

# A STEP CHANGE IN MULTISTAGE PERFORATING

IPS 16-21

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# AGENDA

- Multistage Perforating in North America
- Horizontal Frac Operations
- Conventional Gun Systems
- New Technology for Multistage Perforating

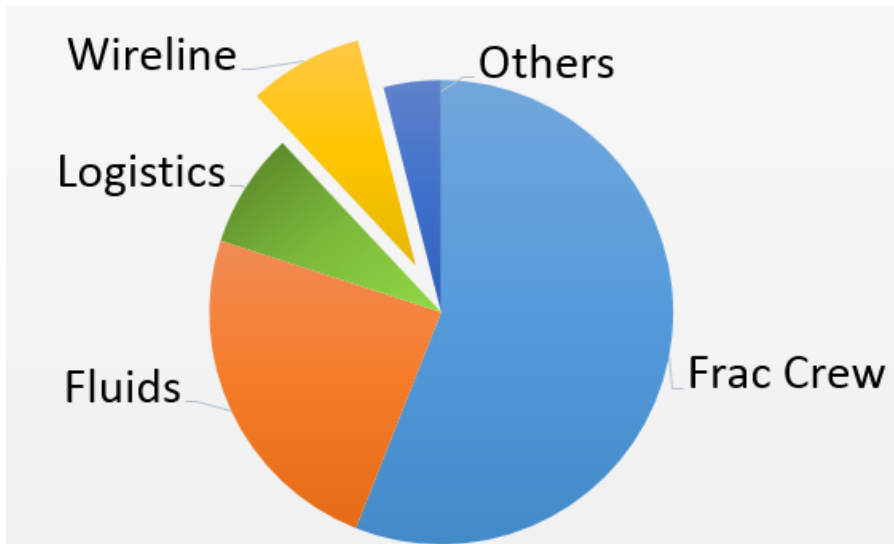




# Horizontal Stage Frac Operation



## Cost distribution for a fracturing operation



## Common Horizontal Frac Operation

- Great amount of equipment and crews from various service companies
- Cost heavily influenced by Fracturing crew expenses
- Economical returns can only be achieved through maximized **efficiency**



