FiberWatch\textsuperscript{®} Distributed Acoustic Sensing (DAS)

Pinnacle, a Halliburton Service has successfully deployed fiber optics in over a thousand wells worldwide and provided valuable information to customers in various challenging environments. This includes covering markets from unconventional resources and mature fields to harsh thermal environments in heavy oil plays. FiberWatch\textsuperscript{®} Distributed Acoustic Sensing (DAS) is based on Rayleigh scattering principles used to determine acoustic strain signals over long distances, effectively turning the optic fiber cable into a series of virtual microphones. Once the data is acquired, advanced processing techniques such as frequency filtering, time and depth domain stacking, etc. can be applied to obtain information for a wide variety of applications.

**Applications**
- StimWatch Injection Flow Profiling
- FlowWatch Production Flow Profiling
- Leak detection / Wellbore integrity monitoring
- Cross-well Analysis

**Features**
- Real-time data analysis
- Robust field ready unit
- FiberView visualization software

**Pinnacle DAS Advantage**

Halliburton acquired Optiphase to further develop the acoustic sensing arm of our industry leading fiber-optic product line. This acquisition has enabled Pinnacle to work closely with manufacturing to enhance the hardware performance. To complement industry acquisition, Pinnacle has developed FiberView\textsuperscript{™} software suite for real-time optical visualization for both DTS (Distributed Temperature Sensing) and DAS interpretation. From manufacturing and operations to data acquisition and analysis, our teams are focused on delivering a complete product that provides real value.

**StimWatch Injection Flow Profiling**

Our industry leading DAS solution provides real-time monitoring of injection fluid, to assess fluid entry points and fluid distribution along the wellbore. Halliburton's ControlFrac\textsuperscript{SM} service allows operators to assess diversion effectiveness, such as Halliburton's AccessFrac\textsuperscript{®} service solution, and determine cluster efficiency in real-time. As with other applications, this service utilizes DAS and DTS as complementary tools to confidently define fracture fluid distribution. This approach applies to a broad range of strategies including plug and perf stimulations, packer/sleeve completions, waterflood, and acid injection.
FlowWatch Production Flow Profiling
DAS is used as a complementary tool to improve understanding of flow distribution along the entire length of a producing wellbore. It is commonly used in collaboration with DTS to interpret and define flow allocation throughout the life of the well. DAS is now a mature technology that provides true diagnostic value across several applications, production analysis included.

FiberView™ software monitoring production flow

Leak Detection/Wellbore integrity monitoring
DAS has been successfully used to pinpoint leaks in casing and production tubing. This technology is providing real value at identifying leak locations and saving significant time and resources to locate leak locations from other means. It has been used to identify leaks due to casing failure, tubing failure, and completion tool failure.

FiberView™ software monitoring leak detection

### Specification Table

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Rate Variable</td>
<td>1 - 10,000 Hz (0.1ms)</td>
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<tr>
<td>Frequency Response</td>
<td>1 - 5000 Hz</td>
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<tr>
<td>Power</td>
<td>100-240 VAC, 50/60 Hz</td>
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<tr>
<td>Operating Temperature</td>
<td>0-40˚ C</td>
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</tbody>
</table>

For more information on downhole monitoring, please email us at askanexpert@pinntech.com.

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