



Weatherford®

REAL RESULTS

Lower Completion Autofrac® System

Weatherford's Radio Frequency Identification (RFID) operated Autofrac system, which incorporates Autostim® flapper valves and ARID stimulation sleeves, permits remote activation of down-hole lower completion equipment. Eliminating the need for intervention and therefore saving clients the associated time and risk. The system further benefits from providing realistic contingencies. In the event of screen-out, the Autostim flapper valve of the next zone isolates the treated interval, allowing the clean-out of proppant laden fluid in a closed well environment without the need to mill out ball seats and/or plugs.

Challenge

The client required a system that could significantly reduce the time and risk associated with the stimulation of multiple zones in a high cost environment. Conventional systems have proven to be time consuming, particularly when trying to recover from premature screen-out.

Objectives

- Facilitate effective lower completion fluid change out with Weatherford's Thru-Tubing services integrated with the RFID Downhole Rabbit System (DRS) to confirm tool positions prior to stimulation operations.
- Stimulate and isolate each zone sequentially from toe to heel utilising the remote functionality of the tools with frequency modulated pressure pulses and RFID tags.
- Enable efficient clean-up through the remote opening on the Autostim Flapper Valves on staggered delays from toe to heel.
- Well test and flow well clean prior to handing over to production.

Item No.	Description
1	7" x 5" Liner Hanger
2	7" Liner Shoe
3	4-1/2" Swell Packer
4	4-1/2" ARID Sleeve
5	4-1/2" Autostim® Valve
6	5" Reamer Shoe



Figure 1: RFID Tag

Date
2015

Location
N Sea

Well Type
Gas Producer

Formation
Rotliegend Leman Sandstone

Well Depth
6300-6400m MD

Hole Size
6.0"

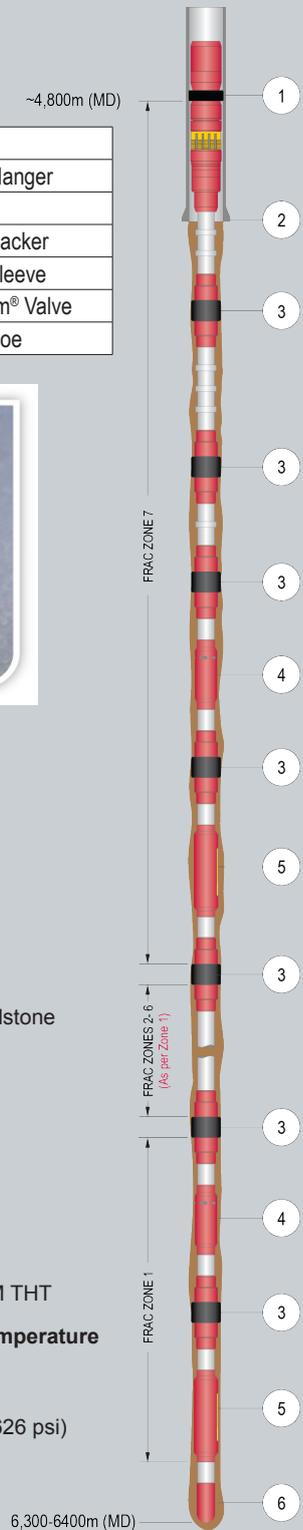
Hole Angle
90°

Tubing Size
4-1/2" 15 lb/ft P110 VAM THT

Bottom Hole Static Temperature
80°C

Reservoir Pressure
180-250 bar (2,611 - 3,626 psi)

Fluid
Brine



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Real Result RR 010 Rev 2



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Lower Completion Autofrac® System Solution

The Weatherford Autofrac Lower Completion system installed into the client’s well incorporated seven RFID Autostim flapper valves and seven RFID Advanced Reservoir Isolation Devices (ARID). These provided the operator with the means to remotely isolate and access the reservoir through the application of alternating frequency modulated pressure pulses to open the ARID sleeve and access the reservoir. RFID tags are circulated during stimulation to close the Autostim flapper valve post stimulation. The system was installed to a measured depth of 6300-6400m.

Results

The lower completion was installed 3 months previously and integrity tested against an Autostim valve located at the toe of the well (REF Real Result RR 009). Upon return to the well, the lower completion fluid (Low Solids OBM) was circulated out to clean brine which allowed the deployment of a smart RFID logging tool, the Downhole Rabbit System (DRS) in the clean-out string. This provides a precise report on the status of each RFID downhole tool which provided the operations team with effective on-site data and facilitated accurate and optimised decision making.