# How Efficient is Efficient?

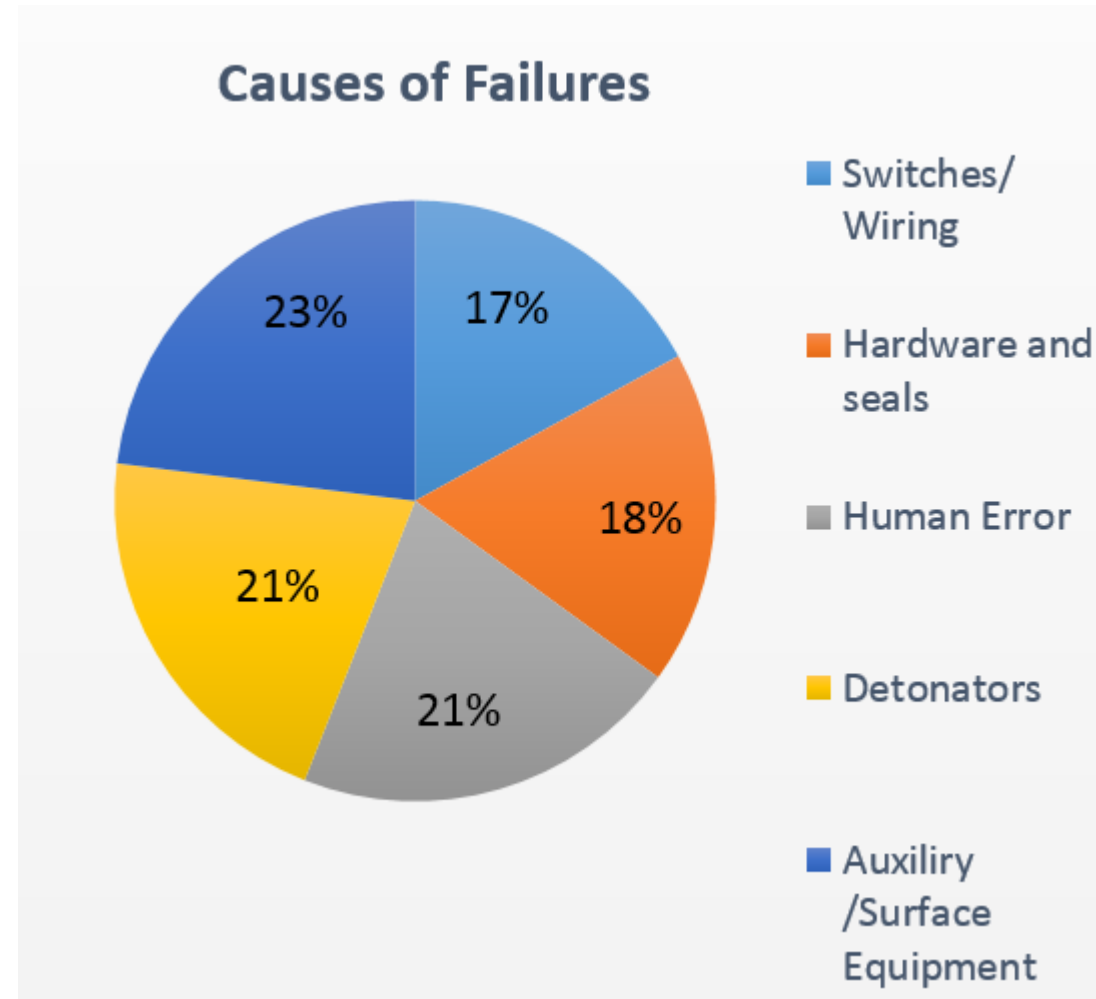
## Opportunities for WL improvement

- Time saved preparing gun string
- Time saved with faster rig-ups
- Time saved preventing misruns



# Conventional Guns Reliability

- Conventional Gun Systems have potential for service quality issues
- Wiring and assembly are critical points in the process



