

Pressure Pumping Update

June 2019



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Introduction

Market dynamics in the pressure pumping space have changed dramatically over the last 5 years

- Frac intensities due to well lateral lengths, sand loadings, higher pressures and higher injection rates are still growing, however growth has significantly slowed.
- Oil and Gas Operators have aggressively de-coupled frac services such as the supply of sand, diesel and chemicals. These services which were previously typically supplied by the pressure pumper are now in 70+ percent of wells being independently sourced by the E&P.
- Pumping efficiency continues to increase, pumpers are pumping more hours per day due to industry trends such as longer wells, more stages and continued increases in pad drilling as well as due to improved maintenance and operating techniques by the pressure pumpers themselves.

Pressure Pumpers are facing significant headwinds

- Significant overcapacity remains in the market, while new equipment orders have slowed significantly, retirements are well below levels previously forecast. Due to this the average age of the frac fleet continues to climb.
- Pricing on a per stage basis has eroded 12-15% since the second quarter of 2018, with US E&Ps facing strong headwinds in the near term, pricing is more likely to continue to erode than improve.
- The market is beginning to see some much needed consolidation, but new entrants continue to join the fray. Market dynamics are such that some small (1-3 spread) pumpers can quickly leverage personal connections to put new equipment to work. While this makes economic sense for these companies, the continued emergence of new entrants is damaging to the overall market.

There are still some levers pumpers can pull to improve financial returns

- Pumpers must focus on further improving pumping efficiencies on location, which is the primary driver of pumper profitability.
- Pressure pumpers must upgrade their fleets and focus on other ways to reduce repair and maintenance costs. While important for long term profitability, this is a difficult ask in an environment with little financing available where investors punish capex, and new fleet additions (without retirements) would grow the oversupply. Pumpers should also focus on reducing the number of personnel supporting a fleet.
- Finally, pressure pumpers should consider utilizing select technologies to improve their overall performance to increase efficiency and decrease R&M cost.

Keane C&J Merger

On June 17th Keane and C&J announced an all stock merger of equals valuing the combined company at around \$1.8 billion

- This is a positive both for the pressure pumping sector as well as the OFS sector as a whole . In our opinion, the market should consider further consolidation. Whether this transaction touches off, a wave of M&A remains to be seen and many such predictions have proved wrong in the past. All stock transactions are likely the only way major M&A takes place in the current environment, with investors forced to wait to recover potential gains. Given the highly fractured OFS sector, at a minimum these transactions can unlock significant G&A savings.
- C&J and Keane’s merger makes good sense if for no other reason than size (and cultural similarities) matter. Both were grown during the shale boom primarily from acquisitions of Tier II and Tier III players and both have worked hard at achieving consistency of products and services.
- Keane’s integrations of Trican and Rockpile have not been without hiccups, and sources indicate lingering issues remain. Similarly, C&J’s integration of Nabors was initiated at the beginning of the downturn of 2015-2016 and experienced significant issues initially. Properly executing this much larger integration will be key to recognizing the full value of this transaction.
- Some simple (but important) things to consider, C&J engineers, electric techs, mechanics, etc. typically receive a company truck, credit card and 14 days PTO. Keane is much less generous (typically no truck or credit card, and 7 days of PTO) and if the combined firm standardizes on Keane benefits to save money (as would be expected) staff retention may be impacted. One should never underestimate how important having your own truck is to field personnel.
- In addition, C&J brings cementing, coiled tubing and wireline to the mix. With the right funding and focus, they could become a completions company to be reckoned with. Note that neither company has significantly differentiated technologies and/or service components that currently differentiate them. The trend over the last few years has been towards more unbundling of services but the combined company may be able to counteract that trend. This is one battle where without proper execution the company could end up as the proverbial dog who caught the car. The reason E&Ps adopt bundled services is typically so they can have “one neck to choke” if something goes down on location. This typically also means that if a company is providing both wireline and frac and one is responsible for a shutdown they won’t be receiving even a standby rate for the other.

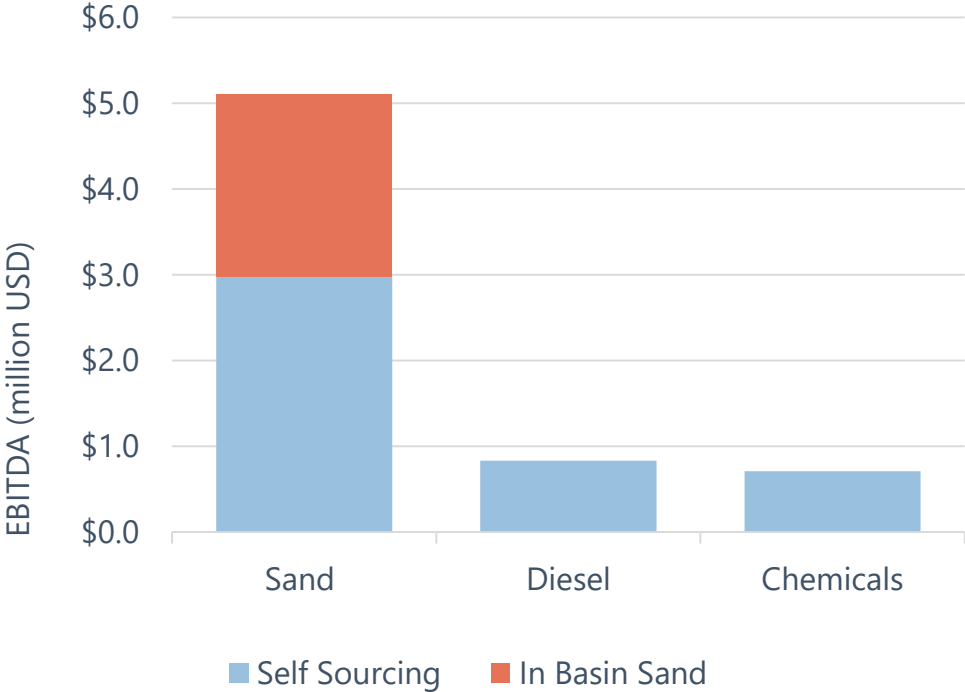
Keane C&J Merger (Continued)

