a team achievement, which is down to the hard work and determination of everyone within the company" said managing director Ben Cottam.●

Pigging specialist celebrates 10 years

SPECIALIST DESIGNER and supplier of heavy-duty pipeline cleaning tools, UK-based **Pigtek Ltd**, will be celebrating its 10th anniversary at the end of this year. Founded by Ralph Hyslop in January, 2000, Pigtek provides solutions for applications where 'standard' or other proprietary equipment will not perform or is proving to be inefficient.

The anniversary also coincides with the relocation to new premises. Still based in Chesterfield, in the centre of the UK, Pigtek will move into a brand new facility on a prime site at Temple Normanton on the edge of the historic market town. With continued year-on-year growth, this new larger site provides enhanced facilities for Pigtek with offices, workshop, storage, and a test yard. ●

PE acquired by Circor International

PIPELINE ENGINEERING has become a member of **Circor International**. The major US-based engineering group has annual sales of $800 million, and provides valves and other highly-engineered products and subsystems that control the flow of gas and liquids safely and efficiently in the energy, aerospace, and industrial markets.

Working closely with Circor's subsidiary **Sagebrush Pipeline Equipment Co** of Tulsa, a supplier of pipeline traps and metering systems, the two companies will now be in a position to provide a global service and strengthen their joint marketing positions world-wide

Pipeline Engineering will now become part of the Circor Energy Group, joining other companies including Pibiviesse, KF Industries, Hydroseal, and Mallard Controls. ●

Gel pigging for unpiggable lines

NEW PPSA MEMBER Aberdeen-based **Aubin Ltd** is a specialist in the development and supply of novel pipeline gel technologies for use in oil, water, and gas pipelines. The company offers a full range of gels and chemical pigs for cleaning, de-oiling/dewatering, debris removal, chemical train separation, and spool filling.

To meet the particular challenge of pigging unpiggable lines, Aubin has developed its *L-Gel* pig which is capable of negotiating restrictions and changes in pipeline internal diameter before reverting to its original size. Typically used to provide enhanced cleaning and dewatering performance, *L-Gel* is designed to maintain 360° internal pipewall contact despite variations in pipeline ID. Supplied cast in a spoolpiece, the gel pig can be introduced into the pipeline without the need for a pig launcher and requires no pig receiver but can be extruded via check valves or other ports. ●

ITF: growing oilfield technologies for the future

by David Liddle, Operations Director, Industry Technology Facilitator (ITF)

THE Industry Technology Facilitator (ITF) was established in 1999 by the oil and gas industry as a not-for-profit international organization owned by operating and service companies (full membership details can be found on its site at www.oil-itf.com). ITF's key objectives are to identify technology needs, foster innovation, and facilitate the development and implementation of new technologies into the upstream oil and gas by the following means:

- identify the shared technology needs of member companies
- seek out innovative solutions
- access the technology development funds
- launch collaborative joint industry projects
- create field-trial opportunities
- deliver technology implementation

ITF interacts with members to understand their technology needs, and adopts a systematic process to seek-out technology solutions and innovations to meet its members' business-driven technology requirements.

The ITF model

The process begins with ITF members providing an input on a confidential basis through one-to-one discussion. This information is collated by ITF and presented in a non-attributable way to the entire membership at our annual general meeting. The membership of ITF decides the working priorities for the year ahead; these are the ITF 'Themes' and are clearly based on industry defined needs.

The formal timeline for the ITF process begins with a 'Theme Day', which takes the form of an open facilitated workshop where ITF members and key industry experts engage to define in detail the key issues and challenges that the industry faces. ITF takes the output from this workshop and turns it into a 'call for proposal' which is issued to a wide audience within the global development community. This community is considered to exist amongst universities, research organizations, small and large companies; in short, anyone with a potential solution.

On receipt of proposals ITF will undertake a screening exercise to see if they fit the specific requirements of the theme. The process of review continues with its members and culminates with proposals of key interest to members who will be invited to present their projects.

