Outline

• Introduction
• Shaker Technology
• Case Study
• Summary
Derrick Corporation

- Over 60 Years family owned and operated
- Vertically Integrated Manufacturing
- 500,000 SF of Manufacturing
  - Recently installed 3rd largest overhead crane system in US (next to Boeing and Caterpillar)
- 700+ employees worldwide
- >20% employees with >20 years

1st – Solids Control Equipment
1st – Performance & Reliability
1st – Post Sale Support
1st – Rig Related Equipment
1st – Land Based Drilling Applications
7 Years in a row!
Hyperpool
4-Panel High G Shaker
Shale Shaker Performance

Performance GENERALLY defined by:

• Capacity
• Solids removal
• Dryness of solids discharge

Performance is affected by:

Shaker / screen properties:

• Screen cut point
• Screen conductance
• Total screen non-blanked open area
• Shaker conveyance rate
• Shaker deck angle

Drilling fluid properties:

• Liquid phase viscosity
• Quantity of solids
• Size of solids
Shale Shaker Performance

Shaker/screen properties effects on performance

<table>
<thead>
<tr>
<th></th>
<th>Increase Cut Point</th>
<th>Increase Conductance</th>
<th>Increase NBOA</th>
<th>Increase Conveyance</th>
<th>Increase Deck Angle</th>
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</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>↓</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Solids Removal</td>
<td>↑</td>
<td>—</td>
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<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Dryness</td>
<td>↓</td>
<td>↑</td>
<td>↑</td>
<td>↓</td>
<td>↑</td>
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</tbody>
</table>

Drilling fluid properties effects on performance

<table>
<thead>
<tr>
<th></th>
<th>Increase Liquid Viscosity</th>
<th>Increase Quantity of Solids</th>
<th>Increase Size of Solids</th>
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</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Solids Removal</td>
<td>—</td>
<td>↑</td>
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</tr>
<tr>
<td>Dryness</td>
<td>↓</td>
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<td>↑</td>
</tr>
</tbody>
</table>
Shale Shaker Performance

- G's Reduced
- Conveyance Declines
- Degenerative Performance Cycle
  - Live Weight Increased
  - Discharge Rate Decreased
  - Increased Solids Loading
Fluid Centering Technology

- Concave screen bed design
- Maximize hydraulic impact to fluid
  - High G’s (>8)
  - Pond Depth
Single-Side Compression

• Cam-Style Screen Compression System
  – 80 Pound force on handle produces 2,000 lb-force on each panel
Single-Side Compression System
Single-Side Compression

- Compression on complete length of screen
- Maintains even screen to deck contact
- Provides even panel compression
• Simple / Quick Operation
  – < 45 Seconds per panel
  – One person operation

• Consistent, Reliable Compression

• Reduced Maintenance Costs

• Lighter Screen Weight
  – 16 lbs vs. 22-45 lbs
  – HSE benefit
  – Reduced packaging & shipping costs
Screen Retention System

Wedge System

Compression System
Compression System

- Bypass Prevention
  - Uniform Panel Pressure Distribution
Pretensioned Panel Bypass

Dynamic Condition
Deck Angle: +3 Degrees
Screen Angles: +3, +8, +8, +8 Degrees
Flow Rate: 350 GPM
Compression Panel Bypass

Hyperpool
Dynamic Condition
Deck Angle: +8 Degrees
Screen Angles: +8, +8, +8, +8 Degrees
Flow Rate: 350 GPM
Bypass Determination

Volumetric Bypass Test Comparative Results

- **Hyperpool PMD Blanked Panels**
  - 13.9% Bypass
- **Pretensioned Blanked Panels**
  - 17.2% Bypass
  - 24.2% Bypass

Graph showing GPM Processed vs. Shaker Feed Flow Rate (GPM) with data points for different bypass percentages.
S. Texas Study - Previous Setup

- 3 Rig Owned Shakers
  - Utilizing API 170 Screens throughout OBM Section
- 2 Rental Drying Shakers
S. Texas Study - Current Setup

- 2 Hyperpool shakers
  - Utilizing API 170 screens
  - Processed 100% of Flow
- 1 Rig Owned Mud Conditioner
  - WAS NOT USED THROUGHOUT TRIAL
Discard Analysis Comparison

