



WELLS ABANDONMENT ACCELERATED

DEVELOPMENT OF A SINGLE-TRIP, CASING- ON-DECK SYSTEM

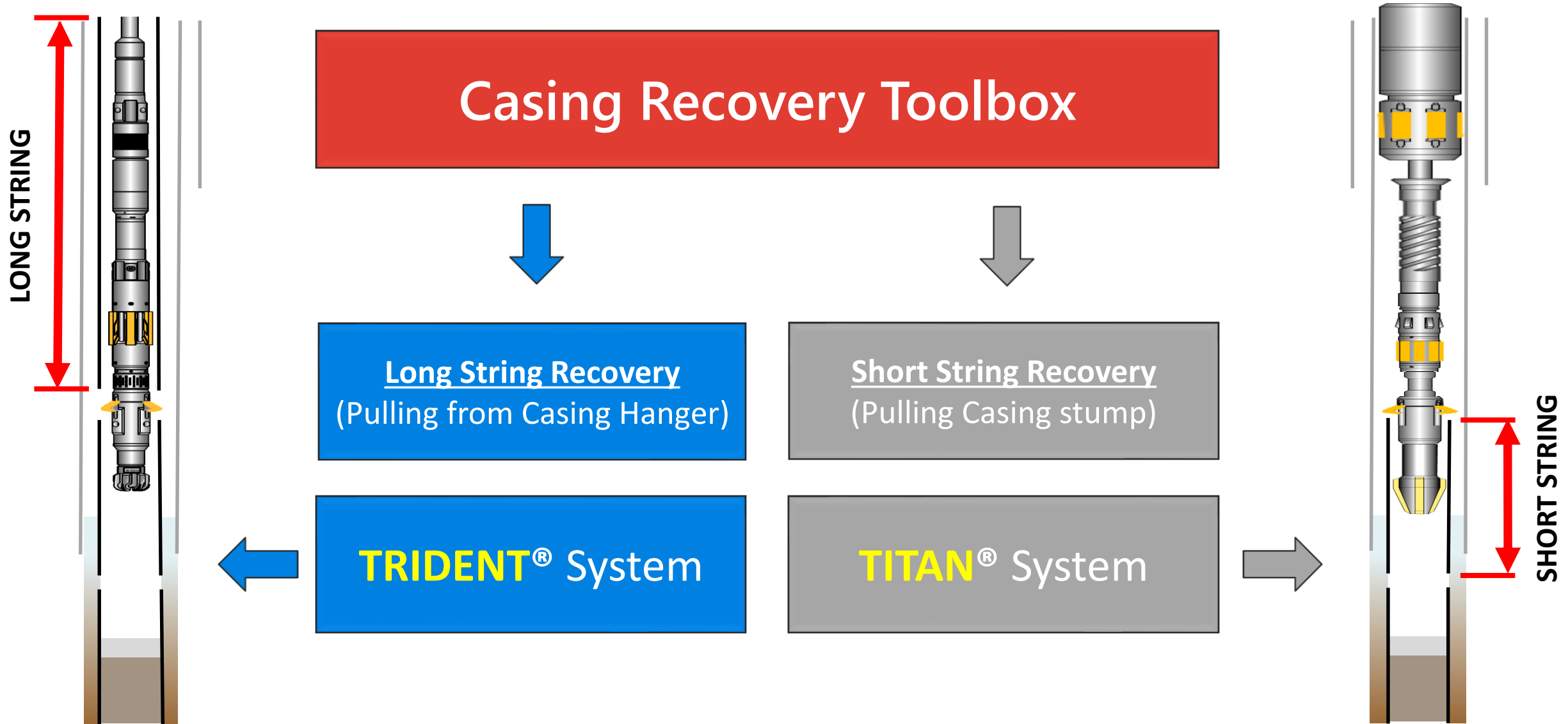
JAMES LINKLATER – ENGINEERING DIRECTOR

ORIGINAL INSIGHT

WHY PERFORM CASING RECOVERY?

Operation	Well Life Cycle		
	Exploration	Well Intervention	Plug and Abandonment
Barrier Plug Placement	√	√	√
Cased Hole Sidetrack	√	√	
Open Hole Sidetrack	√	√	
Sustained Annulus Casing Pressure (SACP) Remediation		√	

