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K-BOS Overview
AADE New Orleans

Reese Jones
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KINETIC PRESSURE CONTROL

Kinetic Introduction

KINETIC PRESSURE CONTROL

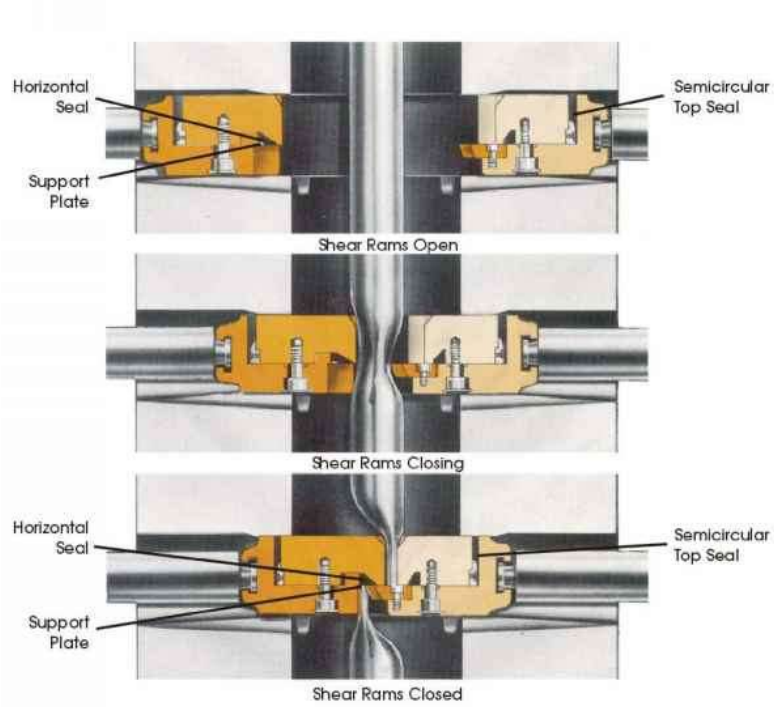
- Well control technology company based in Houston
  - Key Partners – Transocean, SCF Partners (PE Firm), NESR
  - ~40 FT Employees + team of advisors, consultants and contractors

- <u>Reimagine Well Control</u>
  - Retrofittable Technologies
  - Stop (surface) Blowouts – no exceptions
  - Significantly reduce Well Control cost & E&P risk Paradigm