Oil On Cuttings

Average 15% reduction in OOC

Well Section

KOP LP TD

% wt OOC

25% 10% 11%

Previous Equipment*

Hyperpool Shakers

*OOC Values from comparable wells were taken from discard of drying shakers.
LGS Summary

Low Gravity Solids - TD

- Previous Equipment Average: 12.5%
- Hyperpool Average: 10.7%

%vol

<table>
<thead>
<tr>
<th>Previous Well 6</th>
<th>Previous Well 5</th>
<th>Previous Well 4</th>
<th>Previous Well 3</th>
<th>Previous Well 2</th>
<th>Previous Well 1</th>
<th>Hyperpool Well 1</th>
<th>Hyperpool Well 2</th>
<th>Hyperpool Well 3</th>
<th>Hyperpool Well 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>9%</td>
<td>10%</td>
<td>11%</td>
<td>12%</td>
<td>13%</td>
<td>13%</td>
<td>12.5%</td>
<td>10.7%</td>
<td>10%</td>
<td>11%</td>
</tr>
</tbody>
</table>
OBM Normal Losses

- Transferred
  - In
  - Made On Location

OBM Normal Losses
- Cuttings
- Evaporation
- Behind Casing

OBM
- Transferred to next well
- Transferred to Mud Plant

Mass Balance Control Volume Well Location
$\text{OBM(out)} - \text{OBM(in)} = \text{Losses}$
OBM Normal Losses

OBM Usage

Previous Equipment Average: 946 bbls

Hyperpool Shakers Average: 547 bbls
• Reduced number of truck loads to/from mud plant by 15 loads over 6 wells

Mud swap-out criteria: $D_{50} \leq 10\mu m$
Transportation

• D50 below 10µm
  – ½ Volume sent to next well & ½ volume sent to Mud Plant
• Historically this took place every 3rd well adding 15 truck loads to that well’s rig move
• Currently: additional trucking cost is every 6th well

Mud Plant
Well 1
Well 2
## Rig Cost Savings Summary

<table>
<thead>
<tr>
<th>Well</th>
<th>Previous Well 1</th>
<th>Previous Well 2</th>
<th>Previous Well 3</th>
<th>Previous Well 4</th>
<th>Previous Well 5</th>
<th>Previous Well 6</th>
<th>Hyperpool Well 1</th>
<th>Hyperpool Well 2</th>
<th>Hyperpool Well 3</th>
<th>Hyperpool Well 4</th>
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</thead>
<tbody>
<tr>
<td>OBM Interval Depth (MD)</td>
<td>13562</td>
<td>10315</td>
<td>10778</td>
<td>10315</td>
<td>11371</td>
<td>11422</td>
<td>10910</td>
<td>10899</td>
<td>9360</td>
<td>12832</td>
</tr>
<tr>
<td>TD Date</td>
<td>1-Jul-12</td>
<td>27-Jul-12</td>
<td>17-Aug-12</td>
<td>7-Sep-12</td>
<td>29-Sep-12</td>
<td>23-Oct-12</td>
<td>20-Jan-13</td>
<td>10-Feb-13</td>
<td>20-Mar-13</td>
<td>10-Apr-13</td>
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<tr>
<td>Solids Control Equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3ea Rig Owned Shakers</td>
<td>2ea Rental Drying Shakers</td>
<td>2ea Hyperpool Shakers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>OBM Normal Losses (BBL)</td>
<td>1286</td>
<td>738</td>
<td>1036</td>
<td>965</td>
<td>873</td>
<td>777</td>
<td>481</td>
<td>736</td>
<td>618</td>
<td>353</td>
</tr>
<tr>
<td>Cost of OBM ($150/bbl)</td>
<td>$192,900</td>
<td>$110,700</td>
<td>$155,400</td>
<td>$144,750</td>
<td>$130,950</td>
<td>$116,550</td>
<td>$72,150</td>
<td>$110,400</td>
<td>$92,700</td>
<td>$52,950</td>
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<tr>
<td>Dryer Shaker Rig up/Down &amp; Mobilization Cost</td>
<td>$3,600</td>
<td>$3,600</td>
<td>$3,600</td>
<td>$3,600</td>
<td>$3,600</td>
<td>$3,600</td>
<td>$0</td>
<td>$0</td>
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<tr>
<td>Drying Shakers Rental ($645/day)</td>
<td>$10,320</td>
<td>$7,740</td>
<td>$8,385</td>
<td>$8,385</td>
<td>$10,320</td>
<td>$9,675</td>
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<tr>
<td>Mud Transportation Cost (15 loads @ 1500/load)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>$22,500</td>
<td>$11,250</td>
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<tr>
<td>API Screen Cost</td>
<td>$8,380</td>
<td>$7,334</td>
<td>$6,436</td>
<td>$6,125</td>
<td>$6,736</td>
<td>$9,256</td>
<td>$13,384</td>
<td>$12,150</td>
<td>$11,250</td>
<td>$23,000</td>
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<tr>
<td>Total Solids Handling and Dilution Cost</td>
<td>$218,950</td>
<td>$133,124</td>
<td>$177,571</td>
<td>$166,610</td>
<td>$155,356</td>
<td>$142,831</td>
<td>$87,409</td>
<td>$124,425</td>
<td>$105,825</td>
<td>$77,825</td>
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<tr>
<td>Average Well Cost</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>$165,740</td>
<td>$98,871</td>
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<tr>
<td>Average Well Savings w/ Hyperpool Shakers</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$66,869</td>
</tr>
<tr>
<td>Average Well Cost Per Foot</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>$14.64</td>
<td>$9.20</td>
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<tr>
<td>Average Well Savings Per Foot w/ Hyperpool Shakers</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>$5.44</td>
</tr>
</tbody>
</table>
Area Cost Savings Projection

