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TECHNICAL REPORT IN RELATION TO CAVITATION JETTER TRIALS ON HERCULES MkII

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1. Introduction

The Normand Subsea has two Hercules MkII systems. As part of the USC contract with Shell the ROVs are often required to clean different subsea components for IMR activities. On the 2nd July 2014 a cavitation jetter was received onboard for trial.

2. Background

The ROVs are fitted with a Dynaset pump for high pressure cleaning, utilizing a reciprocating jetting nozzle; and a zip pump for low pressure cleaning. This setup has been used on the ROVs for several years. The system has proved effective at removing soft marine growth but is less successful for hard.

3. Approach

a) For the trial, the cavitation jetter was fitted to Hercules 27 (H27) [in addition to the standard jetter], whilst Hercules 26 (H26) was left with the standard jetting configuration.

b) The cavitation jetter was mounted to the outboard starboard side of the ROV (see Picture 1). The jetter was given a hydraulic supply from the ROV's POV 1 at a pressure of 2650PSI. The standard T-bar handle that was fitted to the cavitation nozzle was replaced with a fish tail handle (see Picture 2) to allow the T4 intermeshing jaws currently fitted to the manipulator a more secure grip. The hoses were also extended to allow for a full range of movements on the manipulator. No further setup was required to interface with the vehicle.

c) During operations at Anasuria FPSO, the cavitation jetter was compared directly with the Dynaset jetter (with a nozzle output pressure of 2000PSI) on Hercules 27 whilst cleaning mooring chains and plates.

d) During operations at Brent platforms, the cavitation jetter was compared to the standard reciprocating jetter used on Hercules 26, set up with a nozzle pressure of 2200PSI, to clean various conductor guides, clamps and caissons.

4. Results

a) The anchor mooring chains and plates at Anasuria were required to be cleaned in order to obtain measurements and for subsequent inspection. The cavitation jetter easily removed all soft marine growth and by using it closer to the plate, hard marine growth was also removed. The standard reciprocating nozzle was then used to try and achieve the same results. It was found that the standard jetter could not remove all the hard marine growth.

b) At the Brent platforms the ROVs were required to clean various clamps, conductors and caissons. Hercules 27 used the cavitation jetter and Hercules 26 used the Dynaset jetter. Both systems were tasked with cleaning identical Conductor clamps, at similar

depths, and with similar levels of marine growth. H26 with the standard nozzle fitted took approximately 3-4 hour to clean a clamp to a satisfactory level. The cavitation jetter, fitted to H27, completed the task within 45 minutes and to a better quality.

c) The cavitation jetter was used to clean thick hard marine growth off several components, it easily removed all the marine growth, even when the ROV was being free flown. This would have been very difficult and time consuming if done with the standard Dynaset and reciprocating nozzle.

5. Conclusions

Positives:

- Excellent cleaning capabilities – far superior to standard jetter nozzle, especially on hard marine growth.
- Ease of installation – the jetter and pump was easily interfaced to our system.
- The jetter lance is rugged and there are no consumable components within – our current jetter requires a new nozzle when the old one becomes worn, thus causing the pressure to drop.

Negatives:

- Lance is too long – this made it difficult to store in our tool tray and difficult to manoeuvre around components
- No compliance in handle and a T-bar fitted – as mentioned previously the lance was modified with a fishtail to better suit the jaws on our T4 manipulator. The handle also offers no compliance so all vibrations and shocks are transferred to the manipulator.
- Pump mounted outboard of the ROV – this will cause a problem when working in and around structures, and will likely result in impact damage to the pump.
- Pump allows seawater in – during the time on board the pump oil had to be flushed several times due to water ingress and emulsification.
- No gauge fitted to the output of the pump – as there is no gauge fitted to the pump, it is difficult to estimate the performance of the jetter.
- No bleed/fill points on the pump – dedicated bleed and fill points on the pump would make for easier maintenance.
- No manuals supplied – there were no manuals or technical documents supplied with the unit making maintenance more difficult.
- Potentially too powerful for some tasks – may cause damage to anodes, paint or coatings on some subsea components.

6. Recommendations

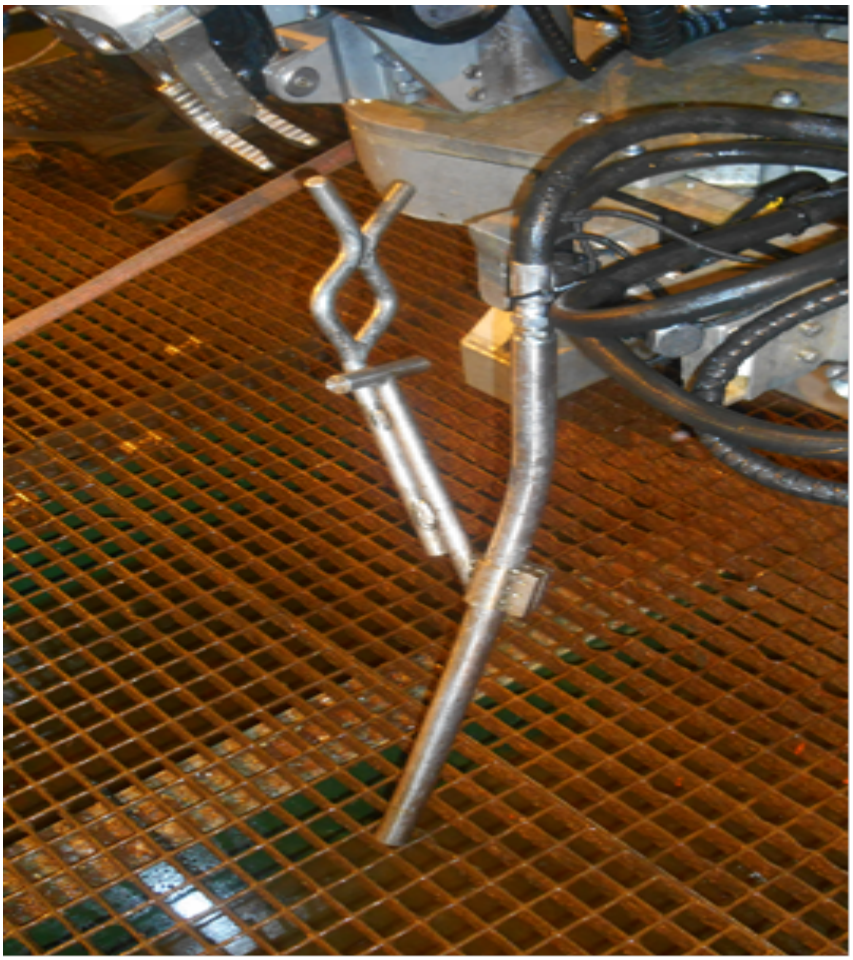
a) The general consensus from the ROV team is that the cavitation jetter would be an excellent additional tool to have, but believe that the supplied pump is superfluous. We would like to source a cavitation nozzle that could be fitted to our existing Dynaset pump and perform further testing. This would allow us:

i) To keep all equipment inboard of the ROV for protection.

ii) Reduce the amount of the maintenance required.

iii) Allow us to switch between the existing HP reciprocating nozzle for less demanding cleaning tasks and the cavitation nozzle for removing thicker/harder marine growth.

b) The lance could also be improved by being fitted with a compliant fish tail joint and by being shorter.



Picture 1.
Showing the lance with fishtail fitted.

Picture 2.
Showing the cavitation jetter fitted to the outboard starboard side of H27.