The process remains flexible at all stages as some interesting applicants may be asked to adapt their approach and modify proposals in either scope, cost, or time in order to make them more acceptable for funding. Successful candidates can receive up to 100% funding for their projects. A standard contract has been developed over many years to make the contractual engagement process easier and, more importantly, the ITF model is that the applicant always retains the intellectual property.

The ultimate objective of the exercise for all is to see the technology developed and be brought to full implementation through deployment. Implementation is a key performance objective for ITF and its members.

Case study

Pipeline Engineering Ltd (PE) has been successful in using the ITF process. This project was not without difficulty in its implementation, but has now gone on to be one of the recent successes with work continuing and trials planned with a major

New Members

Full
Aubin Ltd, UK
Sonotec GmbH, Germany
VP Engineers, India

Associate
Petrofac Training, UK

Individual

David Bull, ViaData, USA
Torbjorn Staalesen, Staalesen Solutions AS, Norway

international operator. The pigging company went to ITF with an idea for an automated multiple pig launcher (AMPL), which would allow the independent launching of one or more pigs for either a regular or irregular pigging programme, without the need for launcher intervention every time.

AMPL now operates in a similar way to standard pigging equipment. The pigs are either pre-loaded into a specially-designed cassette, which is then inserted into the standard trap, or they are loaded into the trap in which the cassette has already been fitted. The number of pigs in the cassette is predetermined by the length of the trap. PE's AMPL development is set to provide many benefits for ITF members, some of which include:

- increased levels of safety
- reduction in spillages due to the reduced number of line interventions
- lowering of polluting emissions, as the amount of flaring is reduced
- less manpower required for pigging
- can be easily removed for non-routine pigging
- reduced number of launcher interventions required to launch a series of pigs
- designed to be more cost effective and quicker to install than current multiple pig launching systems available

By the end of 2009, the AMPL is set to have undergone major trials with a Middle Eastern operator, and work is expected to continue with ITF member support on development of the system. ●

Inspection of non-piggable pipelines - Part 2

by L J ("Hans") Gruitroij, A Hak Industrial Services BV, Geldermalsen, Netherlands

In Part 1, published in the July, 2009, issue, the author gave an overview of the problems of unpiggable pipelines, and introduced his company's PigLet tool and accompanying service package.

Ultrasonic measuring head

The ultrasonic measuring head consists of an ultrasonic transducer and a rotating 'mirror'. The ultrasonic signal is transmitted to the pipe surface via the rotating mirror, and is also received via this mirror. A sound pulse is sent from the transducer in the centre of the pipe in the direction of the pipe wall: from the inner wall, the sound pulse will be partially reflected back to the centre of the pipe where it is detected by the ultrasonic transducer. A portion of the sound pulse at the pipe wall will not be reflected but will travel through the pipe steel and will be reflected back from the outer pipe wall. The time difference between both reflections (inner and outer pipe wall) determines the wall thickness at that point.

The ultrasonic sensor uses the rotating mirror to enable measurement of the complete circumference of the pipe wall. The step motor which rotates the mirror can be adjusted in various steps to the proper speed of revolution to suit the particular application.

To increase the detectability, or measuring quality, different ultrasonic sensors with different frequencies and crystal sizes can be used. The type of transducer depends on the size of the pipeline, size of defects which have to be detected, the product, and the cleanliness of the pipeline. Various measuring configurations can be made in order to optimize the system to comply with a client's requirements.

Prior to the job, the measuring head will be prepared and calibrated, and will be re-calibrated prior to the inspection.

Data-acquisition system

The data-acquisition system developed for the *PigLet* system is used both to capture the data and to control the unit. Its core features are high data storage capability, state-of-the-art computers, and high-resolution TFT screens. The data-acquisition system consists of both the hardware consoles and the software.

PigLet console

The *PigLet* console contains the electronics and a high-capacity computer specially-developed to digitize and analyse the raw data. The computer is also used for controlling the *PigLet's* speed, rotation, and data communication between it and the console. One monitor shows ultrasonic C-scan and A-scan images, and the second monitor is used to change the parameters during inspection without interfering with the inspection. In addition, the system can be used for on-line post-processing, and can produce a valuable on-site report. A menu bar shows the distance travelled, the ultrasonic coverage, the average coverage per pipe section, clock position, and other parameters. This information is available on-line and is monitored by the inspection engineer. In others displays, the wall thickness is shown in colour ranges, the internal radius is shown, and amplitudes are given that are used to discriminate between internal and external defects. The A-scan includes the multiple backwall echoes that are used accurately to determine the remaining wall thickness.