THE CASING RECOVERY TOOLBOX

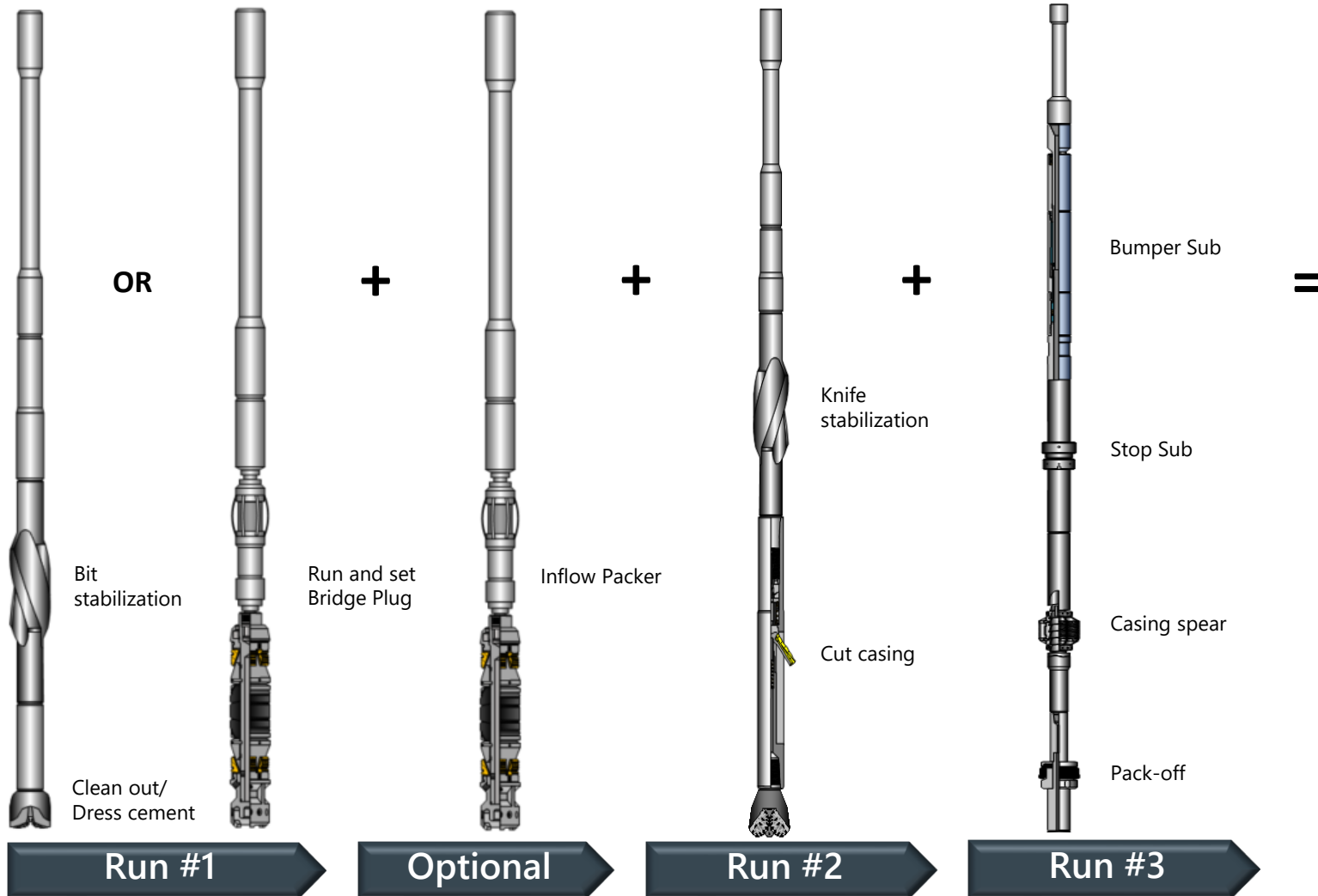




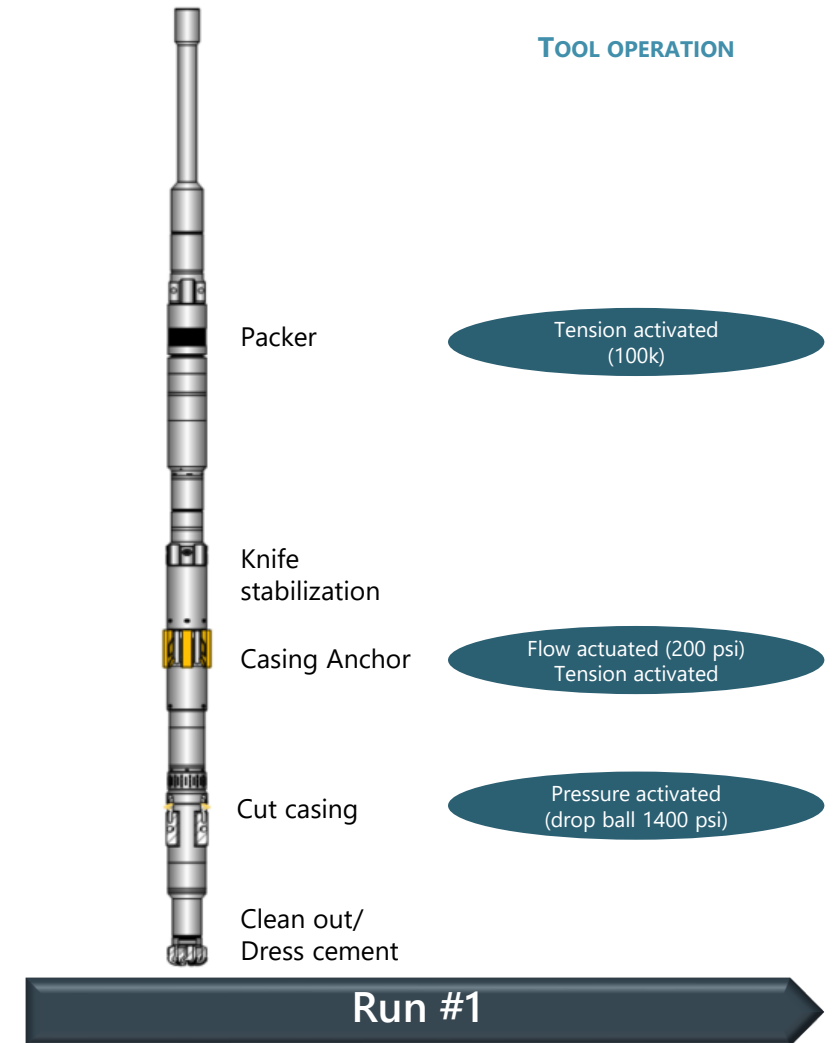
LONG STRING
TRIDENT[®]
SINGLE-TRIP
CUT & PULL
SYSTEM

TRIDENT FUNCTIONALITY = TRIP REDUCTION

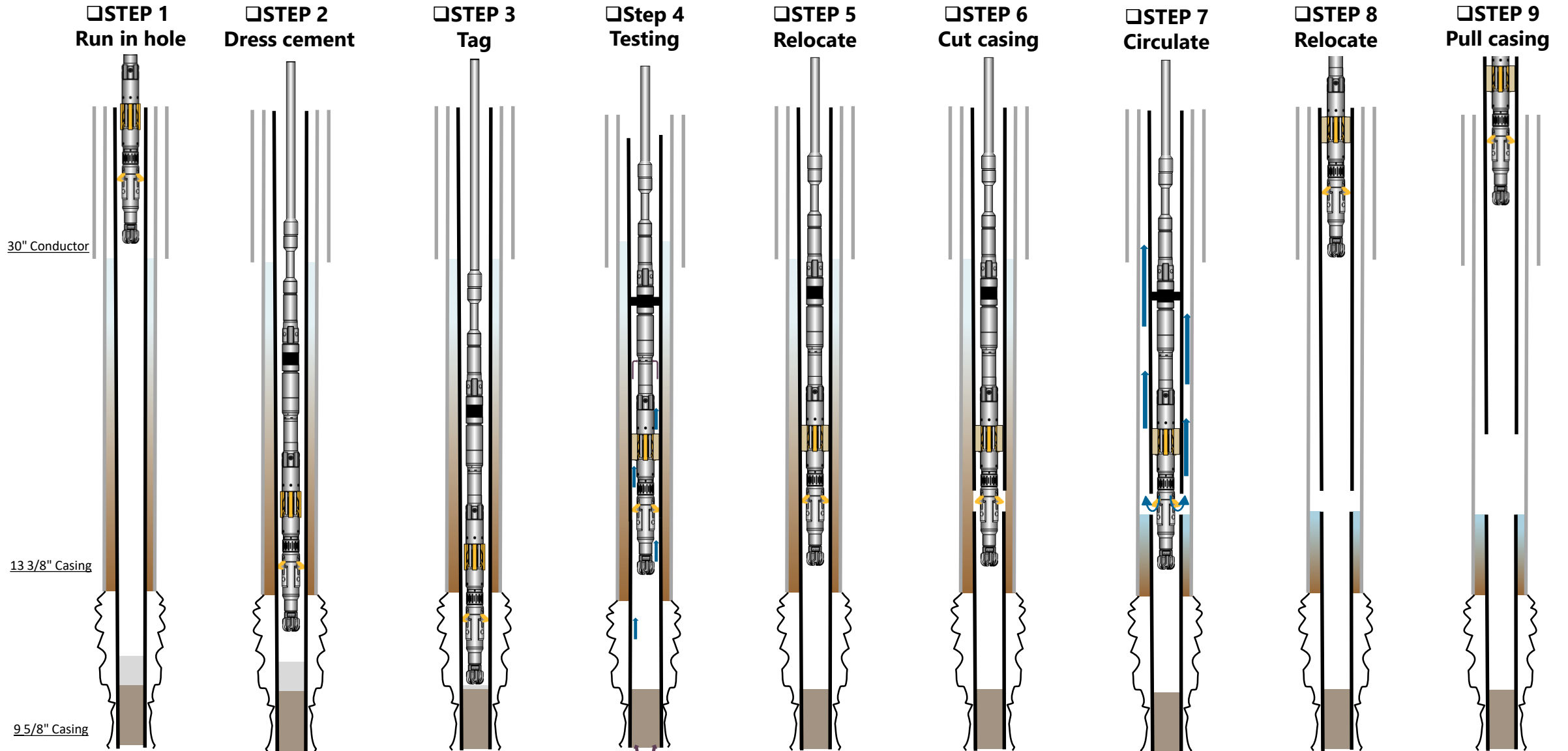
STANDARD OPERATION



ARDYNE OPERATION



TRIDENT System example operation



Dressing
Cement

32% Time
Saving
vs
Conventional
Operation

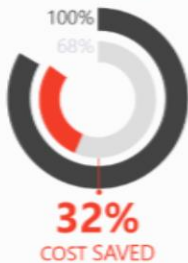
CASE STUDY – 2017NOR012

32% TIME SAVINGS ON CUT & PULL OPERATION

TRIDENT Single-Trip Cut and Pull System saves rig time and eliminated handling of 2 BHA's



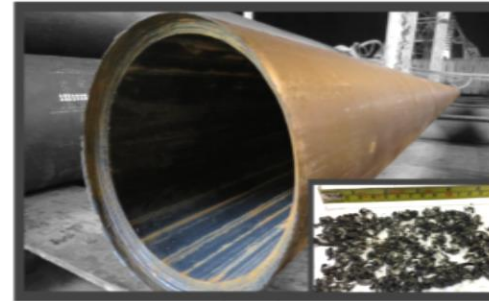
Industry Standard
Ardyne Operation
Customer Savings



TRIDENT™

- Enabled cement plug drilling - 3 meters
- Weight tested cement plug with 10 tons.
- Completed casing cut at 740mMD
- Enabled circulation of annular gas
- Recovered casing to surface from hanger - 27mMD

The TRIDENT System saved the client 2 trips, and 32% of planned rig time.



Casing cut and swarf collected by TRIDENT



THE OPERATION

A North Sea operator wanted to perform a slot recovery operation on a platform well in a safe, efficient and cost-effective manner. Planned operations included drilling the top of a cement plug, verifying hard cement, cutting the 9 5/8" casing at 740mMD, and recovering the string of 9 5/8" casing. The operation would require 3 trips in hole with conventional technology.

THE SOLUTION

TRIDENT™ was deployed to perform the required operation in a single trip. TRIDENT™ was fitted with a roller cone drill bit to drill the top of the cement plug and weight test to verify hard cement plug. TRIDENT™ Cutter was activated and a successful cut was conducted in 6 minutes. TRIDENT™ Packer was engaged and annular gas was circulated out through the annulus outlet on the wellhead. After relocating the TRIDENT™ Anchor below the casing hanger, the casing was recovered to surface. All operations were conducted in a single trip

TRIDENT Animation [HERE](#)

FASTER. SIMPLER. BETTER.

