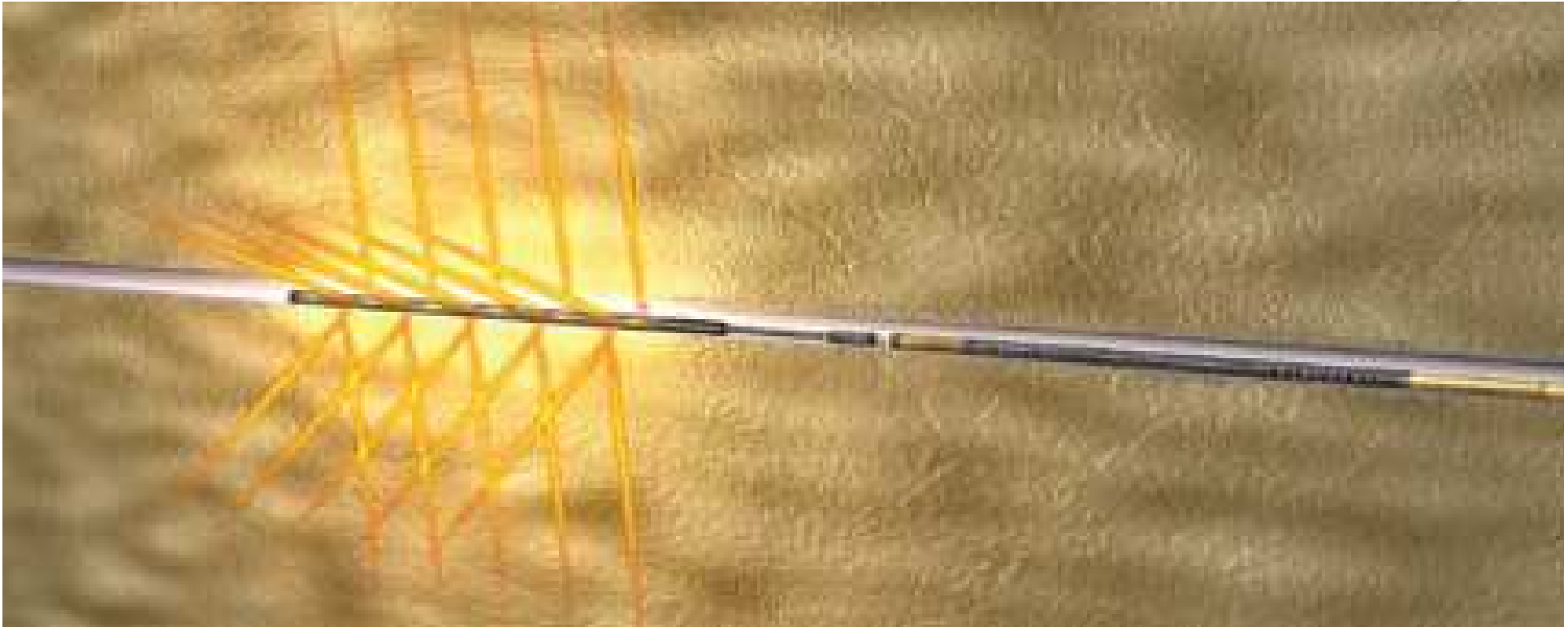


# Ballistics on Tractor Conveyance

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Brian Schwanz - VP Welltec  
MENAPS 2011, Abu Dhabi

