WELLTEC summary of completion SPE papers prepared by or relating WELLTEC NORWAY

Reducing Costs With Well Tractors for Horizontal Wells

Hallundbaek, Jorgen, WELLTEC
7875-MS OTC Conference Paper - 1995

Abstract:

“The Well Tractor is a new concept for a down hole tool that significantly reduces operation costs for servicing horizontal wells. The Well Tractor is a cost-effective alternative to the very expensive and time consuming conventional drill pipe conveyed operations. The Well Tractor is capable of pulling coiled tubing and/or wireline horizontally beyond 10,000 ft. The Well Tractor is capable of pulling more than 25,000 ft of coiled tubing and/or wireline into a highly deviated well. Furthermore, the tool is designed for pushing other tools into the hole, e.g. logging tools, video cameras. The lateral reach capacity with coiled tubing is therefore increased considerably. Time consuming production logging operations of horizontal wells utilising jointed pipe can be carried out by the Well Tractor as a wireline job.

The Well Tractor is used for cleaning, setting and pulling of p……”

Reduction of Cost with New Well Intervention Technology, Well Tractors

Hallundbaek, Jorgen, WELLTEC
30405-MS SPE Conference Paper - 1995

Abstract:

“We have successfully tested a new concept for a down hole tool, a Well Tractor, that significantly reduces operation costs for servicing horizontal wells. The Well Tractor is a cost-effective alternative to the very expensive and time consuming conventional drill pipe conveyed operations.

In general the Well Tractor is capable of pulling coiled tubing and/or wireline horizontally beyond 10,000 ft. The Well Tractor is capable of pulling more than 25,000 ft of coiled tubing and/or wireline into a highly deviated well. Furthermore, the tool is designed for pushing other tools into the hole, e.g. logging tools, video cameras. The lateral reach capacity with coiled tubing is therefore increased considerably. Time consuming production logging operations of horizontal wells utilising jointed pipe can be carried ...”

Zonal Isolation in a U-shaped Well using Coiled Tubing and Well Tractor®

89522-MS SPE Conference Paper - 2004

Abstract:

“An 80m long retrievable "one-run" straddle assembly was successfully installed in order to shut off a gas breakthrough in the 130 degrees deviated reservoir section of a "U shape/Fish hook" sub sea oil
producer in the Njord field. Coiled tubing with an internal electric line in combination with a tandem fluid driven tractor was used to convey the straddle assembly....

**Well Construction on Wireline**

Karlsen, Ole Eddie, WELLTEC
Lothe, Guthorn, Statoil
Aasland, Stig, Statoil
109039-MS SPE Conference Paper - 2007

Abstract:

“A further evolution of wireline intervention technique has emerged allowing mechanical manipulation in horizontal wells using a combination of Wireline Stroker and field proven Wireline Tractor technology - best described as Well Construction on wireline in a highly deviated well.

This technology represents a cost-efficient method for setting and retrieving of specific downhole hardware (i.e. plugs and straddles) as a resource-efficient alternative to existing technologies.

This paper will present the following case history and the benefits of the operation, particularly in deviated wells, where tractor technology in combination with the Wireline Stroker exemplify the advantages of this technology.

In a well offshore NORWAY, producing since 1995, completed with 2 Sliding Side Doors (SSD) to control zone production, attempts had been made to close both SSD’s in October 2003,..

**Successful Milling and Removal of a Permanent Bridge Plug With Electric-Line Tractor-Conveyed Technology**

Stragiotti, Stephen, StatoilHydro
Karlsen, Ole Eddie, WELLTEC
121539-MS SPE Conference Paper - 2009

Abstract:

“A new application of running wireline stroker technology in combination with wireline milling technology has been proven successful in the Norwegian Sector of the North Sea. In August 2008, on an offshore platform, a wireline stroker and wireline milling rotational unit were used to mill out and remove a permanent type bridge plug at 1,264m (approximately 4,147 ft) MD (50° deviation).

