PERSPECTIVES AND DEVELOPMENT OF THE RLWI BUSINESS

An interview with **Erik Dietrichson,** Manager - Eastern Region Well Intervention Service, **FMC Technologies**

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Riserless Light Well Intervention or RLWI – is the term used to describe the method for performing inspection and maintenance of subsea wells from a monohull vessel by sluicing a toolstring suspended in a wireline into the subsea well under full pressure, but without using a high pressure riser. RLWI is a cost efficient method as it can be performed from monohull vessels rather than costly drilling rigs. Wireline operations are used to perform production logging by measuring the locations of liquid in-flow and water content, to install a plug to isolate intervals with high inflow of reservoir water and to re-perforate the well casing by use of explosives to establish a new production interval at a higher level. It is also possible to increase the production rate from a well by removing scale growth that will reduce the well's flow area. Another routine operation is to install a so-called insert-down-hole-safety-valve, to replace the function of the initially installed safety valve.

"The fastest growing segment of the subsea XT market is the Asia/Pacific region with a projected growth for the next 5-year period of around 17% per year. The Well Intervention market is expected to grow, but with a time lag compared with the market for subsea XTs".
Erik Dietrichson, Manager - Eastern Region Well Intervention Service, FMC Technologies

The need for offshore well intervention work on both platform and subsea wells in the Asia Pacific is rising due to redevelopment work at brownfield sites, the increasing need for enhanced production and the need to extract the maximum amount of hydrocarbons from current fields.

Well access is becoming more challenging and ultimately resulting in higher costs for industry. In an ever-maturing Asia Pacific market, industry have to look to newer intervention techniques to extend production life and enhance production volumes and recovery as well as executing safe and effective abandonment campaigns.

Erik Dietrichson is manager for the Eastern Region Well Intervention Service department with FMC Technologies. In this interview you can read his perspectives on the current and foreseen market for RLWI services and how the service is expected to develop.

How did FMC Technologies come into the RLWI market?

Fifteen years ago Statoil had an ambition to reduce costs for subsea well intervention and side track drilling by 50%. Since the drilling rig represented a significant part of the overall cost for an intervention, a logical starting point was to move the well intervention service from drilling rigs purpose-made for drilling to specialized monohull vessels. FMC Technologies rose to the challenge by starting development of riserless light well intervention systems. Development of equipment and service from a novel starting point is a long and challenging process taking several years until an industrialized service can be offered. Today RLWI is an industrialized service where the focus is cost effectiveness and efficiency. There is no doubt about the potential of the service as an effective tool for increasing the oil recovery factor for fields that have been developed with subsea wells. Statoil, our biggest client, saw the potential very early and established a centralized organization responsible for providing the service to the fields they are operating. All requests for RLWI services are evaluated, prioritized and planned within a highly competent and specialized organization.

FMC Technologies has been in the RLWI business for more than 10 years. How has the service developed over this period?

In 2005 FMC Technologies entered into an alliance agreement with Island Offshore Management, who owns and operates vessels, and an oilfield service company providing the wireline systems and downhole tools. FMC Technologies RLWI system, referred to as the “subsea lubricator stack”, is installed on top of the subsea tree from a monohull surface vessel. The complete RLWI equipment package is 35 m high and weighs 75 tons.

The first unit, Island Frontier, has been working continuously for Statoil in the North Sea since April 2006. From April 2009 the fleet was expanded by two units; the Island Wellserver, which is also on contract to Statoil, and the Island Constructor, which has been engaged in the UK sector for BP, but has also been certified to work in the Norwegian sector from 2010. It has performed RLWI work in Norwegian waters for Shell, ConocoPhillips and Statoil.

In the period from April 2006 to February 2015, the alliance has performed well intervention operations on more than 320 subsea wells. The typical duration for intervention operations in the North Sea is 10 to 25 days per well for year-round operations. The growth of RLWI in the last few years is a direct result of oil and gas companies actively working to increase the percentage of recoverable hydrocarbons from their fields being produced from subsea wells.

