New system reduces multilateral completion time

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IN THE LAST TWO YEARS, there has been a dramatic increase in the availability and the complexity of multilateral drilling and completion systems. Many systems with new features and improved functionality have been introduced that have enhanced the application opportunities for multilateral technology.

Sperry-Sun's Technology Advancement for Multilaterals (TAML) level 5 system is among the latest of these offerings.

Mechanically simple to run, this innovative system utilizes a minimal number of trips to establish the junction and to achieve both mechanical and hydraulic isolation at a multilateral junction without cement.

In addition, it provides re-entry capabilities into both the main and lateral wellbores. Virtually any type of completion can be attached and run with this system.

This article describes the mechanical and operational functionality of the system and some of its potential applications.

SYSTEM DESCRIPTION

The TAML level 5 system incorporates many of the design features from existing proven systems, as well as from lessons learned during previous operations.

The system was developed in response to a need for:

• Providing hydraulic isolation of the window junction;

• Mechanically tying back the lateral liner to the main casing string;

• Optimizing the flow area of each producing string;

• Minimizing the number of steps or components to complete the junction.

Designed to utilize a standard pre-milled window and a drilling whipstock to facilitate casing exit, the system contains an internal sealing element to accept the polished stinger of the flexible hanger.

An integral packer element provides external sealing integrity.

The entire assembly is kept in place by a standard nipple profile and the Sperry-Sun latch system that is used in many multilateral systems.

The flexible hanger for the system is designed to deform as it is inserted into the junction, thereby creating a mechanical and hydraulic seal between the lateral and the main wellbore.

A vector block assembly above the flexible hanger ensures that re-entry tools travel through the main wellbore leg of the flexible hanger.

Lateral re-entry is accomplished by setting a tubing whipstock in the internal landing profile.

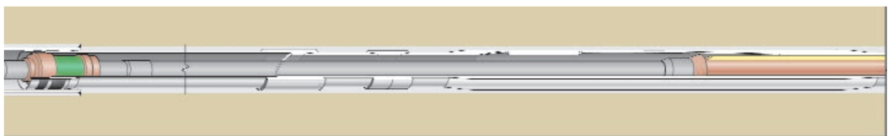
Re-entry tools can be run on either coil tubing or wireline.

The initial system specifications call for 9 5/8-in., 47-lb/ft casing and an 8 ½-in. lateral wellbore drill out. The specs also include a 5 ½-in. lateral liner, 1,000 psi pressure rating (burst/collapse), and a 4 ¾-in. bore equivalent flow area through each leg. Maximum tool size is 3 3/8 in. through the junction.

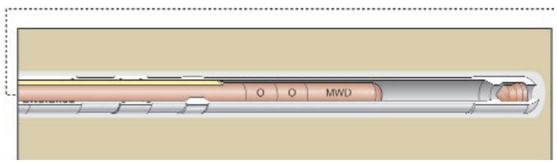
OPERATIONAL SEQUENCE

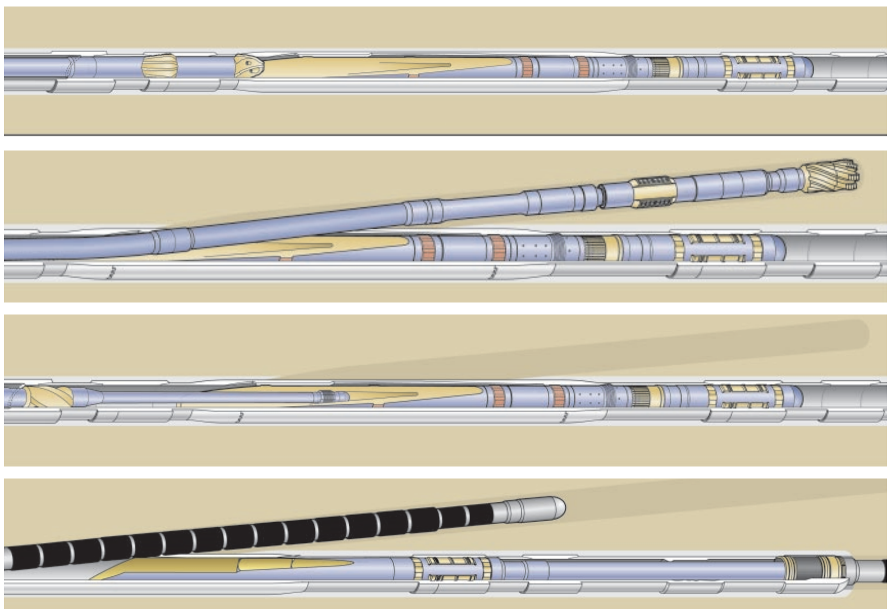
The following are key operational steps.