The 3.25?? high expansion bridge plug was inadvertently set in the tubing in March 2008 at 1,264 m. It was decided to attempt to mill out the plug on electric wireline to regain production from the well. A study was initiated to evaluate if it would be feasible to develop a wireline conveyed stroker and milling system capable of removing the plug. During a two months design period, several different bits and milling tools where designed and test....”

**Milling of Permanent Bridge Plug Successfully Performed on Wireline**

Karlsen, Ole Eddie, WELLTEC
Stragiotti, Stephen, StatoilHydro
123924-MS SPE Conference Paper - 2009

Abstract:
“A technological breakthrough within the application of wireline technology has been achieved. In August 2008, on an offshore platform in the Norwegian Continental Shelf, a wireline tractor and a new wireline milling system were used to mill and remove a permanent bridge plug at 4,147 ft MD.

The operator decided to mill out the plug on electric wireline and worked closely with the service company to develop this novel solution. Having developed and tested several bits and milling tools, results showed that by combining the wireline miller with hydraulically provided weight on bit (WOB), it would be possible to mill out the retaining rings of the plug, which would cause the plug to collapse. The milling control unit allows the WOB to be adjusted for each application and also controls the reactive torque, the force generated when the milling bit engages...”

**Milling of Permanent Bridge Plug Successfully Performed on Wireline**

Stragiotti, Stephen, Statoil., Andersen, Øyvind, StatoilHydro., Karlsen, Ole E., WELLTEC 123924-PA SPE Journal Paper - 2010

Abstract:

“A technological breakthrough within the application of wireline technology has been achieved. In August 2008 on an offshore platform on the Norwegian continental shelf, a wireline tractor and a new wireline milling system were used to mill and remove a permanent bridge plug at 4,147 ft measured depth(MD).

The operator decided to mill out the plug on electric wireline and worked closely with the service company to develop this novel solution. Having developed and tested several bits and milling tools, results showed that by combining the wireline miller with hydraulically provided weight on bit (WOB), it would be possible to mill out the retaining rings of the plug, which would cause the plug to collapse. The milling control unit allows the WOB to be adjusted for each application and also controls the reactive torque—the force generated when the milling bit engages...”

**Breaking the Boundaries for Wireline Sand Removal.**

Karlsen, Ole Eddie, WELLTEC., Mathiassen, Erling, Statoil ASA 134950-MS SPE Conference Paper - 2010

Abstract:

“A new application of wireline tractors in combination with wireline sand removal technology has been proven in the Norwegian Continental Sector. Statoil experienced problems with sand build up in one of their production wells and needed to gain knowledge whether it was sand production or mechanical issues that disturbed the well. When using traditional equipment only 2.5 dl of sand were removed, which provided no conclusions for the operator.

It was decided to use the wireline cleaner PST (Power Suction Tool) to determine what caused the decrease in production. The PST is a newly developed cleaning device that can be run on electric wireline, either with a wireline tractor or as a “stand alone?? tool.

The PST removed 26 liters of sand after the second run, which corresponds to a full bailer chamber that was used on this particular job. The PST is capable of carry...”
Riserless Well Intervention for Subsea Workover

Skeie, Terje, WELLTEC., Hjorteland, Öyvind, WELLTEC., Arnskov, Michael Macdonald, WELLTEC A/S
143226-MS SPE Conference Paper - 2011

Abstract:

“The number of subsea wells has increased steadily over the years and is estimated to have exceeded 5500 by the end of 2010.

Subsea wells do in general have substantially lower recovery rates than what is normally achieved from comparable non-subsea wells. This is due to the high intervention costs which are directly related to the rates of the rigs required to carry out such operations if the traditional and conventional approach is adopted. Hence the incentive to increase recovery rates has been limited as the balance between cost and revenue has been unfavorable, even with increasing oil and gas prices. However, this has also stimulated the development of alternative methods which can enhance recovery rates and not least address the challenges created by more fields passing maturity and exploration moving to more demanding areas.

Lightweight and riserless inter......”

