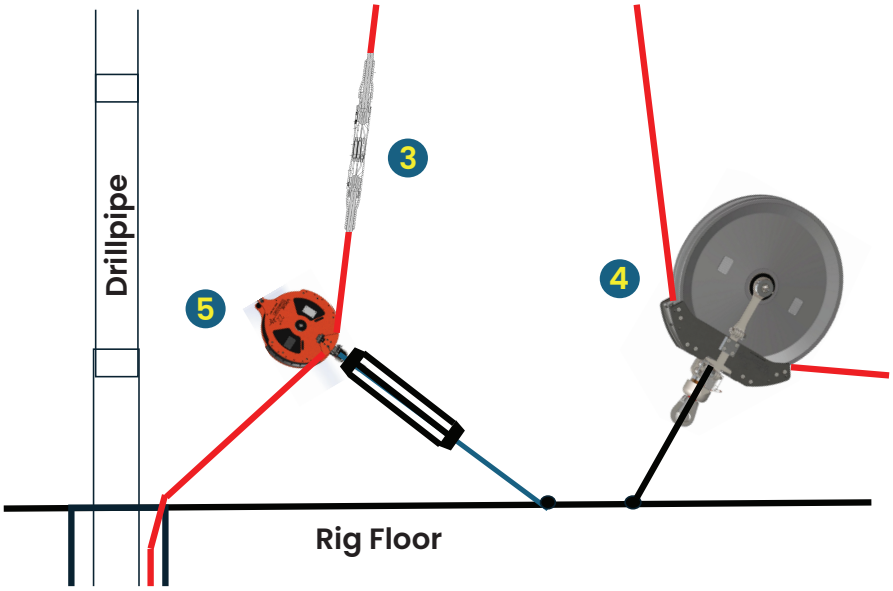
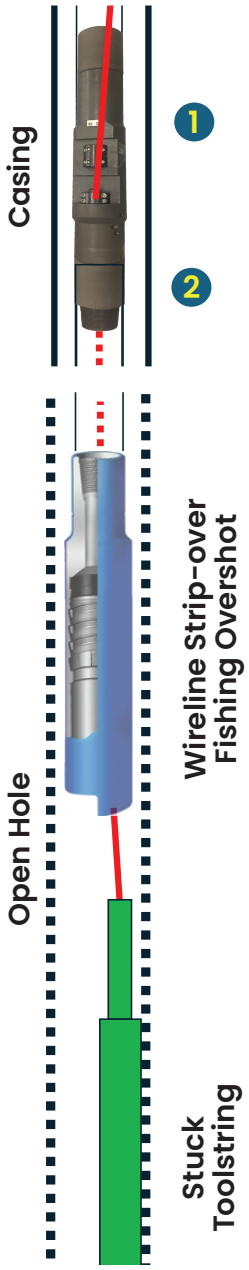
Wireline Logging While Fishing System (LWF)



Logging While Fishing System Components

1. Wireline Side Entry Sub (SES)
2. Cable Cutter Sub (CCS)
3. High-Strength Torpedo Adapter
4. 32-in Wireline Sheave Wheel Dual Groove
5. 17-in Wireline Sheave Wheel



- **Stuck Toolstring/Cable Scenario**

  During a wireline logging operation, if the wireline cable or logging toolstring become stuck in the wellbore, a strip-over fishing operation is initiated to recover the equipment.

- **Additional Logging Deployment**

  After a successful fishing operation, to complete the logging objectives an additional logging run is typically carried out using a pipe-conveyed logging (PCL) deployment.

- **Logging-While-Fishing (LWF) Contingency**

  The Logging-While-Fishing (LWF) system serves as a contingency that interrupts the strip-over fishing operation and converts it into a functional equivalent of a pipe-conveyed-logging deployment.