# Outline

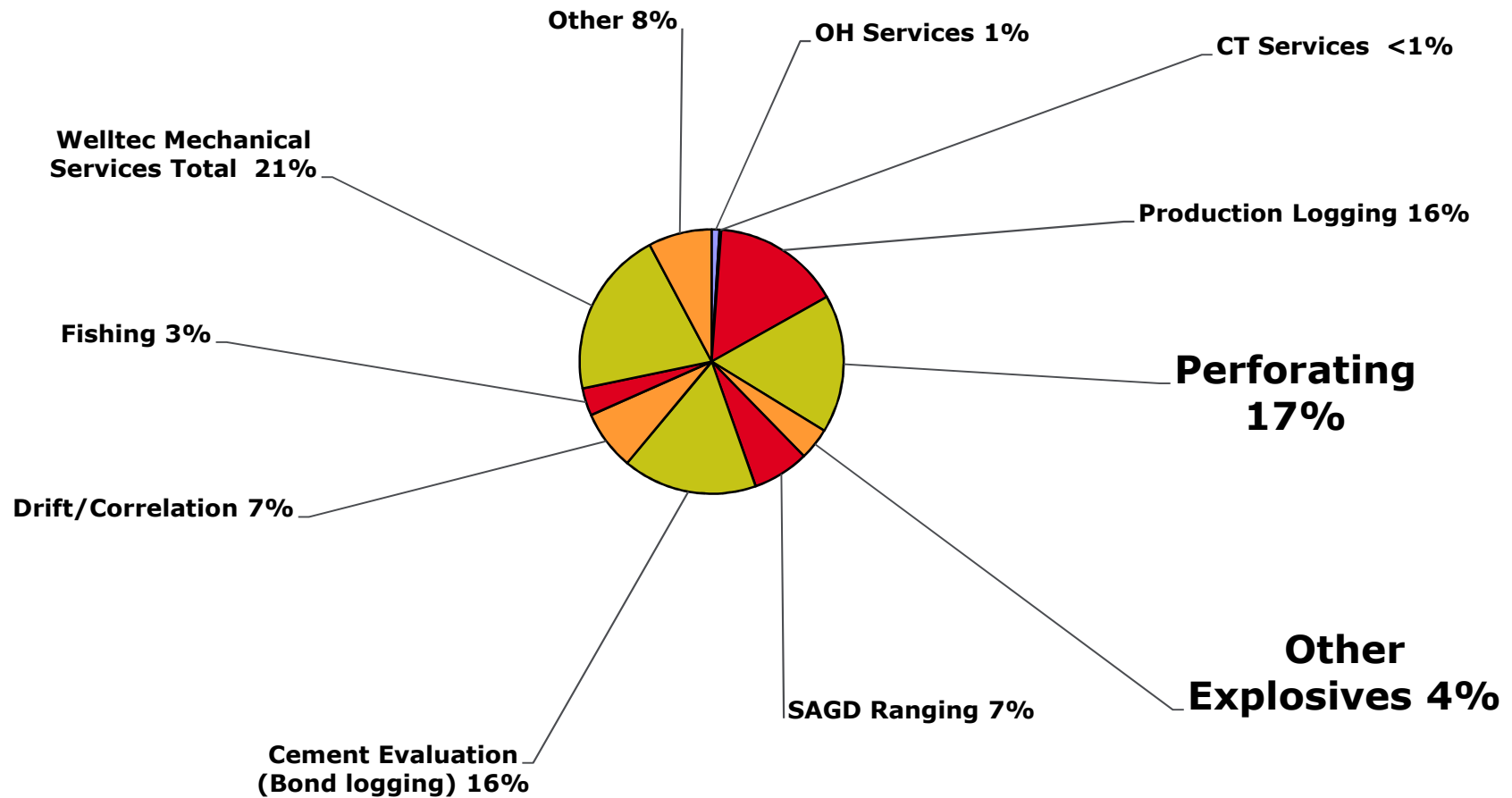
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- Tractor Activity with ***Ballistic*** services
- Tractor and Ballistic Safe Sub Operation
- Addressable Switches and Related Hardware
- Case Histories
  - **High Temperature**
  - **Pipe Recovery Operations**
  - **Plug and Packer Setting**
  - **Heavy Oil**
  - **Sub Sea**
  - **Records**



# Tractor Activity by Service Conveyed

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***Ballistics are 21% of Tractor activity in 2010***

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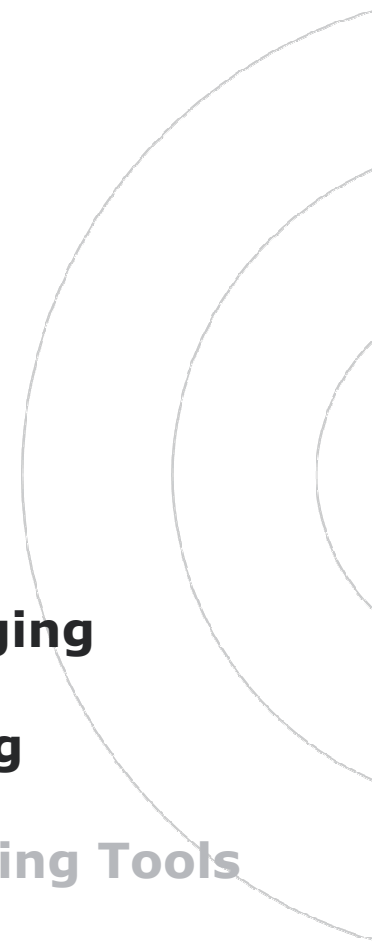
## **Ballistic Activity on tractors (in order of frequency)**

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Types of Ballistic services conveyed:

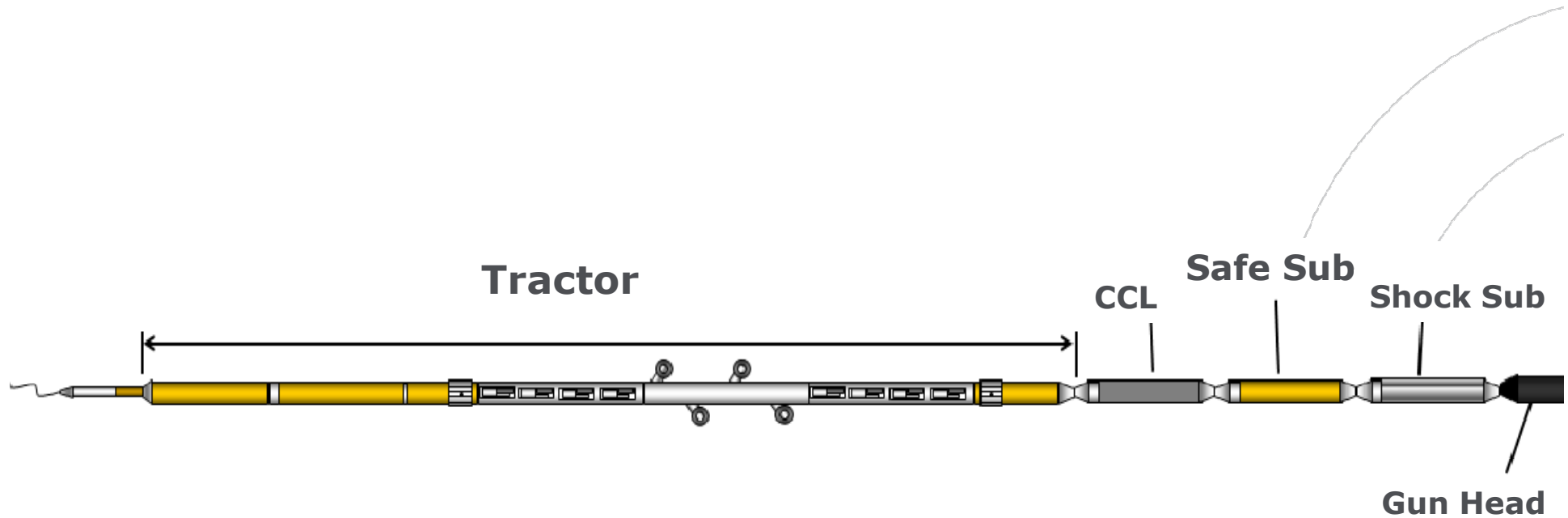
- **Perforating for Production**
  - **Select Fire Operations**
- **Plug and Packer Setting**
- **Back Off Operations**
- **Perforating for Squeeze job - after cement logging**
- **Perforating for Circulation - drillpipe and tubing**
- **Explosive and Chemical Pipe Cutters and Severing Tools**

***Over 3800 runs in hole to convey ballistic services***



# Tractor – Perforating Tool String

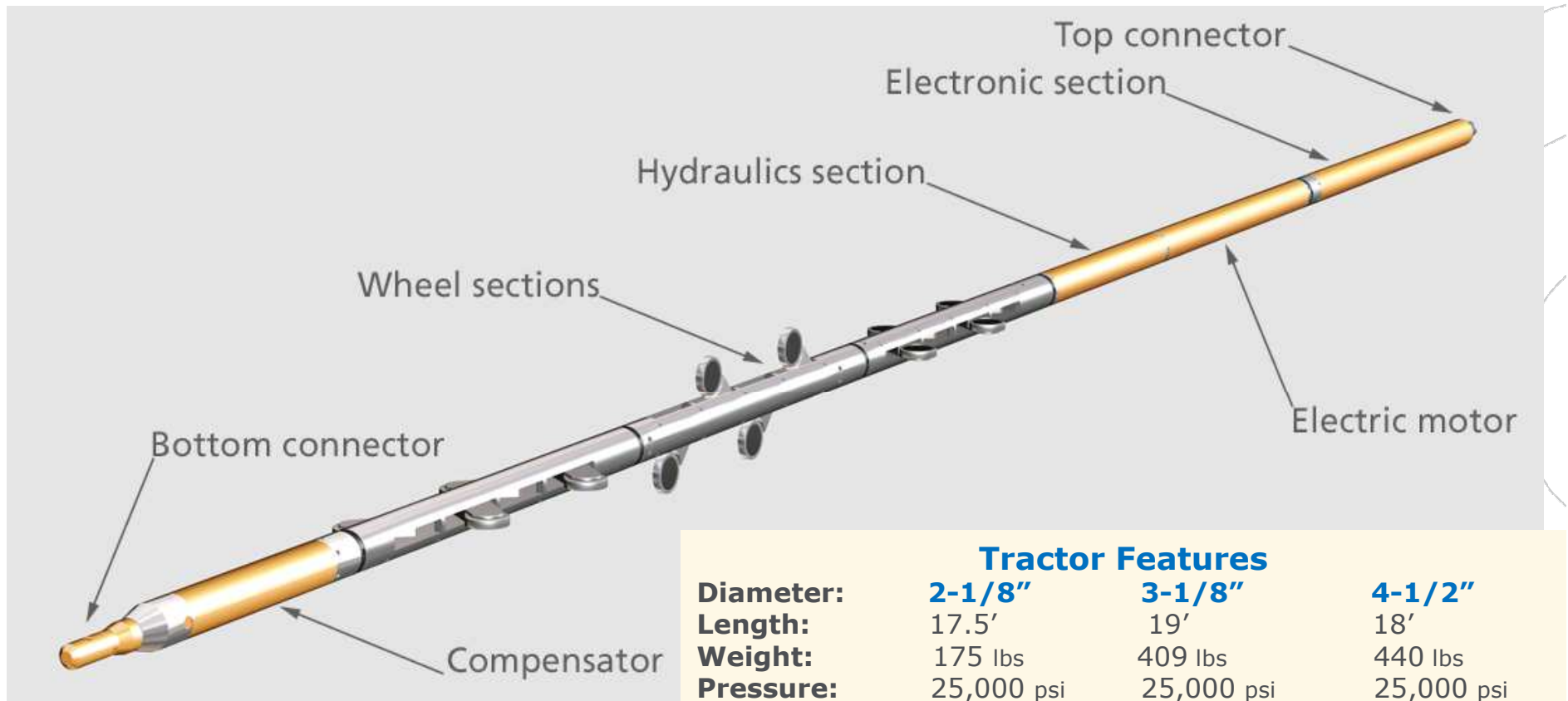
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Other equipment that may be run:

- Release Devices
- Weight bars as spacers
- Cable Head Swivels
- Head Tension Sub

# Electric Wireline Tractor



<b>Tractor Features</b>			
	<b>2-1/8"</b>	<b>3-1/8"</b>	<b>4-1/2"</b>
<b>Diameter:</b>	2-1/8"	3-1/8"	4-1/2"
<b>Length:</b>	17.5'	19'	18'
<b>Weight:</b>	175 lbs	409 lbs	440 lbs
<b>Pressure:</b>	25,000 psi	25,000 psi	25,000 psi
<b>Temp Rating:</b>	400° F	400° F	400° F
<b>DLS: (@ 4" ID)</b>	60° /100'	32° /100'	32°/100' (5")
<b>ID Range:</b>	2.2 – 9.2 in	3.4 – 12.5 in	4.55 – 19.2 in
<b>Tractor Force:</b>	600-1000 lbs*	1200-2400 lbs*	1200-1700 lbs
<b>Tractor Speed:</b>	20-60 ft/min*	25-100 ft/min*	40-60 ft/min*

\*Force and speed can be configured for application

# Tractor Sizes

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# Perforating Animation

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# Ballistic Operations with Tractor

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## 1. Five Safety barriers for Ballistic Operations

- \*Perfo Checklist – All procedures are discussed, signed off by tractor engineer, perforating engineer and company man

- \*Power Box Key - Zero Reset and Safety Switch Key

- \*Tractor Perfo Electronics – K2 relay disconnects perfo

- \*Safe Sub – blocks stray voltage and unintentional deto

- \*High Voltage Detonators or Addressable Switch

## 2. Tractor Safe Subs must be used on all ballistic operations.

## 3. Shock Subs will nearly double life of tractor electronics

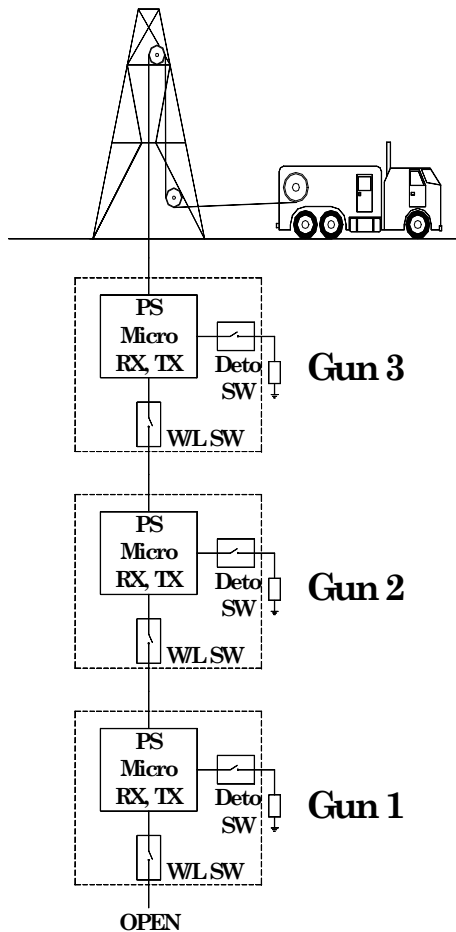
## 4. Add Sinker Bar (5ft), and 2<sup>nd</sup> Shock Sub for back offs

## 5. Do not use Severing Tools – Tractor lost or permanently damaged

## 6. When running a String Shot do not run a shot greater than 480 grain. Anything over 480 may cause damage to the tractor.