TRIDENT SYSTEM
CS 01 2017 02

**Dressing
Cement &
Pressure
Testing**

**46% Time
Saving
vs.
Conventional
Operation**

CASE STUDY – 2017UK011

TRIDENT® SYSTEM SAVES 14,5 HOURS RIG TIME

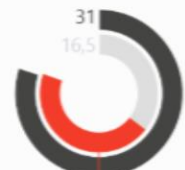
TRIDENT delivers 46% efficiency gain in P&A casing recovery operation



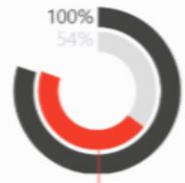
Industry Standard
Ardyne Operation
Customer Savings



2
TRIPS SAVED



14,5
HOURS SAVED



46%
EFFICIENCY GAIN

SINGLE TRIP FUNCTIONALITY - Dress, Test, Cut, Circulate and Pull

- Tag / Dress cement as required to 7,630ft – verify Top with 10K set down weight
 - Set Anchor & Packer to positive test cement plug
 - Inflow test functionality available if required
 - Reposition assembly to cut depth, set anchor and applied 50K overpull to put casing in tension and cut casing at 4 090ft
 - Set Tension Set Packer above cut to circulate
 - Verify casing free – with pressure and overpull
 - Reposition to top of stump and reset TRIDENT Anchor
 - Retrieve casing to surface from 2 234ft
- = 14,5 hours rig time savings

THE OPERATION

A North Sea operator conducted a permanent P&A operation on a fixed installation. The well had previously been temporary abandoned by setting a cement plug and recovering the 9-5/8" casing down to 2 234ft. Casing was preferred to be cut in tension due to potential free standing stump.

THE SOLUTION

TRIDENT™ conducted the operation in a single run. Initial dressing and tagging of cement plug was conducted prior to relocating to cutting depth. With the TRIDENT Anchor set, sufficient overpull was applied to stretch the casing and the cut was completed in 2min. An attempt to circulate the annulus was conducted, but debris was blocking the annulus. Verification that the casing was free was conducted by increasing the overpull on the TRIDENT Anchor and movement was seen with pressure dropping off. Relocating the anchor to the top of the casing stump and recovered the casing to surface.

For more information on the TRIDENT System click [HERE](#)



TRIDENT System

FASTER. SIMPLER. BETTER.

TRIDENT SYSTEM
CS 08 2017

RESETTING THE STANDARD

TRIDENT® Anchor and Packer delivers a 23% efficiency gain on routine Cut & Pull operation



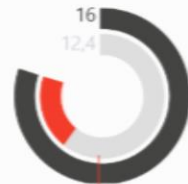
Anchor Setting in both 9 5/8" & 10 3/4" Casings

Resetting the standard – 23% efficiency gain

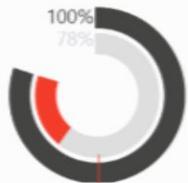
Industry Standard
Ardyne Operation
Customer Savings



1
TRIPS SAVED



3,6
HOURS SAVED



23%
EFFICIENCY GAIN

FASTER. SIMPLER. BETTER.

TRIDENT System = 3,6 hours rig time savings on simple Cut & Pull operation

- RIH to 3 255 ft depth and cut 9 5/8" casing with TRIDENT Anchor set.
- Lifted casing 4ft to verify casing was free
- Released Trident and pulled up to casing hanger at 600ft
- Anchored Trident in 10 3/4" and set Packer with tension to circulate annulus fluid out of hole
- Recovered casing to surface

THE OPERATION

The TRIDENT Single-Trip casing recovery system was deployed on a Semi-Submersible rig in the North Sea, to perform a routine cut and pull operation on 9-5/8" x 10-3/4" casing. The operation could have been conducted with conventional equipment in two runs, but the TRIDENT System's integrated and upgraded packer and anchor performed in a single trip, saving significant rig time even on this routine operation.

CONTINGENCY FUNCTIONALITY

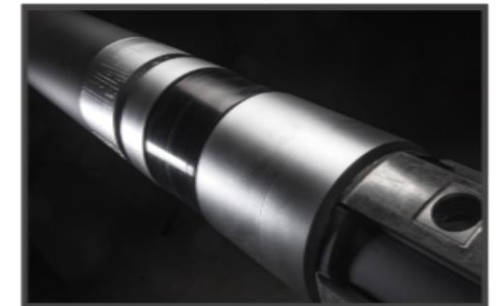
TRIDENT Anchor

1. No need to reposition marine swivel if additional cuts are required.
2. No spear space-out requirement for additional cuts if conventional spears were run



TRIDENT Packer

3. Ability for high pressure test in 9 5/8" with TRIDENT Packer
4. TRIDENT Packer seal in 10 3/4" allowing for annulus circulation



