Lightning strikes and disables operation, but Halliburton’s MaxFire® electronic firing system delivers, saving USD 2.2 million in rig time

MaxFire electronic firing system performs as designed in extreme conditions

Location: Gulf of Mexico

Overview
During a challenging shoot and pull operation on a deepwater well in the Gulf of Mexico, lightning struck the derrick, disabling the top drive, draw works, roughneck, and compensator. This occurred while the perforating string, including the Halliburton MaxFire® electronic firing system (EFS) was at a depth of 3,500 ft (1067 m) above the proposed perforation target of 27,814 ft (8,478 m). This lightning strike shut down operations for 23-plus hours. Because Halliburton’s MaxFire electronic firing head was the primary firing head, an estimated USD 2.2 million of costs with having to trip out, check/repair/change the affected bottomhole assembly, and trip in was avoided.

CHALLENGES | SOLUTIONS | RESULTS
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Operator needed to perforate its deepwater well at a depth standard perforating solutions could not be utilized | The MaxFire EFS was utilized and is pressure rated to an industry-leading 40,000 psi (275 MPa), but can be set up to actuate with low pressure. This allowed Halliburton to perforate the well without exceeding pressure limitations of other downhole tools and equipment | The zone of interest was perforated at 27,814 ft (8,478 m) TVD with a temperature of +/-300°F (150°C) and pressure of 21,405 psi (1,478 bar). It was accomplished with 460 psi (32 bar) overbalance

Lightning struck the derrick disabling top drive, draw works, roughneck, and compensator for 23-plus hours | The MaxFire EFS is designed and tested to aircraft certification standards to withstand lightning strikes and electromagnetic interference | The reliable MaxFire EFS technology saved the operator from having to trip out of and trip in the well to check the survivability of the electronic firing head. This tool performed as designed and was able to survive the electrical discharge from the lightning strike, still performing to its designed parameters

Lightening strikes are no match for the MaxFire® electronic firing system in the Gulf of Mexico.
**Lightning proves no match for the MaxFire® electronic firing system**

Unexpected events caused by nature can slow or shut down operations for days or weeks, costing operators millions of dollars in the Gulf of Mexico. To increase reliability and ensure success under any condition, operators depend on new and existing technologies to complete and produce wells in a manner that is safe to personnel, environment, and equipment. When developing new technology, the unexpected must be taken into account, and these tools must address safety, operational flexibility, reliability, and be rigorously tested in extreme conditions (including weather, lightning, high temperature/pressure, etc.).

The Halliburton MaxFire® memory-based electronic firing system (EFS) meets these challenges. This safe, precise, and adaptable electronic firing system can initiate a gun system through a predetermined sequence of pressure cycles. Firing can be aborted with reset pressure, at any time, and the tool can last up to 30 days in extreme downhole conditions—the highest in the market. It can either be run on top or bottom of the gun. Additionally, the MaxFire EFS is designed and tested to aircraft certification standards to withstand lightning strikes and electromagnetic interference.

During a challenging shoot and pull operation, lightning struck the derrick, disabling the top drive, draw works, roughneck, and compensator. This occurred while the perforating string, including the MaxFire EFS, was at a depth of 3,500 ft (1067 m) above the proposed perforation target of 27,814 ft (8,478 m), which had a temperature of +/-300°F (150°C) and pressure of 21,405 psi (1,478 bar). This lightning strike shut down operations for 23-plus hours, costing an estimated USD 950,000 to repair the rig, inclusive of lost rig time.

The MaxFire EFS initiated the perforation gun with a low activation pressure of 460 psi (32 bar) overbalance. The overbalance was achieved with heavy and corrosive calcium bromide wellbore fluid. This tool withstood the electrical discharge from the lightning strike, provided assurance that the operation could continue as normal without tripping out and back in the well to check the tools, and had the flexibility to operate after the time delay related to the rig repair. Even with the damage sustained to the rig from the lightning strike, the MaxFire EFS performed as designed to successfully initiate the perforation string, saving the operator approximately USD 2.2 million by eliminating the costs associated with having to trip out, check/repair/change the affected bottomhole assembly, and trip in the well.