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Multi Services Unit – Cost Effective Solution for Wireline & Slickline Services (Pakistan Case Histories)

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Abstract

The continuous need in oil & gas industry for technologies and techniques which not only improve the operational quality and efficiency but can also save time and money has resulted in the development of Multi Services Unit (MSU) which provides both wireline and slickline services in a single unit.

Typically, when both wireline and slickline services are required for well intervention operation, separate wireline and slickline unit and personnel are used. Separate arrangement for logistic, personnel accommodations and security are required on top of the daily cost incurred for having both units on the wellsite. Each slickline and wireline unit have applications of its own and even with the latest advances in tools technology, there is limited wireline application that slickline unit can performed and vice-versa. The introduction of MSU will help to reduce the well intervention costs as well as rig time. In addition, the need to use expensive memory logging tools on slickline unit can be avoided as the conventional logging tools can still be used on MSU.

This paper discusses the successful introduction of MSU in Pakistan. MSU was utilized in more than 75 operations in Pakistan with various E&P operators in its first six month. MSU has so far provided both slickline and wireline solutions ranging from slickline completions works, memory gauges logging, perforation via slickline/wireline, wireline correlations, wireline bridge plug settings, wireline pipe recovery and production packer setting. All these operations were executed by a single unit and crew. The paper evaluates the cost effectiveness of MSU as opposed to typical use of separate slickline and wireline units. It evaluates additional advantages profited by the E&P operators through the use of MSU such as reduced logistic, accommodation, security requirements, reduced equipment footprints and reduced rig time. The paper also describes conversion process from slickline unit into MSU, the initial complications, continuous improvements and lessons learned made during MSU introduction.

In conclusion, the Multi Services Unit is proven to be an economically attractive solution which helped to reduce well intervention cost without sacrificing the operation quality and safety.

Introduction

The oil and gas industry is constantly developing methods and technologies which can minimize the operating cost and time. The Multi Services Unit (MSU) is one of the technology that was developed to optimize oilfield operations by delivering both slickline and cased-hole wireline services in a single unit.

Conventional slickline unit is a fast, low risk and relatively inexpensive method which is use for well intervention operations such as checking tubing clearance, tubing cleanout, setting plugs, fishing, activating perforating guns, completion works, memory gauge logging, etc. However, slickline applications are limited by the weight of tools which it can run and limited type of tool which it can mechanically operated. In addition, slickline cannot be used for real-time logging applications. These limitations are overcome through the use of wireline unit. Wireline unit not only allows real-time logging applications but also have the advantages of higher lighting weight capacity and able to operate more variety of downhole tools through its electrical signal. Wireline applications are relatively more expensive and higher risk than slickline due to the type of tools which it uses. Nevertheless, the use of wireline is necessary for real-time logging, perforation, correlations, setting packers/plugs, pipe recovery, etc. Since both wireline and slickline units are used in different type of applications which are critical in well intervention operations, both units are required on the well site. Though having both wireline and slickline units on well site operations is a normal practice for most E&P operators, there is a need to develop an improved

solution to optimize the operation by reducing the cost and time. The introduction of MSU is one of the solutions which can help to achieve this objective.

MSU have been used successfully in Gulf of Mexico and North Sea in addition to some other parts of the world. It has been introduced in Pakistan oil and gas industry since December 2009.

Multi Services Unit

The original unit was a slickline unit. Due to the demand for cased-hole wireline applications during production testing operations, it was much more economical and faster to convert the slickline unit into MSU rather than to purchase a separate wireline unit. In addition, having MSU will give the added appeal for the E&P operators who value the advantages of having a single unit which caters for both cased-hole wireline and slickline operations.

Equipment Modification Process

In order to convert the existing slickline unit into MSU, some modification were made. Few additional components were added such as six way valve, heavy duty motor for the wireline cable, wireline drum, hydraulic oil cooling system, brake system for wireline drum and solenoid valve. The schematic of the installed components is shown in **Fig.1**.