# Conventional Gun Shop Operations



## Intermediate Adapters



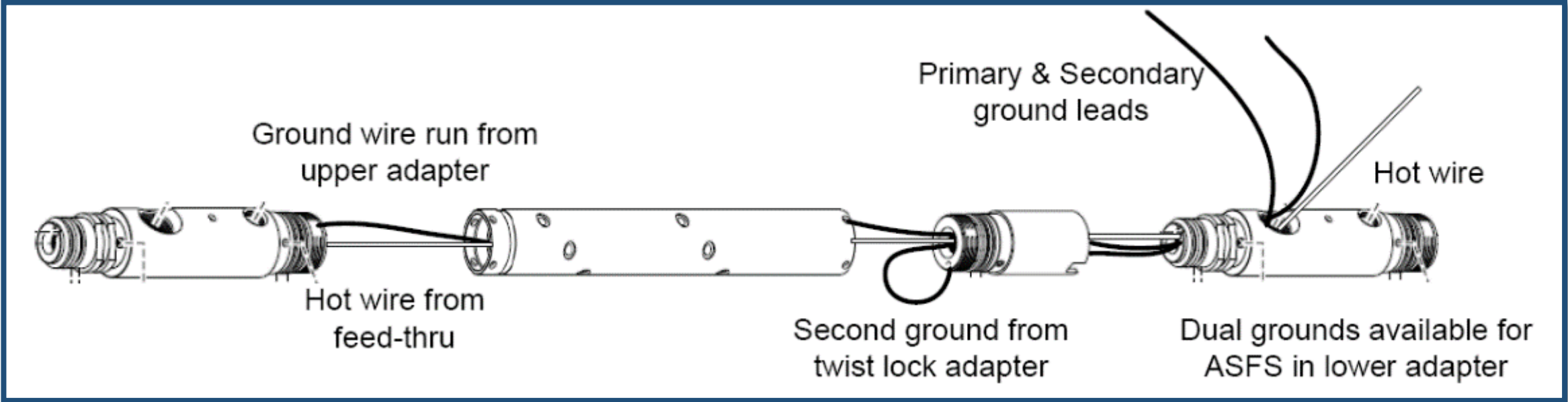
## Loading Process



## Gun Strings



# Conventional Gun Shop Operations





# Conventional Wellsite Operations

- Perforating strings range from 4 to 10 guns per string
- Radio Silence zone required
- Gun string electrical connections
- Detonators armed at the well site



# A Revolutionary Multistage Perforating System

A new benchmark for Multistage Perforating:

- ✓ Safest initiator system in the industry
- ✓ Improved Reliability
- ✓ Improved Operational Efficiency
  - Gun Shop
  - Well site



