From: Knox, Tom
Sent: Tue May 04 16:23:05 2010
To: Phil Cole
Cc: David Thigpen; Sotirios Vahaviolos, PhD; Keck, Danny L; Mike Lange; Nyholt, John J; Openshaw, Graham (TecPM); Webster, Simon
Subject: RE: Contact
Importance: Normal
Attachments: DC_May07_BOP.PDF; image001.gif

Phil,

The attached file show a schematic of the "Ram" mechanism. The Ram in the vertical grey bar in the attached drawing. UT access can be via the end-cap (top of picture) or across the casing above the locking bar (horizontal mechanism). Not that the tail of the Ram is tapered at an angle of 30^0 which may have a bearing on what you can do. Danny and John Nyholt will be looking at UT on the casing today to see if they can see the Ram at various position within the casing. Any ideas and suggestions on what can be done, or on your previous experience in the nuclear industry is most welcome. Please be aware that our need for speed is great. We have been asked to be in the field within 48 hours, it may be that we use equipment from other sources but practical experience in this type of inspection goes a long way. We will greatly appreciate any advice of help you can offer. If you have kit ready to go then let us know but it needs to be in Louisiana within 24 – 48 hours.

On the passive side, we are very interested in what can be done here, we are particularly interested in finding any flow restriction between the bottom of the BOP and the riser at the top. If you can supply engineering details of the probes that you would need to marinise and the electronics that goes with it we can look at the marinisation as there is a team in Houston doing this for all of the technologies we are looking at.

Many thanks for your continued support on this.

Regards,

Tom

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From: Phil Cole [mailto:Phil.Cole@pacuk.co.uk]
Sent: 03 May 2010 20:54
To: Knox, Tom

Cc: David Thigpen; Sotirios Vahaviolos, PhD; Knox, Tom; Keck, Danny L; Mike Lange
Subject: RE: Contact

Tom,

Per our conversation earlier, this is a summary of what we might be able to do using acoustics/acoustic emission, and how we would get there, all subject of course to having proper and complete drawings and information:

1 Scope and Needs

a. Identify the presence and location of any flow restrictions in the 40 ft. long ~36" diameter BOP.

b. Determine the position of five rams inside the BOP.

2 Possible Approaches using acoustics/acoustic emission

a. Flow restriction that results in a pressure drop and turbulent flow will generate sound over a wide bandwidth, listening for this using contact sensors (passive acoustic emission) from the outside of the BOP should allow the approximate location of the source of this sound to within +- ~ one diameter or better.

b. Sound transmitted across the BOP (active acoustics) should be affected by the presence of any ram or piston, this approach has been demonstrated by PAL on an isolation valve prototype design intended for a highly critical valve application, even to the extent of measuring piston position by the measurement of transit time. (Transmission distances were <12" in this case.)

3 Passive Acoustic Emission

a. Physical Acoustics Limited (PAL) developed the "VPAC" technology with BP for estimating leakage rates through valves, this uses passive high frequency acoustics. A surface mounted contact sensor measures sound that is travelling in the metallic structure.

b. The short wavelengths used in VPAC allow the source to be localised.

c. The limit of detectability for liquid on a 36" valve with 5 bar D.P. is ~4 litres/minute.

d. 5000 bbls/day equates to 550 litres/minute.

e. 550 litres/minute on a 36" valve with 5 bar D.P. equates to an expected signal level of 92 dB, near saturation and 80 dB above background.

f. This indicates that any significant flow restriction in the BOP it should be possible to locate by making measurements at regular intervals.

g. Challenge is to make these measurements at 5000 ft by ROV:

   i. Marinise the sensor and simple local electronics.
   ii. Ideally get the raw signal to the surface (600 KHz bandwidth).

l. Alternates:

a. Pre-process and send an rms signal with limited bandwidth, however this loses the frequency content which can be very useful especially since this is an unknown.
b. Sample the waveform and send stored digital information.
c. Best we talk to the ROV people and find out what they can do.

4 Active Acousto-Ultrasonics

a. Two sensors at 180 degrees to each other are used to measure transit time of signals transmitted from one and received by the other, there are many propagation paths so it is essential to understand these and identify the signals, most of which are static so can be identified in dry trials.
b. When a piston is in the near line of transmission sound travels through this and is detected usually at an earlier time than other signals present, even if not an earlier time, as long as this path can be identified the data can be used.
c. As the piston is moved out of the direct line of transmission the "piston" signal moves in time according to the extended signal path, until meventually it is lost.
d. Work required to try this on a BOP:
    i. BOP drawings.
    ii. BOP on dry land, in conditions as expected in field, with the ability to move the pistons to order.
e. Work required to marinise:
    i. Marinise the sensors for use on ROV.
    ii. Probably need to marinise some specialist electronics.
    iii. Digital signals to surface.

I hope this gives you an insight in to what the acoustics side of our business can offer for this application.

Let me know what else you need.

Regards
Phil Cole

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From: Keck, Danny L [mailto:Danny.Keck@bp.com]
Sent: Sunday, May 02, 2010 6:45 PM

To: Mike Lange
Cc: David Thigpen; Sotirios Vahaviolos, PhD; Phil Cole; Knox, Tom
Subject: RE: Contact

primary contact is Tom Knox at BP Sunbury on Thames

knoxt@bp.com
+441932 771916 office

Copy myself on correspondence as we are working this from both ends. if you will

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From: Mike Lange [mailto:Mike.Lange@mistrasgroup.com]
Sent: Sunday, May 02, 2010 12:35 PM
To: Keck, Danny L
Cc: David Thigpen; Sotirios Vahaviolos, PhD; Phil Cole
Subject: RE: Contact
Danny
All of Mistras will pull together what we can. The BP UK contact is?
Thanks

--

Mike Lange

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