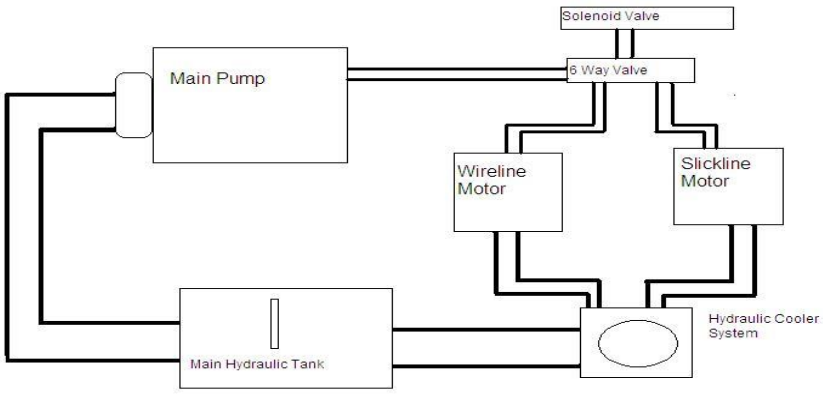

Fig. 1 – Diagram of installed components

The original slickline unit had two slickline drums which are one split drum carrying two sizes of slickline cables side by side and a second drum carrying one size of slickline cable. In order to accommodate a new wireline drum, minor modifications were made. The newly installed wireline drum carries a single mono conductor wireline cable. The original slickline drum which was kept is the split drum which holds two sizes of slickline cables (as shown in **Fig. 2**). Installation of additional heavy duty motor and brake system for operating wireline drum are necessary since wireline cables are heavier and operating it with the existing slickline system will only limit the wireline operation capability. With each drum operating independently, both wireline and slickline jobs can be done on rig site one after the other in a short span of time. The function of the solenoid valve allows the cabin operator to choose either wireline or slickline services.

Fig. 2 – Multi Services Unit

As shown in **Fig.1**, there is a main pump which pumps the hydraulic oil to the motors. This is a bi-directional pump which has a closed circuit for bi-directional flow of hydraulic oil that controls the direction of the drum. The hydraulic oil flows to the motor via six way valve which is controlled by the solenoid valve (for selecting the service either slickline or wireline). The hydraulic oil is pumped from the main closed circuit pump which enters the motor. The hydraulic oil is then dumped in the case drain valve which takes it to the hydraulic oil cooling system. Hydraulic oil cooling system is added into the new MSU to avoid hydraulic oil from heating up especially during a long wireline operations in hot and dry environment such as in Pakistan. The cooled hydraulic oil then enters the main hydraulic tank; from there it is sucked through the charge pump to the main pump. The same process starts again and the cycle continues.

The wireline and slickline operations would still require separate pressure control equipment, which both are mobilized along the MSU unit during operations. It is worth to point out that the MSU wireline operations referred in this paper only refer to cased-hole wireline applications not the open-hole wireline applications. This is the current MSU limitation as the open-hole wireline applications would require much bigger size cable to run bigger logging tools. This would need a much bigger motor and bigger space to place the wireline drum which currently cannot be accommodated in the original slickline unit.

During the initial testing, the hydraulic oil heated up due to the higher load of wireline cable and tool string. This issue was solved by introducing hydraulic oil cooling system in the unit. The modification was initially tested in the base, which was successful and then was tested successfully again at the rig site. Since the installation of the hydraulic cooling oil system in the MSU, there was no further complication from hydraulic oil heating up while running wireline operations.

Field Applications and Evaluation

The MSU was first introduced at an exploration well during production testing operation. The first job was a tubing conveyed perforation (TCP) correlation job. The unit performed the job with successful correlation of the required zone. After the TCP correlation, the slickline drop bar operation was executed to fire the TCP guns for perforation. This operation was also successful. The MSU were providing both cased-hole wireline and slickline operations which such as running junk basket, setting bridge plug, cement dump bailer, wireline perforation and slickline completion jobs. All jobs were successfully executed without any serious incident with the MSU performing both wireline and slickline runs one after the other in a short span of time. All safety protocols were observed regarding the rig up and rig down of the equipment. The MSU continuously worked at the well site for 48 hours non-stop. Coventional slickline and wireline unit would not only added cost to the operator but would have performed the same job at a longer time than MSU as additional time will be required to align and rig up each slickline and wireline unit.

Since the first successful introduction of the MSU, the unit has been performed more than 75 cased-hole wireline and slickline operations with different E&P operators in Pakistan without any major issue. Even though the benefits of MSU applications are quite obvious it is worth to evaluate them further based on the experiences from the jobs executed.

Reduced Operating Cost

The conventional method of having both slickline and wireline unit requires the operator to pay daily equipment rental for both units. The wireline unit can be expensive as it provides both cased-hole and open-hole wireline services. In a production testing operations only cased-hole wireline and slickline services are required. Nevertheless, the operators usually have to pay complete services from the wireline unit even though only cased-hole services are required from the wireline unit. The combined costs for both slickline and wireline units are higher than having a single MSU on well site. In addition, only one time mobilization and demobilization charges are incured with the use of MSU. For a 12-hour operation, the minimum crew required for slickline operation is normally three (3) to four (4) whereas for wireline it will be four (4) people. MSU will typically require four (4) or maybe five (5) persons which are trained to perform both cased-hole wireline and slickline operations. This further reduces the operating cost for wireline and slickline operations.

