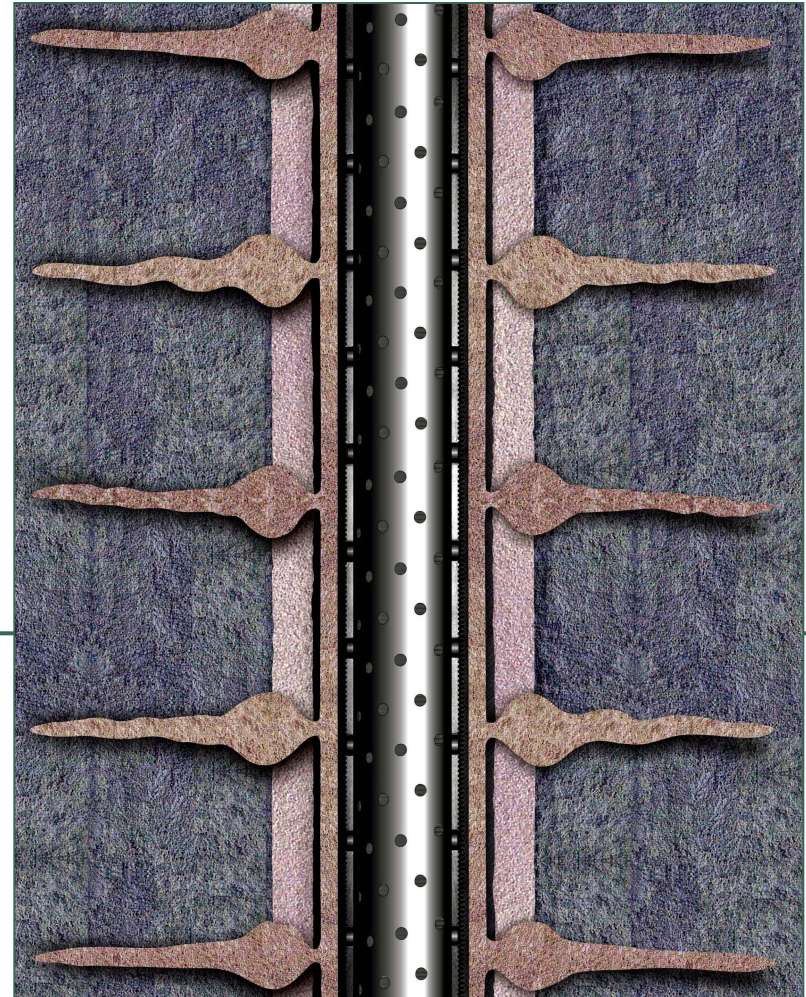




**Weatherford<sup>®</sup>**

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## **Gravel Pack Systems**





# Weatherford's Premium Performance



## Discover

**breadth and depth**  
of completion technology

**custom-engineered systems**  
for your toughest wells

**knowledge** you can count on  
– every time



# Discover Premium Performance

Weatherford provides completion options with a broad range of products to meet every application

- Packers
- Subsurface safety systems
- Flow controls
- Downhole control valves
- Intelligent completions
- **Gravel packs**