Continued

- There are other pressure pumpers of similar size and capabilities that have the same problem such as BJS, PTEN, and FTSI to name a few. They need to do something to further differentiate themselves from the market and achieve critical mass. Consolidation seems like a reasonable outcome.
- A few of the mix have some differentiated technology. Liberty drives technology to maximize efficiency. ProPetro is a geographic play with a lower cost position, high utilization and a sprinkling of technology (DuraStim, electric). ProFrac has the newest fleet in the industry and a lower cost of capital due to vertical integration. These companies have a level of differentiation that may carry them further. Consolidation is one option, but they have others.
- HAL and SLB are in a different class. HAL is the biggest and the best and will remain that way. Size matters and HAL utilizes, maintains and deploys equipment better than anyone. SLB has differentiated technology but has done a poor job transferring that to their frac fleets. The acquisition of WFT's frac equipment (which was old and poorly maintained) did not help. SLB needs to hit it out of the park via a technology and/or innovation to remain viable in pressure pumping.
- The small, Tier III pumpers will have long term issues. They may be able to survive and even prosper in the short term but at some point, will have to reach a size and critical mass that is differentiated. They will struggle to do that in the current environment. Consolidation may be their only play.
- The electric pressure pumpers (US Well, Evolution, others) are the wild cards in this scenario. They will be favored in the short term for the obvious reasons such as environmental and lower operating cost (if they can deliver). Electric pumpers should continue to be favored and gather momentum. These companies will also be potential acquisition candidates for larger conventional pumpers.

Impact of Decoupling

Industry Average EBITDA Loss | Calash



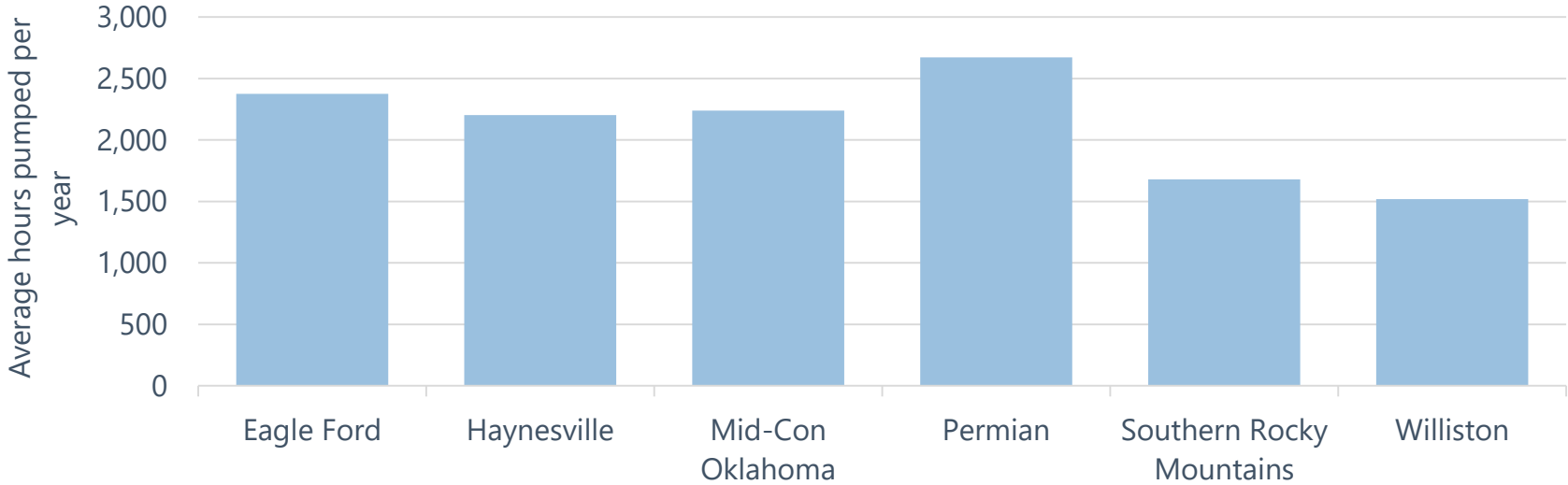
- One of the most pervasive trends in pressure pumping in recent years has been E&Ps decoupling supply of key frac ingredients from provision of pressure pumping services. Historically, sand, diesel, and chemicals were provided by the pressure pumper, who was able to attach a 5-15% margin when reselling these ingredients.
- Two to three years ago around 75% of jobs saw provision of these materials by the pressure pumper, whereas today the percentage supplied by pressure pumper is around 30%.