We have seen a development in the types of downhole tools available. The tools also become more and more sophisticated. This includes cutting and milling tools and tools for sand bailing. We have also experienced that the vessels can perform complex operations with several hoses and umbilicals in the water simultaneously in areas with high and unpredictable sea currents. The limits are being pushed continuously with respect to technology, complexity and operability.

As we speak, drilling rigs are being taken out of service and there is a surplus of service vessels in the market. Is the RLWI market affected by the drop in the oil price?

We see some drop in activity due to the operators cutting cost. However, this drop in activity is common across all aftermarket and E&P activities. Low oil price should be a strong incentive for squeezing as much production as possible out of existing subsea fields since the wells are drilled and completed and the subsea infrastructure is in place. The incremental cost for additional oil volumes will be lower than the cost per barrel for development of new fields. If the cost for a typical RLWI operation is 5 million USD and the incremental increase in volume following a successful operation results in 1 million additional barrels, the cost per barrel will be 5 USD. Development cost of a medium sized new field offshore Norway is typically 50 – 60 USD/barrel. A lower oil price is actually an incentive to produce more oil and gas from existing fields.

What is the market size for RLWI services and do you see this as a growth area for FMC Technologies?

According to Quest's subsea database there are now more than 5000 subsea wells in operation worldwide and another 3000 wells planned in the next five years. Of these close to 50% are going to

be in the water depth interval 600 to 2000 m. With a forecasted annual growth rate of around 10%, there will clearly be a significant increase in the RLWI market. Even if the actual growth turns out to be one half of the currently projected growth of 10% per year, there will still be a significant growth in the RLWI market.

However, the market is characterized by some key numbers. There are three countries with around 1000 subsea wells each; UK, Brazil and Norway. UK is the most mature market and has no deepwater wells beyond 600 m water depth at this time. By mature, I mean that their wells have the highest average age, which is now approaching 13 years. Brazil is also quite mature, but there is one very significant difference; around 60% of the wells are located in water depths between 600 and 2000 m. Norway has more than 900 subsea wells in operation and only 20 of those are beyond 600 m. If you look at the operators, there are only 6-7 oil companies operating more than 200 subsea wells each. Two companies are dominating the market; Petrobras and Statoil are responsible for operating 8-900 subsea wells each and both companies have all these wells in their respective home country. Petrobras operates 96% of all subsea wells in Brazil and Statoil operates around 80% of all subsea wells in Norway. The operators that are often referred to as the majors; Shell, BP, Total and ExxonMobil have 3-400 subsea wells each, but these are spread over 4-8 countries. The consequence is that the biggest operator in West Africa, Total, is one third the size of the Brazilian and Norwegian markets, and the biggest operators in the US Gulf of Mexico are one tenth the size of the Brazilian and Norwegian markets. In addition, the market in the Gulf is the most fragmented of all national markets with around 40 operators having less than 20 subsea wells each. On top of all these considerations comes the fact that all subsea wells in ultra-deep waters of more than 2000 m, and there are around 140 of these, are all located in GoM and Brazil. The consequence of the market structure, combined with the slow acceptance of riserless intervention technology outside the biggest operators in Norway and UK, Statoil, BP and Shell, is that purpose-built RLWI units have only found sufficient market volumes for continuous operation in the North Sea area, even though there have been a couple of short campaigns in West Africa. RLWI has been tried from vessels of opportunity both in West of Africa and the GoM without resulting in any long term activities.

Where will the growth come?

