Case study: West Virginia, United States

Lucida service delivered exceptional drilling performance with record-breaking four slimhole MAD wells

A customer tasked Baker Hughes to drill a series of wells with a challenging 6¾-in. curve and lateral sections in the Marcellus shale in West Virginia. The curve sections were planned with 8°/100 ft (30 m) buildup rate (BUR). The lateral section length would range from 9,000 to 11,000 ft (2743 m to 3353 m). The Marcellus is typically drilled in 8½-in. (215.9 mm) hole size, and for this slimhole application, it was critical to deliver first-rate drilling performance, maximize reservoir contact, and deliver excellent wellbore quality.

Baker Hughes proposed the **Lucida™ advanced rotary steerable service** for this challenging application and engaged a multidisciplinary team to configure the bottomhole assembly (BHA) and provide drilling parameter optimization.

The Lucida advanced rotary steerable service has a robust integrated BHA with a fully customized drill bit and multi-chip module electronics to deliver exceptional drilling performance. The **Dynamus™ extended-life drill bits** were specifically designed for this application with advanced drill bit directional control features, premium cutters, and a proprietary connection to handle the rigors of the challenging lateral section in the Upper Marcellus shale formation.

The Lucida service's automated wellpath trajectory control system integrates both azimuthal and inclination hold modes with continuous proportional steering to automatically correct wellbore trajectory for any formation trends. The automated wellpath trajectory control system, enabled by near-bit directional sensors, checks azimuth and inclination every millisecond. The integrated system automatically adjusts steer forces second-by-second for precise 3D control, even at very high penetration rates.

The planning and execution resulted in exceptional drilling performance for the four wells. All four wells drilled the curve and lateral sections in one run. The four wells are summarized in Table 1.

A key factor to deliver four slimhole MAD wells was the superior wellbore quality provided by the Lucida service. The average dogleg severity (DLS) in the lateral section was as low as 0.47°/100 ft (30 m) and only went as high as 1.04°/100 ft (30 m). The automated wellpath trajectory control system provided excellent control in both inclination and azimuth as demonstrated by the low average DLS in the lateral sections.

The multidisciplinary team planning, integrated BHA, and onsite execution produced four MAD wells, repeatedly setting the slimhole daily footage record and then breaking the record on the next well, delivering exceptional drilling performance.

Challenges

- Drill a one-run slimhole curve and lateral section
- Extend drilling performance
- Maintain low DLS in the lateral

Results

- Drilled four one-run curve and lateral sections
- Achieved four Mile-A-Day (MAD) wells
- Produced a slimhole record 7,226 ft (2202 m) drilled in 24 hours
- Delivered an average DLS of 0.47°/100 ft (30 m) to 1.04°/100 ft (30 m)

Well	Depth Out ft (m)	Interval ft (m)	Hours	ROP ft/hr (m/hr)	Average DLS in lateral °/100 ft (30 m)
1	16,006 (4879)	9,923 (3025)	50.27	197.4 (60.2)	0.77
MAD achievement: 6,918 ft (2109 m) in 24 hr					
2	15,088 (4599)	9,413 (2869)	42.05	223.9 (68.2)	0.85
MAD achievement: 7,160 ft (2182 m) in 24 hr					
3	16,768 (5111)	11,438 (3486)	46.95	243.6 (75.0)	0.47
MAD achievement: 6,623 ft (2019 m) in 24 hr					
4	20,480 (6242)	14,015 (4272)	52.73	265.8 (81.0)	1.04
MAD achievement: 7,225 ft (2202 m) in 24 hr					

Table 1 – Four single-run curve and lateral MAD wells drilled in the Marcellus shale

Baker Hughes