Software

The software used has been developed in-house, and is designed to show and give the field engineer direct information about the condition of the pipe using the online ultrasonic C-scan information. In addition the travel speed, distance travelled, and the rotation of the *PigLet* are given on-line.

In order to optimize the quality of the data and the inspection coverage, the measurement parameters can be changed on-line, and for this the second monitor is used.

Defect assessment

After the inspection report is completed, a defect assessment can be carried out. The most commonly-used method for this is ANSI B31.4/8, and the result of this is to calculate the maximum allowable operating pressure (MAOP) and determine the factor with the design pressure (DP). The MAOP is said to de de-rated when the de-rating factor MAOP/DP is below unity. At lower MAOP/DP values, deeper defects can be tolerated by a shift of the defect acceptance/rejectance curve to larger length and depth. The factor MAOP/DP is one of the most important for determining defect detection and sizing requirements for inspection tools.

The critical defect depth is defined as the defect depth of localized corrosion with a maximum length according to its definition which lies exactly on the acceptance/rejectance curve. This curve, and hence the critical defect depth, are dependent on the method (suc has ANSI B31.4/8, RStreng, Shell92, DNV), the de-rating factor (MAOP/DP), the pipe diameter, and the pipe wall thickness. The defect-acceptance curve is also dependent on the pipe's steel grade, and different equations on critical defect depth have to be derived.

Limitations of the tool

The *PigLet* can be used for the inspection of the relatively-short pipelines that are commonly thought of as being unpiggable; however, some limitations of the tool must be mentioned. Due to the ultrasonic technology, a liquid is required to transport the ultrasound through the pipe. Normally water is used, but also inspections using products such as crude oil, petrol, kerosene, NAFTA, etc., have been successfully carried out. If the inspection has to be carried out in another product, tests have to be carried out to determine the suitability of the product as a transmission medium.

Due to the mechanical design of the measuring module (one sensor and rotating mirror) the capturing of data in bends is limited due to misalignment. All ultrasonic tools have a problem with the scattering of the ultrasound by debris and gases in the pipeline, and therefore a good cleaning and a fully-filled line is required for the optimum inspection results. ●

Leaders in pipeline publishing and information merge

TWO OF THE leading providers of technical and business information for the pipeline industry, Scientific Surveys and Great Southern Press (GSP), have merged. The newly-formed company has an international scope, with head offices in the UK and the Asia Pacific as well as a strong presence in Houston and contacts throughout South America, Europe and the Middle East.

Together, the companies will continue to produce their full range of pipeline products, as well as launching a new print magazine *Pipelines International*. Editor-in-chief John Tiratsoo said PI will be accompanied by a major online presence, and will reflect the diversity of the global pipeline industry.●

New evidence for the suitability of EMAT inspection technology in assessing stress corrosion cracking and similar defects in pipelines

by Thomas Beuker, Rosen Technology and Research Center (RTRC), Germany, and Bryce Brown, Rosen USA

RECOGNIZED AS A MAJOR integrity threat since the 1970s, the phenomenon of stress corrosion cracking (SCC) now forms an important part of integrity management programs worldwide. Whereas SCC has conventionally been detected with liquid coupled ultrasonic technology, advances made in recent years in ultrasonic systems based on an electro-magnetic acoustic transducer (EMAT) mean that this technology now has the potential to be established as a preferable alternative: dispensing entirely with the need for a liquid coupling, EMAT is a highly cost-effective inspection method for gas pipelines in particular. This paper presents a summary of the field tests conducted to establish the suitability of high-resolution EMAT technology in assessing SCC and similar threats in pipelines.

