evolution of borehole camera technologY

*Hanna Flamme, Mount Sopris Instruments, Denver, CO, USA*

*Lia Martinez, Mount Sopris Instruments, Denver, CO, USA*

*Jim LoCoco, Mount Sopris Instruments, Denver, CO, USA*

*Curtis Baker, Mount Sopris Instruments, Denver, CO USA*

*Thomas Goodwin, DGRT, Arcadia Ridge, QLD, AU*

Video camera systems are an important tool within the borehole surveying and geophysical logging communities. They provide fast and accurate visualizations of real-time borehole and completed well conditions. Historical applications include well inspection and evaluation, casing examination, borehole monitoring, equipment recovery, and geologic investigation. In open boreholes, several attributes can be considered, including light reflectance, relative grain size, mineralogy, and in many cases visualization of open vs. sealed fractures and whether fractures are hydraulically important. New generation borehole video camera systems are not limited to water exploration and production wells. They can also be used for shaft and tunnel inspections in the construction and mining industries. Here, we discuss recent developments in borehole camera system technology.

Historically, downhole video cameras required CCTV cameras recording analog video by sending the video uphole along coaxial cable on winch systems spooled with up to about 5000-ft. These analog systems are often limited to a single down-view only camera, or they require two separate cameras, one with down-view and another with limited side-view. The side-view camera requires manual control via a joystick to move and focus the camera in specific azimuthal directions within the borehole.

In contrast, new generation digital borehole cameras can focus and collect video across the entire 360-degree side-view and down-view simultaneously on wirelines up to 7500-ft. Operators specify quadrant view, downhole view, or both in any combination. This design eliminates the need to rotate or refocus the camera during logging while also providing high resolution HDMI quality videos. User-friendly software allows operators to save still images easily. Integration with just about any winch to display real-time depth simply requires basic depth encoder information. In addition to significant improvements in video quality, new digital camera systems do not require specialized software or computer setups. Instead, camera control is performed from a web browser and the built in Wi-Fi network of the camera system. This allows users to control with camera with any phone, tablet, or computer within Wi-Fi range of the surface console. Also, new digital cameras are not restricted to coaxial cable. New digital systems can be integrated with all standard geophysical wireline types including 1/8-inch single conductor, 3/16-inch four conductor, and coaxial cable.

During this presentation, we will identify and evaluate the differences between the most common analog and digital cameras currently available on the market. We will also provide examples of downhole videos from various applications and environments.