

## **High temperature, high pressure, color, dual camera with live JPEG compression and HDR capability for oil well inspection.**

The Oil and Gas industry requires more and more inspection of the oil wells. Such wells can be up to 40000ft long and contain dirty fluid under high pressure and temperature due to depth. Until a few years ago there were no cameras dedicated for this market; the existing cameras were low performance monochrome analog cameras and could not fullfil the requirements of today's technical challenges.

The typical defects to be inspected are cracks, pipe rusting, water injection, broken pipes, objects blocking the flow, broken valves, fallen tools to be recovered and many others. The videos must be transmitted to an operator at the surface and evidences must be recorded as still images or as video to prepare further interventions. For some applications the video is not transmitted and is recorded inside the camera.

The most important challenges are:

- temperature of 125 degrees Celcius or more
- pressure of 15000 psi or 1000 bar
- no light at all, all lighting is provided by the camera
- limited power available as the current has to travel a 40000ft long conductor
- very limited bandwidth
- narrow pipes with bends and section changes
- fail operational and fail safe approaches on some design elements

Due to the limited memory storage or transmission bandwidth, the images must be compressed. A live JPEG compression with an adjustable compression level and programmable quantification tables is implemented.

The camera is equipped with two automotive grade color image sensors and LED lighting. One sensor looks down the hole and the other looks on the side of the camera to inspect the pipe's surface. The camera is capable to rotate 360 degrees to scan the full pipe's surface.

Several power optimization, stand-by, and cooling techniques are used in order to reach the required temperature range.

The whole camera measures less than 5 cm in diameter and is more than 3 meters long (excluding weight bars). The camera head itself, developed by Aphesa is only a fraction of that length.

The project is the result of a two-years collaboration between APHESA and several other companies, one being a top ten Oil and Gas service company that specializes in well interventions. Aphesa is an image sensor, camera and HDR (High Dynamic Range) specialized company and develops custom cameras and lighting systems for customer specific applications.