BOP - Case for Change

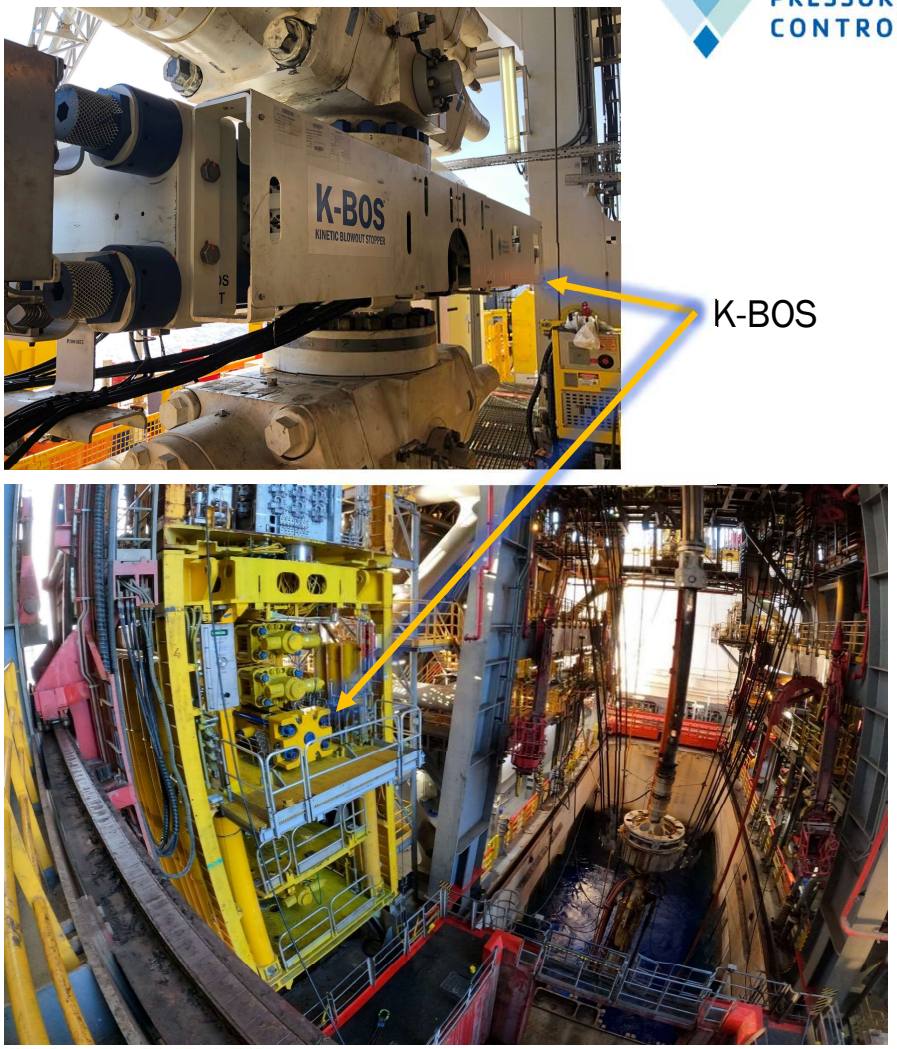
KINETIC PRESSURE CONTROL

- Historic “Blindspots”
  - Unshearables
  - Unsealables
  - Time & Personnel Critical



K-BOS® Overview

- Retrofitted into a BOP cavity, added to the BOP stack,
- Independent controls compatible w/ all typical rig systems
- Pyro-mechanical gate valve; deregulated, like an airbag in a car
- H2S compatibility



Performance Summary:

Item	Typical BOP	K-BOS Performance
Component Integrity	- Working components and elastomers exposed to corrosive well bore fluids. - Maintenance between each well.	- Working components 100% isolated from well fluids until activation -- Compatible w/ sour fluids up to 50% H2S
Time to Secure the Well	30 to 60 seconds (if possible)	Less than 1 second
Shearing and Sealing Capability	Unshearables Include: Tool Joints, BHAs, Tool Strings, Casing, Landing Strings, etc. Vulnerable to washout if closed under flow and pressure	Shear anything but the bit, including: • BHAs, Tool Joints, work strings, SL/WL/EL • Not affected by pressure or flow up to RWP. • Rated to shear moving pipe (10m/s)

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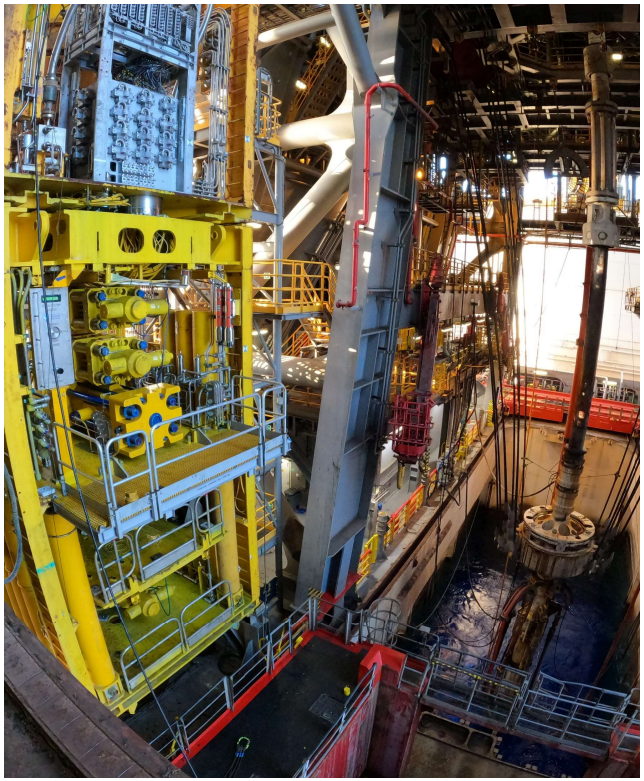
USGOM - Update on Deepwater Invictus

