By Colter Cookson

With oil prices supporting robust drilling activity and operators favoring longer laterals and greater proppant intensities, the demand for hydraulic fracturing services is increasing rapidly. In response, pressure pumpers are expanding capacity by bringing cold-stacked spreads back into the field and commissioning new ones.

"Requests for new equipment are becoming more common, but we see much greater interest in refurbishing and modifying equipment that was parked and often cannibalized for parts during the downturn," says Richard Cote, director of business development for Propell, a company that builds, upgrades and repairs completion equipment. Much of the refurb work involves converting 2,500 horsepower pumpers to 3,000 horsepower, continuous duty pumps, Cote says, explaining that they offer higher capacity and longer service intervals. He adds that many fleets are looking to standardize the equipment across their fleets so they are easier to operate and maintain.

"A few pressure pumpers who have had issues getting parts for their engines, transmissions, radiators and pumps gradually are transitioning those components to other brands that have larger and more robust support networks," Cote says. "From a control standpoint, companies are looking to become more self-sufficient. They want the ability to reprogram the controls without calling the original equipment manufacturer, so they are specifying more open control systems."

In some cases, Cote says clients request the safety and ease-of-use features available on new equipment. "For example, we have a unique driveline containment system. Like a traditional guard, it keeps technicians from falling onto the driveshift between the transmission and pump. It also protects employees from parts that might fly off if the driveshift fails.

"Other changes ease maintenance," Cote continues. "These include building platforms and stairs to give workers access to maintenance points, adding slide-out fenders so technicians have more space to stand as they work, and slide-out storage racks that make it easier to reach equipment generally resides in tight spaces."

Propell also can retrofit quick-change systems for engines. "These systems let a customer pull up with a service truck and use boxes to do an oil change in five or ten minutes, including changing out filter canisters," Cote describes. "They are much faster than crawling underneath the unit, pulling plugs and trying to collect oil in pans."

Cote says the company has similar quick-change systems for hydraulic systems and radiators.

"In addition to easing maintenance, some of the upgrades extend service life, Cote reports. As an example, he cites pre-cleaners that are installed ahead of air intake filters to keep dust from clogging them. "By putting better filters in fabrication systems, such as rare earth magnets or spinner filters, we have helped several fleets lengthen their service intervals," he adds.

Like frac fleets, coiled tubing companies are looking to expand their total capacity. Cote says, "Usually, they want to refurbish units rather than buy new ones," he relates. "There are fewer coiled tubing units on the market than there are frac pumps, so that is harder to do. But when equipment is available, refurbishing it costs less and eliminates the need to worry about complying with Tier 4 engine emission standards, which apply to all new-build equipment."

Cote adds that refurbishment is much faster, a major advantage with lead times to new equipment stretching into next year. He says many of the refurbishments involve finding ways to install larger reels that can hold wider-diameter coiled tubing without exceeding weight limits.

Twin pumps are getting more powerful, with requests for 2,400 horsepower units outpacing those for 1,200-1,600 horsepower units, Cote reports. "For new builds, we are developing a twin pump platform that meets Tier 4," he comments. "Like its predecessor, it will be loaded, with remote monitoring, as well as safety features similar to the ones on our frac pumps, including access stairs and pull-out storage racks for discharge piping."

Cote says the new twin pump will be ready by the first quarter of next year. Integrated Frac Fleets

Dragon Products LLC has been busy refurbishing frac spreads, says Bill Lang, the company's sales director for pumps and stimulation equipment. "However, we are seeing companies begin to ask if they are optimizing spend by refurbishing old equipment rather than going for new builds," he says. "In most cases, the answer is yes. But that is changing as the best of the cold-stacked fleets come into service and attrition takes its toll on the oldest equipment."

"Innovation Toward the end of 2017, Lang says, Dragon began receiving inquiries about new-build horsepower. "For both refurbishments and greenfields the answer is yes. But that is changing as the best of the cold-stacked fleets come into service and attrition takes its toll on the oldest equipment."

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new builds, we are getting interest from established well servicing groups, startups with investment bank backing, and exploration, drilling and production companies who are looking at entering the frac business," he comments.

"As always, these companies want their fleets to include technologies that provide cost efficiencies," Lang says. "For example, pumps are getting bigger, better and faster. The move from carbon steel to stainless steel fluid ends has increased runtimes from 500-600 hours to 1,200-3,000 hours, depending on the region. Also, radiators have gone from standups to laydowns that operate more efficiently, which keeps transmissions running at their peak.

Lang says Dragon can manufacture every major component in a frac spread except the radiator, the engine and the transmission. "We are looking at building integrated frac spreads. That will give well servicing companies several advantages, including lower purchase costs, one-stop support for all the equipment, and efficiency that the components will work together," he says.

Sand Delivery Systems

In addition to providing the spread, Dragon can build trailers for moving sand from the mine or transload facility to the wellsite. Gary Lidiak, who oversees the company's sand delivery products, says one of its best sand delivery systems is a trailer modeled after grain trailers that have been used in agriculture for decades.