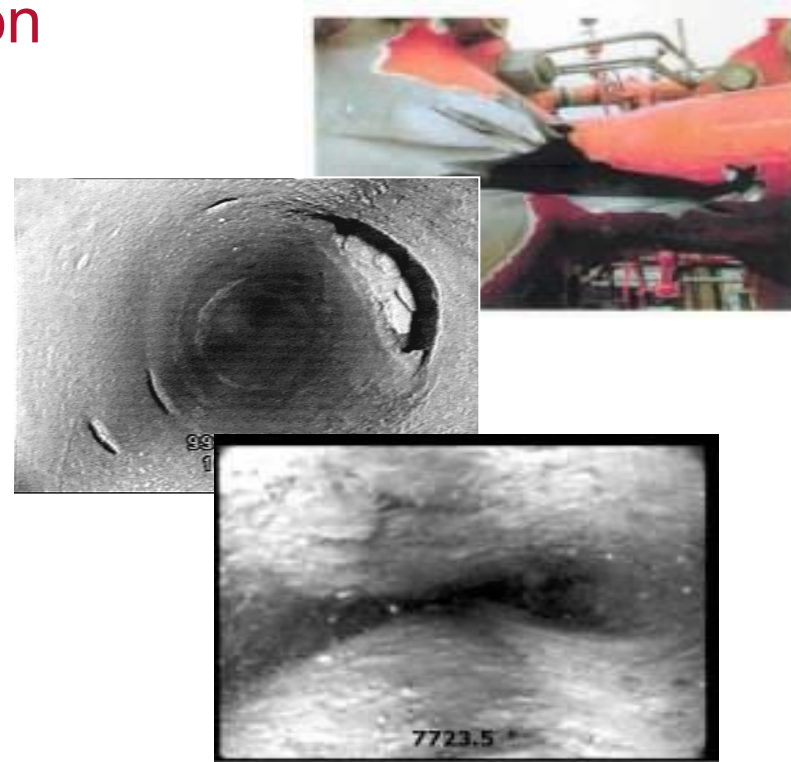




# Controlling Sand Production

## Problems caused by sand production

- Environmental and Safety
  - Erosion of wellheads and surface piping
- Shut in production due to sanding up
  - Tubing, casing, separators, flowlines
- Well damage
  - Collapsed casing
  - Erosion to tubing and casing
  - Pump damage
- Formation damage
  - Disturbs natural sand matrix
  - Loss of sandstone affects remedial action effectiveness
  - Reduction of fracture conductivity
- Disposal
  - Can be considered a hazardous material with high disposal costs





# Controlling Sand Production

## Common Methods

- Production rates
- Oriented perforating
- Stand alone screens
- Cased hole and open hole gravel packs
- Frac packs
- Expandable sand screens

## Three Goals

- Control the movement of formation fines
- Create minimal restriction to production
- Contribute to the longevity of the well



# Weatherford's Fit in the Market

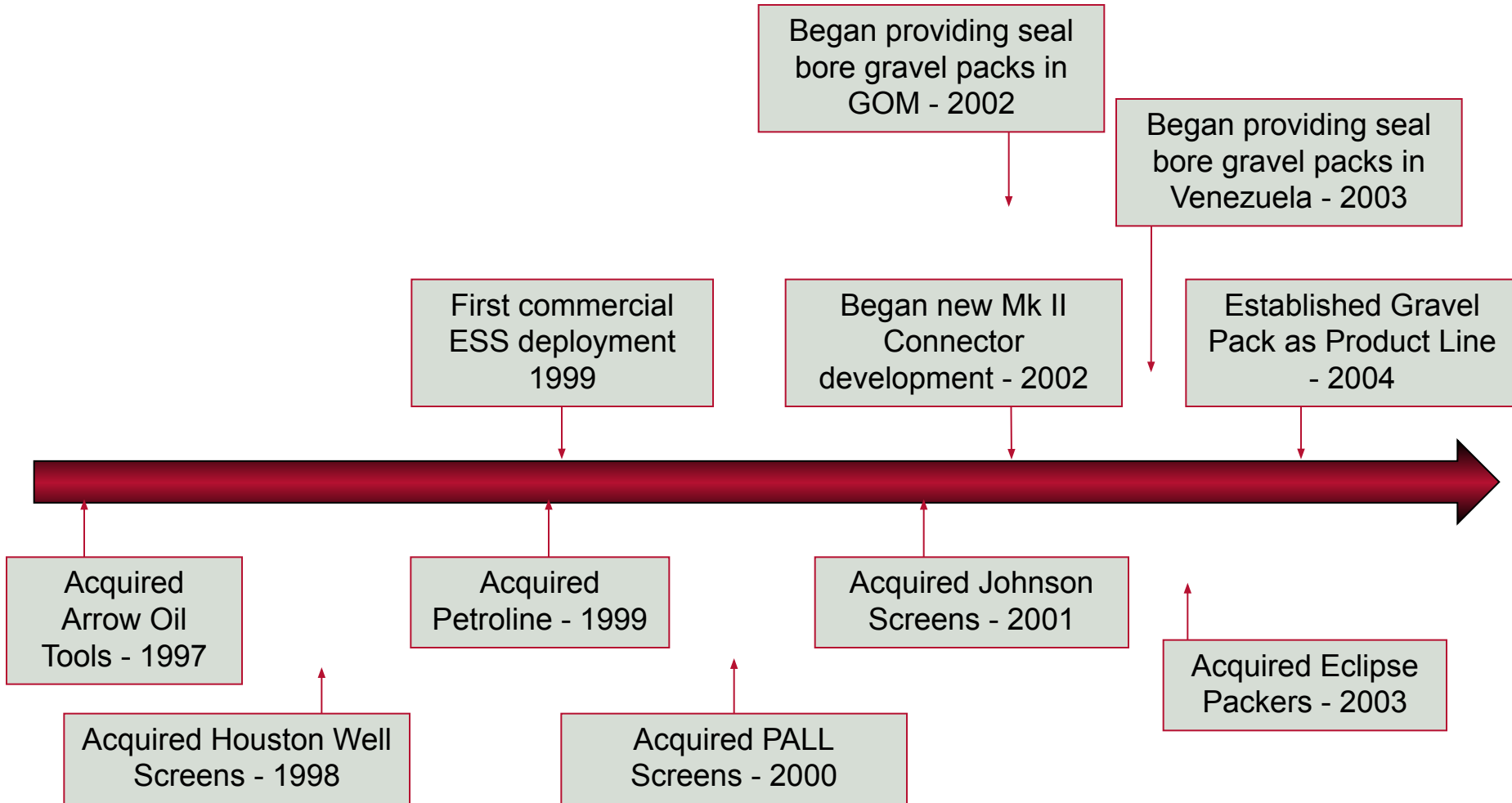
## Is Weatherford a sand control company?