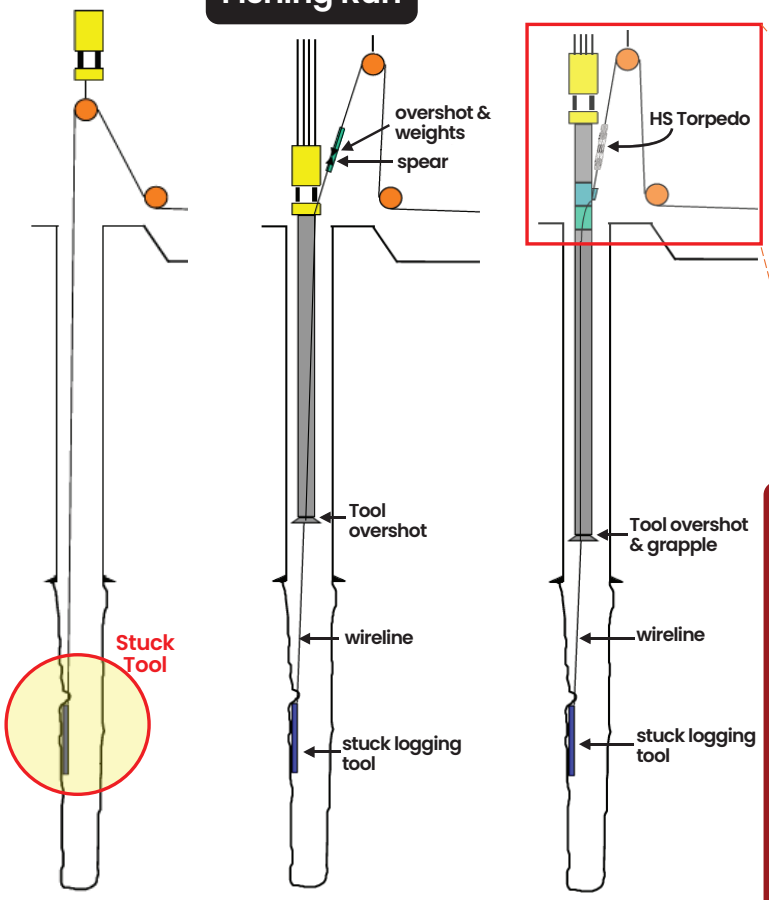
- **Safety and Operational Efficiency**

  The implementation of the LWF system enables monitoring the fish latching process and the acquisition of logging data above and below the stuck depth, eliminating the need for a separate expensive time-consuming logging run.

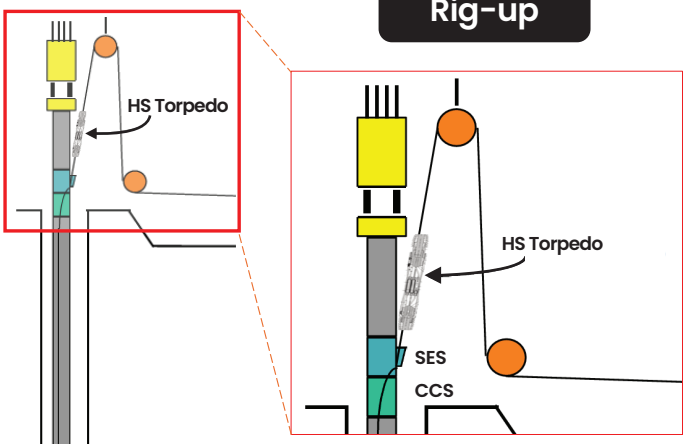
The details of the different operation stages required to transform a Stuck-Tool situation into a Logging While Fishing operation are documented in an animation posted in our website and the following pages.

Logging While Fishing (LWF) Operation with Free Drillpipe

Strip-over Fishing Run

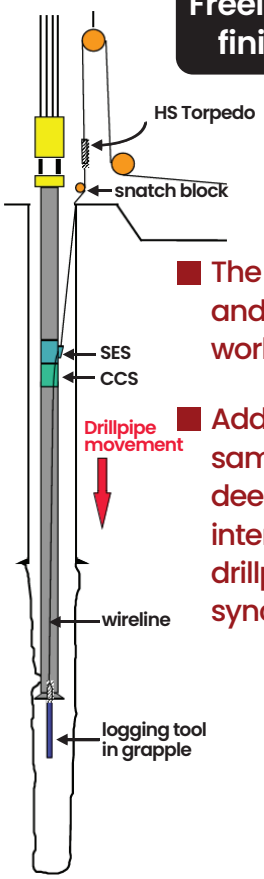


LWF Surface Rig-up



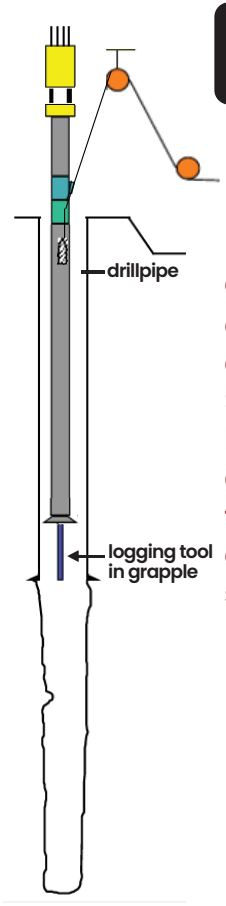
- The end of the tool-side of the cable is fed through the Cable Cutter Sub (CCS) and Side-Entry-Sub (SES) before is attached to the end of the winch-side cable section using a torpedo connection.
- The torpedo connection provides continuity of the electrical conductors and a solid mechanical attachment.
- This set-up allows the toolstring to be powered and functioning while the SES/CCS slide freely over the cable when the drillpipe is lowered into the well.