"During the past 18 months, grain trailers have become increasingly popular for sand delivery," Lidiak says. "These trailers deliver sand by using gravity to drop it on a belt or hopper, a process that is faster, cleaner and easier than blowing it out with pneumatic systems. It also eliminates the safety hazards associated with using a crane or forklift to move sand boxes.

"Unfortunately, grain trailers are built to deliver agricultural products that generally weigh 65-75 pounds per cubic foot. Sand weighs 95-120 pounds, so it can cause reliability issues for repurposed trailers," Lidiak warns. "To provide an alternative, we applied our oil field technology to create a trailer that can deliver sand as quickly and efficiently as but has the severe-duty toughness to work for a long time.

The bottom-drop trailer features a heavy-duty drivetrain and a tough chassis, Lidiak describes. He adds that it uses welds rather than rivets except on a few places that do not need to bear the sand's weight, a boon for durability. "When we tested the trailer in the Bakken, the operators and drivers loved it," he comments. "The trailers ran well, even in the harshest weather."

Moreover, he notes, Dragon's system is topped with an aluminum lid rather than a tarp. "This keeps moisture out and eliminates the need to periodically repair the tarp," Lidiak says. He emphasizes that the trailer unloads quickly. "We have gone from optimum capacity to empty in nine minutes," he illustrates. "This is much faster than pneumatic systems, which can take an hour to an hour and a half to unload."

Pneumatics take so long in part because the driver has to hook up hoses before turning on the blower to empty the sand, then unhook them. Lidiak says. "With our system, all the driver does is pull out a conveyer belt, open the bottom hatch using a control in the cab and wait for the sand to empty. He never has to get out of the cab, lift hoses, or turn on blowers, so he is faster, safer and more comfortable," Lidiak concludes.

For hauling cement, barite and sand, he says Dragon soon will introduce a pneumatic trailer that combines a light-weight design with oil field durability.

Durable Fluid Ends

ST9 Gas + Oil’s curved fluid end has been a great success, assesses Chris Buckley, the company’s president and chief executive officer. "We have three companies that use the product and in nine to try it," he reports. "It is too early to tell how much the fluid end will extend equipment life, but it has been in the field since January with no issues, and our computations suggest it will last 14-19 percent longer than the best alternative fluid end in the current list."

Buckley attributes the fluid end’s long life to an unusual geometry. "Instead of creating a bore that is full of straight lines, we use curves from top to bottom and front to back in order to make the flow faster and reduce the chance of cavitation," he details.

Cavitation occurs when small, liquid-filled bubbles form within the liquid in low-pressure areas. When the pressure increases, the bubbles collapse and generate shock waves that typically wear out the pump, Buckley notes.

Superior materials also play a role in the design. For example, Buckley says. "We have worked with our vendors to optimize the formula and cleanliness requirements for the material, reducing the grain structure of the forging as much as possible, and optimizing the heat treating specification." Buckley says. "This makes our plungers smoother than traditional tungsten carbide plungers, allowing them to benefit from the material’s hardness without turning into and damaging the packing."

In bench tests, Buckley reports the company is evaluating another way to extend packing life. "We are moving the packing system from the fluid end out and on the stem, which is durable but also affordable," he says.

According to Buckley, a key part of customizing the ST9 Gas + Oil’s curved fluid end is what types of inclusions are acceptable. "What we typically disassemble and reassemble fluid ends once a week for maintenance," he mentions. "To simplify that task, we have developed a nut and plug combination that allows technicians to pull plugs without using slide hammers or crank mechanisms. Instead, they use a simple method of screwing the nut in and out."

This process eliminates the need for cumbersome tools and protects the technician’s fingers, Buckley says. "It is much faster," he adds. "We think it will cut the time required to get into the pump by 80 percent."

ST9 has re-engineered its plungers as well. "Instead of using the nickel-based hard-surfacing alloy typically found on most plungers, we only offer plungers made from tungsten carbide that has been heat treated in a way that minimizes porosity and optimizes the surface tribo­logy," Buckley says. "This makes our plungers smoother than traditional tungsten carbide plungers, allowing them to benefit from the material’s hardness without turning into and damaging the packing."

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Electric Fleets

In the meantime, Buckley indicates ST9 is focusing on perfecting electric frac fleets. "Electric fleets can be powered with field gas, which can reduce fuel costs as much 80 percent and cut a typical spread’s daily operating expenses by $40,000. The fleets also reduce emissions by 99 percent. At the same time, they improve safety by eliminating the need to pump diesel into running trucks and reducing the number of employees on site by 45 percent," he explains.

Electric fleets will benefit equipment longevity and community relations, Buckley argues, explaining that they produce 78 percent less vibration and 69 percent less noise than diesel fleets.

ST9’s electric trailers and pumps have been designed from the ground up for electric operation. Buckley assures. "Instead of pairing a big, off-the-shelf electric motor with a standard mechanical pump, we are using multiple small electric motors that communicate with each other," he relates. "This enables us to adjust the torque dynamically to provide the load among the motors to optimize performance."

That real-time optimization gives the pump a pure torque curve that minimizes kinematic bump ripple in the flow going into the well, Buckley reports. He says during bench tests the prototype will be in the field next year, with production models following in 2020.