Casing hanger in rotary and another job well done

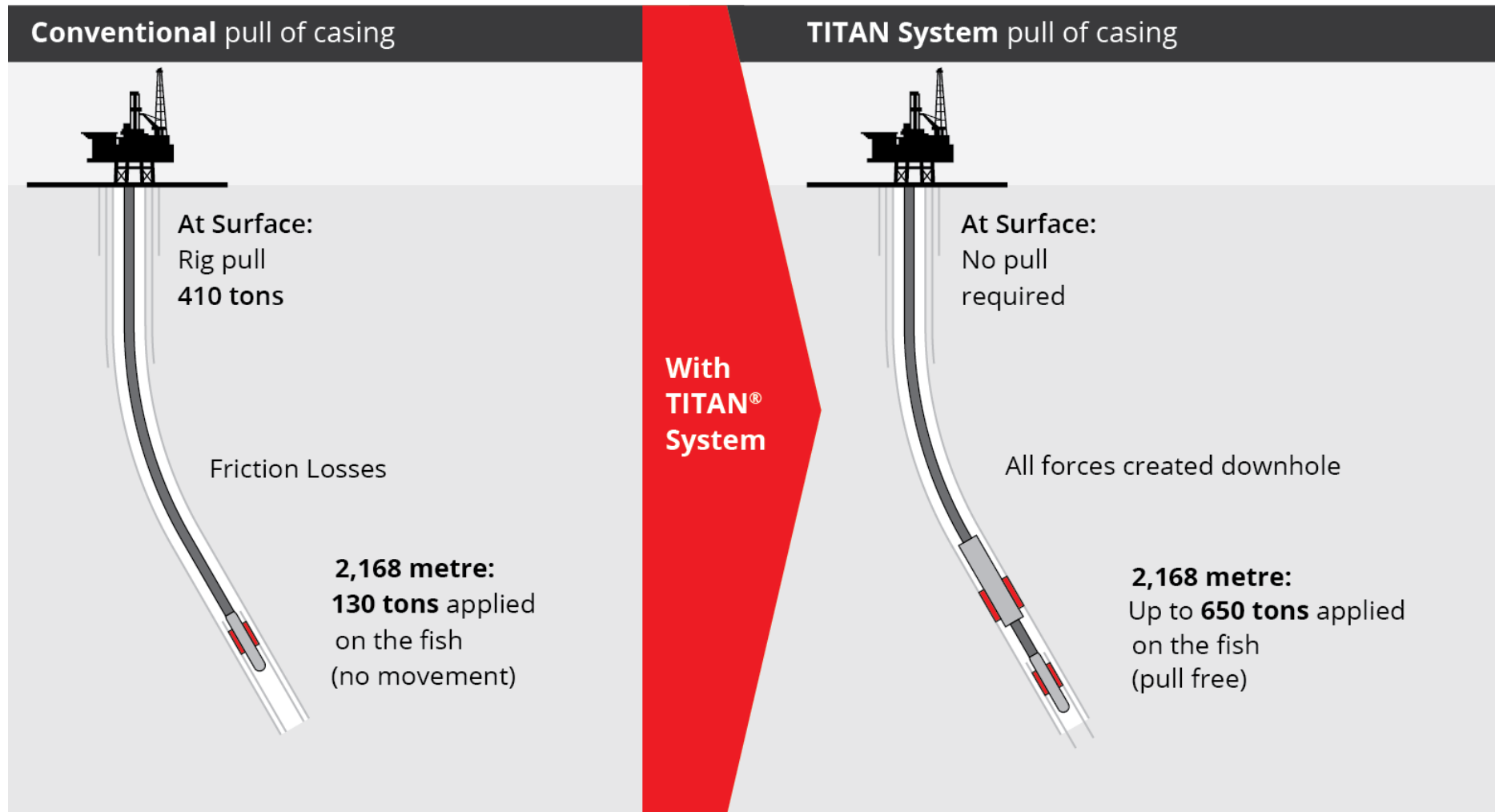


For more information on the TRIDENT System click [HERE](#)

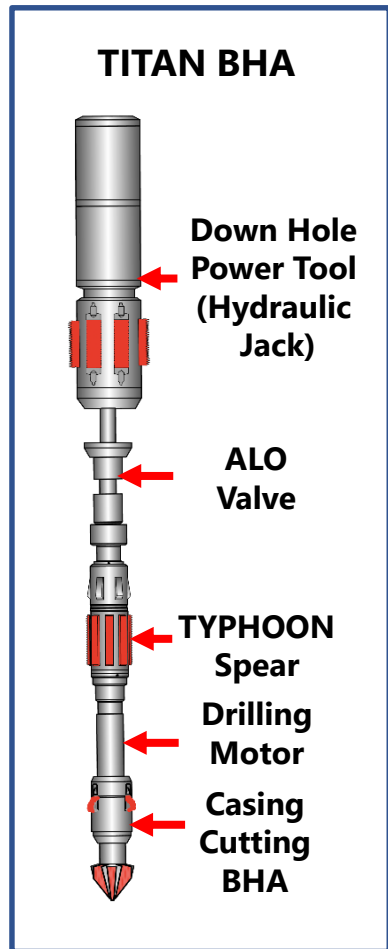


SHORT STRING
TITAN[®]
SINGLE-TRIP
CUT, JACK & PULL
SYSTEM

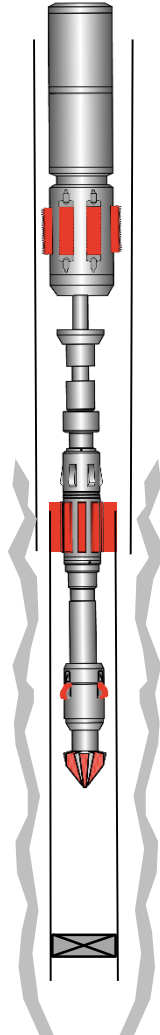
DOWNHOLE HYDRAULIC JACKING VS PULLING CASING FROM SURFACE



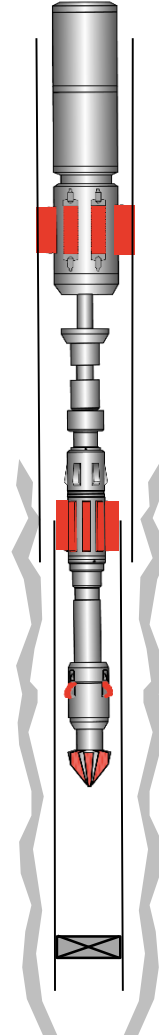
TITAN SYSTEM EXAMPLE OPERATION



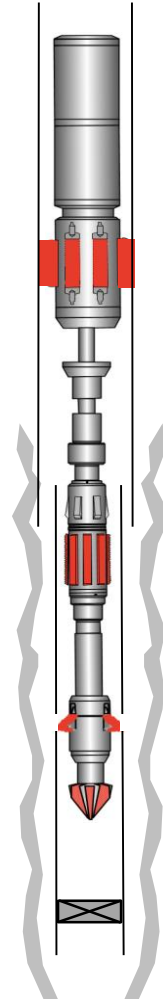
□STEP 1
Run in hole &
Take Pull with rig



