Electronic engines drive growth at Command Drilling

Derek Lowe, Command Drilling

THREE YEARS AGO, **Command Drilling Inc** committed to using electronically controlled diesel engines on its new drilling rigs and repowers.

Today, the Calgary-based contractor enjoys steady growth and a strong competitive position, thanks in part to substantial fuel savings, higher reliability and reduced maintenance made possible by engine electronics. One measure of success came earlier this year, when the **Canadian Association of Drilling Contractors** ranked Command Drilling number one in Alberta for the previous year with an overall 85% utilization rate on its 2 SCR electric and 8 mechanical rigs.

Another measure can be found in the company's growth, which has averaged 20% a year for the past 5 years.

Formed in 1986, Command Drilling is a mid-sized company with 150 employees, working mostly in central Alberta. The rigs, from 1,200-3,000 hp and capable of depths from 2,400-4,000 m, include 3 telescopic doubles, 2 cantilevered doubles and 5 cantilevered triples. An 11th rig, a mechanically driven cantilevered double, recently joined the fleet.

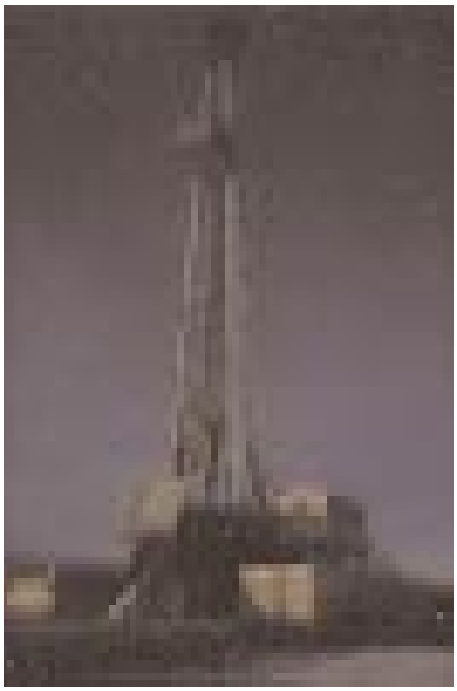
The 2 SCR electric rigs, built in 1995, are used mainly for underbalanced drilling in the Brazeau River region in southwestern Alberta. Electric power provides finer torque control for difficult "kick" conditions in that area.

COMPETITIVE PRESSURES

With 550 rigs operating in Alberta alone at the start of 1998, land-based oil drilling is intensely competitive. Drilling contractors are constantly seeking an edge, and Command Drilling found one in modern drive systems built on electronically controlled diesel engines.

All 8 mechanical-drive rigs, from brand new to 20 years old, have drawworks powered by **Caterpillar** 3406E and 3408E diesels equipped with an electronic control system known as HEUI (Hydraulic Electronic Fuel Injection). The company plans to power all new rigs with electronic engines and to gradually install electronic units to replace mechanical engines driving pumps on existing rigs.

Until recent years, the drilling industry favored mechanical engines, which were perceived as easier to service and maintain than electronic diesels. Command Drilling shared some of that perception and also questioned whether the lighter-weight electronic engines could deliver their rated horsepower in continuous service. Performance and reliability are critical in engines expected to log an annual 300 days of service, or 7,200 operating hours, at a rated speed of up to 1,800 rpm.



'Switched-on' drilling 'commands' attention: Command Drilling says its decistion to move to electronically controlled engines has helped improve efficiency and the firm's competitive edge.

SUCCESSFUL TRIAL

In essence, electronics enable significant horsepower increases from the same engine block. For example, the mechanical 3406 engine is rated at 360 hp, while the electronically driven 3406E delivers up to 525 hp.

Command Drilling tried its first electronic diesel in 1994 on Rig 6; a newly built cantilevered double. The company chose a single 3406 engine for the drawworks rather than using two mechanical 3306 diesels.

When the rig was placed in service and drilled past 2,100 ft, it was immediately apparent that the 3406E would consistently deliver the same horsepower to the hoist as the older configuration. The engine also responded far better to changes in load – a decrease in engine speed brought no corresponding drop in horsepower.