Freeing the tools and finish the logging



- The toolstring is caught and pulled free by working the drillpipe.
- Additional logging and sampling is done in deeper or shallower intervals by moving the drillpipe and wireline synchronously.

Removing the cable and SES



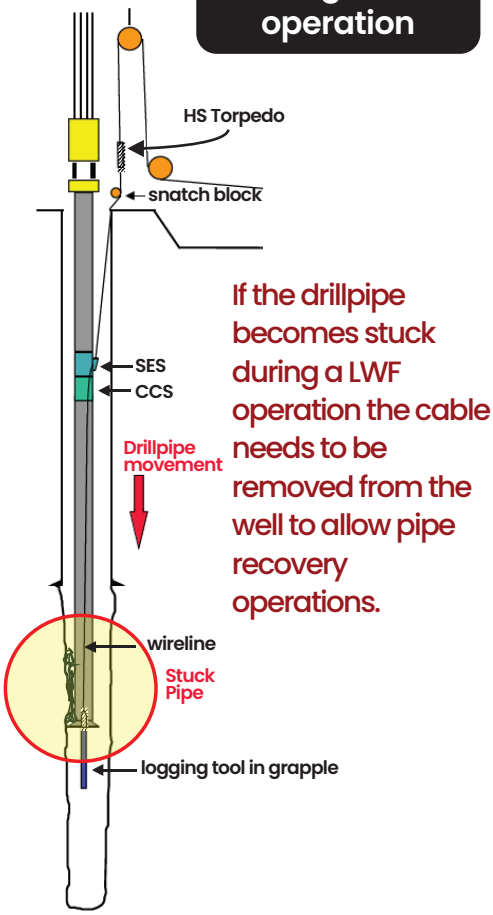
Once the logging and sampling is completed the SES/CCS is brought back to surface, the cable is released from the toolstring and pulled to the surface

Removing the drillpipe and tools

The SES/CCS and wireline are rigged down before the pipe and toolstring are removed from the well

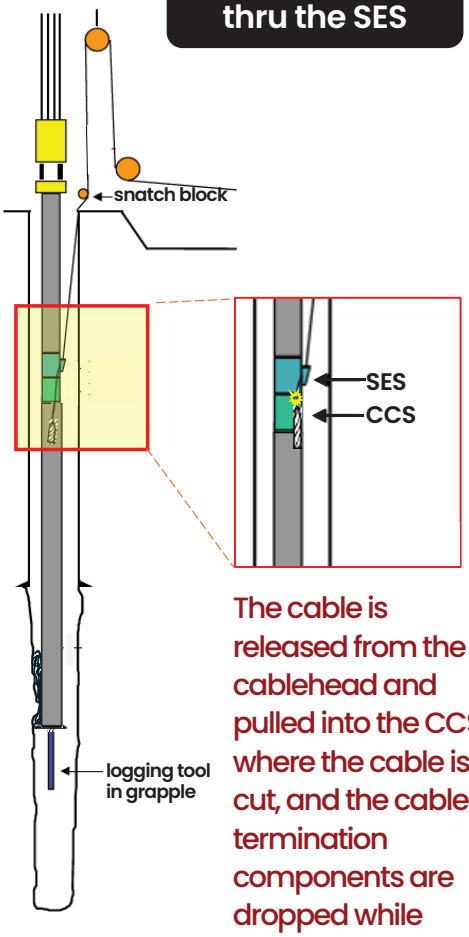
Stuck-Pipe during a Logging While Fishing (LWF) Operation

The drillpipe becomes stuck during a LWF operation

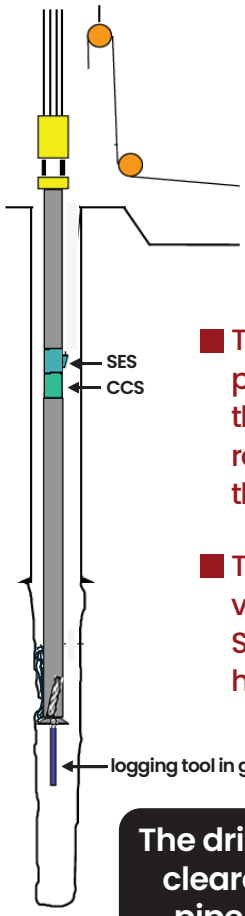


If the drillpipe becomes stuck during a LWF operation the cable needs to be removed from the well to allow pipe recovery operations.

Pulling the cable thru the SES



The cable is released from the cablehead and pulled into the CCS where the cable is cut, and the cable termination components are dropped while keeping the feedthrough hole cleared.



- The cable is pulled through the SES and removed from the well.
- The SES ball valve seals the SES cable entry hole.