The fastest growing segment of the subsea market is the Asia Pacific region with a projected growth for the next 5-year period of around 17%. However, the number of subsea wells today is only 400; half of those are in Australia. The highest growth in the number of subsea wells will come in Brazil and West Africa, with around 11% per year from today's level of 1000 subsea wells in each area. Other more mature areas, such as Norway and UK, have a projected growth of 6-8%. Current market conditions might very well lead to a growth lower than projected. We observe that the volume of the real RLWI market today is much lower than the hypothetical market. I think that the market will grow steadily as a result of the increase in the number of ageing subsea wells and when RLWI is accepted as a reliable deepwater service, but also as a result of an accelerated general interest when more operators realize that today's RLWI technology is well proven and can significantly contribute to raising the recovery rate from fields developed with subsea wells at a per-barrel-cost which is much lower than the cost of new oil.

One of the big buzz words in the industry is "Vessel of opportunity". This is an approach not pursued by FMC Technologies. What is your perception of the "vessel of opportunity" approach?

It is correct that FMC Technologies has decided to enter into long term relationships with vessel operators to provide an integrated RLWI service. We consider an integrated service comprising vessel, well access equipment, wireline services and ROV to be superior to a vessel-of-opportunity approach when it comes to safety, efficiency and robustness. What we have experienced offshore on all three vessels we operate from today is that in reality there is one joint crew onboard. The crew members know and respect each other; they are familiar with all the equipment onboard, all routines and all work procedures. The operations are performed smoothly and without any intercompany tension. A long term integrated service approach also enables a close integration between well access equipment and topside equipment. Running and handling procedures, arrangement of equipment and deck layout are optimized for the service provided. In fact the world's two most experienced RLWI service providers both operate according to the principle of a dedicated vessel and an integrated service approach.

Permanent Plug and Abandonment is an emerging market for offshore service companies. As we have discussed previously, the number of subsea wells are increasing and all of them will have to be properly abandoned at the end of their lives. Will RLWI play a role within plug and abandonment?

Yes, RLWI has a significant role within P&A today. The Island Wellserver has participated in two large plugging campaigns over the two last years. Subsea wells subject to abandonment were visited by the intervention vessel prior to a drilling rig completing the P&A job. As a direct result of an RLWI vessel doing parts of the P&A, the time spent on P&A, together with cost for the operator, was significantly reduced. Typical operations for the well intervention vessel is to perform diagnostics of the well, setting of mechanical plugs, killing the well, cutting or punching tubing, XT removal and finally do the wellhead severance. Current methods available for P&A does not allow for a complete P&A from RLWI vessels but it is expected that methods which enables cement logging behind several layers of tubing or casing, milling tools, perforation and wash type tools and cementing tools will be developed in the future. We expect that the P&A scope available for an RLWI vessel will continue to increase as new methods for plugging and diagnostics are developed.

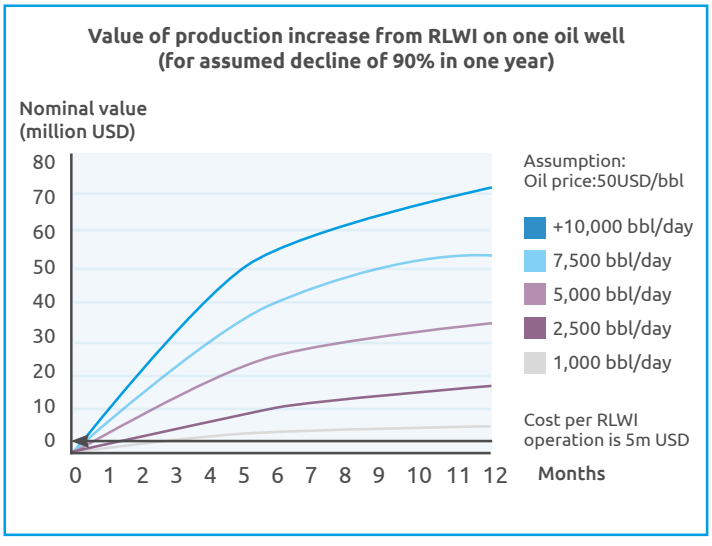
RLWI is a new service to many operators outside of the UK and Norway. Do you expect there will be reluctance to the risk of hiring a RLWI vessel since this is still considered a new technology?