Pressure pumpers consistently underestimated how prevalent this decoupling would become.

- This led to pumpers investing in large inventory of now outdated assets associated with sand logistics such as transloads, rail cars, sand kings, trailers and even mines. This equipment (and often the debt and/or long term commitment associated with its purchase) now sits on company balance sheets providing little to no return for most pumpers.
- In the Permian Basin, E&Ps have very aggressively switched from northern, white sands sourced from the great lakes states to in basin sands which are significantly cheaper primarily due to the reduced logistics required. This has reduced income for pumpers both by lowering the per ton sand cost that pumpers supplying sand charge margin on, as well as by simplifying sand logistics (coupled with solutions such as sand boxes and silos) which pumpers previously managed. Nearly the entire savings of the switch to in basin sand has been captured by E&Ps.
- For spreads that have fully decoupled, this is estimated to be responsible for an around \$9 million EBITDA loss for an industry wide basis this has led to an around \$6.5 million Average EBITDA loss per spread per year. Margin on sand, diesel, chemicals was a major EBITDA contributor for pressure pumpers and decoupling has been one if not the largest head winds for pressure pumpers' profitability.

Annual Pumping Hours

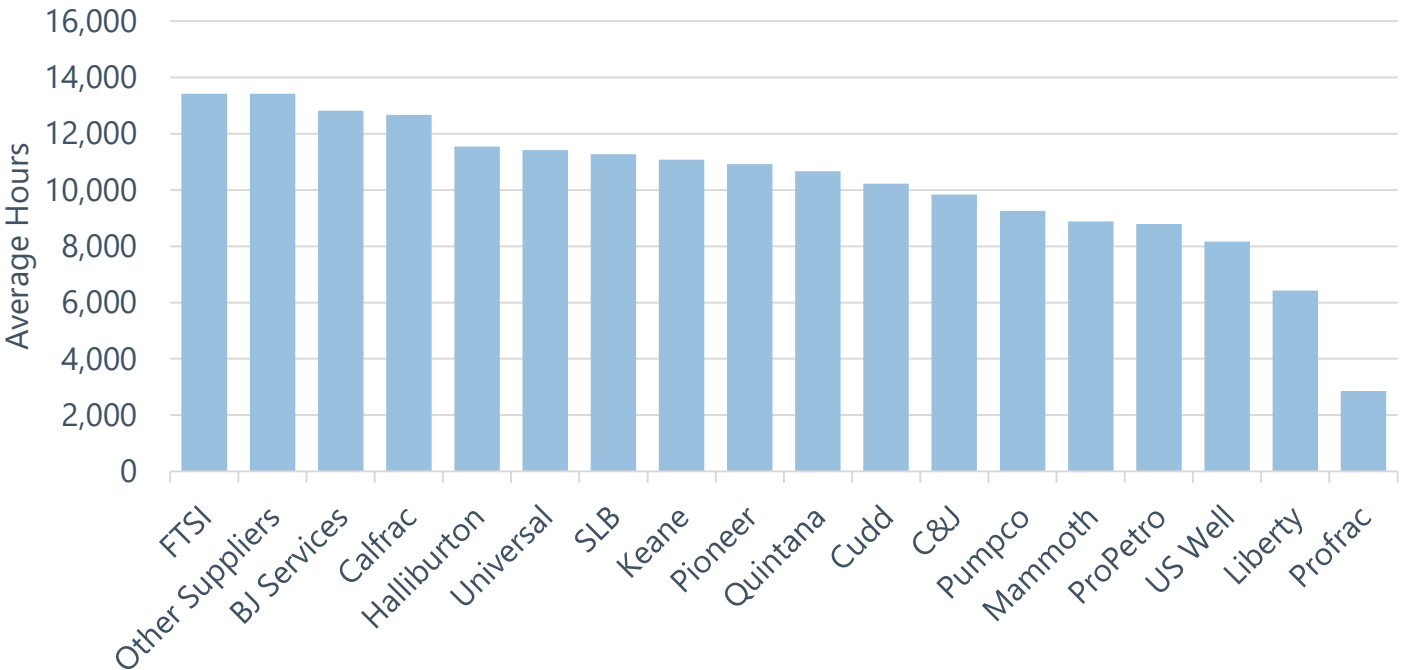
Representative Pumping Times | Calash



- As previously mentioned, one of the largest drivers of pressure pumper profitability is their ability to pump as many hours in a day as possible. Outside of factors that pumpers can control, such as equipment reliability, a number of other factors impact pumpers' ability to maximize pumping times, such as basin dynamics and associated equipment and services. For example, issues with wireline up time can significantly impact pumpers who may have no control over this if they are not an integrated service company. Pumpers may receive lower standby rates however.
- Basin dynamics also have a major impact on pumping time with factors ranging from distance between well sites, frequency of use of multi-well pads, and number and length of stages per well impacting the typical hours a spread will pump per year. While in theory pumpers should be, and are to a degree, compensated when variables outside of their control impact annual pumping times, in today's challenging environment pricing likely does not fully account for the outside variables.
- Where and for who a pressure pumper works has a significant impact on pumper profitability. In a less oversupplied market, pumpers would gravitate towards E&Ps who provided them better opportunities to pump more hours or price jobs accordingly.