Step One: Drilling the lateral—The sequence begins with drilling out of a pre-milled window to create the lateral wellbore. This step is done with a traditional multilateral system and whipstock. Once the lateral has been drilled and the wellbore is stable, the drilling whipstock is removed in preparation for running the lateral liner and completion.



Multilateral junction construction begins with installation of a pre-milled casing window.





Key steps in the operational sequence for the TAML level 5 system include, from top to bottom: Installing the window; installing the whipstock; drilling the lateral hole section; retrieving the whipstock; and directing the bullnose into the lateral hole section.

Step Two: Installing the deflector—The system deflector assembly is then run into the lower latch assembly (landing profile).

The landing profile automatically orients the deflector toward the lateral window. The external packer element is energized, sealing the external main wellbore from the rest of the well.

Step Three: Running the lateral liner—The lateral liner and system hanger assemblies are then run into the hole. A bullnose on the lateral liner deflects off of the deflector assembly and into the lateral wellbore.

Step Four: Orienting the liner running tool—The liner running tool engages the upper orienting latch coupling.

The drillpipe is then rotated to engage the orienting latch assembly. The kelly mandrel is released from the latch assembly and the running tool stroke is initiated.

Step Five: Setting the hanger assembly—The liner running tool strokes through the orienting latch assembly as the hanger sets into the deflector assembly and engages the deflector's internal sealing element. The liner hanger packer is set.

Step Six: Removal of the liner running tool—The liner running tool assembly is then removed, and the lateral junction is completed.

Although there are several operational steps to this process, there are only two trips into the hole once the lateral is drilled.

One is to set the deflector assembly; the other is to run the lateral liner, the completion and the flexible hanger assembly.

There are several completion options, and the system can be run to the surface as a single or dual completion.

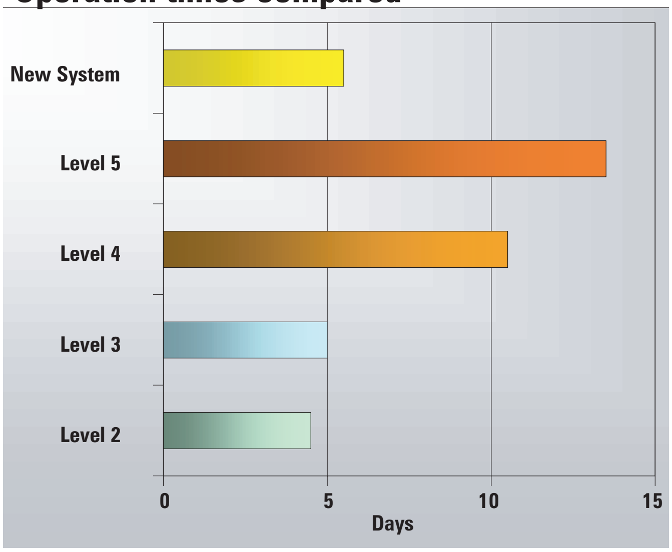
The top end of this system is similar to the TAML level 5 completion system already employed in many multilateral wells in the world. This system will provide selective re-entry and intervention capabilities in both the lateral and the main wellbore.

In addition, it will be possible to stack the systems to provide more than one lateral capability from a single wellbore if selective re-entry of the lower lateral is not required.

OPERATIONAL EFFICIENCIES

As previously mentioned, two of the primary drivers of new multilateral technology have been increased functionality and improved operational efficiencies.

Operation times compared



A comparison of operation times for generic TAML levels 2-5 is shown in the accompanying chart, a plot of TAML system level versus days to install.

For the numbers shown in this figure, these criteria were used:

- Multilateral junction at 10,000 ft;
- Trip time = 1 day;
- 2 days to drill lateral;
- Completion is an open-hole screen.

As expected, the installation time varies widely and generally increases as the TAML level and complexity of operation increase.

TAML levels 2-3 have short operations times but have some limitation as to completion and production capabilities.

A TAML level 4 has increased flexibility in regard to hole and completion size, but operation time has also increased.

The TAML level 5 system gives mechanical and hydraulic separation at the junction and allows for non-commingled flow, but operation times have increased still further.

The new system gives all of the functionality of the previous systems—re-entry capability, hydraulic and mechanical isolation at the junction, and non-commingled production capability. But it provides these functions at only a fraction of the operation time of the predecessor level 5 systems.

It is important to remember that this example has been made generic for demonstration purposes only. Specific systems could have different operating parameters which would affect the construction time.

Various operating conditions of the well could also have an effect depending on what is required to control them.

CONCLUSIONS

The multilateral service industry is advancing very rapidly both in terms of systems capabilities and operational efficiencies.

Advanced systems have dramatically increased the capabilities of the industry to deliver viable, commercial multilateral services that can have a large impact on field and reservoir development strategies. Now it is up to the industry to embrace these technologies and utilize them fully.