Case study: Malampaya Gas Field, Philippines

TeleCoil Intelligent CT Services saved 34 hours of rig time and an estimated USD 1.77 million

The Malampaya gas field is located 49 miles (80 kilometers) northwest of Palawan Island, Philippines. For over a decade, this gas field produced enough natural gas to provide half the electricity needed to power Luzon Island, the largest island in the Philippines. A recent drop in production prompted the major operator to execute the second phase of its field development plan, which called for drilling two additional wells.

During the first phase of development, the operator collaborated with Baker Hughes to conduct perforating operations using coiled tubing (CT). There were five wells in the first phase, and each required accurate correlation of perforation depth and unloading of the well with nitrogen to create underbalance prior to perforating. Because of the complexity of the operation, the Baker Hughes team made a simulation run with a dummy-gun bottomhole assembly (BHA) to make sure the BHA drifted and reached the bottom of the well as required. The simulation mimicked the actual perforating operation, except that the guns were not live. After reviewing data from the simulation run and confirming depth and expected downhole conditions, the Baker Hughes team completed perforation operations with live 4½-in. **Predator™ perforating guns**. This resulted in clean perforations on all five wells in Phase 1.

For the second phase, the operator wanted to minimize the time that the dynamic positioning double redundancy (DP2) semisubmersible rig needed to be in position. Because shifts in weather or sea conditions can cause the rig to disconnect from the subsea wellhead, the more time spent on location, the greater the risk. Baker Hughes proposed using the **TeleCoil™ intelligent CT service** to eliminate the need for an extra simulation run on each well. This solution would save a full day of rig time for each of the wells.

The Baker Hughes team carried out the operation in one run on each well, using TeleCoil CT services to provide perforation correlation and a BHA consisting of the **Guardian™ firing system** with an electronic bridge wire detonator, a backup hydraulic time delay MK II absolute pressure firing head, the Baker Hughes **StimGun™ propellant-assisted perforating system**, and 4½-in. Predator perforating guns.

A 656-ft (200-m) gun string was connected to the combination BHA for each well. The guns were armed at the surface, and were then run in hole to depth—10,915–11,571 ft (3327–3527 m) in one well and 11,847–12,503 ft (3611–3811 m) in the other. Casing collar locator (CCL) signals were used to confirm depth, and monoethylene glycol (MEG) was pumped to achieve a mixture of 25% MEG and 75% seawater in the wellbore.

Although the initial plan called for creating underbalance before perforating, fluid had been lost to the formation during drilling. The strategy was changed to perforate with an overbalance of pressure because the drilling fluid in formation would make underbalance less effective.

Challenges

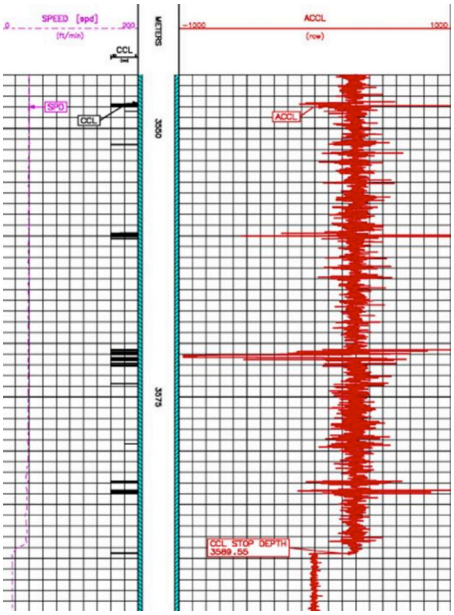
- Run operation from a DP2 semisubmersible rig
- Perforate 656-ft zones in each well (10,915–11,571 ft in one, and 11,847–12,503 ft in the other)
- Circulate, correlate, perforate, and stimulate in one CT run

Results

- Completed two high-rate, big-bore, subsea gas wells in single CT runs
- Saved 34 hours of rig time and an estimated USD 1.77 million
- Reduced operational and safety risks

Using CCL signals relayed to surface through the TeleCoil CT system, the team verified that the guns were at the appropriate depth and detonated them electronically. Permanent downhole pressure and temperature gauges indicated that the guns had fired as planned. The spent guns were then pulled out of hole and recovered at the surface without incident.

CT perforating operations—including time to run in hole, perforate, and run out of hole—took only 13 hours for each well. Compared to the 30 hours it took for CT perforating operations during Phase 1, Baker Hughes cut the operation time by more than half. Assuming an average daily rig rate of USD 1.25 million, using TeleCoil intelligent CT services with tubing-conveyed perforating (TCP) solutions from Baker Hughes saved 34 hours of operational time across both wells and over USD 1.77 million, all while reducing safety and operational risk.



The CCL log is used to confirm BHA position in the wellbore.