KINETIC PRESSURE CONTROL



18-3/4” 15,000 psi K-BOS was activated in subsea drilling operations by Transocean in the US GoM and the device sheared a 6-5/8” 50# V150 drill string in deepwater while latched up to the well head. This activation was planned as part of the P&A for an exploration well and was a complete success.
On the left you can see the K-BOS installed into the BOP stack. In the middle you can see the drill string suspended over the drill floor for inspection after the shear, and on the right you can see an image of the upper fish.

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18-15M K-BOS® – Capability

- Shear and Seal in <<1 second
- Seal Rated from 0psi - 15,000psi working pressure
- Rated from 0-350F
- Rated to 12,500 ft water depth
- Compatible with Sour Fluids up to 500 psi p.p. H2S
- Rated to Shear:
  - Tubulars: 0” - 18” OD and 0 - 220 ppf, and Up To MYS 165ksi
  - All typical Wireline products

8.5” OD Tool Joint
64ppf, V150

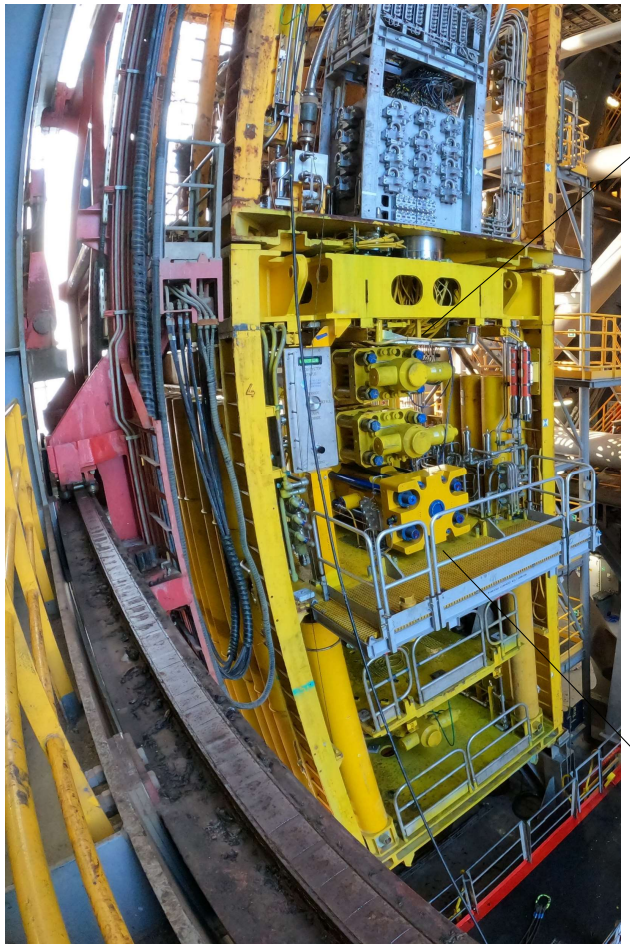
18” OD Casing Q125
6-5/8” OD Inner String V150
Combined 167 ppf