# Safety- Ballistic Interrupt



# Reliability & Efficiency - Gun Shop



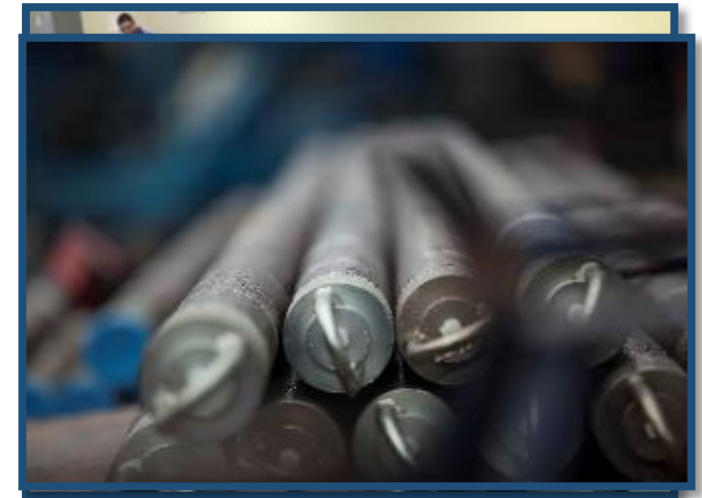
## Intermediate Adapters



## Loading process

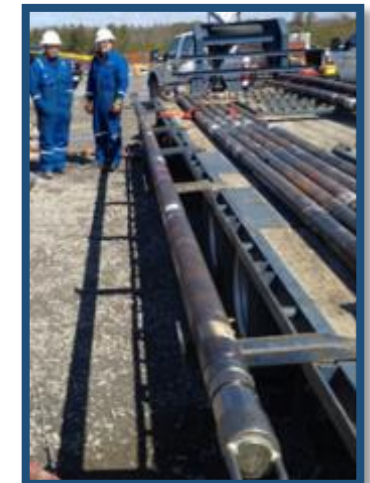
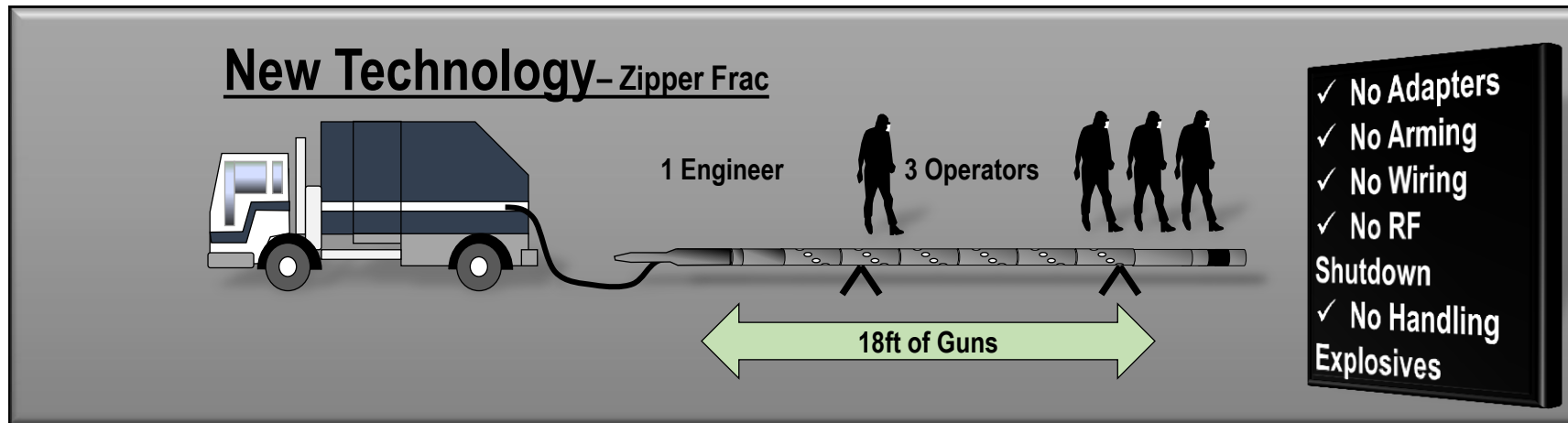
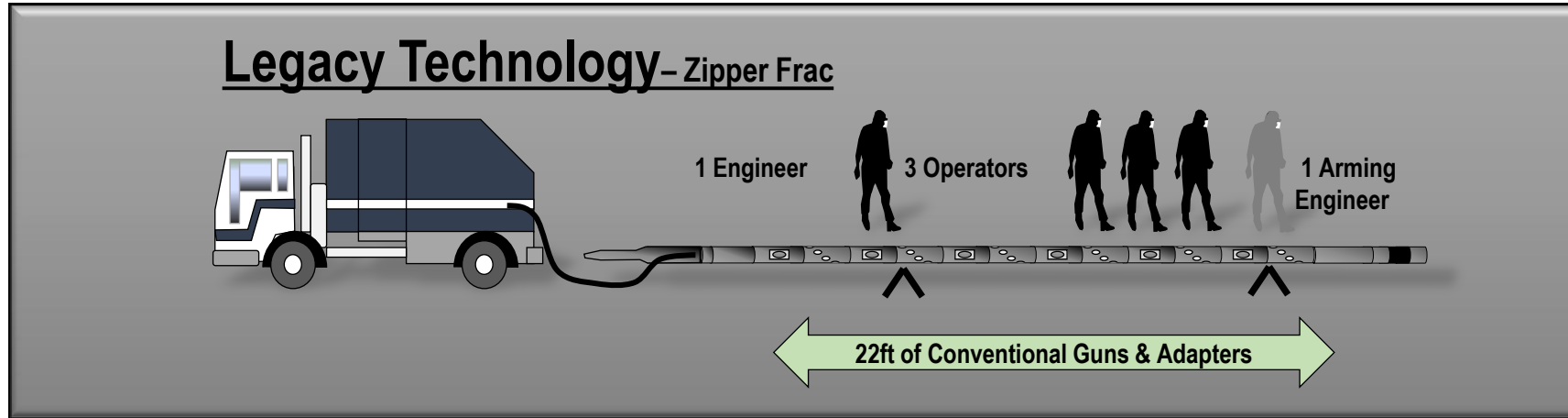