Test approach and nature of EMAT

The process of qualifying an inspection technology for a specific type of defect is typically based on three criteria: sensitivity to sub-critical flaws (Fig.1), depth and length sizing accuracy, and defect characterization capability. Rosen used these criteria in a test series conducted to initiate the qualification process for EMAT as an inspection technology suitable for crack detection and assessment in gas pipelines.

Inspection tools incorporating EMAT technology usually consist of two measurement units to achieve complete coverage of the internal pipeline surface and a sufficient number of sensors to support high-resolution analysis of cracks and crack colonies (see Fig.2). Since EMAT-based inspection tools provide a detailed view of the dimensions and distribution of the detected anomalies both around the circumference and along the pipeline axis, they greatly facilitate the subsequent evaluation process.

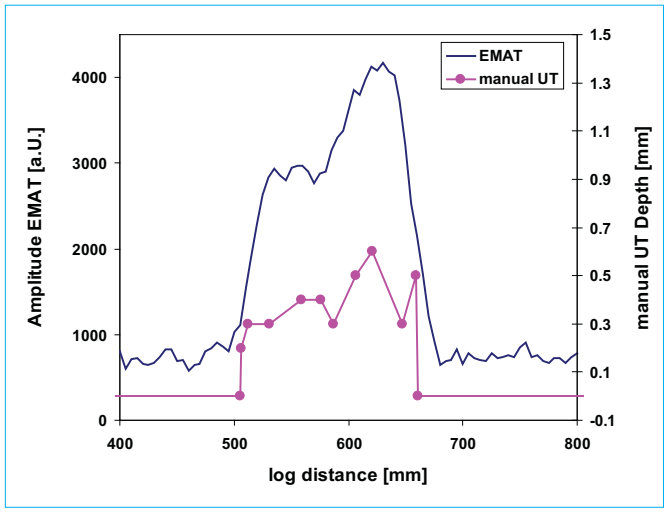

Fig.1. Sensitivity of EMAT technology. The graph correlates a manual UT depth profile with the profile of the integrated EMAT amplitude. This example is taken from an excavation campaign following an EMAT inspection survey.

Sensitivity

The sensitivity threshold for individual cracks accepted throughout the pipeline industry is 30mm (1.18in) in length and 1mm (0.039in) in depth. A combination of artificial and natural crack-like indications was studied following inspection with the EMAT tool. The minimum dimension detected with EMAT technology was found to be 20mm (0.79in) in length and 0.65mm (0.026in) in depth with a probability of detection (POD) of 92%. The analysis conducted

Fig.2. RoCD2 EMAT in-line inspection tool during the launch process.

proves conclusively that the sensitivity of EMAT is comparable to more established inspection technologies and notably that the target for detecting subcritical flaws is met.

Depth and length sizing capabilities

A depth sizing model based on electro-magnetic acoustic inspection was developed by Rosen as part of the test project. This model incorporated a quantitative multi-parameter process whereby various parameters derived from the datasets, e.g. amplitude and frequency content of the different wave modes, were correlated to the depth of a crack indication. This model was then applied to artificial crack-like flaws as well as natural cracks and SCC (see Figs 3 and 4). The accuracy levels achieved in these tests was found to be +/- 0.64mm (0.025in) with a confidence level of 90%. This result is comparable to that of widely accepted crack evaluation processes based on other inspection technologies.

Beside the depth of a crack, its length is an essential parameter for integrity assessment. A threshold criterion is used on the signal amplitude to determine the length of a flaw. Sizing results for

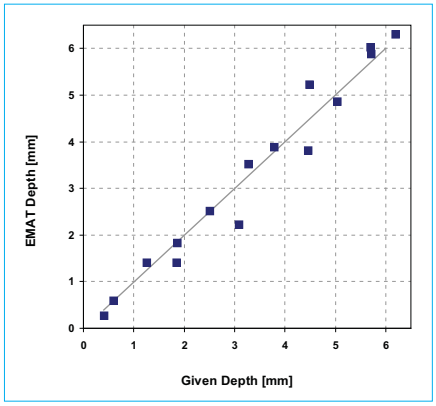

Fig.3. Application of the EMAT sizing to a population of artificial flaws in a 16in test joint.