0.125 Slick Line /
5/16” Braided E-Line

9.5” OD Drill Collar
214ppf, MYS 120

USGOM - Installation Overview

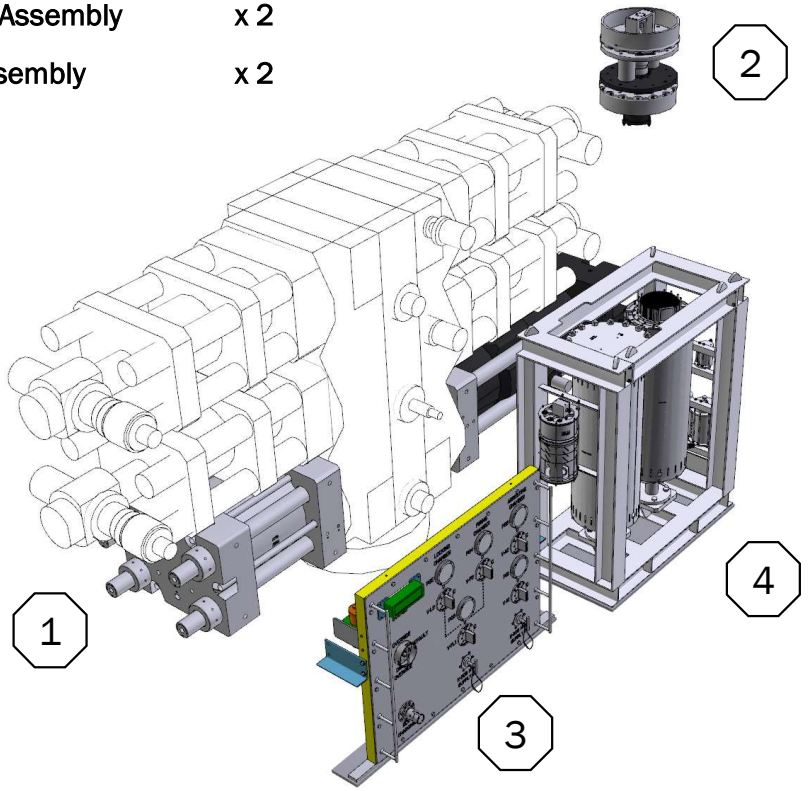
KINETIC PRESSURE CONTROL



1. K-BOS x 3
2. Wet Mate Assembly x 2
3. Controls Skid Assembly x 2

(PBOF Cables not shown)