World First Riserless Light Well Intervention (RLWI) Technique To Mill and Clean Hard-Packed Debris, and Then Pull a Bridge Plug From a Live Subsea Well Using Electric Wireline

Delot, Quentin, Statoil ASA., Eikeland, Tommy, WELLTEC NORWAY., Gundersen, Svein Helge, Statoil., Skeie, Normann, WELLTEC
159636-MS SPE Conference Paper - 2012

Abstract:

“A subsea production well in the North Sea was being serviced with a riserless intervention which inadvertently resulted in fill atop a temporary bridge plug. Riserless slickline and traditional e-line attempts to remove the debris and pull the plug were unsuccessful. A rig or intervention vessel with riser for coiled tubing cleanout was unavailable for approximately a year. The operator requested innovative solutions and selected a unique riserless light well intervention consisting of an e-line cleaning tool with a reverse circulating bit and bailer sections to break through the hard-packed debris, vacuum it into the bailers, and retrieve it to surface. The remaining debris in the internal fishing neck of the plug was sucked up by a...”

New Water Depth Record for Electric Line Operations, Retrieving Asphaltenes with Riserless Light Well Intervention

Ashcraft, Steven, Anadarko., Karlsen, Ole Eddie, WELLTEC NORWAY., Luviano, Angel E., WELLTEC., Morrison, Bevan, WELLTEC
166337-MS SPE Conference Paper - 2013

Abstract:
"Capabilities in the industry have been expanded on a recent operation performed in the Gulf of Mexico, where a new electric line (e-line) water depth record was set in addition to demonstrating that asphaltenes can be removed on e-line with Riserless Light Well Intervention (RLWI).

The operator had planned to set a removable hold open sleeve with a subsurface-controlled PB valve across a failed surface controlled subsurface safety valve (SCSSV) on one of their subsea wells. The well had not been re-entered since production start-up, which meant that the downhole conditions were unknown. During the slickline gauge run, the toolstring hung up after only 581 ft in the well and could not be jarred any deeper. After a failed attempt to chemically remediate the blockage, the client decided..."

Open Hole Packers Provide Zonal Isolation for a High Pressure Acid Stimulation within a Chalk Reservoir


166391-MS SPE Conference Paper – 2013

Abstract:

“This paper overviews the design, development, qualification, and field trial deployment of a hydraulically expandable metal packer that enabled a cementless, zonal, high-pressure acid stimulation program to be accomplished.

Achieving effective zonal isolation within long reach horizontal wells using conventional means with cement is challenging to the industry. Achieving effective cement within long step outs is limited by the Equivalent Circulation Density (ECD) (impacted by fracture/pore pressure) or by the inability to achieve effective cement (i.e., without channels/micro annuli) simply due to the sheer length of the horizontal section of the well. Additional challenges are then imposed to achieve zonal isolation within unconventional reservoirs or wells that require hi...”

A New Approach that Enables Simpler Well Completion and Higher Recovery

Bårdsen, Johnny, WELLTEC., Skeie, Terje, WELLTEC., Hannah, Neil, WELLTEC

163931-MS SPE Conference Paper - 2013

Abstract:

“Focusing on a new way to complete and maintain wells, this paper will explain how a newly developed completion approach enables safer, more sustainable operations with higher production and recovery rates from a simple, durable and cost effective well construction.

The approach, here referred to as the flex-well, concentrates on simplicity while providing all the components an operator requires to design and construct a completion that is fit-for-purpose; it can be as minimalistic or as intricate as the operator requires in order to accomplish maximum reservoir drainage. The flex-well has been engineered to provide a low total-cost-of-ownership solution that meets global operators’ current and future drilling, deployment, and production challenges...”

Qualification and Field Trial of a Metal Expandable Well Annular Barrier
Abstract:

“The ability of cement to achieve a pressure seal across the reservoir section for the life of a well becomes ever more difficult to achieve because of increasing depths and more complexity in well design and operations. Mature fields with depleted zones combined with the desire and ability for extended reach wells exacerbates the challenge of delivering a cement-only, fit-for-purpose liner.

