



- c) In order to address sealing the well at the BOP. If the LMRP can be removed from the BOP, conventional wisdom would suggest that another subsea BOP could be placed on top of the Horizon's BOP in order to close the well in. (Assuming that the BOP can be stabbed on with a riser in place and with hydrocarbons entering the riser – this has significant associated risks). Alternatively, a subsea disconnect device could be used to stab onto the top of the BOP (18 3/4" connection) and used to close the well in. The subsea disconnect device has been used by Shell for the last couple of years for Surface BOP operations in Brazil. The tool consists of two shear rams and has a mini mux control system with a (broadband) acoustic control from Nautronix. This device could be run on wire with shear rams open. Stabbed onto the 18 3/4" profile on top of the BOP and activated to shut the well in on the two 13 5/8" shear rams. There are two systems in the world. Shell is using their subsea disconnect system in Brazil. Stena Drilling has the other, which we believe is available. (This device can be transported by air - Antonov transport planes). Removing the LMRP could be achieved by the 2<sup>nd</sup> drillship that is being mobilized to the Horizon location. Contact for Stena Drilling is John Banks +44 1224 401180 or alternatively Kyle Ramsay Lewis +1 (713) 530-7744 or [john.banks@sdlabz.com](mailto:john.banks@sdlabz.com). Alternatively Brian Tarr at Shell could provide technical information relating to the equipment. Brian Tarr contact info: +1 (281) 544-5275, [brian.tarr@shell.com](mailto:brian.tarr@shell.com)

2. Recommendations with regard to testing:

- a) We believe that the testing of the hot stab functions with the ROV pump, on surface, is a positive step to prove the integrity of the ROV controlled part of the subsea control system and that this could be carried out as a single test prior to the subsea BOP's being run. This would provide reassurance that the ROV pump had the necessary specifications for opening and closing rams on the Subsea BOP. Some equipment would be required to connect the ROV pump to the control functions on surface.
- b) Consideration could be given to periodic testing of the disconnect function prior to the first BOP pressure test on a new well. We do not support the disconnect function being tested on a regular testing schedule as there is the potential for significant equipment damage while attempting to reconnect. Disconnecting at times of high environmental loading would also be impractical. (I.e., at times of significant loop current activity). A witnessed disconnect function test once a year, or similar, may help reassure system integrity.
- c) Consideration should be given to checks that confirm the ratings and shearing capabilities of BOP shear rams. All shear rams are designed to cut a certain type and size of pipe if backed up by the appropriate bonnet type. (With or without boosters). Shear rams can be interchanged between BOP's and rigs. Confirming the type and capacity of a shear ram to cut pipe could be checked as a part of the first BOP pressure testing documentation and checked against the proposed work program for each well.

3. Other items

- a) Significant statistical information relating to the reliability of surface and subsea BOP's has been captured by the Norwegian organization, Sintef. Data relating to equipment failures and Subsea BOP reliability statistics, breaking down component reliability data is held by this organization. (Some of this data is publically available information and some is stored for sponsoring companies).