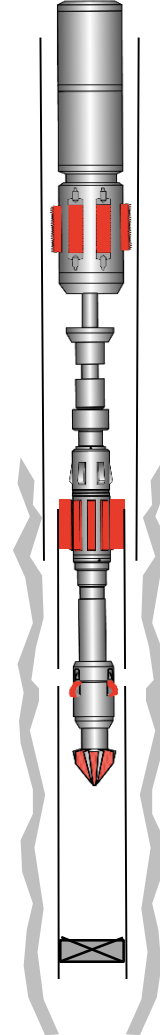
□STEP 2
If No Go set
Anchor and Jack



□STEP 3
If No Go RIH
& Cut Deeper

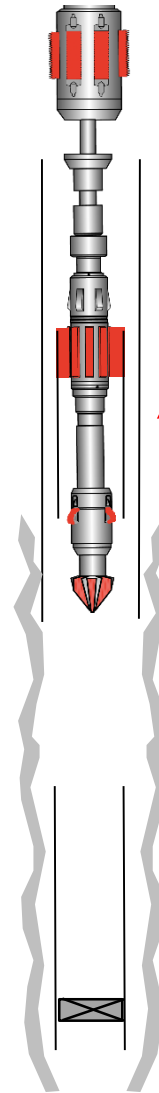


□STEP 4
Pull back & Take
Pull with Rig



□STEP 5
If No Go Set
Anchor and Jack
Casing and recover

Repeat steps 3,4 & 5
As required
Without coming
Out of the hole





SHORT STRING

TITAN®

CASE HISTORY

Enabling
Open
Hole Side-
Track

TITAN – Cut,
Jack & Pull in
a single trip

CASE STUDY – 2017NOR014

COST EFFECTIVE OPENHOLE CASING RECOVERY

The TITAN™ System delivers a 41 hour time efficiency in open hole casing recovery



Industry Standard
Ardyne Operation
Customer Savings



4
TRIPS SAVED



41
HOURS SAVED



65%
EFFICIENCY GAIN

TITAN SYSTEM

The TITAN System unifies casing cutting and recovery with a downhole hydraulic power tool, in a single trip operation.

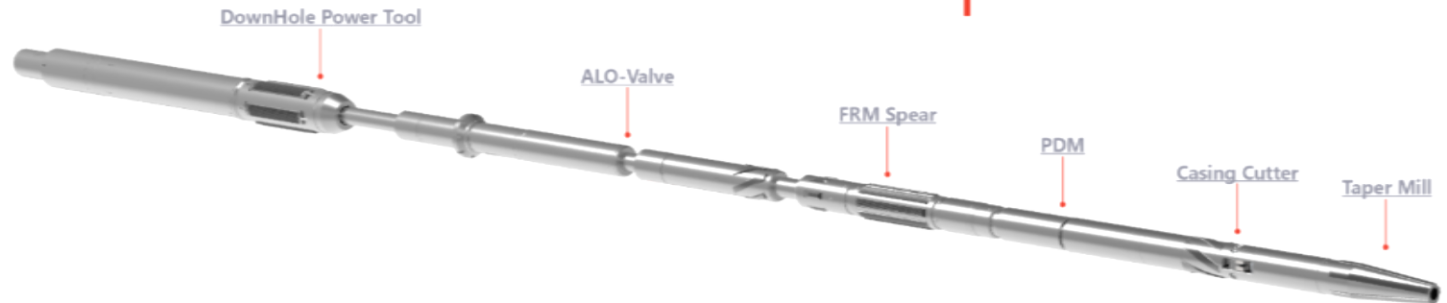
The downhole adaptability of the TITAN System ensures and maximises the recoverable casing in challenging circumstances by utilizing the pulling capacity of the hydraulic power tool with added repeatable casing cutting capability.

THE OPERATION

The TITAN System was deployed on a semi-submersible rig in the North Sea for a slot recovery operation where the operator required the 9 5/8" casing to be pulled approximately 50m below the 13 3/8" shoe into the openhole.

Experience from the field has shown that it has frequently not been possible to recover casing from the openhole using conventional methods.

THE SOLUTION



41 HOURS
SAVED BY THE
TITAN SYSTEM

A BOEING 787
TAKES 41 HOURS TO
CIRCLE THE GLOBE



FRM SPEAR

RESETTING THE STANDARD FOR
OPENHOLE CASING RECOVERY

FASTER. SIMPLER. BETTER.