4. ROV Panel Assembly x 2
5. 2x APDs
6. DMAS, EDS



13-10M K-BOS® - Design Capability

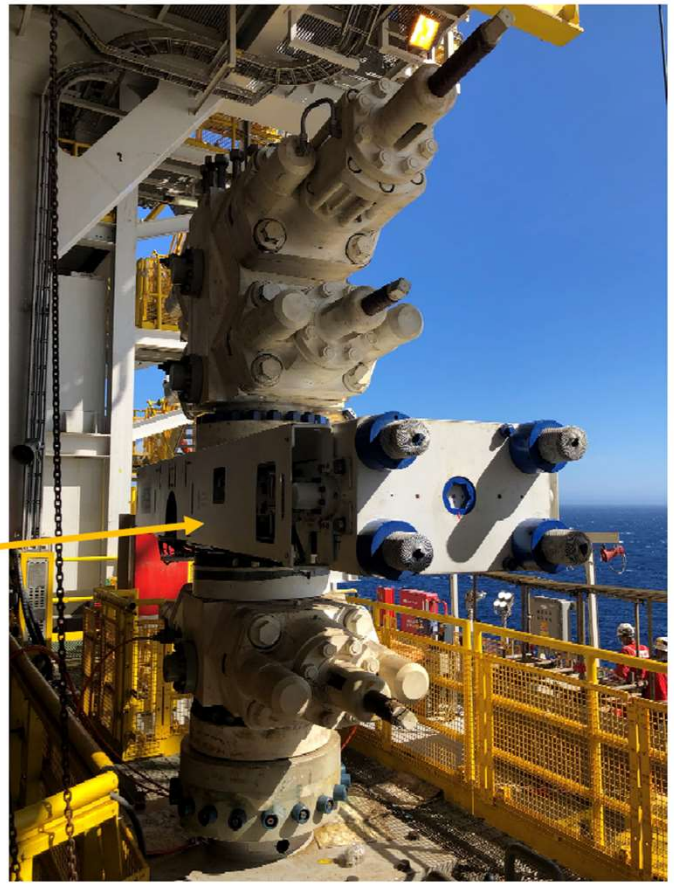
KINETIC PRESSURE CONTROL

Shear and Seal in <<1 second

- Up to 8-1/4" Drill Collars (158 ppf)
- 6-5/8" drill pipe and tool joints
- Wireline and Slick line
- Tubing with side load
- Up to MYS 165ksi
- Seal Rated from 0psi - 10,000psi working pressure
- Temperature Rated from 0-350F
- Compatible with up to 5,000psi partial pressure H2S fluids

Fits in existing drilling crossflow spool,

easily retrofitted onto any 13-10M rig BOP



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K-BOS Surface Drilling Control System

KINETIC PRESSURE CONTROL

K-BOS

Control System Container

Power Supply from Worksite

Remote Control Panel #2
Installed in Operator Cabin

Remote Control Panel #1
Installed in container

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13-10M K-BOS – API 16A PR2 Qualification

6-5/8" OD HWDP Landing String, 0.813" WT S135
Model (L) vs. Test Result (R)