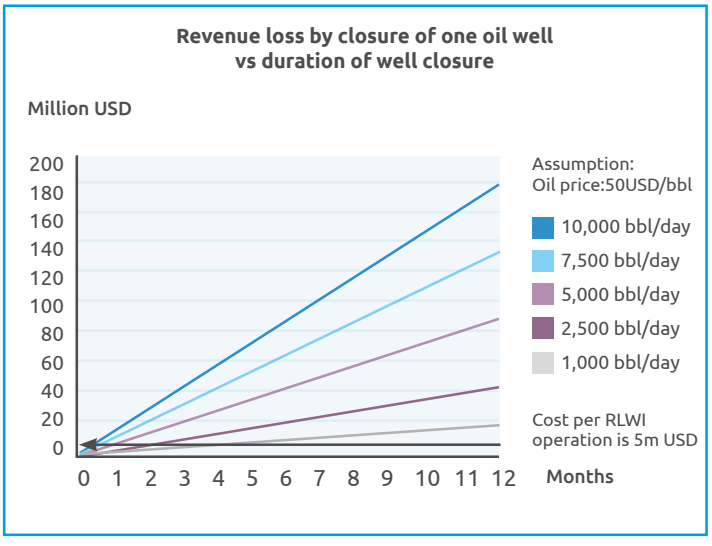
Today we operate in some of the world's toughest environments. We have been West of Shetland for several seasons operating in an environment with high and unpredictable ocean currents and we have been in full year operation offshore Norway since 2006. The perceived challenge in other regions is the water depth. However, the latest version of our well access system, the RLWI Stack #4, is designed for 2000 meter water depth. We are basing the design on the same technology that FMC Technologies is using for deepwater subsea trees, which has been installed down to 3000 m. Independent third party studies have concluded that our strategy for hydrate prevention is very robust. Finally, our experience from West of Shetland has provided unique knowledge with respect to handling equipment in these waters under challenging conditions. The operations in this area are also the most demanding RLWI operations we have done with respect to equipment in the water. For RLWI the challenge is

high speed ocean currents, not water depth. Our Stack #4 is now installed on Island Performer and is ready for operation through a new company, FMC Technologies Offshore (FTO). FTO is a joint venture between FMC Technologies and Edison Chouest Offshore, established to service the global deep water well intervention market.

FMC Technologies' view is that the RLWI technology is ready for deep water. Which challenges must be overcome to succeed with RLWI in other regions?

First of all - as an operator you don't need much of a success for RLWI to be very good business. The payback from a successful RLWI operation on a subsea well can reach 10 to 50 times the cost of the operation. A modest example can be for example a drop in the production rate in a good well due to high water content or scale build-up. If the well is brought back on track with a production increase of 1000 – 2000 barrels per day, the cost of a typical RLWI intervention operation is recovered in 2 to 3 months even with the oil prices we see today. Due to FMC Technologies's global presence with service bases in all regions with significant offshore activity, there is competence, routines and experience in place to support RLWI operations locally. Operationally we will face the same challenges that we face with other operations, nothing more. The biggest challenge we see with migration to other regions is that the initial work scope for RLWI is not enough to support a dedicated RLWI vessel full time. However, the vessels are very versatile units capable of construction work, Tree-on-Wire installation and acid stimulation, in addition to RLWI. We have faith in RLWI as an economic beneficial service even in regions with deep water and we are confident this is an emerging market. The establishment of FTO is proof of our commitment to provide RLWI service to the global deep water market.





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The growth of RLWI in the last few years is a direct result of oil and gas companies actively working to increase the percentage of recoverable hydrocarbons from their reservoirs being produced from subsea wells at a cost per barrel for the incremental production that is substantially lower than the cost per barrel for developing new offshore fields.

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