INTEGRATED VIDEO CALIPER
COMPLETION FAILURE DIAGNOSIS IN HORIZONTAL WELL

EV's Integrated Video Caliper (IVC) tool incorporates qualitative and quantitative measurements to improve wellbore diagnosis effectiveness.

MULTI-STAGE HYDRAULIC FRACTURING

The development of drilling and completion technology, as well as the increased efficiency and improved design of fracturing operations, has led to a rise in the number of extended horizontal wells accessing tight oil and gas reservoirs. Fracturing is conventionally a multi-stage process with various methods utilised to isolate zones.

On one such operation, an operator in Alberta, Canada experienced poor flow back following a fracturing operation, indicating a potential blockage. The cause of this blockage was initially assumed to be a stimulation ball stuck on a seat or debris in the well and a milling operation commenced.

When poor progress was made with a number of mill assemblies, EV were called to assess the problem.

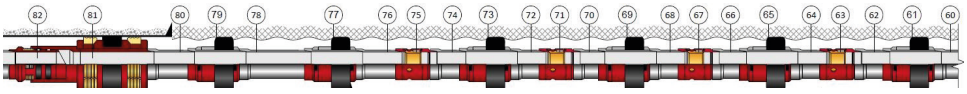

Figure 1: Section of lower completion showing four fracturing stages isolated by open-hole packers.

INTEGRATED LOGGING SOLUTIONS FOR WELL DIAGNOSIS

EV's IVC tool provides a unique solution whereby high definition sideview and downview video can be deployed in a single run with either a 24 or a 40 arm multi-finger caliper tool.

In the case presented here, the objective was twofold; to pinpoint the depth of the obstruction as well as gather quantitative information regarding the condition of the liner.

As part of the solution, EV provided a complete interpretation package, including in-depth joint by joint analysis of the casing while integrating the camera data for a conclusive report.

Post processing took advantage of the pipe deformation analysis (PDA), offered by Epidote; whereby the maximum advisable dimensions for a mill assembly were determined from the anomalous tool eccentricity observed across areas of deformation.

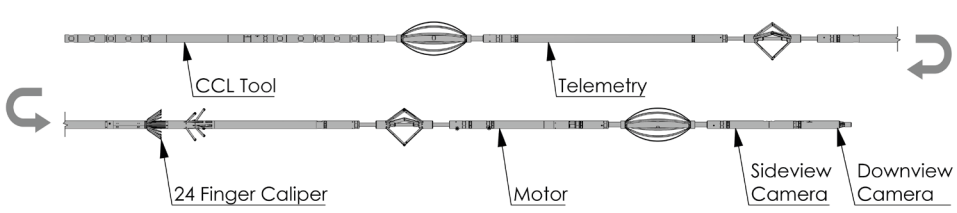

Figure 2: EV's Integrated Video Caliper tool

THE CHALLENGE

Diagnose reasons for an unsuccessful milling operation following a Multi-Stage Hydraulic Fracturing job in a horizontal well in Alberta, Canada.

THE SOLUTION

An IVC24 was deployed on e-coil in a single run to diagnose the problem. The applied solution includes a 24 arm multi-finger caliper, sideview and downview high definition cameras. This unique combination offered real-time logging data and video images at surface. The solution also included a full interpretation package.

THE RESULTS

Visually identified location of lower completion failure using the HD downview camera. The multi-finger caliper successfully pinpointed regions of bending, buckling and ovality along the liner above the point of failure. The use of IVC24 ultimately resulted in a reduced coiled tubing intervention, saving the customer the associated costs and time.

SEEING IS BELIEVING

Downview video footage identified the location of, what appears to be, a catastrophic liner failure above an open-hole packer. The nature and extent of the damage was such that the toolstring could not pass this depth and therefore neither the caliper nor sideview camera alone could have identified the problem.

The multi-finger caliper data identified a number of concerning regions of pipe ovality and buckling across the logged interval. This buckling helps to explain the access issues experienced during the milling operation and is confirmed by the drift simulation carried out via Epidote's PDA. The drift simulation goes even further and advises the maximum length and diameter of rigid assembly that would successfully pass through this section.

The deformation analysis provides an understanding of the pipe failure mechanism and one can theorise that a similar level of pipe deformation across deeper stages may have compromised the mechanical integrity of the pipe. This most likely led to a reduced collapse resistance due to the induced ovality from the deformation.

MOVING FORWARD BY STEPPING BACK

IVC demonstrates the unique value of combining qualitative and quantitative measurements in a single string. These measurements can either be complementary, such as a high resolution assessment of pitting or corrosion, or independent as in this case.

On this occasion, the camera visually identified the location and nature of the failure while the caliper quantitatively diagnosed the extent of the pipe deformation leading to a better understanding of the failure mechanism and access issues.

Figure 5 represents the total cumulative costs incurred during the operation, highlighting EV's potential to contribute to significant cost reduction. Had the operator elected to deploy the diagnosis solution sooner, cost savings would have been significant.

Figure 3: Downview image of obstruction believed to be collapsed liner

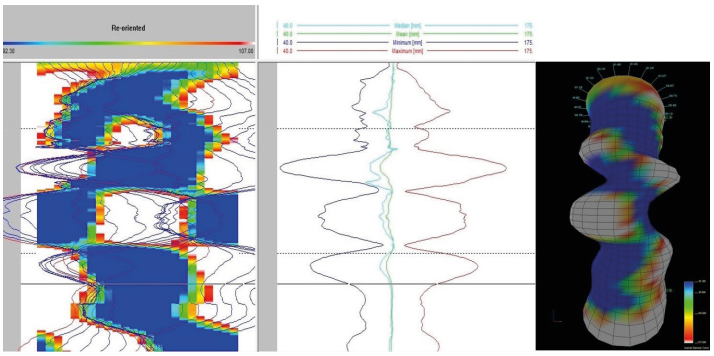

Figure 4: Buckled liner section illustrated from minimum and maximum multi-finger traces and 3-D well plot

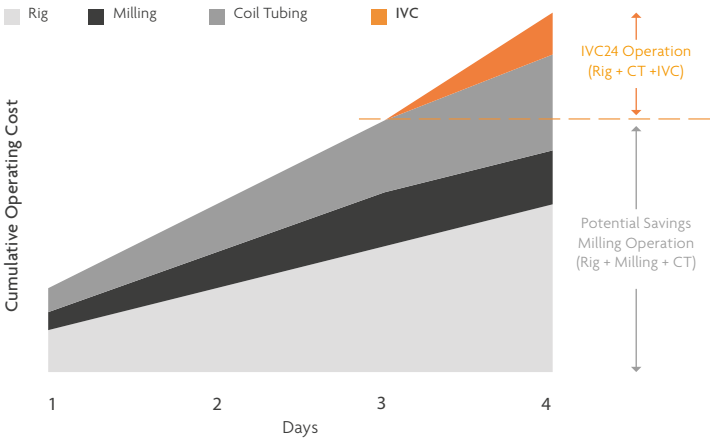

Figure 5: Graphic representation of cumulative costs and potential for cost savings