- Largest worldwide manufacturer of oil and gas well screens
- Leader in development of Expandable Sand Screens ESS<sup>®</sup>)
  - New and revolutionary technology
  - Over 400 installations
- Broad selection of cased-hole packers
  - Mechanical and hydraulic
  - Permanent and retrievable
- Moving into the gravel pack market
  - Currently performing gravel packs in Gulf of Mexico, California, and Venezuela



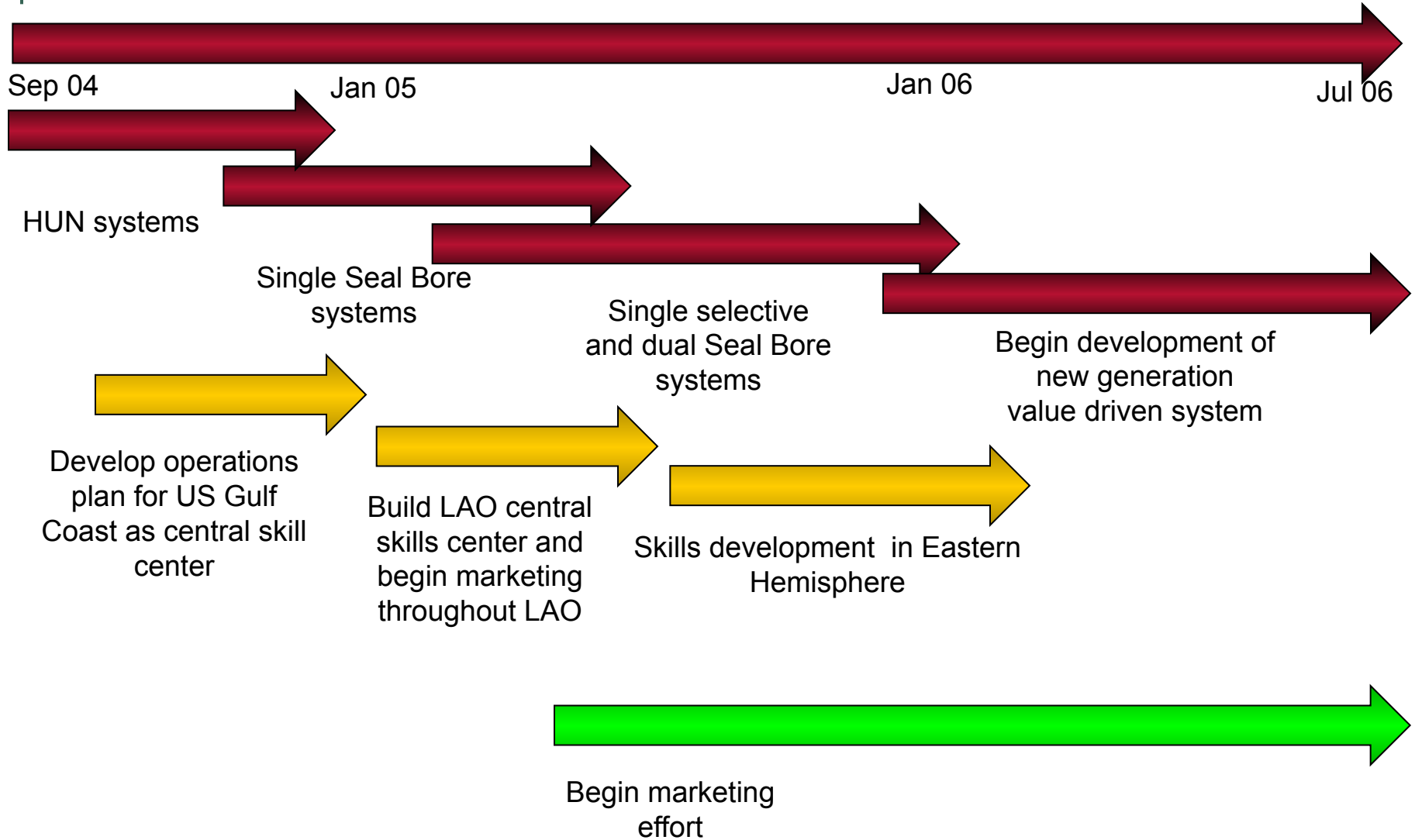


# Weatherford's Evolution as a Sand Control Provider





# Product Development Timeline







# Weatherford's Strategy

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Weatherford will establish itself as a provider gravel pack solutions focused on overlooked, neglected, and price sensitive markets.