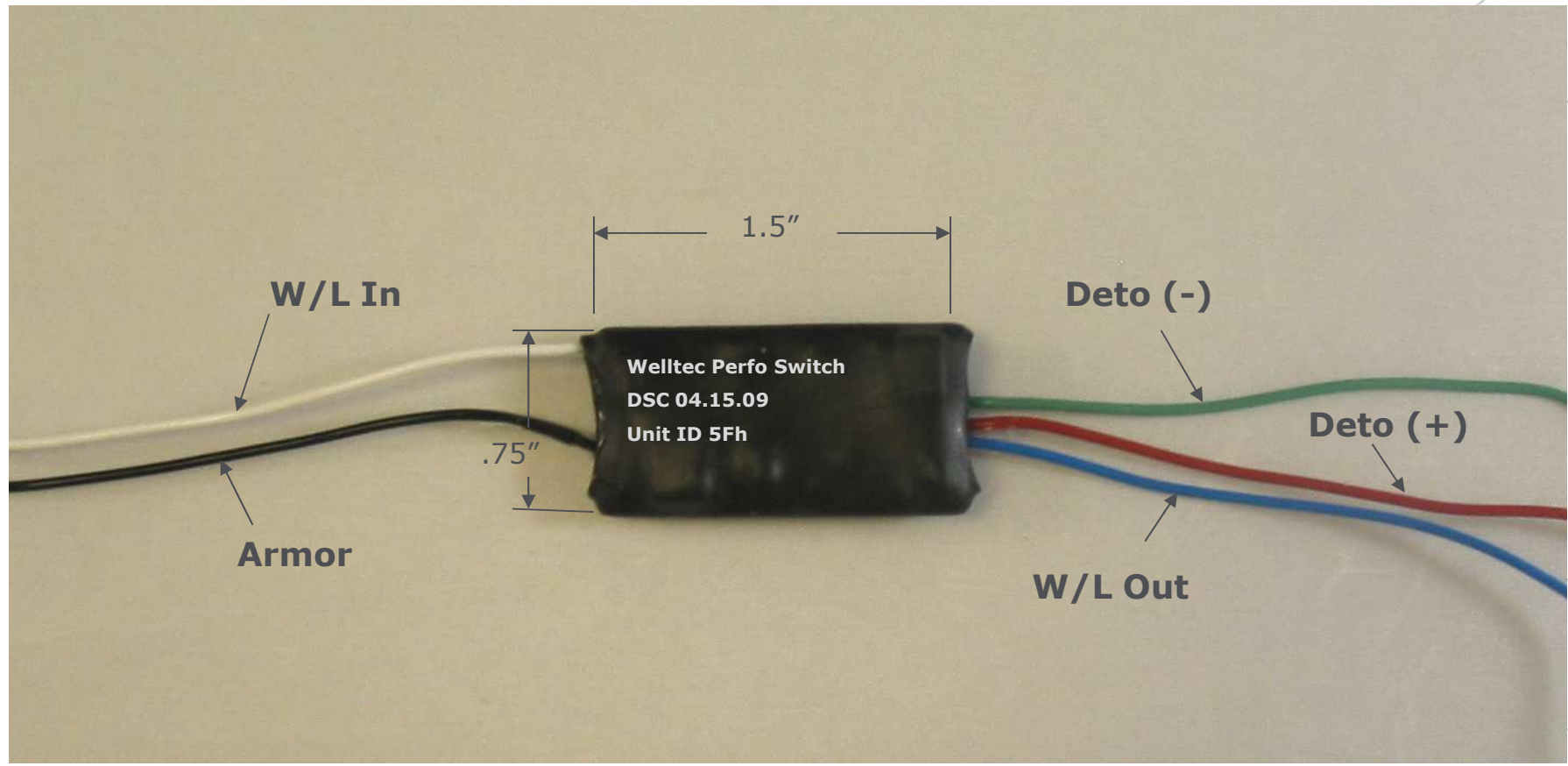
# Recommendation: Addressable Perforating Switches



## Features:

- Replaces conventional Piston Switches
- Operates with all detonator types
- ***Provides another safety barrier***
- Totally expendable and simple to connect
- All guns fire on negative voltage
- Fits through 13/16" port plug hole
- Fail-safe two-way communication
- State machine controller with uplink status
- Skip-over non-fired guns & continue up string
- Up to 40 guns per run
- Temp. rating – 175°C
- Voltage rating – 600V
- Pre-job safety tester complies with RP67
- Proven to be very reliable: >8000 switches - only 1 misrun caused by defective switch

# Recommendation: Addressable Selective Switch



## Haynesville (High Temperature) Case History

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### Well: 6-1H

Date: 4 July, 2011

Sabine Parish, Louisiana

**BHT – 350 degF**

TDMD – 16,702'

TVD – 12,100'

Max Dev. – 91 deg

3 3/8" Select Fire (3 guns)