The TITAN System is Ardyne's latest patent pending casing recovery technology

TITAN SYSTEM
CS-10-2017

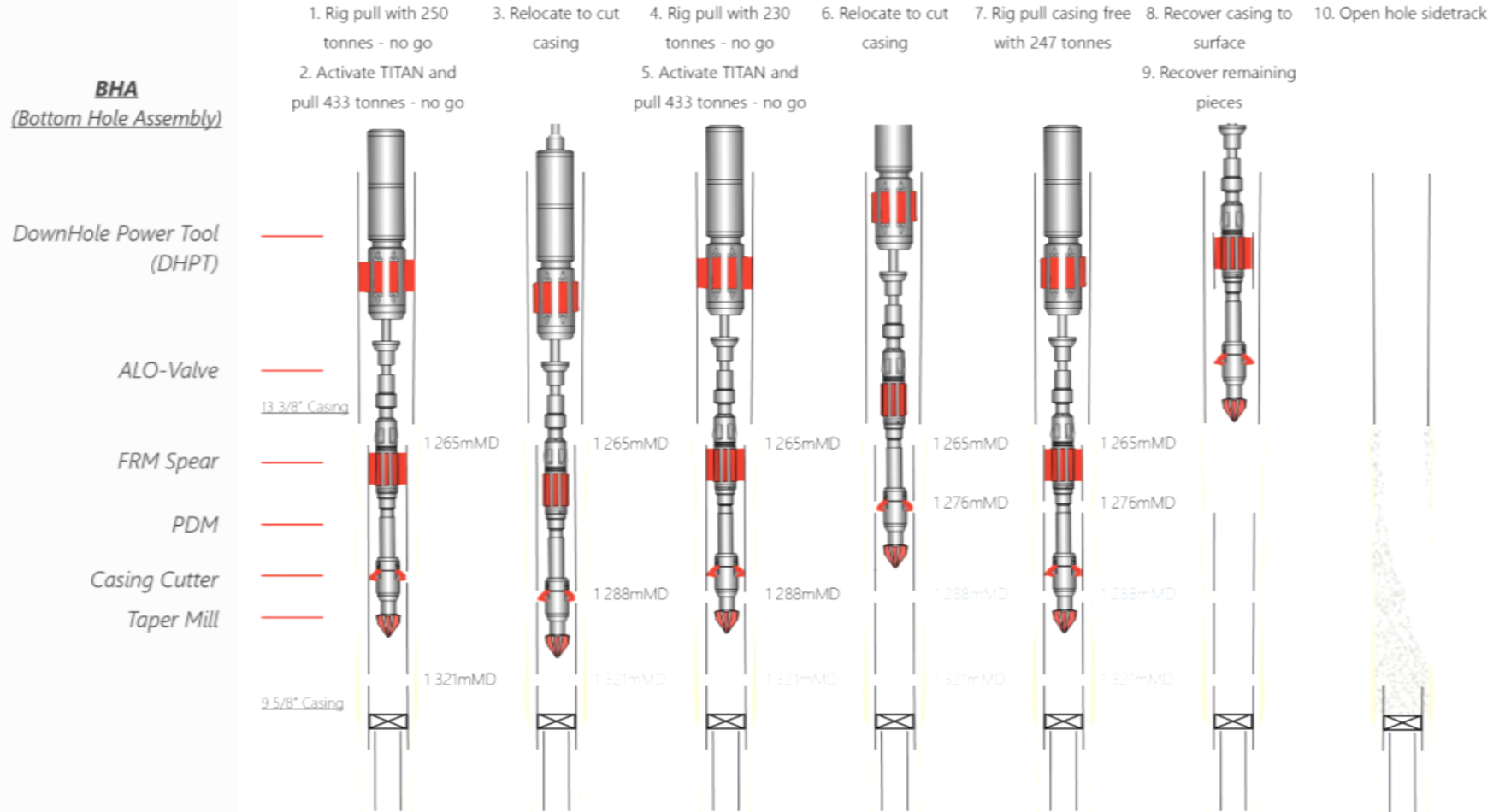
Enabling
Open
Hole Side-
Track

TITAN – Cut,
Jack & Pull in
a single trip

CASE STUDY – 2017NOR014

SINGLE TRIP SEQUENCE - 41 HOURS SAVED

Breakdown of operational sequence for single trip operation with TITAN System



FASTER. SIMPLER. BETTER.

The TITAN System is Ardyne's latest patent pending casing recovery technology

TITAN SYSTEM
CS-12-2017

Rock to
Rock
Cement
Plug

TITAN – Cut,
Jack & Pull in
a single trip

CASE STUDY – 2018UK015

RESETTING THE STANDARD FOR OPENHOLE CASING RECOVERY

The TITAN® System - repeatable on demand casing cutting and jacking capability in a single trip



Industry Standard
Ardyne Operation
Customer Savings



5
TRIPS SAVED



26
HOURS SAVED



65%
EFFICIENCY GAIN

TITAN SYSTEM

The TITAN System unifies casing cutting and recovery with a downhole hydraulic power tool, in a single trip operation.

The downhole adaptability of the TITAN System ensures and maximises the recoverable casing by utilizing the pulling capacity of the hydraulic power tool with added repeatable casing cutting capability in a single trip.

THE OPERATION

The TITAN System was deployed on a semi-submersible rig in the North Sea for casing recovery operation where the operator required 400ft of 9 5/8" casing to be pulled from the openhole. Having the TITAN System deployed means immediate action can be taken when conventional methods are ineffective.

THE SOLUTION

The TITAN System not only maximises recoverable casing, it reduces tripping distance, BHA handling and overall trips; saving hours from your operation, improving safety and reducing costs. The TITAN System gives **total flexibility on sequencing of repeated jacking and cutting operations** in a single trip as it is not reliant on single-use ball drop activation or pipe manipulation. The TITAN System's capabilities are available **on-demand** with the tension-activated ALO-Valve, and mechanical of flow activated TYPHOON® Spear enabling **multiple cutting and jacking in a single trip**.

SETTLED SOLIDS
ENCOMPASSING
RECOVERED CASING



Read more about the TITAN System

TITAN System	DownHole Power Tool	ALO-Valve	TYPHOON Spear	PDM	Casing Cutter	Taper Mill
RUNS	700+	150+	100+	Industry Standard	Industry Standard	Industry Standard

FASTER. SIMPLER. BETTER.
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The TITAN System is Ardyne's latest patent pending casing recovery technology