To address this challenge, an operator and service company have joined forces to design, develop, and qualify a hydraulically expandable metal well annular barrier (WAB) assembled on the outside diameter (OD) of a liner while maintaining full-bore inner diameter (ID). Intended initially for use in NORWAY’s Valemon field, the operator is also exploring options for other applications in the Snorre and Brage field...”

Rigless Intervention: Barriers and Misperceptions About Using Lightweight Intervention Solutions To Increase Oil Recovery from Deepwater, Subsea Wells.

Morrison, Bevan, WELLTEC,., Karlsen, Ole Eddie, WELLTEC NORWAY.
24054-PT OTC Presentation - 2013

Abstract:

“In recent years, the number of subsea wells has increased steadily; a 2011 report estimated more than 5,500 worldwide. One of the key challenges the industry faces with subsea wells is generally lower recovery factors compared to wells with surface access. A key reason for this difference is because workover activities to improve recovery rates in subsea wells has traditionally required use of large rigs, risers, jointed pipe or coiled tubing (CT), with high operating rates. The high costs of these operations can make it difficult to achieve the necessary increases in production rates and revenue to justify the workover investment, even with increasing oil prices; therefore, operators often forgo production-improvement workovers. However, a growing global population and soaring ene...”
workover investment, even with increasing oil prices; therefore, operators often forgo production-improvement workovers. However, a growing global population and soaring energy demand m......

**Improved Recovery Rate in Brownfield Subsea Wells Using Riserless Light Well Intervention**

Abstract:
“The combination of increasing global energy demand, known reserves being depleted, and the offshore locations of new oil and gas discoveries is pushing drilling and production into deeper and deeper waters. As a result, the number of subsea wells has increased steadily over the years to more than 5,500 by the end of 2012. Unfortunately, due to their location in deep water, interventions in subsea wells have typically required drilling rigs. Thus operators have been reluctant to perform interventions on these wells. This problem has only been exacerbated as drilling rates increase and sourcing rigs becomes more and more difficult. Thus, recovery factors are much lower—typically 10% to 30% lower—than recovery rates of dry-tree, platform-based wells. Therefore, cost-effective riserless light well interventions (RLWI) are crucial if subsea opera...”

**Electric Line Riserless Light Well Intervention (RLWI) Methods Key to Increasing Recovery from Subsea Wells.**
Karlsen, Ole Eddie, WELLTEC, Andrews, Garry, WELLTEC
169188-MS SPE Conference Paper – 2014

Abstract:
“The number of subsea wells has increased steadily and by the end of 2012 exceeded 5,520. These wells pose a number of challenges incl. generally lower recovery factors compared to wells with surface access. The high operating rates of rig have had a natural damper on the incentive to increase recovery rates, as the balance between cost and revenue has been unfavorable - even with increasing oil and gas prices. However, this has also spurred the drive to develop alternative methods to enhance recovery and cope with the challenges of maturing fields and exploration under more difficult circumstances. Adopting frequent lightweight well intervention has proven crucial for subsea operators to realize the potential of 50% oil recovery. Such operations are becoming more common, but there are increasing challenges and demands as development moves toward deeper wate...”

**World’s First Hydrate Plug Milling on E-line**
Karlsen, Ole Eddie, WELLTEC, Skeie, Terje, WELLTEC, Buch, Jorgen, WELLTEC, Keith, John, WELLTEC
169189-MS SPE Conference Paper - 2014

Abstract:
“Operators now and again struggle with a complex phenomenon causing unwanted and often unpredictable hydrate plugs to form in producing or injection wells, blocking production and re-entry. Conventional remediation methods can be costly, time consuming and often ineffective. This paper will share the learnings from a world’s first operation, demonstrating that hydrates can be milled using electric line (e-line) tools. The operation was performed from a Vessel of Opportunity as a Riserless Light Well Intervention (RLWI) operation in the North Sea, offshore UK. A hydrate plug was tagged below the subsea tree in a water injection well. This unconventional solution was chosen to restore injectivity and access through the wellbore to reduce overhead and time expenditure, and improve operational HSE. In less than 20 hours of actual milling time, 173 ft (52 m) of hydrates were removed on e-line allowing th...”

