

Cameron Personnel - Interview Questions

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Interview Personnel

Dave McWhorter: Cameron Drilling Systems VP Engineering & Quality

Ed Gaude: Cameron Drilling Systems Engineering Manager Drilling Controls
(David Jones, Cameron outside counsel)

Neither Ed or Dave have actually worked on the Horizon BOP system. All Cameron systems are similar. 97-01 approximately 30 BOP controls systems were manufactured in a 'build cycle'.

Ed is pretty familiar with this system as a result of supporting the ongoing investigation.

There are 2 EDS sequences - HP shear and Casing

Pipe sequence: 1st Shear ram only plus LMRP disconnect

Casing sequence: 2nd Sequence ram and casing ram plus LMRP disconnect

EDS sequence or logic diagram

Sequence needs to be pre-selected (Casing or Pipe)

EDS activated by pressing enable PB and EDS PB

In the EDS sequence how

For rams green is normal and open and red for closed

Unsure if lamp flashes until feedback is received - Can be confirmed.

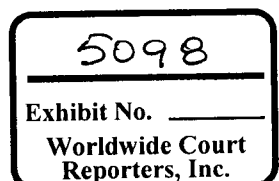
The EDS sequence will continue regardless of status or success of preceding action

Is the functionality of the 3 panels the same - Yes

Some sequences have parallel sub-sequences. Are all sub-sequences driven by time? Yes

If EDS was operated and did not go through the full cycle would the dead man system operate - the dead man system will perform it's own functions regardless of status of EDS sequence.

Potential reasons why DM will not work:



1. not armed
2. batteries dead
- 3 No accumulator volume

Dead man system will activate

On loss of hydraulic power
Loss of electrical power
Loss of communications

What would happen if function is in block and EDS sequence is initiated?
EDS sequence will be performed?

Is there a topside system mode that will inhibit BOP functions. Some systems can provide lock-out features but this should be addressed on an individual system basis.

Generic panel in Bingle - What would you expect to see on a panel - lights will progress on each function as it occurs flashing then steady new state.

If MUX cable was severed - flashing lights then go back to old state steady - second case they will flash for 7 seconds and not 3 seconds.

Who programs control system? Cameron

Transocean has a PC that could modify the program but no history of this being used.

On EDS what other indication is seen. Is there a POD stinger confirmation indication on panel? Function light will change state if state has changed.

Pod has hydraulic and electric sections - there are riser and stack stingers.
Stingers are extended into receptacles and then energized to make a seal.
To remove equipment the reverse is required - de-energise and retract.

Flow meters are just used for monitoring - no input into sequences - subsea engineers should be familiar with fluid usage for specific valves.

EDS is not reliant on DM batteries.

Value of DM hydraulic trigger? TBA

Both conduit and hotline pressures need to trigger the DM hydraulically

If LMRP is accidentally separated the auto-shear function will close the blind shear rams

Cameron have a red-lined drawing showing what they believe to be modifications undertaken by Transocean.

Dave provided and explanation of the red-line drawing - reference?

Off-set drill pipe in the BOP? Drill pipe is not expected to be centralized. Ram blocks (one V one flat) will centralize pipe. 2 V's are more efficient - newer systems

Dave would be surprised if rams would not centralize pipe even

Dm BATTERY LIFE - recommended one year in service. Not rechargeable

Is the battery a Cameron part number? The battery was manufactured specifically for Cameron but it may be possible for Transocean to purchase directly.

Cameron will have records of battery purchases from Transocean. May be able to identify where batteries have been used on specific rigs.

10 Mk2s in service in Transocean with Dead Man Systems.

Information available on Cameron support for Horizon

Typically Transocean provide sub-assemblies to Cameron for repair. Typically Cameron are not involved offshore in majore services.

Most overalls or modifications are performed onshore. Some maintenance can be performed offshore.

Is EDS test routine- need to ask Transocean.

All systems is tested at Cameron's at SIT - Cameron procedure

Commissioning procedures agreed with client - Normally Cameron hands involved in commissioning tests offshore.

DM and EDS can be function tested on surface

Auto shear can be tested on surface by lifting LMRP with crane.

There are distinctive noises associated with ram closure - fluid flow and ratcheting sound at the end of cycle when ST lock is closed.

45 seconds is required for ram closure according to API

60 seconds for annular closure

Accumulators are for emergency only on lower stack - autoshear and DM

Accumulators are charged by pod functions

What could compromise accumulator pressure - accumulator dump, leak, not charged?

Any kind of indication on charge function - non, apart form panel indication of function.

Fluid is kept on accumulator via a check valve.

No indication of N2 pre-charge

SEM status is shown on other bridge panel.

Dump function would dump all accumulator fluid to sea.

Fluid leak would be picked up with panel visual indicator. No fluid consumption in quiescent state.

Potential indication that accumulators are still charged - some pressure (ROV cutting activity)

Cameron to confirm if charge was a green light?

Cannot dump and charge at the same time?

Cameron have not seen a condition when all lights on a panel are red.

If one panel was out the other panel is operational. If one panel was destroyed by fire the other two panels would still operate

EDS - push and hold enable and the push EDS.

To select mode - push enable and push EDS mode button

Cameron provide shearing document - step to go through to establish the BOP cutting capacity.

Taper string is in BOP -

Rams cannot cut a tool joint

Standard bonnet on BOP. 3000 psi operating pressure - even 3 1/2" pipe field joint.

In a controlled mode - close variable ram - lower pipe joint onto ram and shear pipe.

3 feet of pipe joint in a 30 foot pipe section - 10%

Casing ram will not close on a pipe joint.

Functional design spec - for control system - Cameron document Cameron to take all documents back - they can be requested.

Stack hydraulic fluid leaks - 2 Cameron are aware of. - Marked up on drawings ST lock circuit - backed off 4 turns - huge leak - outrunning a 6 gpm ROV pump leak - need to confirm actual leakage from ROV crisis team. JIC fitting on the end of a hose. Shear ram and ST energize lock function are actuated at the same time

Leak would be present for both EDS and DM sequences.

When ROV tried to close shear ram what happened - no movement - changed to dyed fluid - large leak seen.

2nd leak - lock side of the sequence valve. First leak was fixed. Another leak was found on lock function. Leak was on downstream side on sequence valve on top shear ram. This would indicated that a ram was closed.

- Explanation of Ram leak and implication...

5K stripping packer - Annular failure - leak and possible loss of rubber parts - experience on annular fatigue and strength testing in a laboratory - on flowing well loss of sealing and rubber products would be likely.

Timing sequences - how long to close a BOP - can only be determined on the actual system. Should have been tested and vetted by Cameron and RBF at the time of commissioning.

High pressure and volume required for shear ram drives sizing for accumulators. Cameron can provide pressures and volumes and pre-charge pressures required for each actuator.

Ray Fleming 6 May 2010