Utilizing its broad range of products and services, it will evolve to a position as an expert provider of mechanical sand control solutions offering the most comprehensive selection of completion and production equipment



# Weatherford's Strategy

## Initial Focus

- Mature and overlooked markets
  - Majority of the world's wells are in mature fields
  - Focus on high volume market
- Economical systems offering added value to producers
  - Weatherford offers all the major tool components
  - Open more market through providing affordable solutions
- Leverage our position with mechanical solutions
  - Provide a broad range of expertise with
    - Drilling
    - Interventions
    - Completions
    - Artificial lift
- Partner with local independent stimulation companies



# Weatherford's Strategy

## Long Term Focus

- Combine conventional practices with new technology
  - GP systems with greater functionality
    - Expandable products
    - Intelligent completions
- Keep gravel pack strategy aligned with Weatherford corporate business model
  - Drive value priced solutions for producers
  - Capitalize on manufacturing efficiencies
  - Focus on the majority of the market



**Weatherford<sup>®</sup>**

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**Focused on Economical  
Gravel Pack Solutions**



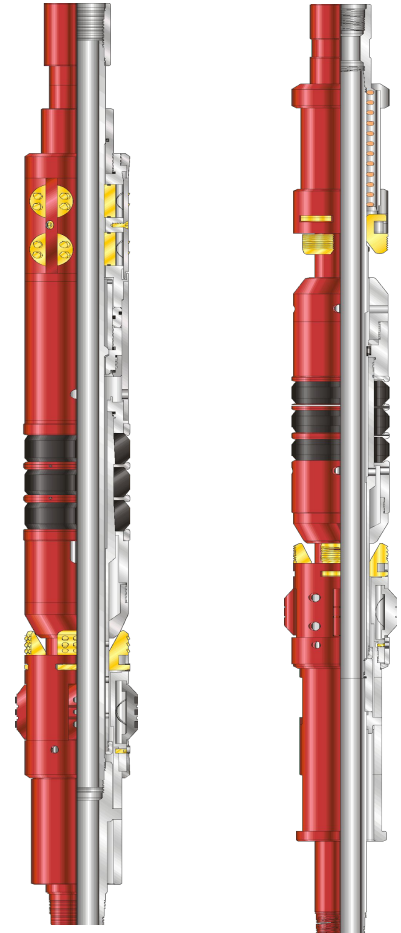
# Hookup Nipple System

## Candidates

- Shallow to medium depth wells
  - Up to 5,000 ft
- Vertical or slightly deviated
  - Tools require rotational manipulation
- Stable well conditions
  - Fluid loss
  - Well kicks
- Land and inland waters

## Equipment Requirements

- Mechanical service packer
- Hookup nipple assembly
  - Mechanical or hydraulic release
    - Hydraulic release is preferred
- Production packer
- Hookup nipple overshot



