Perforating and Pipe Recovery with Digital Slickline – First Application in Colombia - Ballena Field
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Ballena Field

Ballena is a gas field located in the Guajira state of Northern Colombia discovered in 1973, since its initial development in 1976. The Chevron production covers the 65% of demand in Colombia.

The main challenges found in the area include:

• Environmentally sensitive
• Locations near the shore line
• Wells between 28 and 37 years old
• Poor Cement quality in the intermediate and production casings
• Sustained annular pressure in many wells
Scope of the Project

Annular pressure due to tubing leak in all cases.
Main Challenges

- Four gas wells temporarily suspended at the end of 2011 via control fluids and mechanical plugs
- A decision was made to abandon 5 wells (Ballena 2, 4, 12A and 10, 12)
- Sustained annular pressure tubing-casing (A)
- No monitoring of B annulus pressure was possible
- Wells located along the shore line
- Not possible to mobilize a rig to locations eroded by the sea
- Limited footprint became a technical requirement for the interventions
- Through Tubing Operations
- No circulation possibility because low Reservoir pressure
- Multiple Tubulars Perforating
- Shallow Perforating Operations
Equipment Required on Location:
- Coiled Tubing Unit
- Cement Pump
- Electric Line Truck
- Slickline Unit

Estimated 10 days of operations per well

Original Abandonment Requirements
Digital Slickline

Digital data telemetry
- Integral coating to the standard slickline cable
- Real time two way communication
- Standard slickline compatible

Surface readout
- Head tension, Deviation, Acceleration
- Gamma ray, CCL, Pressure and Temperature
- Surface controlled jarring and tool release
- Perforating
- Production Logging
Case Studies - Location Layout
Ballena 4

Well Conditions:

- 3 ½”, 9.3 ppf Tubing
- Minimum restriction: 2.65”
- 7”, 26 ppf Production casing
- Perforations at 5,152’ – 5,172’

Job Requirements:

- Gauge runs (tubing)
- Blanking Plug retrieval
- Bullhead cement (500 ft)
- Tag cement top
- Perforate @ 2,000 ft using 2” gun to communicate 3 ½” + 7” + 9-5/8” tubulars
- Pump cement plug #2
- Calibrate tubing
- Chemical Cutter @ 30 ft
- Pump surface cement plug
• Rig-Up: 1 hr
• Gauge runs (1 ¾” to 2.3”): 2.5 hrs
• Blanking Plug Retrieval: 1.5 hrs
• 2 perforating runs @ 2,000’ and 294’: 2.5 hrs, 100% fired. With real time GR-CCL correlation
• 2 5/8” Chemical Cutter @ 15 ft
• Tension activated electronic firing head
• Entire abandonment operation completed in 6 days – Daylight activity only
Ballena 12A

Well Conditions:

- 3 ½”, 9.3 ppf Tubing
- Minimum restriction: 2.44”
- 7”, 26 ppf Production casing
- 39° max incl.
- Perforations at 6,188’ – 6,208’MD

Job Requirements:

- Gauge runs (tubing)
- Blanking Plug retrieval
- Bullhead cement (500 ft)
- Tag cement top
- Perforate @ 1,700 ft using 2” gun to communicate 3 ½” + 7” + 10 ¾” tubulars
- Pump cement plug #2 to surface
Ballena 12A - Operations

- Rig-Up: 1 hr
- Gauge runs (1 ¾” to 2.3”): 3.5 hrs
- Blanking Plug Retrieval: 2 hrs
- 1 perforating run @ 1,690’: 2.5 hrs, 100% fired. With real time GR-CCL correlation
- Tension activated electronic firing head
- Entire operation completed in 5 days – Daylight activity only
Results
Summary and Conclusions

• Ballena 4 and Ballena 12 A were successfully abandoned.

• Digital Slickline unit reduced the operating time by 50% as compared with the initial plan combining the footprint of a slickline setup and the versatility of a electric line truck.

• The total of the well interventions were performed with different tool strings configurations conveyed with Digital Slickline with real time data transmission including Gamma Ray, CCL, Pressure, Temperature, Tension and Acceleration.

• The perforating operations were performed using a tension activated electronic firing head with no failures and were effective to allow cement placement between the three strings and to recover the tubing.

• For the shallow depth chemical cutter an especial arrangement of anchors was proposed by product center and modifications to the pulleys array was done at field to improve firing sequence transmission.