

Unique applications of the

STYLWAN 3D-FEI TripSaver

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The STYLWAN three-dimensional Finite Element Inspection (3D-FEI) system is highly versatile and readily allows for applications that are unthinkable with any other inspection technique. The 3D-FEI owes its versatility partially to its Measuring capabilities and partially to its very high degree of tolerance to adversities. The two are combined in a compact, highly portable package that can be used to inspect Steel Cable, Coiled Tubing, Production Tubing, Sucker Rods, Drill Pipe, Kelly, Choke, Kill & Booster lines, Marine Riser Systems, Cable Armor, Hoisting Cables, Mooring Cables, Drive Shafts (Race car), complex form materials etc. If you can think of it, the 3D-FEI can probably inspect it.

10.1 THE PIPE CLEANER AS THE INSPECTION PLATFORM



STYLWAN has compared its 3D-FEI inspection equipment with many of the industry workhorses. One of them is the NDT-5700 inspection unit that is shown on the left. The NDT-5700 is a one-dimensional (1D) inspection system. As with all 1D systems, the pipe must be precisely centered and the surface must be clean. Failure of centering results in OFFCENTERING errors and a dirty pipe surface results in SENSOR LIFTOFF. The NDT-5700 would lose 75% of the signal with as low as 0.035" (0.9mm) of sensor liftoff resulting in **Total-Loss-of-Detection**.

An imperfection must be Detected before it is Evaluated and Classified. To assure centering, the NDT-5700 uses massive pipe centering mechanisms, each one bigger and heavier than the entire 3D-FEI inspection system. To minimize SENSOR LIFTOFF the NDT-5700 demands clean pipe and uses another suspension/centering mechanism (one mechanism for each pipe size). Pipe cleaners are therefore used to clean the pipe prior to inspection.



On the other hand, all of the STYLWAN 3D-FEI inspection systems are highly tolerant to OFFCENTERING and SENSOR LIFTOFF. These tolerance tests are part of the STYLWAN 3D-FEI STANDARD ACCEPTANCE TEST which is certified by DNV (certificate # HIO-00-0077). A STYLWAN 3D-FEI system can withstand 3.5 tube diameters OFFCENTERING without loss of Detection (4% of the reading typical error - high Detection reliability)!

Following a direct comparison test, the 3D-FEI inspection system was moved to the pipe cleaner as shown on the right. The test joints were rerun with repeatable inspection results. Additional test joints were also run. Because the 3D sensor array examines the entire pipe circumference, the spiraling of the pipe through the cleaner does not affect the quality of the inspection, neither does dirty pipe surface or OD coated material. The sensors are non-contact and far away from the pipe surface while they maintain ample sensitivity to perform the inspection (Sensitivity Test - also certified by DNV).



The 3D-FEI or AutoCull™ enhanced pipe cleaner can easily carry out a complete used pipe inspection (Wall & Transverse) thus eliminating the NDT-5700 and its high consumables cost (i.e. contact sensors); freeing up yard space; minimizing the pipe movement and reducing both the number of crews and their size resulting in substantial cost savings for the operator while minimizing the turn-around time through a superior inspection.

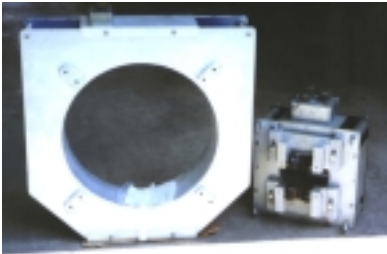
10.2 WELLHEAD INSPECTION OF DRILL PIPE, TUBING and SUCKER RODS



The STYLWAN 3D-FEI brings lay-down inspection quality to the wellhead. In addition to inspecting the drill pipe and the production tubing, the 3D-FEI can also inspect the Sucker Rods (through the tubing shown on the left). Drill Pipe and Sucker Rod imperfections are evaluated as Stress Concentrators thus failure seeds are detected early on. The 3D-FEI is the only inspection unit that generates a Corrosion Gauge (CG) and Environment Induced Cracking (EIC) information which dynamically adapt the inspection parameters.

10.3 OFFSHORE DEPLOYMENT

The 3D-FEI is highly portable and the inspection sensors are built inside the inspection heads. External, specialized sensors, can easily be installed also. With the 3D-FEI, there is no need for centering or a clean pipe surface for competent inspection. An offshore inspection system is shown on the right (the small internal sensors are not shown). The inspection head on the left has 10.5" ID clearance and the inspection head on the right has 5.5" ID clearance. Capability wise, appearances are deceiving.



Larger inspection heads are also available (16.0" ID clearance is shown on the far left). Inspection of tubing through pressure spools is possible (near left). Precise location of collars between the snubbing unit BOPs can be combined with inspection. The STYLWAN 3D-FEI is the only inspection unit capable of concentric material inspection.



Inspection / Baseline of new Choke & Kill line (above left) and Coiled Tubing at the mill (above, second from left). Inspection of used MUX cable (above, third from left) and Detected arc burn damage (above right).



STYLWAN has compared its 3D-FEI with many commercial 1D Drill Pipe buggies. On the left, a comparison test between an NDT-2000 drill pipe buggy and a STYLWAN 3D-FEI. The NDT-2000 is an original drill pipe inspection unit that has been copied widely by the parasitic NDT equipment manufacturing industry, so, the comparison results apply to many other drill pipe units as well. Notice that the STYLWAN inspection heads are designed to readily accept 1D drill pipe sensors also (a set of sensors and centering mechanisms per pipe size). In addition, concentric inspection through pressure spools (unthinkable with 1D) was demonstrated (bottom right corner of the picture).

Inspection of Drill Pipe during a trip utilizing the STYLWAN 3D-FEI provides a superior inspection compared to the one obtained by shipping the drill pipe to shore as has been established through direct comparison with the 1D workhorses (NDT-5700, NDT-2000).

With internal sensors, the same 3D-FEI unit (shown on the right) can inspect Marine Riser Systems onboard the rig. Far right: The inspector is using an internal sensor to inspect the C&K lines

3D inspection of Marine Riser Systems is normally carried out onboard in less time that it takes to ship the risers to shore at a typical cost that is compatible with the shipping costs alone.



Onboard the rig, a STYLWAN 3D-FEI can inspect the risers during transit from location to location, the drill pipe during every trip and all other OCTG as needed, thus averting potential transportation damage after the inspection and delays. Only materials that need repair are then shipped to shore. The quality of inspection and the cost savings are unsurpassed by any other inspection technique.

STYLWAN for a better inspection at a lower cost