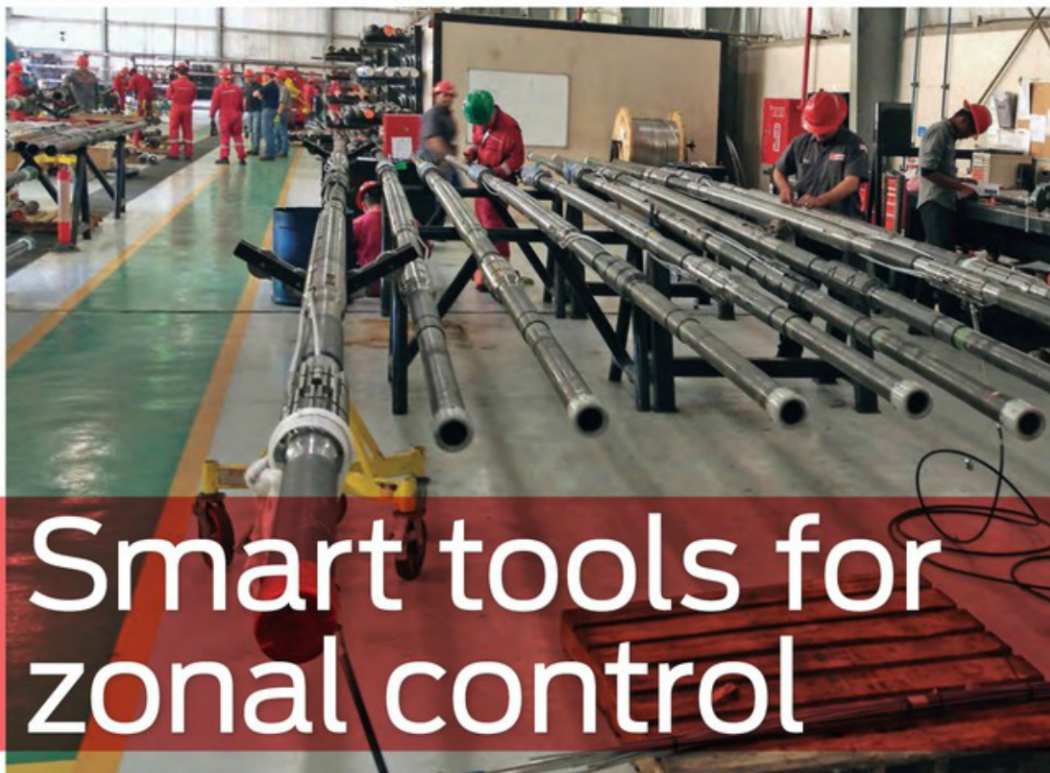




FULL CONTROL: The SmartPlex Downhole Control Module and pictured mounted (highlighted) on an interval control valve.



Smart tools for zonal control

A new electro-hydraulic downhole control system minimises control lines while providing increased zonal control. Jennifer Pallanich details how Halliburton's latest downhole technology can actuate multiple zones.

Halliburton developed the SmartPlex downhole completion system to selectively engage intelligent completion internal control valves.

"The SmartPlex system is about minimising control lines while increasing zonal control" in dry-tree applications, says Elias Garcia, Halliburton's global technical advisor for flow control. He sees the system as particularly useful for mature fields, where water production may be a concern, and extended-reach wells, where there are often many zones to stimulate.

The SmartPlex design helps eliminate the complexity of the installation and can remove some capital costs by requiring fewer control lines and connections, Garcia notes. The minimised number of control lines frees up real estate in the tubing hanger for other tools the operator may want to run.

Ahmed Jasser, Halliburton

region technical manager for intelligent completions, says: "Whether it's a three-zone system or a 12-zone system, we're running three lines.

It's consistent, as opposed to previous installations that may have six lines running, five lines running. With this one it's always going to be three lines running, which makes it modular and easier to integrate."

Using the SmartPlex system can also reduce the amount of time needed for actuations, according to Halliburton. In short, Garcia says, the system can actuate a zone in about half an hour because it does not need to pressure up and pressure down at every zone, a process that can take 20 minutes per valve position.

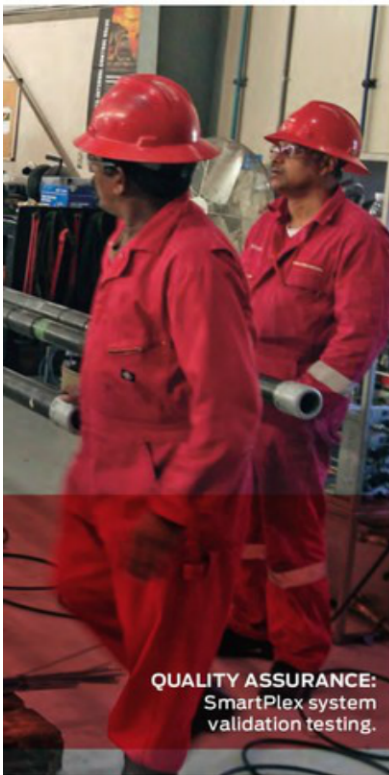
The SmartPlex system can accommodate 12 zones using two hydraulic lines and one electric line. Doubling the system capacity can provide control for