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TITAN SYSTEM
CS-01-2018

**Rock to
Rock
Cement
Plug**

**TITAN – Cut,
Jack & Pull in
a single trip**

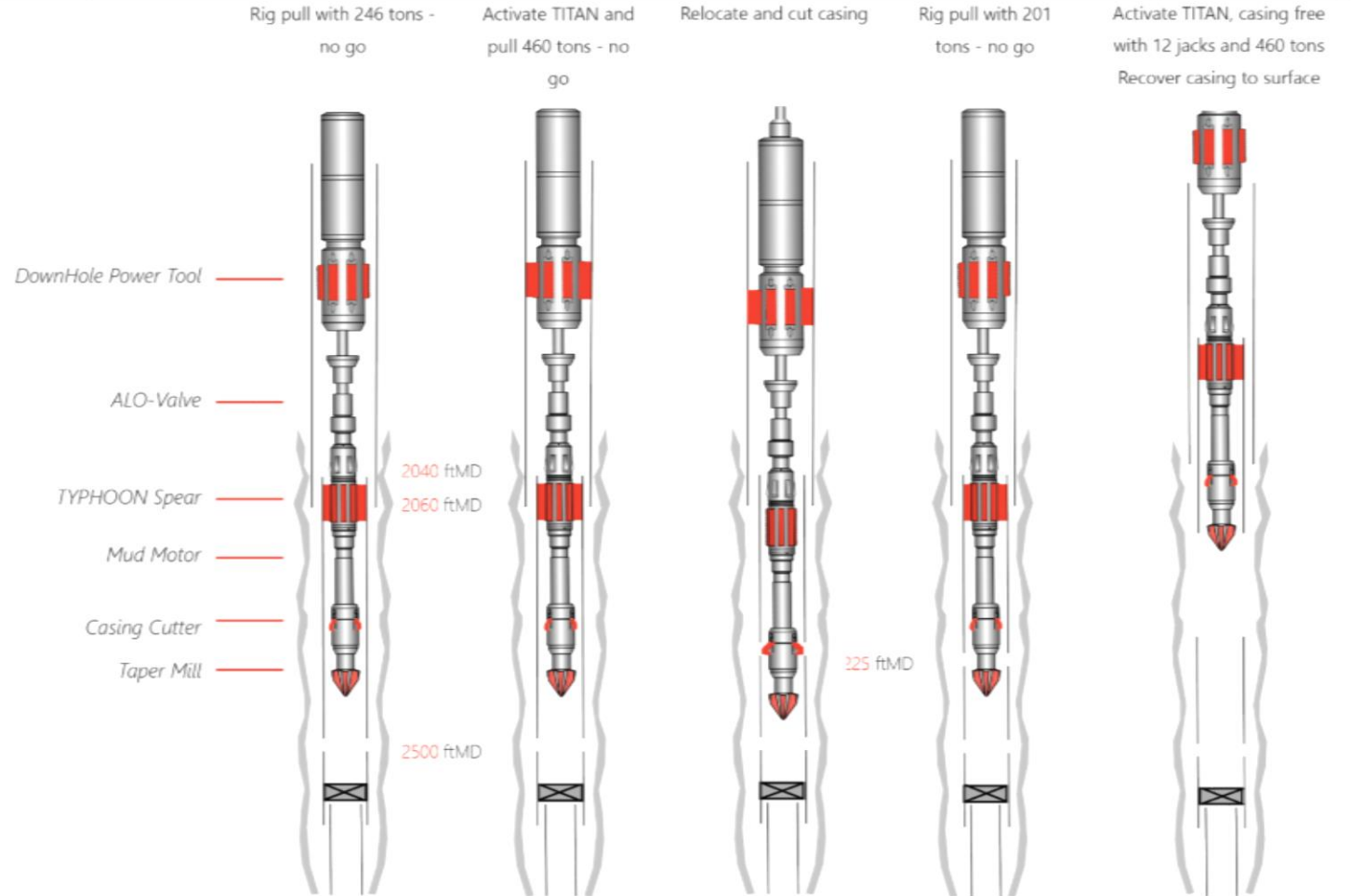
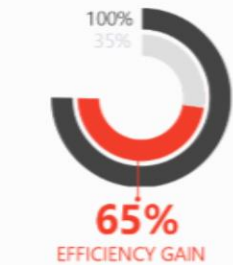
CASE STUDY – 2018UK015

DOWNHOLE ADAPTABILITY IN ONE SOLUTION

Saving hours from your operation, improving safety and reducing costs



Industry Standard
Ardyne Operation
Customer Savings



FASTER. SIMPLER. BETTER.
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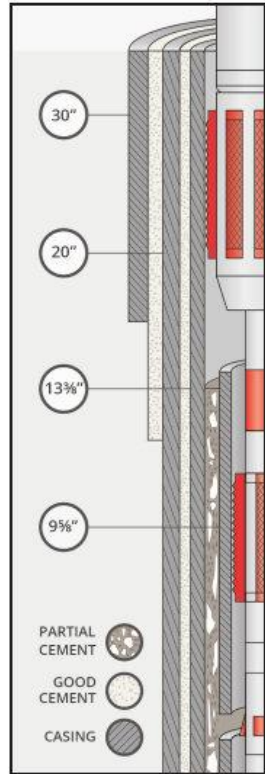
The TITAN System is Ardyne's latest patent pending casing recovery technology

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TITAN SYSTEM
CS 01 2018

CEMENTED CASING RECOVERY

A Proven Alternative to Casing Milling



TITAN® SYSTEM

The TITAN System unifies casing cutting and recovery with a downhole hydraulic power tool, in a single trip operation.

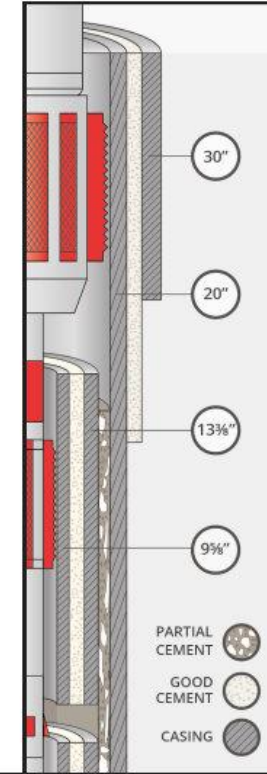
The downhole adaptability of the TITAN System ensures and maximises the recoverable casing by utilizing the pulling capacity of the hydraulic power tool with added repeatable casing cutting capability in a single trip.

THE APPLICATIONS

WELL STAGE	DRIVER	SURFACE UNIT	REQUIREMENT	TITAN SOLUTION	VALUE
Workover	Well integrity	Rig or Rigless	Sustained annulus casing pressure issues	Restore well / casing integrity by recovering leaking casing / external patch & re-cement	No milling / swarf
Brown Field	Re-entry / Workover	Rig	Slot Recovery Sidetrack Barrier placement (depth)	Open Hole Sidetrack - potential hole size enabler by pulling casing below the shoe	Rock to Rock Barrier No BOP Cleaning
P&A	Permanent barrier plug installation	Rig or Rigless	Casing removal for barrier placements (depth)	Recovering casing in settled annular solids	No logging

SINGLE STRING RECOVERY

DUAL STRING RECOVERY



TITAN System	DownHole Power Tool	ALO-Valve	TYPHOON® Spear	Mud Motor	Casing Cutter	Taper Mill
RUNS	750+	200+	170+	Industry Standard	Industry Standard	Industry Standard