



# Time to shine

Barry Ekstrand, Key Energy Services, USA,  
explains why coiled tubing is a technology whose  
time has come.



**T**he roots of coiled tubing (CT) go back to 1944, when British engineers developed and produced long, continuous pipelines for transporting fuel from England to the European continent to supply the Allied armies. Today, CT is one of the fastest growing segments of the oilfield services sector. According to ICoTA (Intervention and Coiled Tubing Association), in the US the coiled tubing unit count has grown from 217 units in 1999 to more than 568 in 2013. Driven by advances in technology and attractive economics, coiled tubing is used to perform an ever-growing list of field operations. While well service and workover applications still account for more than 75% of CT use, with the expansion of fracturing technology, CT use has increased dramatically in horizontal wells.

### **A mission critical component of any modern completions programme**

Until a few years ago, the use of coiled tubing in fracturing was uncommon. Historically, CT fracturing methods were limited to placement of small

fractures in the formation, or use in some acidising situations. However, the ability to tap into vast new oil and gas resources in shale formations is driving a new wave of CT utilisation. The shift to drilling horizontal laterals in shale oil and gas plays has led more companies to employ coiled tubing units for well completion and intervention work.

In North America, CT is rapidly becoming the ‘tool of choice’ in most horizontal wells to mill up frac plugs or clean up after the stimulations. The reasons for integrating CT into a well programme are simple and powerful: greater efficiency and faster time-to-production. Generally speaking, CT is two-to-three times faster than doing the same job with a workover rig. As a result, operators can complete more of the wells in their drilling portfolio and get them online quicker, so hydrocarbons can get flowing sooner.

### **Working live, saving time**

A primary benefit of CT is the ability to perform interventions on live wells. When using CT for the completion of an oil or gas well, there is no need to kill the well. Live well interventions eliminate unforeseen formation



**Figure 1.** A Key Energy Services coiled tubing unit. The spooled continuous pipe can reach lengths of up to 48 000 ft for the smaller diameters (1.25 in.) and is used to convey tools, log, stimulate, clean-out and perform other Intervention functions in oil and gas wells.

damage and the time involved in killing a well and bringing it back online, saving the operator time and expense. Another benefit is that coiled tubing can be run through existing tubing. Not only does this eliminate the time involved in pulling production tubing, it also eliminates the expense of re-dressing the production packer.

### Perfected in major shale plays

CT first proved itself as a viable completion technology in the Fayetteville, Haynesville and Eagle Ford shale plays. Here, where the wells are deep and the pressure is high, workover rigs became less attractive as a completions option. In addition, the transition to drilling longer laterals in shale plays has led to the use of larger diameter coil, 2 in. and 2 3/4 in. tubing.

Coiled tubing pipe of 2 to 2 3/4 in. has been proven highly effective in horizontal well completions where it is used to drill out the bridge plug. Both 2 in. and 2 3/4 in. pipe are being used today depending on downhole pressure, completion size, and lateral length. However, 2 3/4 in. diameter is the rock star in extended reach laterals. With more weight on the bit and better control of the BHA operators can drill out faster, and with the larger diameter, higher circulation rates can be achieved, resulting in better well bore clean up.

Like any well servicing equipment, there are challenges with the larger diameter 2 3/4 in. pipe. The biggest challenge is managing the fatigue of the pipe due to its larger diameter – downhole pressure and circulating pressure, coupled with pipe movement, can mean faster wearing of the larger pipe. As a result, pipe fatigue needs to be carefully monitored. When a reel of coiled tubing needs to be replaced, transportation logistics and the time to accomplish the task can become a critical logistical consideration. These are all important reasons for choosing a service provider with a solid record of CT performance and experienced personnel that understand how to best use this advanced equipment.

### The big question: cost versus time

CT is one of two options when drilling out the bridge plugs used to isolate hydraulic fracturing stages in a horizontal or vertical well. Which is the best solution? CT or workover rigs? The answer depends on the ultimate goal. Is the goal to simply minimise the well cost? Or is it to get the well online faster and production in the pipe as quickly as possible? In plain economics, well costs for performing the work will be less with workover rigs. For example, in the Eagle Ford shale play, a workover rig costs approximately US\$ 7200 for a 12 hr day while a coiled tubing unit costs closer to US\$ 40 000/d. But, if an operator needs to get production in the

pipeline fast and hydrocarbons on the market as quickly as possible, CT is a proven solution that will help them meet their operational goals. When used over multiple wells, the efficiency benefits provided by coiled tubing multiply as well, potentially saving weeks of valuable time. Remember, exploration means nothing if there's no production.

### Paradigm shift expands use of CT

While shale plays have generated greater usage of CT, recent paradigm shifts regarding multi-well paths and simultaneous stimulation or 'super fracs' where a giant manifold is hooked up to multiple wellheads on a single well pad, are making CT a popular option as well. 'Super-fracs' could continue to revolutionise domestic energy development by significantly lowering the costs of unlocking even more and deeper reserves of shale gas and tight oil than were accessible by traditional fracs. CT can help operators amplify their operating efficiencies by eliminating the need to move equipment while still providing time and space saving benefits, to get as many wells in their drilling portfolio completed and online and hydrocarbons flowing. CT provides the ability to quickly move in and out of the hole when fracturing multiple zones in a single well. It also provides the ability to fracture or accurately target the treatment fluid to ensure complete coverage of the zone of interest. As well, more uniform treating of long target zones can be achieved which is particularly important in horizontal wellbores. Simply put, CT is important to a modern, technologically-savvy well completions programme.

### Set to further improve efficiency in the Permian Basin

Following the efficiency gains brought by CT to the Eagle Ford play in South Texas, coiled tubing now stands to repeat these operational improvements in the Permian Basin play in West Texas. Traditionally, workover rigs have been the equipment of choice in the region with some operators also using CT as an option. However, with the number of horizontal wells increasing in the area, this could quickly change. Consider the potential. When one takes into account all the producing rock in the region, the Permian Basin is the second largest field in the world. In fact, there is more oil in the Permian than anywhere else in the world per single geological formation with the exception of the Ghawar field in Saudi Arabia. Now, consider the geology: there are 4 - 7 pay zones in some areas. Operators could easily have six wells on a pad with each of these wells going after a different pay zone.

As West Texas operators further adopt CT technology as part of their unconventional horizontal programmes, the use of CT in the Permian Basin is steadily growing. Fuelling that change is expertise being brought over from engineers with experience in unconventional horizontal fields in East and South Texas. The lessons learned from these areas are being shared with operators in West Texas and applied to the area with great results. Operators are already starting to prove that going after these deeper zones can yield incredible results. As wells get longer, deeper and more complex, CT will become even more important in the region. In the next three years it is projected that some 60% of work in the Permian will be done using CT technology.

### Driving innovation to deliver results

Coiled tubing has come a long way since its early days in the oilfield. Changes in the technology have been rapid. Today, CT allows service companies to get in and out of much deeper wells, more quickly and conduct more useful work than was possible even a few years ago. With the percentage of horizontal wells going up massively in North America and those well types requiring more coiled tubing intervention, the demand for expertise in CT technology is projected to increase accordingly. CT will continue to evolve to help meet the challenges of the future as more sophisticated completions arise in the years ahead. ■