Fleet Age Distribution

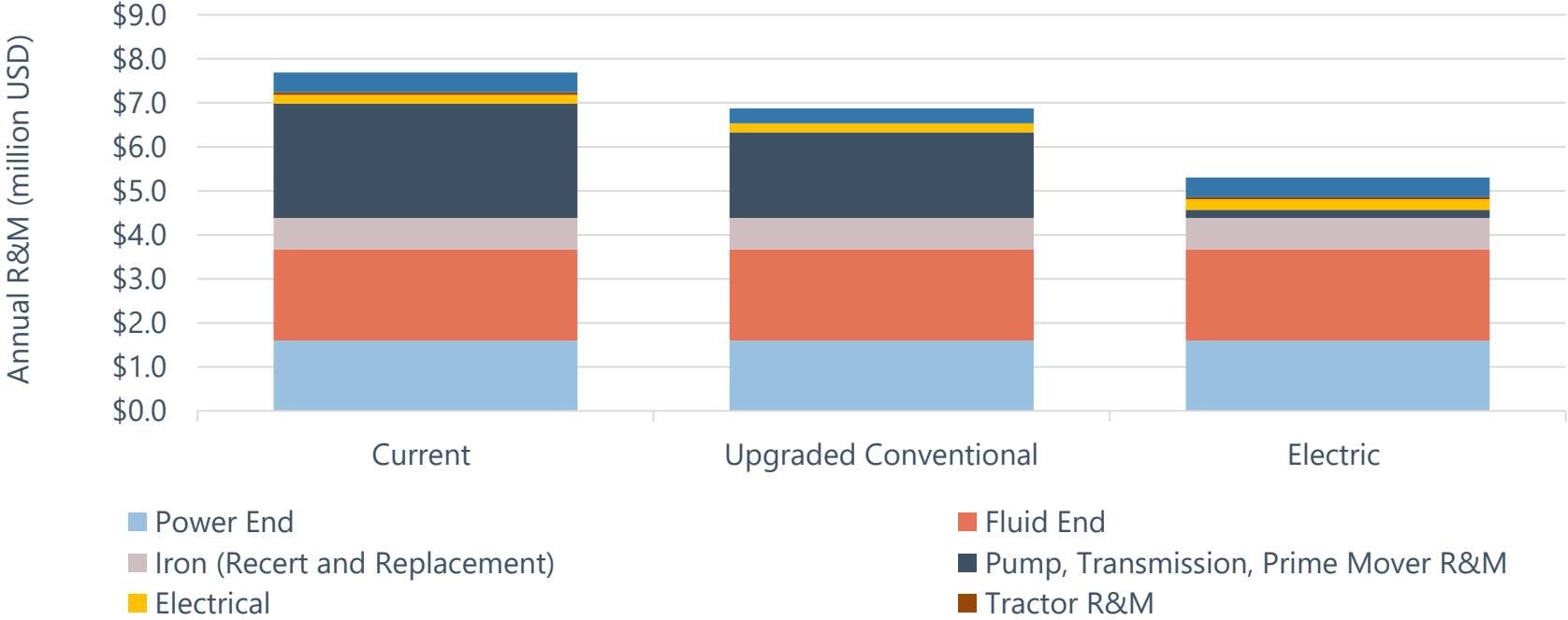
Estimated Equipment Age Distribution Estimate | *Calash*



- One of the largest factors in a pressure pumpers ability to maximize pumping time and thus profits is the condition of their equipment. While age is not the only factor in equipment reliability, it is a key one. Maintenance programs also play a key roll in equipment reliability, and well maintained older equipment can frequently out perform poorly maintained newer equipment. Issues impacting maintenance range from availability of capital to adoption of more advanced maintenance methods to the make up of fleets. Fleets that were purchased consistently by a pumper with similar engines, transmissions, and pumps are typically easier to maintain than fleets that were assembled through acquisitions.
- Overall, the US frac fleet is older than ever before due to a lack of investment in new capacity, reduced retirements, and historically high pumping intensity. Given the over supplied market and lack of available capital to invest in new equipment, the fleet will continue to age, increasing the importance of maintenance programs to pressure pumpers and their ability to remain profitable.

R&M Cost Comparison

Estimated R&M Cost Comparisons | Calash



- Repair and maintenance is one of the largest operating costs of frac spreads. Typical conventional frac spreads annual operating costs are around \$7.5 million. Though age and quality of maintenance regime play a major role. It's important to note that some pressure pumpers capitalize their fluid and power end replacement costs, which leads to lower quoted R&M figure (around \$6 million).
- Beyond new or better maintained equipment, operators have various options to structurally lower R&M costs including by adopting upgraded conventional fleets or electric fleets. Upgraded conventional fleets can reduce R&M costs by integrating upgraded cooling packages (extending engine and transmission life), re-configured maintenance stations (driving reduced down time and associated costs) and removal of tractors from location. Electric fleets can lower R&M costs by removing maintenance associated with engines, transmissions and radiators.