It is worth to estimate the amount of saving made by utilizing MSU. For calculation purpose, it is assumed that the each equipment mobilization and demobilization cost are the same for each slickline, wireline and MSU. The mobilization and demobilization cost per person are also assumed same for each unit. It is also assumed that for single unit operation, it will require one day of slickline operation and one day of wireline operation which is assumed to occur on consecutive days. The MSU operation is assumed to only require 1.5 days as it is expected to execute the job faster than separate units. Wireline unit cost three times more than slickline unit as the unit is able to provide both cased-hole and open-hole wireline services. The MSU unit cost is only double the slickline unit cost as it only caters the slickline and cased-hole wireline services. The daily personnel operating cost for each wireline unit and MSU is assumed to be 75% higher than slickline personnel cost. Based on these assumptions, the overall savings calculated by utilizing MSU is more than 20% compared to using separate units. Even though this is just a simple calculation with conservative assumptions that may vary from client to client, the savings made from MSU cannot be denied. The saving can be quite significant when slickline and cased-hole wireline services are required for long period of time at the rig site.

Reduced Rig Time

The rig operating time is wasted in rigging up and rigging down equipment for different units. For each slickline and wireline operation, each unit needs to move in and align itself before picking up the equipment to rig up on the well. This can

be time consuming when multiple slickline and wireline operations are required one after the other. Using MSU will help to reduce this rig time as the same unit is aligned to perform both jobs. The time lost in moving and aligning the units is saved by doing both jobs with MSU. Rig time is further reduced as less time required to rig-up and rig-down the MSU. The savings of rig time during slickline and wireline operations further minimize the entire operation cost for the operator.

Reduced Logistic Requirement

Separate logistic arrangements are required when using separate slickline and wireline unit. The operator need to plan ahead when to mobilize each unit to the well site so that he can minimize the daily cost of having unit on standby at the wellsite. At the same time, it is important to try to avoid lost time on the rig while waiting for the equipment to arrive. It can be difficult to estimate the timing needed and utilizing two separate units required additional logistic planning and arrangement to ensure a smooth operation. In addition, having two separate crews will require additional accommodation, food and utilities. Not only this translates to additional cost to the operator but also additional challenge to manage as accommodation at the wellsite is usually very limited. With single MSU to cater the requirement for slickline and cased-hole wireline operation, the logistic hassles are reduced.

Reduced Security Requirement

In high security risk areas such as Pakistan, there are many security issues relating to terrorism, kidnapping and snatching of vehicles. When two separate units along with its crew members are moved for operations in remote high risk areas, it poses higher risk to the individuals and units. Separate security arrangement required for both units arriving at different times, resulting in extra cost for the client as well as the service provider. Security issues are reduced when MSU is used as there is only one unit and crew that need to be protected. Using MSU helps to reduce the burden on the operator and the service provider in providing adequate security to the unit and personnel.

Reduced Footprint

In small operating areas such as in remote location or in the environmentally sensitive areas, the need to to reduce the operation footprint is critical. In these places, the space can be very limited and the rig site can be congested. The MSU fits this scenario perfectly as it reduces the equipment footprint requirement compared to conventional separate unit option. Since the MSU crew is also trained to perform both jobs in a safe and efficient manner, there will be fewer individuals at the rig site with less need for space and accomodation.

Improved Service Delivery

Introduction of MSU help to improve the service delivery of the service provider as MSU have wider range of applications compared to single slickline unit. The MSU provide slickline and cased-hole wireline solutions which help to reduce well intervention costs and time without compromising the safety and service quality of the operations.

The advangtages of MSU does not only benefit the operators but also to the service provider. By converting a single unit to MSU, the service provider avoids huge capital expenditure of purchasing two separate units. The maintenance costs for single MSU will be less and the overhead for additional crew for separate slickline/wireline unit will be reduced. By training the existing personnel to provide multiple services, will increase their values and motivation. Overall, the MSU will put the service provider at an advantage when compared to competitors which provide separate units solution.

Though MSU have been proven to provide an economical solution which replaces the need to use separate slickline and wireline unit, it is important to realize that MSU application is only limited to cased-hole wireline and slickline applications. This is most useful especially in production testing operations. A wireline unit would still be required for full-fledged wireline services that included open-hole and cased-hole applications. There is still futher development to be made in the future before MSU will be able to cater open-hole wireline services as well.

Conclusions

The Multi Services Unit was successfully introduced in Pakistan where it was proven to provide a cost and time effective solution compared to conventional separate slickline and wireline units. The MSU helped to reduce the slickline and wireline operating cost, reduce the operating time, reduce the logistic and security requirement and provide smaller operating footprint. In addition, MSU provided advantages not only to the E&P operators but also to the service provider as it improve the service delivery by having wider range of applications when compared to single unit. The MSU reduces the capital expenditure cost, maintenance cost and overhead for the service provider. MSU does not compromise on the safety and quality of the conventional slickline and wireline operations making it the most attractive solution for wireline and slickline operations in the future.

Nomenclature

MSU	*Multi Services Unit*
E&P	*Exploration & Production*
TCP	*Tubing Conveyed Perforation*