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Oilfield Innovation's wireline abandonment replaces drilling rig & pulling unit well plugging

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Oil and gas wells were first drilled in China around the 4th century, or earlier, using drill bits on the end of bamboo poles. Subsequently, the Chinese invented the rope and drop method, which uses a vertically raised and dropped metal cookie cutter to bore a hole. Percussive hammering of a cookie cutter borehole into the earth using this rope or cable tool drilling method continued until the 20th century when it was completely replaced by the advent of rotary drilling tools, which could drill faster, deeper and directionally.

Thereafter, rotary drilling rigs were used for both well construction and well destruction operations while slickline and wireline tools were relegated to the secondary role of data gathering and setting of solid mechanical and/or expandable elastomeric plugs downhole.

This secondary usage of a cable or wireline, comprising slickline, braided wire line and/or electric wire line, has led to a gap between the drilling and wireline professions, who have forgotten the robust nature of the 4th to 20th century art. The Scottish company Oilfield Innovations proposes filling that gap with a new and robust wireline method usable to displace drilling rigs and pulling units from the vast majority of onshore, offshore and subsea well abandonments at a fraction of the cost.

Drilling rigs and pulling units are productive when drilling and performing well workovers because hydrocarbons may be extracted from such activities. However, expensive drilling rigs or pulling units are the most inefficient means of well abandonment because hydrocarbons cannot be extracted from abandonment, which causes non-productive time.

Additionally, the use of drilling rigs and pulling units involve significantly more risk because existing barriers must be removed, whereas non-intrusive and field proven wireline tools may be used without disturbing existing wellhead barriers during rig-equivalent logging and plugging of wells through the existing completion.

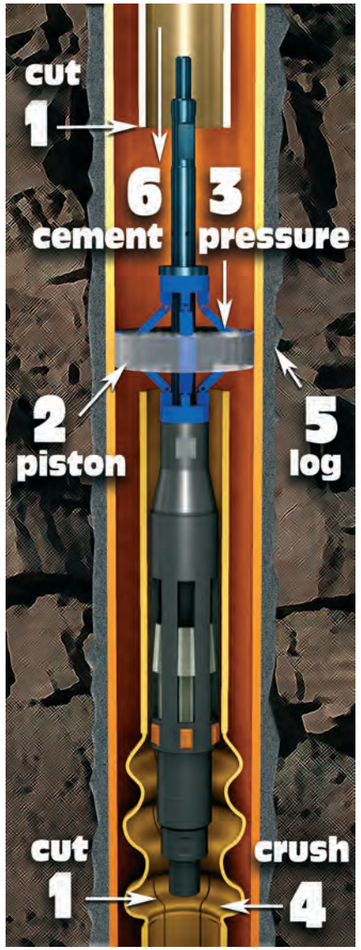
While the original bamboo pole drilling method was able to drill up to 800 feet or 243 metres, the rope or cable and drop method was robust enough to drill several thousand feet or metres into solid rock.

Oilfield Innovations proposes using the robust nature of cable operations to reach thousands of feet or metres into a well to cut the production tubing and then place a piston upon the severed tubing end so as to crush it like the Coca-Cola can pictured to the lower left.

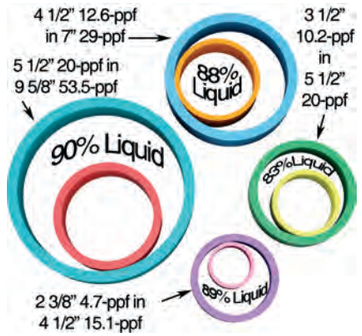
Oilfield Innovations' patented method, shown in the upper right graphic, cuts (1) the tubing, (2) places a piston within the casing and uses (3) hydraulic pressure to (4) crush the tubing so that the primary cement behind the casing may be (5) logged prior to placing a (6) cement plug in the unobstructed space; while using the remaining uncrushed tubing to place tools and cement.

This patented method may use any new or proven tools. For example, a conventional packer with its anchoring slip segments removed may be used to form a crushing piston.

While the art of crushing tubing downhole will be developed over time, there is no doubt that the piston method, invented by a Greek named Heron of Alexandria almost 2,000 years ago and applied with great effect ever since, will work because pistons apply such forces everyday within, for example, the combustion engine.



Modern wells are designed to maximise the flow of hydrocarbons. Consequently, the crushing of the hollow production tubing within the casing is relatively simple since the tubing walls and completion occupy only 10-20% of the space. Additionally, while tubing



is relatively strong in tension, it is relatively weak in compression because it may move and become eccentric.

Accordingly, as illustrated above, there is little doubt that a piston occupying 100% of the space can force the tubing or completion components occupying only 10% to 20% of the space into the 80% to 90% of the liquid filled space within the casing's internal diameter. Hence, as the tubing becomes eccentric and helically buckles within the casing, it loses its structural shape due to eccentricity and collapses under tens to hundreds of tonnes of crushing force hydraulically applied by the piston.

The presence and inevitable eccentricity of the tubing within the casing drives the conventional desire to pull the tubing since leak paths may develop where the tubing touches the casing and logging tools cannot measure primary cementation through the tubing to confirm that cement behind the casing is still bonded and competent. Oilfield Innovations' method of crushing the tubing, instead of pulling it, provides a rig equivalent well logging and plugging method. Furthermore, additional Oilfield Innovations' patented methods of vertically cutting or scoring the tubing may be used to better control where crushing occurs as well as increasing the crushing ratio.

The patented methods described herein use relatively low cost and field proven technology to plug offshore, subsea and onshore wells, as shown in the lower right graphic; wherein conventional wireline technology is usable through a pressure controlled lubricator and blowout preventer sealed to the existing production tree and wellhead to permanently plug and fluidly isolate producing formations on live wells in a rig-equivalent manner. Hence, over time, these methods will become the preferred operations and displace drilling rigs and pulling units from well abandonment.

Wireline is, by conventional definition, the lowest cost and safest means of intervening in a live well. The most prominent disadvantage of wireline intervention is the possibility of breaking wire and losing tools downhole. However, this disadvantage is mitigated by the ability to crush tubing and dispose of lost wire and tools downhole during well plugging and abandonment.

Additionally, while the method of cutting and crushing may initially use only field proven downhole tools, significant improvements will ultimately be realised with the use of newly developed and qualified downhole tools patented by Oilfield Innovations.

The market for a low cost and low risk well plugging technology is enormous. It is very likely that there are millions of wells waiting on plugging and/or abandonment given that the average number of wells drilled since the early 1970s is between 70,000 and 100,000 per year.

To meet this challenge, the four largest service providers, who control around 75% of the service market, are preparing much higher cost solutions for operators and governments, who lose tax revenue through the deduction of abandonment expense. However, both operators and governments around the world will favour lower cost and safer methods, like those of Oilfield Innovations, if they are available.

The Scottish company Oilfield Innovations is presently seeking investors and operators willing to test the technology, but until it is developed and deployed, well plugging will continue to use higher cost and higher risk alternatives for the non-productive act of well abandonment, thus leading operators and governments to pay more than they should. The question is not whether using tools proven for almost 2,000 years and cable operations proven since the 4th century will work, but rather how much operators will spend and governments will lose on well plugging before Oilfield Innovations' methods are used worldwide? ■

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