3 runs in the hole

Restriction at approx 12,500' and tool worked up and down to pass

1 misrun on first gun fired due to "o" ring failure in shock absorber

All guns fired at perforating depth approx 12,750'



## Haynesville High Temp Job

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Damaged O-ring found in Shock Absorber connection



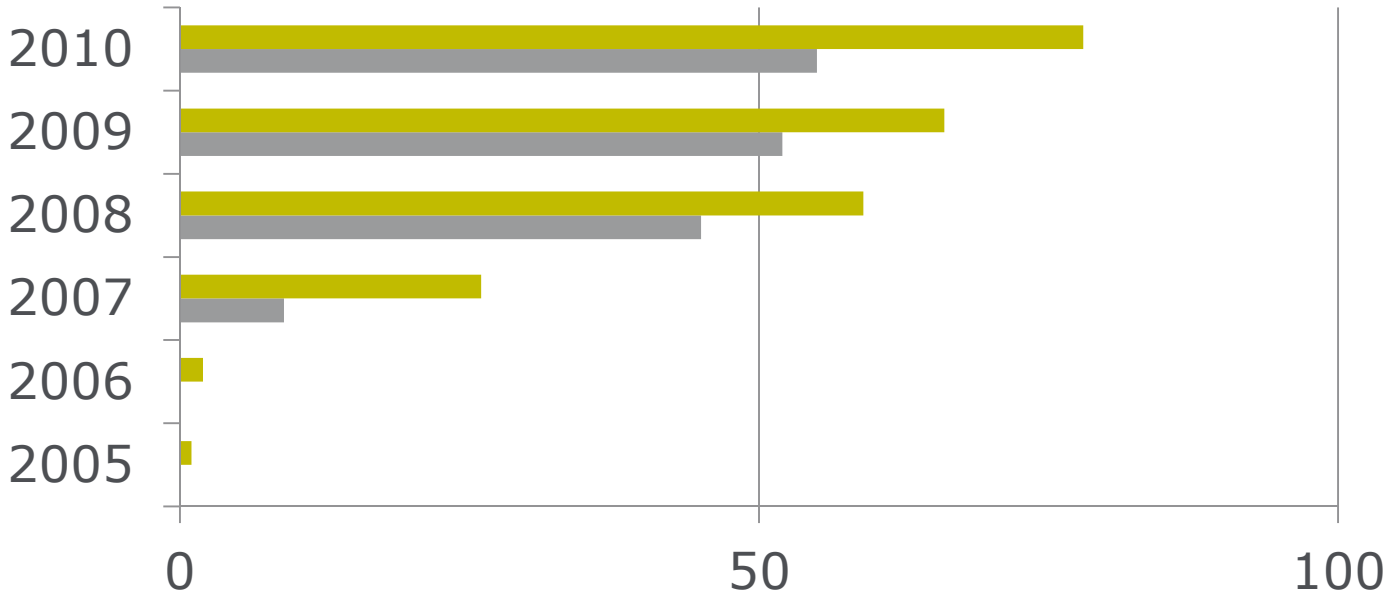
Tractor# 10824258 was found to be a fully functional and made all 3 RIH's on Box 6-1H. The damaged O-ring that caused the initial misrun was type 70 Duro. Recommendation - to replace with more robust type 90 Duro on HP/HT jobs. All maintenance and field personnel have been made aware of this change.

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# Stuck Pipe Conveyance Services