HD Service ArrowSet™ 1-X  
Packer                  Packer



# Hookup Nipple System

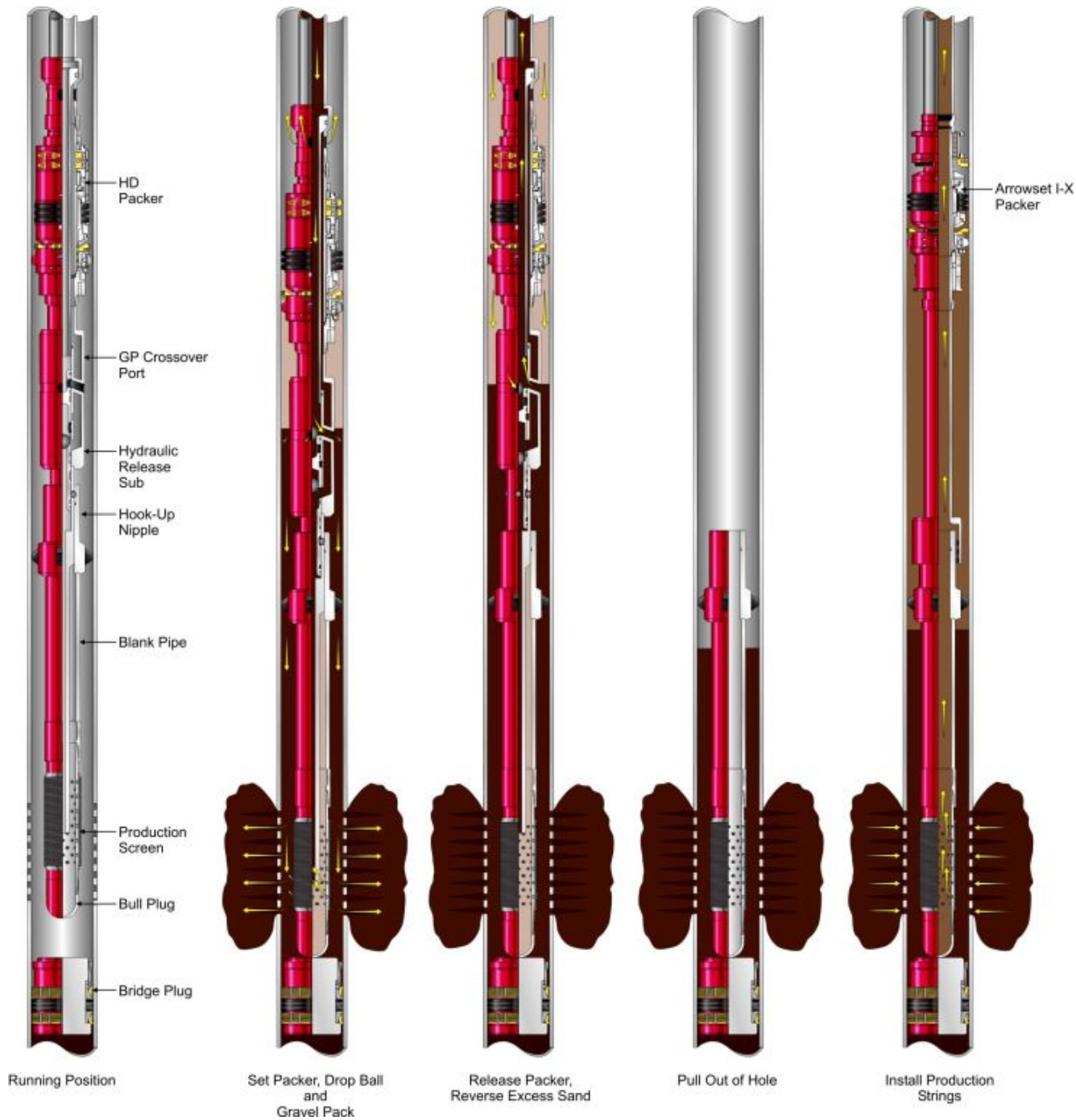
## Circulating or squeeze packs

- Circulating pack is preferred
  - Better for longer intervals
  - Forces sand placement to bottom
  - Accommodates laminated reservoirs
  - Viscous or non-viscous carrier fluids
- Squeeze packs sometimes necessary
  - Poor casing integrity above packer
  - Not an issue with short zones

## Procedure

- Performed in two trips
  - Install and perform GP with service packer
  - Pull out with service packer and crossover assembly
  - Install production string, overshot and packer