## Gun Strings





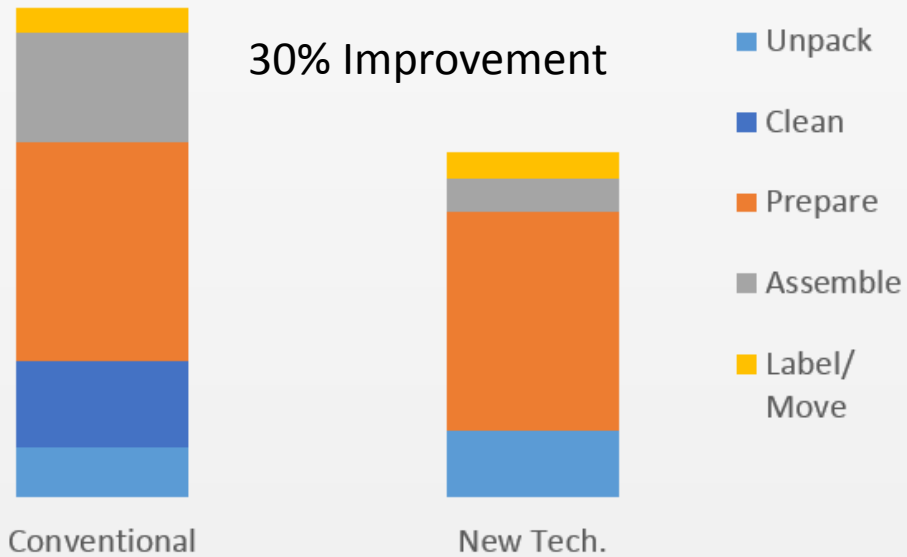
# Reliability & Efficiency - Well site



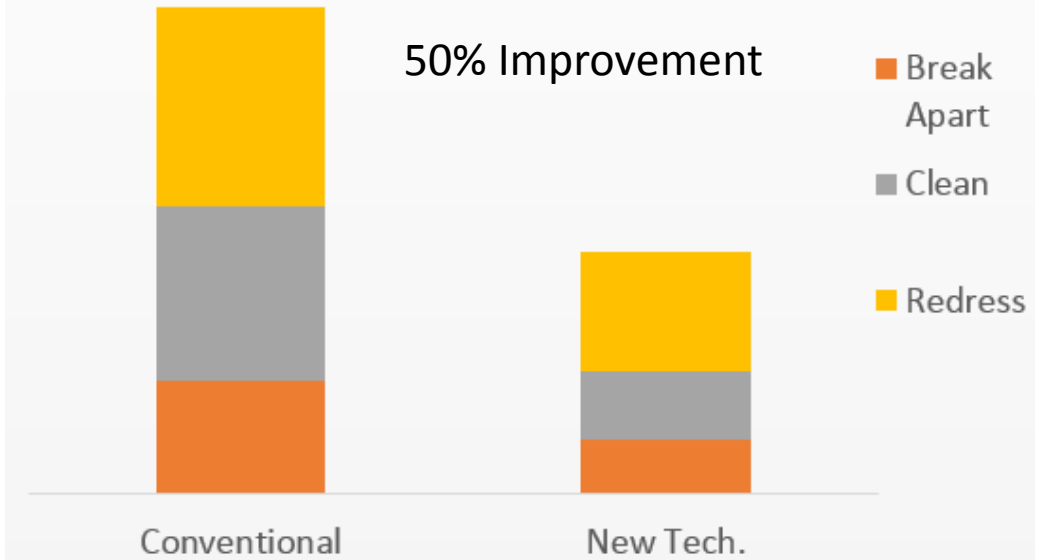
# North America Land Deployment



Gun Shop Efficiency ( Conventional vs New Tech.)



Wellsite Efficiency (Conventional vs. New Tech.)



# Specifications

Specifications	
Gun Diameter in, (mm)	<b>2-7/8 , 3-1/8, 3-1/2</b> (73.0, 79.4, 88.9)
Gun Length ft, (m)	1, 2, 3, 5 (0.3, 0.6, 0.9, 1.5)
Shot Phasing/ Density	60°/6 shots per foot (60°/20 shots per meter)
Reliability	99.9 % or higher
Max Temperature / Pressure	340°F (171°C) – 18K Psi or 20Kpsi
Arming Options	Ballistic Interrupt Detonator / Radio Safe Detonator
Gun Housing type	Slick, Scalloped
Guns Selectivity	Up to 40 addresses