Just as striking was the improvement in fuel economy. The 3406E cut fuel consumption by 20%-30% over the previous configuration. Electronic engines in drawworks applications on the other rigs have shown similar results. On repowers of drawworks involving older rigs, fuel savings alone will provide full payback in two to three years.

Better fuel efficiency also means improved environmental performance. The electronic engines are virtually smokeless, even during startups and under variable loads. The electronic engines also help maintain constant drill rpm, ensuring optimum production while preventing bit damage that can result from excessive speeds in difficult formations. From the electronic control module, rig operators can easily preset the optimum engine speed and know it will remain constant without mechanical adjustment.

REAL-TIME MONITORING

The electronic control system monitors the engines in real time by way of multiple sensors that measure engine speed and timing, coolant temperature, oil temperature and pressure and other critical parameters. Sensor signals feed back to a microprocessor, which automatically adjusts the engine to maintain maximum power and fuel efficiency.

Operators can access information about the engine on an Electronic Modular Control Panel, also manufactured by Caterpillar. Fuel consumption can be tracked closely, hour by hour. In the event of an engine problem, such as overspeed, overcrank or high coolant temperature, the electronic system activates a warning lamp on the control panel and logs a diagnostic code.

These diagnostic codes can be used to cut troubleshooting time dramatically. For example, after a problem was detected recently on Rig 4, service technicians were able to pinpoint the problem and replace a fuel injector that had failed. This reduced downtime by 60%-70%.

Over time, the electronic system also

builds a complete running history of the engine. Operators can use the data to examine even small, intermittent engine problems, analyze what the engine was doing when the problem occurred, and adjust operating practices if necessary.

IMPROVED FUEL SYSTEM

Contributing to the electronic engines' efficiency is Electronic Unit Injection, which optimizes fuel delivery to the cylinders independent of engine speed. In a conventional engine, combustion efficiency decreases with engine speed because of a reduction in fuel injection pressure. Electronic unit injection eliminates this problem.

In 3406E engines, injection is mechanically actuated by way of a camshaft. In the 3408E, injection is hydraulically actuated by way of high-pressure oil delivered to each injector through a fluid manifold. In either case, engine sensors instruct the injector when to inject, at what pressure and for how long. Combustion occurs with optimum efficiency and minimum fuel consumption across the engine's entire operating range.

The HEUI system also substantially helps to increase durability and reliability by eliminating mechanical components such as the governor, injection pump, high-pressure fuel lines and nozzles.

CUTTING TRUCKING COSTS

To date, the electronic engines on the rigs at Command Drilling have logged more than 20,000 hours with no noticeable change in horsepower or fuel efficiency. According to company officials, there's no question the improved performance and savings on fuel and maintenance have helped the company's competitive position.

In addition, the modern engines' low weight to horsepower ratios have boosted efforts to reduce trucking and set-up costs. In a competitive market, saving in the cost of moving a rig can mean the difference between winning and losing business.

In line with this effort, the SCR electric cantilevered triples Rig 7 and Rig 8 are unitized, requiring just 20 truckloads, versus up to 40 truckloads for some older rigs. This can reduce trucking costs by $35,000 to $55,000, easily enough to make a difference in competitive bidding.

The new diesel engines contribute directly to the savings. The 3,000-hp Rig 8 is powered by two 3512 diesels. Previous engines of equivalent horsepower were so heavy that the generator set alone accounted for a truckload. By contrast, Rig 8's generator set and entire SCR building can be carried in a single load.

LOOKING AHEAD

As growth continues, Command Drilling continues to seek improvements in drive system performance. For example, on Rig 9, two 3408 diesels are coupled to 700 hp mud pumps via Pacific Rim gear reducers. This configuration enhances efficiency and eliminates maintenance associated with belts, pulleys and bearings on conventional drive systems. The Rig 9 engine/pump packages have logged more than 5,000 hours free of alignment problems.

ABOUT THE AUTHOR

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