Frac Pump Comparison

Frac Pump Comparison (typical 45k HHP Spread) | *Calash*

	Standard Spread	Electric Spread	MGB Spread – Alternative
Initial Capital Outlay	\$27M	\$29M+\$22M	\$28M
Annualized Maintenance Cost	\$7-8M	\$5-6M	\$6-7M
Fuel Savings Capabilities	No	Yes	Yes
Emissions Reduction	None	80%	52%
Personal Reductions	None	20%	10%
Smaller Footprint	No	35%	35%
Sound Attenuated	No	Yes	Yes
Less pumps required for Operations	No	Yes	Yes
In field maintenance capabilities	No	No	Yes



Typical Standard Unit



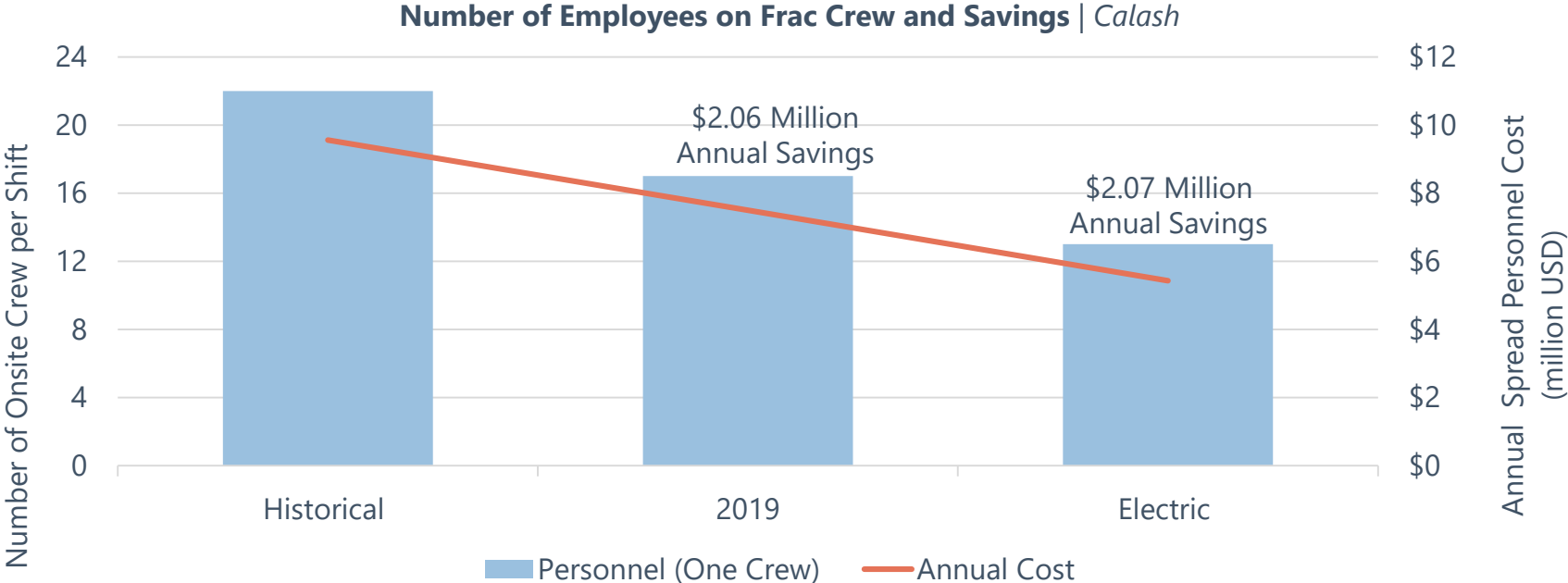
Electric Frac Unit (Lime)