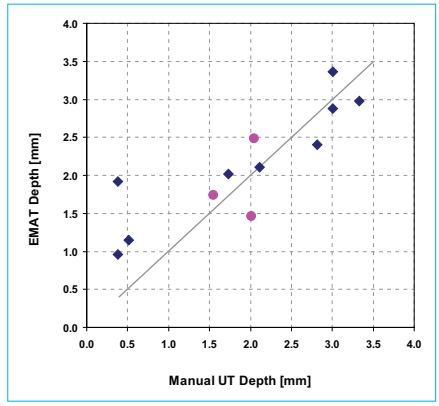

Fig.4. Two sets of natural defects were sized using the EMAT sizing model. The depth has been verified using an NSDS (near side detection and sizing) UT probe.

artificial defects of different length are shown below; even for short defects, a stable length sizing can be achieved. However, due to the physical size of the applied shear wave, short features result in a slightly larger scattering of the length measurement.

The length determination accuracy of EMAT is similar to the results furnished by magnetic particle inspection (MPI) technology.

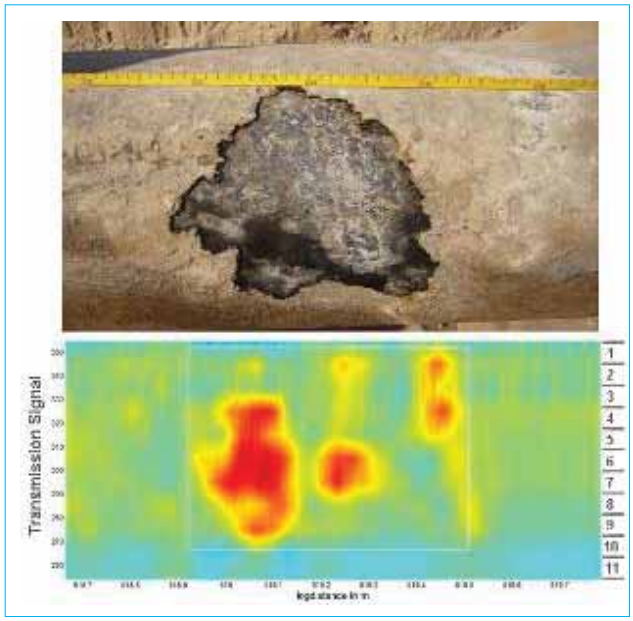

Fig.5. Top half: photograph of coal tar coating disbondment; bottom half: EMAT representation of the same feature following a 16in in-line inspection.

Defect characterization and coating assessment

Over and above the criteria of sensitivity, depth and length sizing, the Rosen test program also investigated the ability of EMAT to characterize different types of defects. Since both risk assessment and corrective measures directly depend on the types of defects present in a pipeline, their reliable identification plays a vital part in asset integrity management. Adopting a multi-parameter correlation model (MPC) taking into account the distribution of the responses to a particular feature type, EMAT was applied to a

sample set of 315 crack-type and non-crack-type defects. Field verification subsequently revealed that the probability of identification (POI) for these flaws was as high as 91 percent.

Apart from direct defect characterization, the ability to identify pipeline coating types is helpful, since some coating types are more prone to stress corrosion cracking (SCC) than others. Additional information on the condition of the coating is also directly relevant to crack-type defects, since coating disbondment is demonstrably a precursor of SCC. The tests revealed that the EMAT inspection system is capable of providing dependable information on both coating type and condition. Identified on the basis of changes in transmission amplitude received through multiple signal channels, the precise position and even lateral dimensions of disbonded areas is reported (see Fig.5).

Conclusion

For the purpose of initiating the qualification process for EMAT as an adequate inspection method for crack detection in gas pipelines, Rosen conducted a series of empirical tests. These tests confirmed the high sensitivity of EMAT even to sub-critical flaws and its excellent depth and length sizing capabilities which are on a par with well established technologies. In addition, EMAT accurately characterized defects and furnished precise and dependable information on the type and condition of pipeline coating encountered. In sum, the sensitivity and accuracy of EMAT inspection systems are the basis for a subsequent application of integrity management programs. This has been discussed exemplary using the API 579 assessment standard.