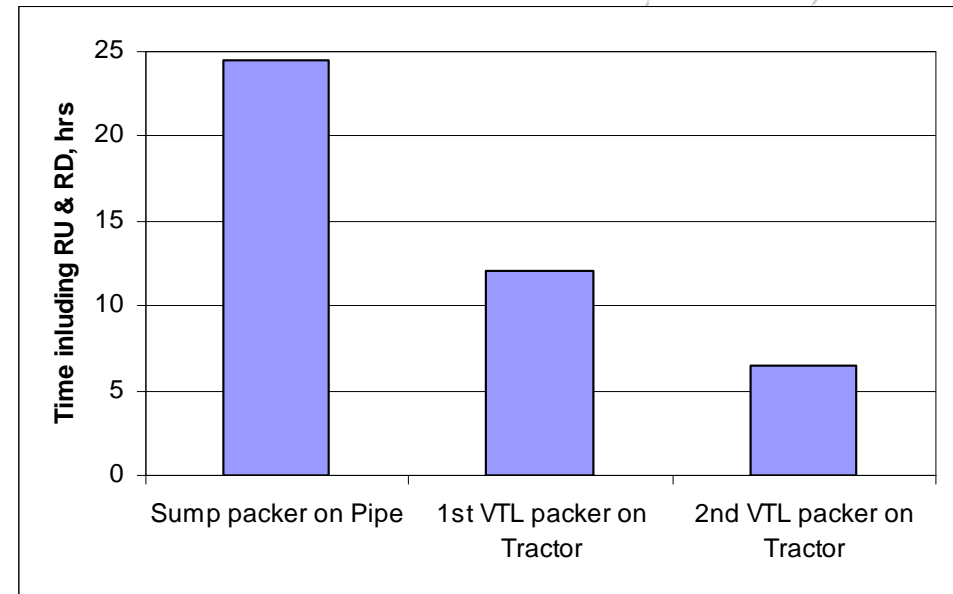
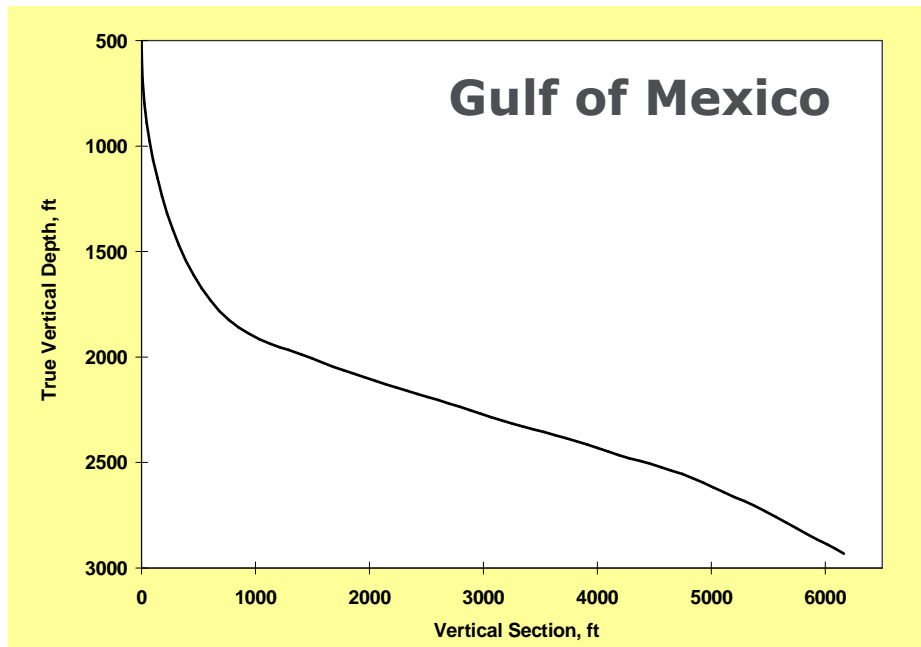
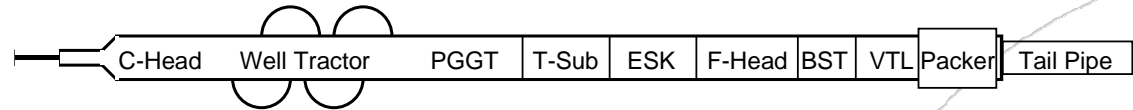
- Tractor high angle free point and back off
- Perforating for circulation
- Pipe cutting

Number of Pipe Recovery & MWD Fishing Jobs



# Two Packer Settings in 18.5 hrs

Tractor 3 1/8" OD



*2 packer runs on Tractor = 19 hrs. 1 packer run on drillpipe = 24 hrs*

# Heavy Oil Operations

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## Challenges

In Canada and Venezuela, many wellbores have heavy oil in the casings  
Oil viscosity approx. 8 API and reservoir temp. down to 44° F  
Casings vary from 7" - 13 3/8" and various sized slotted liners

## Benefits using tractor conveyance

Faster runs, less cost and safer than with TCP  
Sufficient power to convey tools in heavy viscous fluids  
Drive over liner tops and convey in multiple casing diameters



*Heavy oil on Tractor  
after conveying  
perforating gun for  
increasing production  
in Venezuela*



# 1st Tractor from Sub-Sea Intervention Ship

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**(World's First – Sept 2000)**

The objective was to perforate several zones to obtain an increased injection rate. All pressure equipment was placed on seabed in a water depth of 1,000 ft  
Due to rig-up height limitations the Tractor was configured with two drive sections.  
Maximum speed: 4,500 ft/hour - Total tool length: 18 ft.