MGB PumpCell Unit

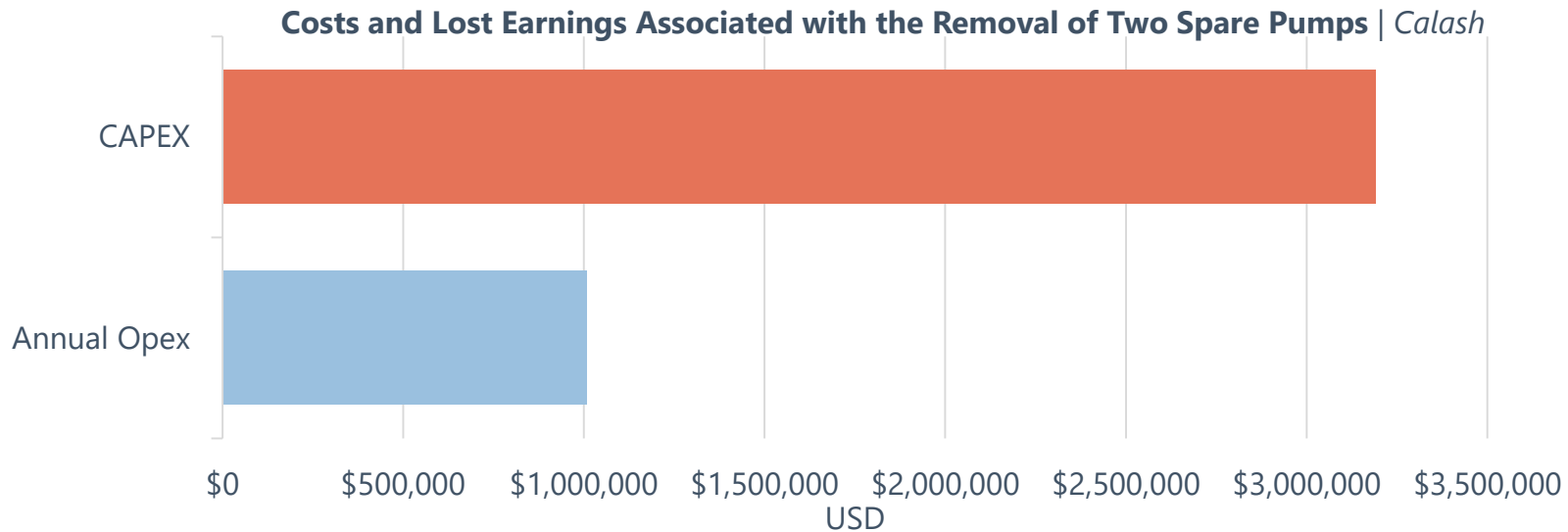
- While upgraded conventional and electric spreads can meaningfully reduce R&M costs and thus improve per spread annual EBITDA, electric equipment comes with higher capital costs. For electric spreads, the higher capital cost is primarily associated with the acquisition of turbines, long term turbines may be either leased or purchased. While initial feedback has pointed to minimal overhaul costs for turbines, the relative newness of this technology in pressure pumping at least leaves open some long term questions about the true cost of maintaining them.

Personnel Costs



- Pressure pumpers have reduced operating costs by reducing personnel on location. While some of these reductions are due to the types of frac jobs being pumped (with increasingly popular slick water fracs needing less personnel operating blenders and monitoring treatments than more complex gel or crosslinked jobs), a significant part of this reduction is due to the intentional removal of hands and technicians from location. Combined, this has led to around \$2 million annual savings for the typical frac spread based on a reduction of 22 to 17 personnel per shift.
- Electric spreads can typically be operated with even fewer personnel but require certain crew, such as master electricians who are more expensive and less readily available in the market. The early movers in the electric space have implemented training programs to overcome this challenge which should provide some protection from new entrants. Despite the potential to operate with fewer people on location, crewing requirements ultimately rest with the E&Ps, who have so far been reluctant to reduce crews below typical conventional spread levels.

Costs and Earnings of Excess Spare Pumps



- Hydraulic Horsepower (HHP) is required to pump at specific rates and pressures on the well and is the key measure of both spread and fleet pumping capacity. As an example, to calculate what HHP will be required to pump 90 BPM at 9,285 PSI, take the following steps:
 - Actual HHP required = (Injection Rate) x (Wellhead Treating Pressure) / (40.8)
 - Actual HHP required = (90 BPM) x (9,285 PSI) / 40.8 = 20,481 HHP
 - Divide that HHP by 0.70 to optimize pump life (20,481 / 0.70 = 29,258 HHP)
 - Add standby HHP to the Actual HHP required (**15,000 Standby + 29,258 Actual = 44,258 HHP**)
- An average Permian frac spread with 45,000 HHP on location has around 15,000 HHP of standby equipment which is moved onto the firing line as pumps are taken off line for maintenance or as equipment fails. This 15,000 HHP account for around 6 typical 2,500 HHP frac pumps. Although spare pumps will always be required as pumps need to be maintained, in recent years the ageing of the frac fleet has led to increased spares on location leading to larger spread sizes. Removing two spare pumps per spread = an implied EBITDA gain of around \$2.2 million per year if these pumps were to be redeployed to a new spread.

Reducing Equipment and Improving Efficiency

How can Pressure Pumpers reduce equipment requirements and improve efficiency on location?

- **Upgraded maintenance programs**

- Standardization of fleets- pumpers with similar equipment across spreads can better predict failures, improve maintenance programs and reduce procurement costs.
- Utilizing preventive diagnostics – better understanding typical equipment lifecycles and proactively maintaining fleets or changing out components that are common failure points can reduce downtime. However, overzealous or unnecessary maintenance can lead to increased costs.
- Consider predictive diagnostics (KCF SmartDiagnostics, Lime) – coupling vibration and temperature sensors with data gathering, machine learning, and virtual twins should lead to accurate failure prediction reducing downtime without unnecessary costs. While many pumpers and suppliers are investigating this technology it is still relatively unproven in the oilfield.