**Improved Zonal Isolation in Open Hole Applications**


Abstract:

“Achieving effective zonal isolation within long reach horizontal wells via conventional means, such as cement or swell packers, is becoming increasingly challenging to the industry. The longer step outs limit the Equivalent Circulation Density (ECD) due to frac/pore pressure limitations. Subsequent complex stimulation operations impose higher differential pressure (dP) across the packers.

To address these challenges, a novel design was introduced, effectively creating an expandable metal, sleeve-type annular barrier that allows cementless completions and effective zonal isolation. The design of the new annular barriers, assembled on a full bore liner, minimizes the running outside diameter (OD) whilst delivering a high differential pressure seal even within a washed out hole.

The qualification process was designed to meet ...”

**New Mechanical Pipe Cutting Capabilities on Electric Line - A Compilation of Case Stories from NORWAY**


Abstract:

“*This paper will present several case histories on the subject of mechanical pipe cutting on electric line (e-line) as well as the operational steps selected to make the pipe cuts. A description of a new pipe cutting tool together with lessons learned to improve future operations will also be discussed.*

A recently introduced mechanical pipe cutter tool has enabled pipe cutting operations to be performed with e-line. Operations can be executed from fixed platforms and mobile drilling units (MODO) and as Riserless Light Well Intervention (RLWI) through a subsea lubricator for wireline work. With expanded Surface Read Out (SRO) capabilities for collected data this has increased the possibility to determine a...”
New Advances in Mechanical Engineering Enables Pulling Forces of up to 60,000 lbs. – Experience Gained from Offshore NORWAY Case Stories

Buch, Jørgen, WELLTEC., Mourani, Houssam, WELLTEC., Ngo, Dong, WELLTEC
173837-MS SPE Conference Paper - 2015

Abstract:

“This paper will present an improvement in engineering in the form of a hydraulic stroking tool with the ability to apply 60,000 lbs. of force. The tool has already been applied offshore NORWAY and lessons learned from these recent operations will also be disclosed.

In one operation, a plug was accidentally set across the christmas tree and blowout preventer (BOP), effectively eliminating the christmas tree as a well barrier element, and constituting a serious HSE risk. Conventional solutions failed to release the plug due to an insufficient pull force and then a failing jar.

In another well, the setting tool had malfunctioned resulting in a partially set plug and a stuck tool.

Novel Approach to Combat the B-annulus Pressure Build-up Challenge

177633-MS SPE Conference Paper - 2015

Abstract:

“In December 2014 a metal annular packer equipped with sealing elastomers, was installed and verified in an offshore platform well in NORWAY. The annular packer was installed to function as a barrier element against pressure buildup from shallow formations in the overburden with limited flow potential, containing liquid only (no gas). The packer was installed between the intermediate casing and the production casing.

Upfront the installation the packer was tested and qualified according to ISO 14310 V3. This paper describes the operation, which was a world's first, as well as the implications this achievement has for the industry in terms of preventing the plague of sustained casing pressure (SCP).

SCP can be defined as pressure in any annulus that is measurable at the wellhead and rebuilds when bled down, not caus...”

Advancement in Mechanical Manipulation Enables Pulling Forces of 60,000 lbs on E-line – Operational Experiences from Pulling Stuck Plugs and Tools

Buch, Jørgen, WELLTEC, Mourani, Houssam, WELLTEC, Ngo, Dong, WELLTEC
173644-MS SPE Conference Paper - 2015

Abstract:
“Accidental plug setting and stuck tools is a cause of great frustration, operational delays and ultimately deferred production. A cost-efficient and swift resolution is always desired. This paper presents a new development in engineering in the form of a hydraulic stroking tool with the ability to apply 60,000 lbs of force. The tool has already been applied in the North Sea; lessons learned from these recent operations are disclosed in this paper.