Cost Savings Comparison to 6 comparable rigs working in the same area

<table>
<thead>
<tr>
<th>Rig</th>
<th>Average Loss due to Evaporation and Cuttings</th>
<th>OBM Additional retention Assuming Hyperpool performance (547 bbl/well)</th>
<th>OBM Cost Savings assuming $145/bbl</th>
<th>Typical Dryer Shaker Cost per well</th>
<th>Typical OBM Swap Out to control LGS PDS % below 10 microns: Trucking Cost</th>
<th>Project savings per well assuming similar performance to Hyperpool Case Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparable Rig 1</td>
<td>781</td>
<td>234</td>
<td>$33,918</td>
<td>$13,000</td>
<td>$3,000</td>
<td>$49,918</td>
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<tr>
<td>Comparable Rig 2</td>
<td>1802</td>
<td>1254</td>
<td>$181,902</td>
<td>$13,000</td>
<td>$3,000</td>
<td>$197,902</td>
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<tr>
<td>Comparable Rig 3</td>
<td>1686</td>
<td>1138</td>
<td>$165,076</td>
<td>$13,000</td>
<td>$3,000</td>
<td>$181,076</td>
</tr>
<tr>
<td>Comparable Rig 4</td>
<td>1247</td>
<td>700</td>
<td>$101,470</td>
<td>$13,000</td>
<td>$3,000</td>
<td>$117,470</td>
</tr>
<tr>
<td>Comparable Rig 5</td>
<td>751</td>
<td>204</td>
<td>$29,623</td>
<td>$13,000</td>
<td>$3,000</td>
<td>$45,623</td>
</tr>
<tr>
<td>Comparable Rig 6</td>
<td>1239</td>
<td>692</td>
<td>$100,287</td>
<td>$13,000</td>
<td>$3,000</td>
<td>$116,287</td>
</tr>
</tbody>
</table>

Projected Average Well Savings: **$118,046**
Hyperpool Conversion Kit
Houston Test Tank
## Capacity Comparison

<table>
<thead>
<tr>
<th>Rig Owned Shaker</th>
<th>Hyperpool Conversion Kit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hyperpool Conversion Kit

- Hyperpool performance in a rig owned shaker
  - No welding or cutting
  - Complete swap out complete in a 3-4 hours
  - No changing of existing manifold system
THANK YOU!

Sam Bridges, PE
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(281) 590-3003