- **Consider upgrades for refurbished equipment**

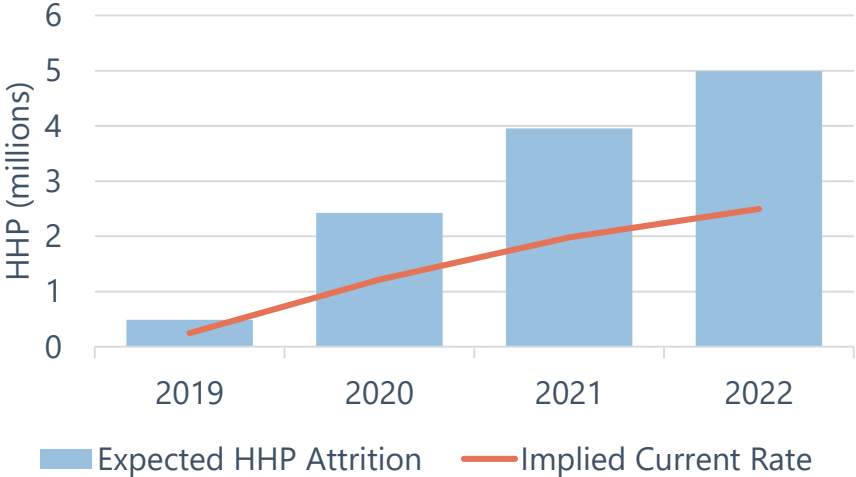
- The complete “zero hour” refurb cost for a frac unit is over \$1 million. Given the lack of investment in new equipment, pumpers should consider upgrading equipment with a view towards reduced R&M costs and increased efficiency.
- This can include upgraded radiators, maintenance stations and real time diagnostics packages, which add minimal cost (MGB Oilfield Solutions).
- Pumpers should consider installation of super duty pumps (such as those offered by Gardener Denver and SPM). However, results are still pending on the true economic return of the high initial cost of these pumps relative to their life cycle.

- **Consider purchase of next Gen equipment**

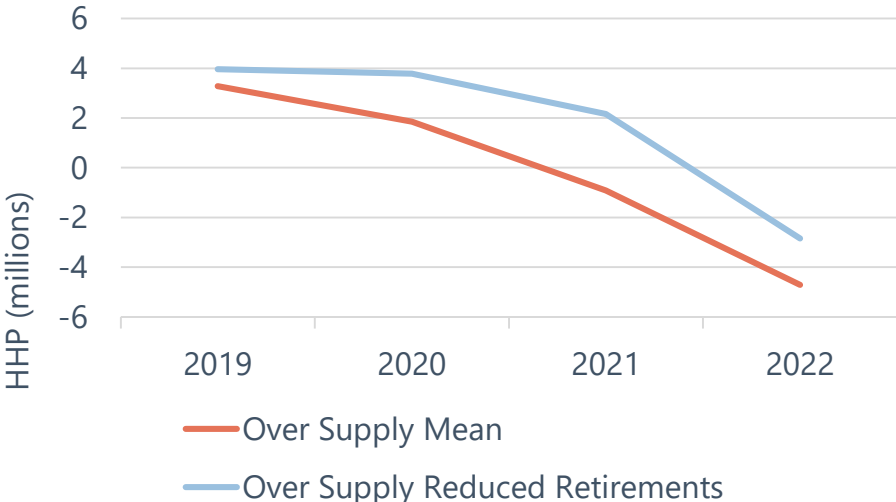
- High HHP Frac Units such as AF Global’s Durastim which reduce the number of trailers needed on location.
- Removal of tractors from location via power packs (MGB).
- Electric equipment (US Well, Evolution, HAL).

Fleet Attrition

HHP Attrition vs Implied Retirement at Current Rates | Calash



Frac Market Over / Under Supply | Calash



- Around one year ago, Calash completed a study based on frac fleet ages, typical refurb and retirement ages, and predicted annual hours (taking into account utilizations, typical regional well profiles, and other factors) forecasted attrition for the US pressure pumping fleet. Through 2018 and 2019, actual fleet attrition is running at roughly half the previously predicted rate.
- Pressure pumpers are retaining old equipment, likely due to a relative inability to order new equipment and a desire to maintain assets on their balance sheets. Most new equipment orders are either replacement orders for existing fleets or new pressure pumpers standing up fleets.
- If this trend of reduced attrition continues the long term outlook for market oversupply is expected to be much worse than previously predicted. In this case, continued depressed conditions for pumpers and continued pricing pressure should be expected. Based on current supply and demand trends, market balance will likely not be achieved until 2022.
- If this scenario is accurate, pumpers and their investors can expect a rough few years. Pumpers who choose to wait and hope for improved conditions will likely struggle and may see reorganizations. Given these conditions, focusing on operational efficiency, reducing operating costs, and (hopefully) consolidation will become a necessity rather than an option.