The first set of frequency modulated pressure pulses were sent from the client’s platform to remotely open the first ARID sleeve and to simultaneously activate the tools in the first section. Upon confirmation of access to the reservoir, the stimulation vessel was connected and the first treatment carried out.

During the 3ppg stage of the proppant treatment, the RFID tags were launched from the platform into the flow stream through a dedicated launcher line, which eliminates the need to alter critical flow rates. This commands the next Autostim Flapper Valve to close after a predetermined delay allowing completion of the proppant treatment and shut-in analysis prior to that zone being isolated. During the flush stage of the stimulation treatment, an early screen out scenario was encountered. This left 9ppg and 10ppg proppant laden fluid in the well bore. However this did not prevent the Autostim Flapper Valve from closing and allowing a barrier to which the well could be cleaned out against.



Figure 2: Main Frac through RFID ARID Sleeve



Figure 3: RFID Autostim



Figure 4: RFID ARID Sleeve

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Results cont.

Once the cleanout was complete, the next set of frequency modulated pressure pulses were applied to open the next ARID sleeve and thus gaining entry into the next zone. Once the formation breakdown of the next zone had been achieved, an ACTIFRAC frequency modulated pressure pulse was applied against the open formation to trigger the respective zones' Autostim flapper valve to open after a predetermined delay.

The operational sequence was then repeated moving up the well from the toe and allowing stimulation treatments to be completed in around 12 hours per zone from stimulation vessel hookup to disconnect. Upon completion of the final treatment, the clean out process was carried out in a full bore completion string without the need for any milling or shifting operations.

Value to Client

The client has sought alternative methods to the current market practices in order to utilise semi-smart technology to save time both in primary and contingency operations while performing multi-zone well stimulations.

The technology reduced the required number of coiled tubing runs and demonstrated the flexibility of the system to recover from screen-out scenario while retaining the system functionality and further permitting access to the reservoir beyond standard coiled tubing reach.

Client Feedback

"Overall RFID performance exceeded our expectations. We were expecting more CT runs for more zones."

- Client Production Technologist

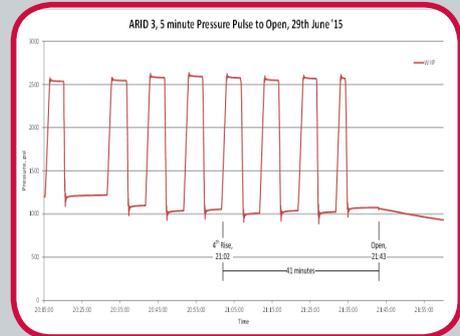


Figure 5: Pressure pulse to open ARID 3

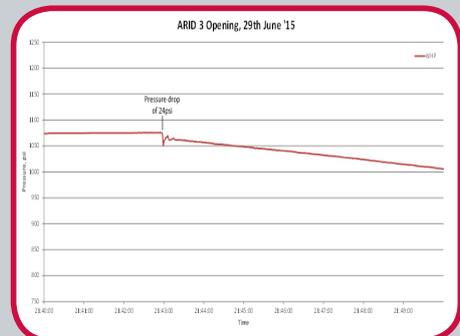


Figure 6: ARID 3 Opening

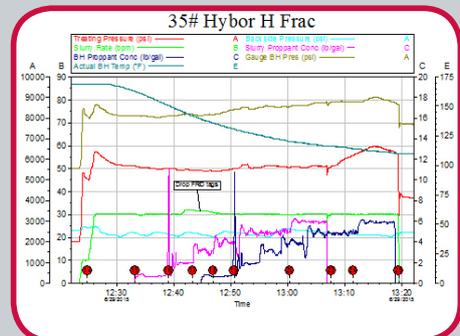


Figure 7: Main frac treatment zone 2

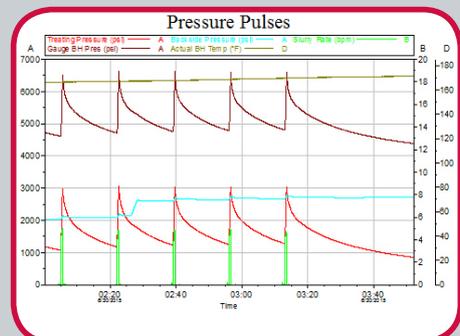


Figure 8: ACTIFRAC pulses to trigger delayed opening of ARID 3

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