Well operation data:

Maximum tractor depth: 15,431 ft MD

Maximum deviation: 79 Deg

Maximum temperature: 68 -122 Deg F

Accumulated running distance: 2,802 ft

Services performed: drift run + 4 run 25 ft  
3 3/8" orientated guns



## Perforating Records

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- Deepest well perforations by tractor at 10,068 m (33,224 ft) MD.
- Most Select Fire guns without misfire, on one well = 74 detonations
- Maximum Temperature for Perforating on tractor = 388 F (194 C)
- Longest cumulative distance driven with 1 tractor in 1 well
  - = 82,157m (271,118 ft)
  - Production logging passes and 1 perfo run
- **70 ft of 3 3/8 Perfo guns 110 degrees (uphill) – 2,500 lbs**

## David Huxley the Human Tractor Pulls 1500 times his own weight

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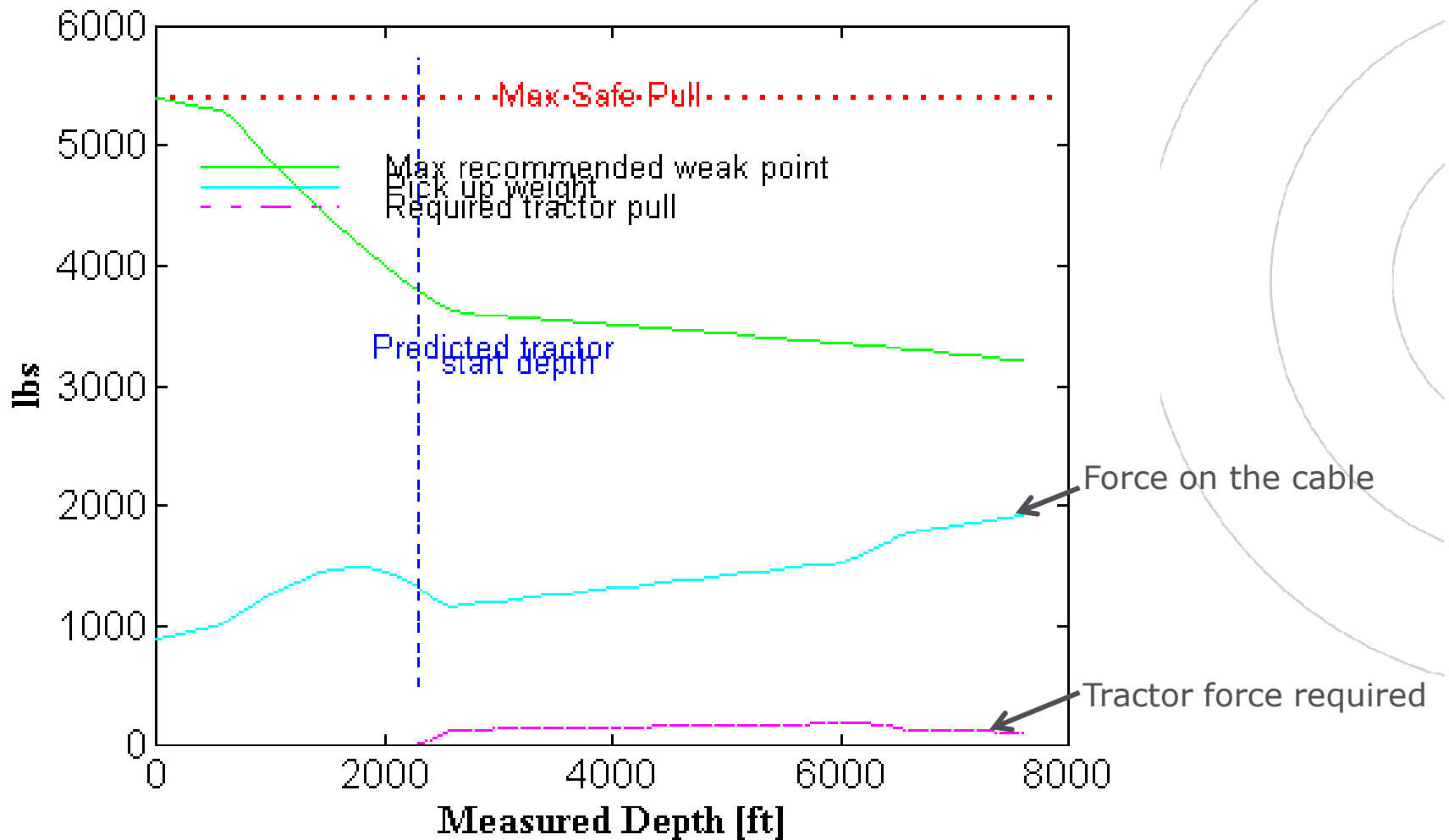


David Huxley pulled a Boeing 747-400, weighing 187 tons, a distance of 91 meters in 1.5 minutes on October 15, 1997 at Sydney, Australia.

The Well Tractor has conveyed 2500 lbs of tools in a horizontal well with a force of 1200 lbs.

# Job Planning Software

## Cable Type: 5/16" (.32") monocable



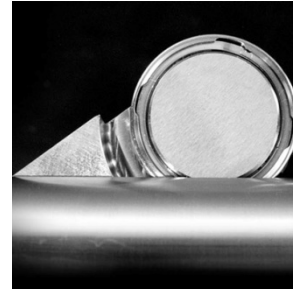
# WORLDWIDE

# Welltec®



# Questions?

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Thank you