Conclusions

- **Market dynamics have changed dramatically over the last 5 years. Unfortunately, uncertainty in the US oil and gas market continues to increase**
 - The majority of efficiency gains and associated savings over the last 5 years have been captured by oil and gas operators. Coupled with changes in procurement and general market oversupply (which is expected to remain for the next 2+ years), pressure pumpers have seen flat to eroding per fleet EBITDA despite the market recovery.
- **Pressure Pumpers MUST change their business model in order to prosper in this environment**
 - Pumpers must upgrade maintenance programs and/or standardize existing equipment. Pumpers should invest (selectively) in new technology to increase efficiency and reduce R&M costs. While ordering new equipment is one way to accomplish these goals the lack of available capital, lack of support for public companies orders, and potential to worsen the oversupply if equipment is not retired means new equipment ordering should be muted. To succeed in this market, a pumper must focus on operational efficiency on location (+70% pumping time).
- **There will be winners in this market**
 - Winners should include companies with a strong focus on maintenance and utilization (HAL), a focus on operational efficiency (LBRT), investment in incremental technology (ProFrac, PUMP), and ability to (selectively) bundle effectively (CJ/Keane).
- **As well as underperformers**
 - Such as pumpers grown via acquisitions and resulting mismatched fleets, providers with limited customer diversification, and pressure pumping tourists who have a relatively small presence in a single geographic region and/or are not primarily focused on pressure pumping as a part of their overall portfolio and are not committed to the market.
- **The jury is still out on electric fleets**
 - Electric fleets are compelling technology with huge potential upside (reduced footprint and emissions, less personnel). Though, the total cost of ownership may be a wash given the potential for higher R&M and capital costs. E&Ps with a focus on ESG should continue to adopt these fleets. Like every other development in the last 5 years, the majority of savings could be retained by O&G operators.

Author Bios

John Jameson

John is a senior executive with proven experience in running all facets of an integrated oilfield service company. He currently holds Board positions and has been involved in start-ups with six private equity and privately held Oilfield Service companies. John is a former President of Weir Oil & Gas' Pressure Control division; covering Wellheads, Drilling and Completion Rental Services and Frac Flowback capabilities. From 2010-2012 John served as President & CEO of Universal Pegasus where he was directly responsible for all aspects of oil and gas engineering. From 2010 to 2012 he was SVP of Weatherford International (US region) with direct responsibility for all aspects of Weatherford's US business units. Prior to that John held multiple senior positions at Weatherford including managing their US pressure pumping business and product lines including Progressive Cavity Pumps (US), Completions and Production Systems (Mexico) and all product lines in Canada.

Sean Shafer

Sean has led or worked on over 100 transactions in the OFS and E&P space. Prior to joining Calash he managed the consulting practice at Quest Offshore, a leading oil and gas data provider and consultancy. He has experience working on diligence and strategy projects across industry sectors for clients ranging from small service companies, to mid and large PE firms, to large E&P companies. Sean's industry experience also includes positions ranging from data analyst to field positions at a Russia based well service company. Sean is also a recognized expert on the economic impacts of the oil and gas industry having testified before U.S. House and Senate Natural Resources Committees and as other U.S. regulatory officials.

About Calash

Calash is a strategy consultancy staffed by seasoned experts with deep experience across the energy, natural resources and industrials markets.

The team's technical and commercial competence comes from a wide variety of backgrounds with an emphasis on energy and industrials.

From our roots in oil and gas, we have successfully expanded into other industries, including mining, renewables, aerospace, utilities and defence.

Having successfully grown and sold our own businesses, we understand the quantity and complexity of the issues managers face in daily operations.

We have many years of working in private and publicly owned businesses, leading start ups, MBOs, running small and billion-dollar revenue businesses, delivering cultural change and restructuring, accelerating growth organically, through acquisitions and integration, executing in technically and operationally difficult environments.

We have lived and worked in every global region; we understand the challenges of managing and growing businesses in unusual and challenging cultures.

We operate from offices in Aberdeen, London, Houston, New York and Sydney. Complementary expertise within the Group comes through Candour Energy, Consultancy-led analytics and Calash Environmental services.

We have completed over 600 projects in commercial, technical and operational due diligence, strategy, market advisory work and restructuring.

Client Comments

The Calash team offers in-depth analysis supported by a team with deep energy experience and expertise. Our team worked with Calash to develop a proprietary market model that not only helped support our initial investment decision but also inform our business strategy going forward. The unique background of the Calash team helped bring a differentiated perspective to our engagement with the hands-on operational experience of the team allowing us to explore specific market and business drivers not typically addressed in more high-level market studies.

Director, US Based Equity Fund

Calash are highly knowledgeable about the sector, with a hands-on approach speaking volumes of their time in the industry. They are pragmatic and commercial in their review and approach. Their outputs and reports are concise and tailored to the end-user. They provided a dynamic exchange of thoughts and were very responsive.

VP, UK Based Private Equity Fund

The Calash team's 'hands on' industry knowledge, global capability and professionalism is of the highest level. Perhaps unusually for many technical consultancies, their senior staff seem to have a good understanding of deal structure and what is relevant to financial clients. They have also proved themselves to be extremely flexible and accommodating.

Head of Research, Multi Strategy Investment Fund

Contact Us



Houston

2990 Richmond Ave. Suite 480
Houston TX 77098
+1 713 266 0631

London

3rd Floor, 2 Portman St
London W1H 6DU

+44 203 795 0075

s.shafer@calash.com

New York

Americas Tower, 1177 6th Avenue
New York 10036
+1 212 392 4809

Aberdeen

13 Golden Square
Aberdeen AB10 1RH

+44 1224 637017

j.jameson@calash.com

www.calash.com

Sydney

5 Forest Road, Double Bay
Sydney NSW 2028

+61 2 9363 3024

c.lynch@calash.com