# Hydraulic Release HUN System





# Seal Bore – Cross Over Tool Systems

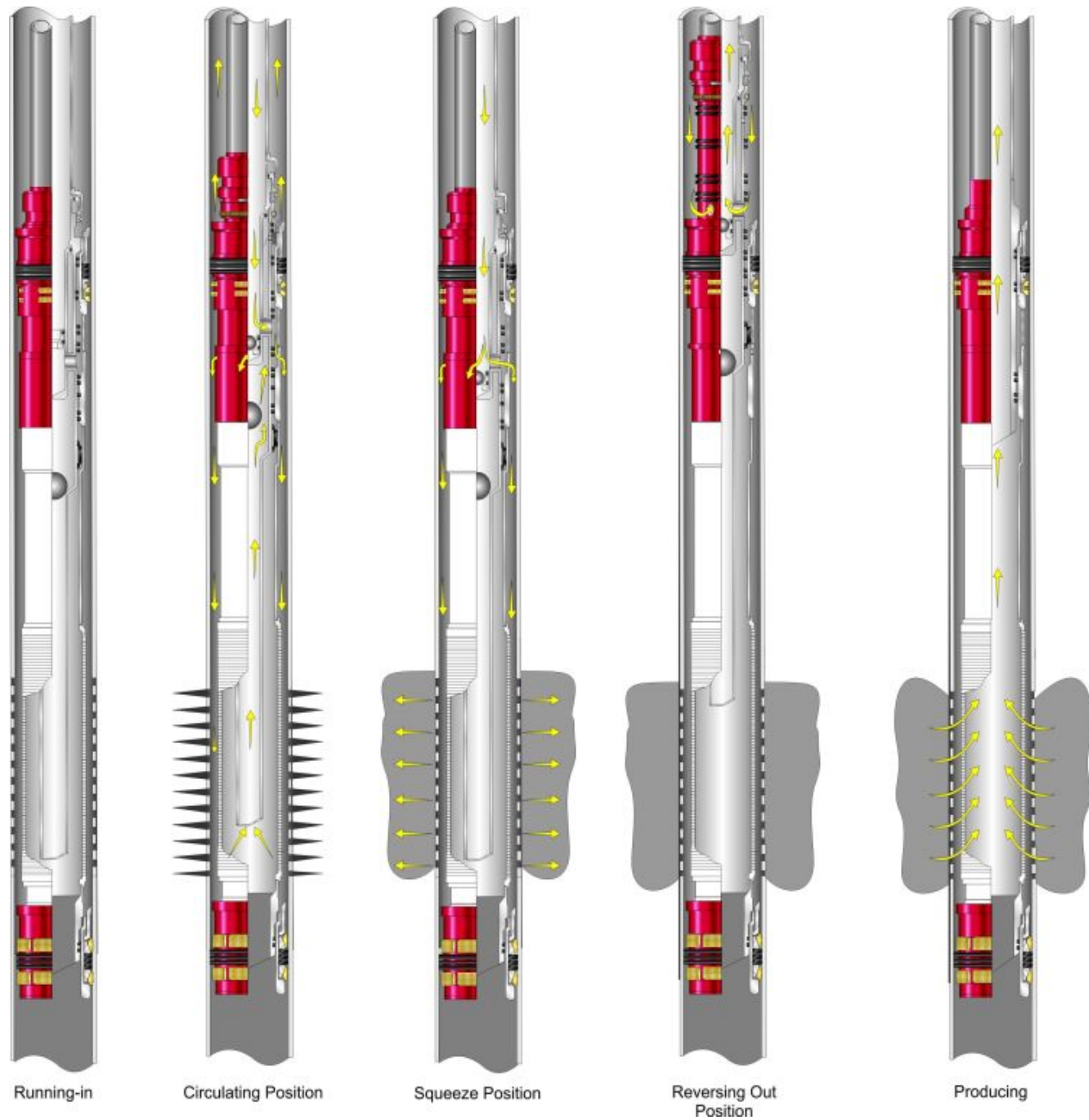
## Candidate Wells

- Short or long zones
- Straight, deviated or horizontal wells
  - All workstring movement up or down, not rotational
  - Facilitates greater working depths
- Single or multi zone completions
  - Singles, duals and selective completions
- Capable of handling high fluid loss and problematic zones
- Squeeze packs, circulating packs, high rate water packs or frac packs
- Land, inland waters, or offshore application