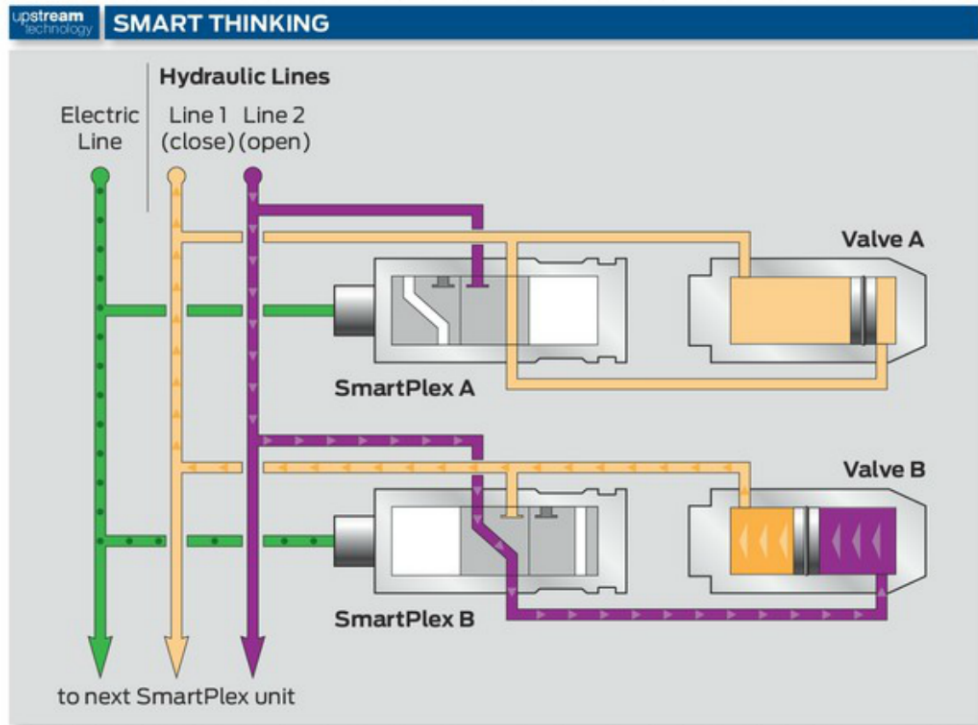
"Whether it's a three-zone system or a 12-zone system, we're running three lines."

Ahmed Jasser,
Halliburton

24 zones at the cost of a second electric line. "From a reservoir perspective, we help them to mitigate the amounts of water



QUALITY ASSURANCE:
SmartPlex system
validation testing.



CURRENT AFFAIRS: Electrically selecting SmartPlex system B creates the hydraulic circuit to operate Valve B while all the other valves remain balanced.

Images: Halliburton

ingress into the production stream," Garcia says. For example if two zones of 10 mainly produce water, it is possible to quickly shut those two off from the surface to maximise production.

An added benefit is that the quick shutdown from the surface makes it possible to fight back against water ingress, which can produce water-coning effects and damage a well, Garcia says.

Halliburton carried out its first field trial in April 2015 in the Middle East, and released the system soon after. "I've seen this go through all the phases of development," says Jasser, who has been on the system's engineering, product line and regional technical teams. "I'm a firm believer in this technology."

Halliburton can manufacture the SmartPlex at its facilities in Singapore and in Texas, where the system for the Middle East trial was made.

In that operation, wellbore clean-up through installation of equipment for the multilateral well took eight days. The field trial was originally designed around a nine-zone system, but due to the drilling complexity was reduced to six zones. "We are able to extend the

wellbore contact and help the client maximise recovery," Jasser says.

The SmartPlex system had been in the ground for the Middle East field trial for about 10 months as of January without issues. "The system response that we got during testing was great," Garcia says.

The control module, which Garcia calls the heart of the SmartPlex system, is electrohydraulic. Halliburton decided not to use a fully electric system partly because the company believes hydraulic fluid and pressure are the "best way to get the most force across that valve", Garcia says.

All-electric systems had reliability issues dating back to the 1990s, which colour the industry's view on all-electric systems.

"They couldn't survive the high temperatures and vibrations. We were putting these components downhole that were meant to be in your home PC," he says. "The tools that go out there in the field get treated pretty rough."

Since those early reliability issues, he says, the technology has evolved. The SmartPlex system uses diodes, which Garcia calls passive electric components. An active component would



"Most people are intrigued about how we get that many zones with a single conductor just by feeding current."

*Elias Garcia,
Halliburton*

be something like a micro-controller, which would require programming.

"The advantage of doing that is we only have a couple of electric components that we

need to qualify," which reduces failure points in the system and increases reliability, he says.

Halliburton sought to combine the best of hydraulics with the best of electric components. The hydraulic system brings a track record and high motive force, while the electric components provide faster actuation, faster system response, and the ability to engage more zones with fewer control lines.

"Most people are intrigued about how we're able to get that many zones with a single conductor and just by feeding current," Garcia says.

"They assume we need a communications protocol, which we don't. It's just the way we feed current through to the system... that allows us to selectively engage each one."

The system is qualified to 275 degrees Fahrenheit (135 degrees Celsius). At that temperature, the SmartPlex can "talk" to zones downhole to about 34,000 feet measured depth, while at 195 degrees Fahrenheit, it could reach over 40,000 feet MD.

"It's a simple, reliable system that gives us a lot of added features without any additional complexity," Jasser says. □