In one operation, a plug was accidentally set across the Christmas-Tree (XMT) and blowout preventer (BOP), effectively eliminating the XMT as a well barrier element and constituting a serious HSE risk. Conventional solutions failed to release the plug due to an insufficient pull."

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**Evolution of a Well Annular Barrier for Mitigation of SCP**

Bårdesen, Johnny, WELLTEC., Dagestad, Vibjørn, WELLTEC

180020-MS SPE Conference Paper - 2016

**Abstract:**

“A novel, Well Annular Barrier (WAB) was introduced back in 2011 as an open-hole, zonal isolation packer. Its strength, ruggedness and pressure capacity over the past four years has proven it a valuable solution. Especially for ensuring the successful cementing of casing strings which were required to be run through challenging environments such as overburden, depleted zones, water bearing sands or unconsolidated zones.

Work is in progress to develop a verification system for WAB expansion and integrity, further growing its capabilities and the operating envelope in which it can be deployed. This will in turn increase the WABs potential applications, and use as a stand-alone, open-hole barrier. The newly developed system consists of pressure and temperature sensors either mounted independently from, or integrated with, the WAB. Annular sealing integrity will be con..."

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**Annular Barrier as an Alternative to Squeezes in Challenging Wells: Technology Review and Case Histories**

Bagal, Joseph, WELLTEC Africa., Onadeko, Gbenga, WELLTEC Africa., Hazel, Paul, WELLTEC HQ., Dagestad, Vibjørn, WELLTEC Scandinavia

AFRC-2583084-MS SPE Conference Paper - 2016

**Abstract:**

“The drilling industry has always relied on cement as a primary barrier. Although the cement represents about 5% of the well cost, when squeezes are required, cementing averages 17% of the well cost. Only 50% of the squeezes achieve the objective of establishing a barrier for well integrity. A little bit more than half of the failures can be attributed to operational challenges (pump failure, cement contamination), or design oversights (cement recipe, centralizers). However there are still cement failures with perfect design and field execution. These failures typically exhibit some of the following characteristics: high deviation, high pressure, washouts, natural fractures, long casing section, heterogeneous sands.

For these specific conditions, it is beneficial to add an assurance that would m....."
A New Electric Line Downhole Jetting Tool Accomplishes Sample Collection and Screen Clean-Out to Restore Production

Husvag, M. A., Statoil., Skagseth, T. F., WELLTEC., Mourani, H., WELLTEC., Sidle, B., WELLTEC., Schwanitz, B., WELLTEC
184792-MS SPE Conference Paper - 2017

Abstract:

“A North Sea well was drilled and completed as a sidetrack with a 4 ½” liner set using open-hole sand screens (2x12m) in the toe and swell packers for isolating the production intervals. Due to poor productivity and injectivity, the well had been shut-in. It was suspected that the completed interval had been filled by particles (mainly barite) from different mud types that were suspended or settled in the completion fluid placed both inside and outside the screens.

Due to multiple uncertainties regarding the fill, it was desirable to perform a drift run to determine the hold-up depth (HUD) and collect samples there. The operator decided to apply a modified version of a known electric-line (e-line) suction tool. The service company modified the tool to include un...”

Next Generation Annular Barrier Verification System

Dagestad, Vibjørn, WELLTEC., Bårdsen, Johnny, WELLTEC., Vasques, Ricardo Reves, WELLTEC
185897-MS SPE Conference Paper - 2017

Abstract:

“International standards for well barrier integrity traditionally prescribe cement as annular sealing material. Despite a more than 100-year long history using cementing techniques, a high number of wells have poor annular integrity and are facing sustained casing pressure (SCP). A quality assessment of the cement seal is obtained by return volume and surface pressure trend calculations together with bond logs. All of these measurements are indirect and open for interpretation. Commonly, excess cement volumes are pumped to account for uncertainties but cement failure rate remains high.

This paper describes an extensive testing and qualification program performed on a wireless downhole measurement system. Testing has been done on a component and system level basis on the permanently deployed equipment together with the hardware, software and telemetry on the equipment designed to retrieve the data. ...”

PSK/16052018