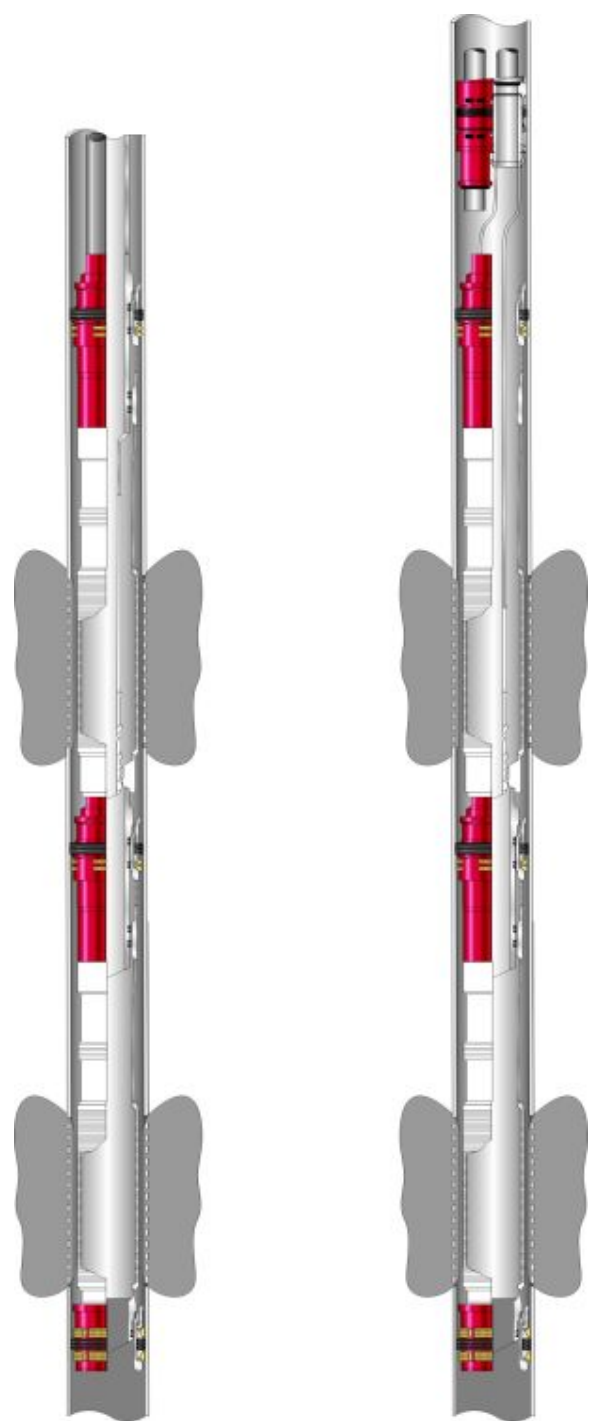
# Seal Bore GP No Tell Tale





# GP Completions

- Stacked Gravel Packs
  - Used for multi-zone completions
  - Multi string or single selective





# Seal Bore – Cross Over Tool Systems

## Equipment Requirements

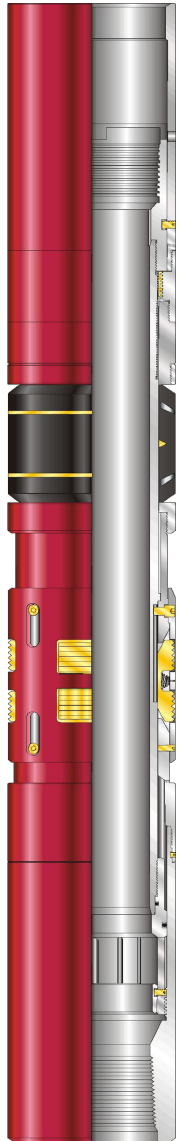
- Weatherford BlackCat GP packer
- GP Extension
  - Choice of Ported or Closing Sleeve types
- Safety Shear Sub
- Wire Wrapped Screens
- Sump Packer



# Seal Bore – Cross Over Tool System

## BlackCat GP Packer

- High-pressure ECNER array packing-element system
- Rotationally locked
- Slips below element simplify retrieval
- Retrieval mechanism protected from debris
- Materials suitable for hostile environments available
- Available in 4 1/2-in. thru 9 5/8-in.
- Pressure ratings up to 10,000 PSI

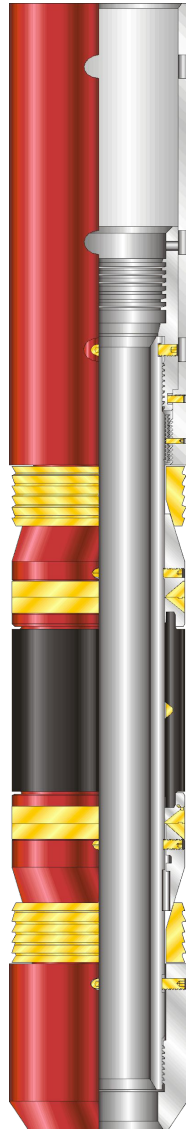




# Seal Bore – Cross Over Tool Systems

## UltraPak™ Permanent Packer

- Full envelope-tested to ISO 14310
- Available with materials tailored for hostile environments
  - 80,000-PSI MY mandrel suitable for sour service
- Full-strength, full-circle slips
- Elastomer options available for hostile environments
- Upper scoop head allows ease of stabbing seals in deviated wells
- Full range of completion accessories available
- Wireline or hydraulic setting options





# Weatherford Screens

## Dura Grip® Screens

- Patented *Dura-Grip* manufacturing process
  - provides greatly improved tensile, torque and collapse strength over conventional slip-on screens
- High-precision slot tolerances
  - Provide optimal exclusion of formation materials
  - Maximize production of hydrocarbons
- Original keystone-shaped wire configuration
  - Maximum non-clogging self-cleaning, and free flow of materials
- House-shaped wire configuration
  - Greater erosion resistance
- *Dura-Grip* screens are the most easily retrievable of all screen products, even in the most rigorous fishing operations
- *Dura-Grip* screens are available in a wide selection of stainless steel and high-nickel alloys