# Multistage Stimulation Perforating Solution

## Safety



- Ballistic interrupter
- Addressable Switch Technology

## Reliability



- Modular approach – easier to load
- Pre-assembled from factory
- Fully disposable (no need for cleaning, quick TAT)

## Efficiency

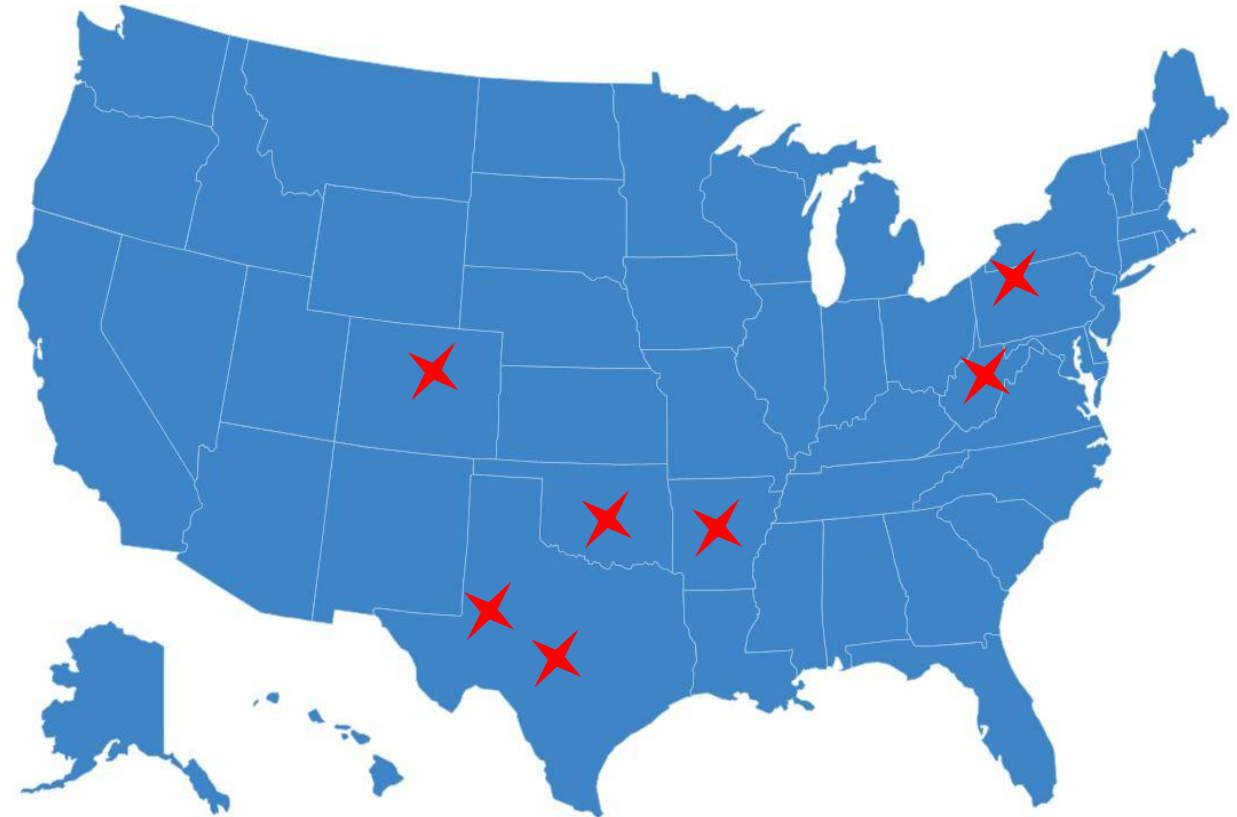


- No well site arming
- Tested and verified
- Optimized rig up



# North America Land Deployment

- 7 locations in North America
- Proven reliability 99.9%
- > 16,000 guns shot
- > 3,100 stages completed



# 2016 INTERNATIONAL PERFORATING SYMPOSIUM GALVESTON

## QUESTIONS?

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