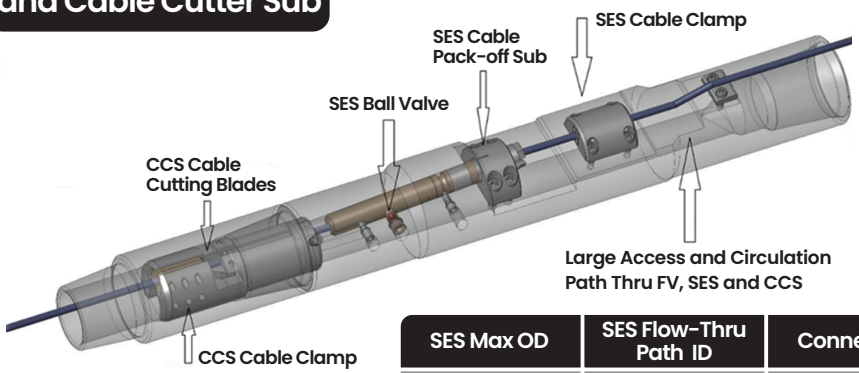
The drillpipe is now cleared to allow pipe-recovery operations

WELL CONTROL RECOVERY PROCESS DURING LOGGING WHILE FISHING OPERATIONS

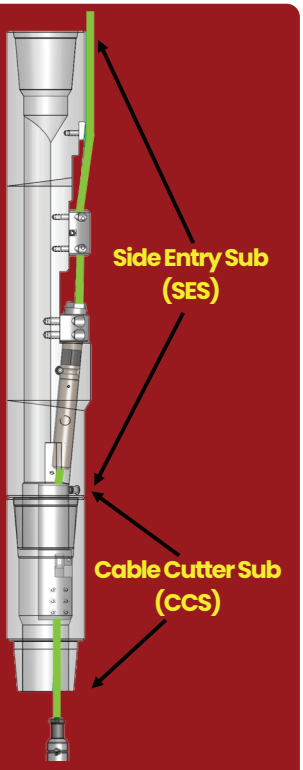
- The process documented here for the Stuck-Pipe condition in LWF operations is equally applicable when there is a loss of well control situation, such a downhole blow out.
- If a loss of well control is a possibility in offshore rigs where the BOPs are at the sea floor, the SES/CCS should be kept above the sea floor to allow adequate sealing of the BOP rams on the drillpipe.

Logging While Fishing (LWF) System Components

Side Entry Sub and Cable Cutter Sub

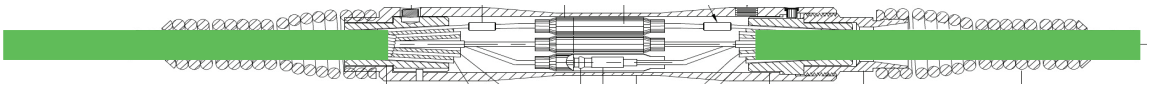


SES Max OD	SES Flow-Thru Path ID	Connection
9″	2.9″	6-5/8″
6.77″	2.17″	5″
5″	1.97″	3-1/2″
3-3/4″	Not Available	2-7/8″



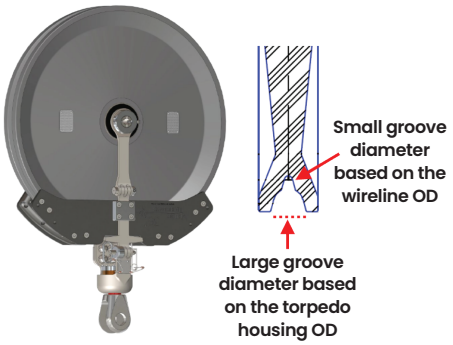
- In LWF operations, to allow the SES-CCS to slide down over the static cable, they are used without their cable clamps.
- When the LWF operation is completed, or at any other time, the cable can be removed from the well by releasing the cable from the toolstring and pulling it until its termination components hit the CCS that cuts the cable at impact.
- After the cable is cut, it exits the SES while the SES pack-off fluid path is sealed by the SES ball valve.
- The CCS performance is independent of the cable strength and condition.

High-Strength Torpedo Connection



- The torpedo connection is designed to host the wireline service company rope socket and cones specific dimensions.
- The torpedo housing metallurgic and geometry are compatible with the 32-in dual-groove sheave wheels and cable tensions expected.

2 x 32-in Wireline Sheave Wheel Dual Groove, SWL: 40 Klbs



- Proof tested to 2x SWL
- Design/Ultimate load of 4:1
- Fully certified (Certificate supplied)
- Tapered Roller Bearings
- Sealed Bearing/Hub System
- Composite wheel is less abrasive to cable/lines
- Full line ancillary items for safety and ease of use

1 x 17-in Wireline Sheave Wheel Single Groove, SWL: 20 Klbs

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