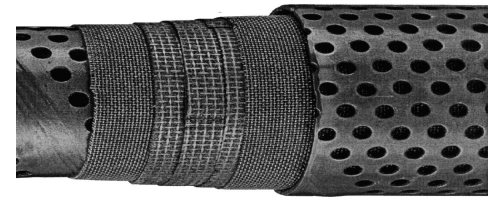
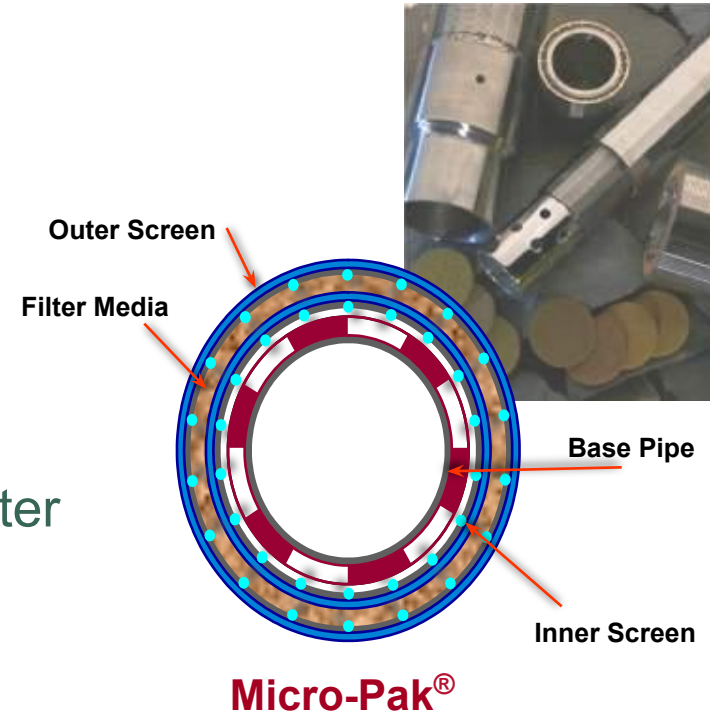




# Weatherford Screens

## Premium and Pre-Pack Screens

- Address difficult conditions
  - Highly deviated wellbores
  - Long perforated intervals
  - Horizontal completions
  - Cased-hole frac pack and high-rate water pack completions
  - Completions requiring a reduced-OD, pre-pack screen
- Provide security against voids in gravel packs
- Increase erosion tolerance during the pumping process



**Stratapac™**



# Pack Media Sizing Criteria

- Slot or pore size of screen exceeds pack media pore size
- Retains pack media completely

NORMAL OPENING SIZES FOR TYPICAL PROPPANT OR RC GRAVEL PACK						
NAME	PACK MEDIA			WIRE WRAP (GA)	PREMIUM	
	d50	d90 (d100)	Pore Size		EXCELFLO (MICRON)	STRATAPAC (MICRON)
50x70	0.0105"	0.0087" (.008")	0.0018"	6	60, 85, 125	60, 125
40x60	0.0138"	0.012" (0.011")	0.0023"	8	85, 125	125
30x50	0.0185"	0.015" (0.0135")	0.0031"	8	125, 175	125
20x40	0.0232"	0.0175" (0.016")	0.0039"	12	175, 250	200
16x30	0.0322"	0.0243" (0.022")	0.0054"	15	250	200
12x20	0.0418"	0.0345" (0.032")	0.007"	25	250	200





# Screen Sizing Guidelines

- Casing Size
  - 5-in. & 5 1/2-in. to 2 3/8-in. *Dura-Grip*<sup>®</sup> or Micro-Pak
  - 7-in. to 3 1/2-in. or 4-in. *Dura-Grip* or Micro-Pak
  - 7 5/8-in. to 4-in. or 4 1/2-in. *Dura-Grip* or Micro-Pak
  - 9 5/8-in. - 5-in. or 5 1/2-in. *Dura-Grip* or Micro-Pak
- Maintain a minimum annular radial clearance of 3/4-in. between the casing ID and the screen OD
- Standard metallurgy is 316L stainless steel wrap wire
  - Other premium metals available
- Base Pipe
  - J-55 or N-80 base pipe on conventional low pressure packs
  - Heavy weight N-80 or P-110 base pipe on Frac-Pack jobs
    - Collapse rating of 10K PSI minimum



# Economical Sand Placement

- Best method of placing sand is with dedicated sand control units
  - High degree of control
  - Less chance of pack contamination
  - High pressure capability
- Alternative
  - Sand injector used with rig pumps
  - Compact and inexpensive





# Weatherford's Game Plan

- Weatherford will be the next major worldwide gravel pack provider
  - Currently providing GP services in North America and Latin America
  - Focus will be on downhole hardware
- Our Plan
  - Provide existing and proven systems
  - Evolve to higher technology systems over time
  - Attention to value pricing
- Strategic Focus
  - Mature assets/Brownfields
  - Economical solutions



# Summary of Offerings

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## Focused on well mechanics

- Total completion solutions
  - Cased-hole packers
  - Well screens
  - Flow control
  - Safety valves
  - Artificial lift
- Total mechanical sand control solution
  - Gravel packs
  - Stand-alone conventional screens
  - Expandable completion systems