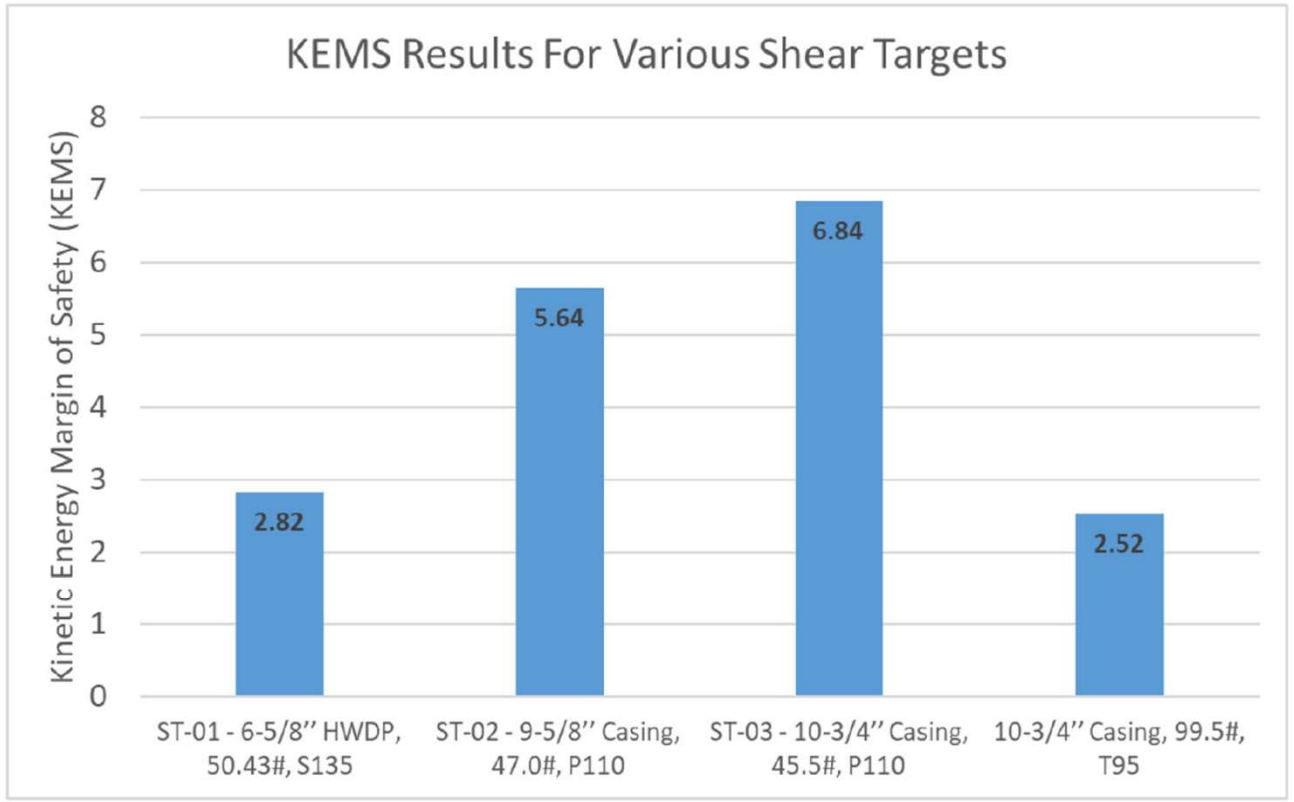

Figure 3.1: KEMS Results

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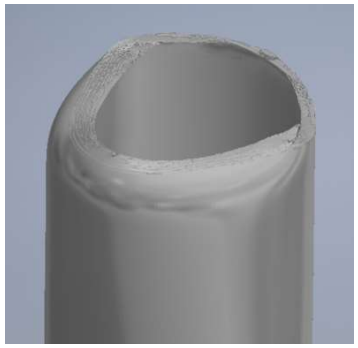
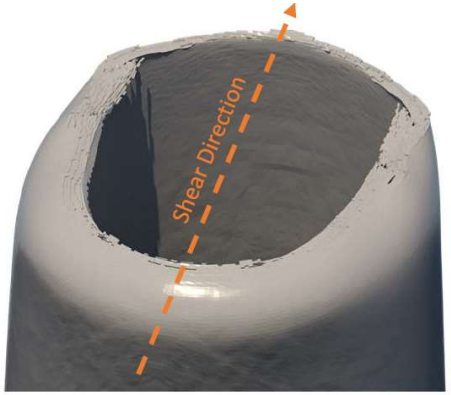
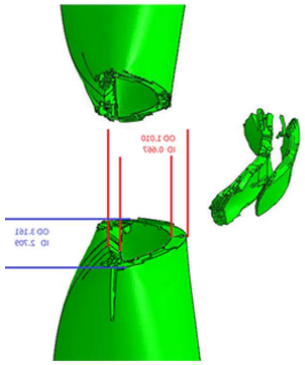
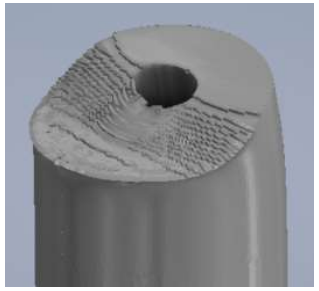
Shearing Modeling Capability

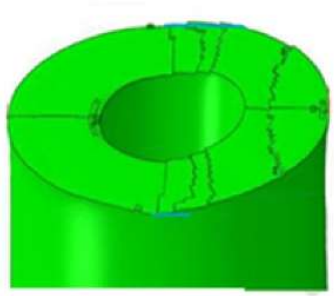
KINETIC PRESSURE CONTROL









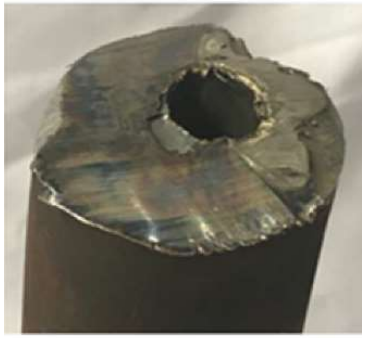


16” OD Casing
Q125 136ppf
6-5/8” OD Inner String,
V150 50ppf

18” OD Casing
Q125 117ppf
6-5/8” OD Inner String
V150, 50ppf

2-3/8” Coil Tubing
Pinned to Bottom

9.5” OD Drill Collar
214ppf, MYS 120



3-1/8” Drill Collar
Pinned to Bottom

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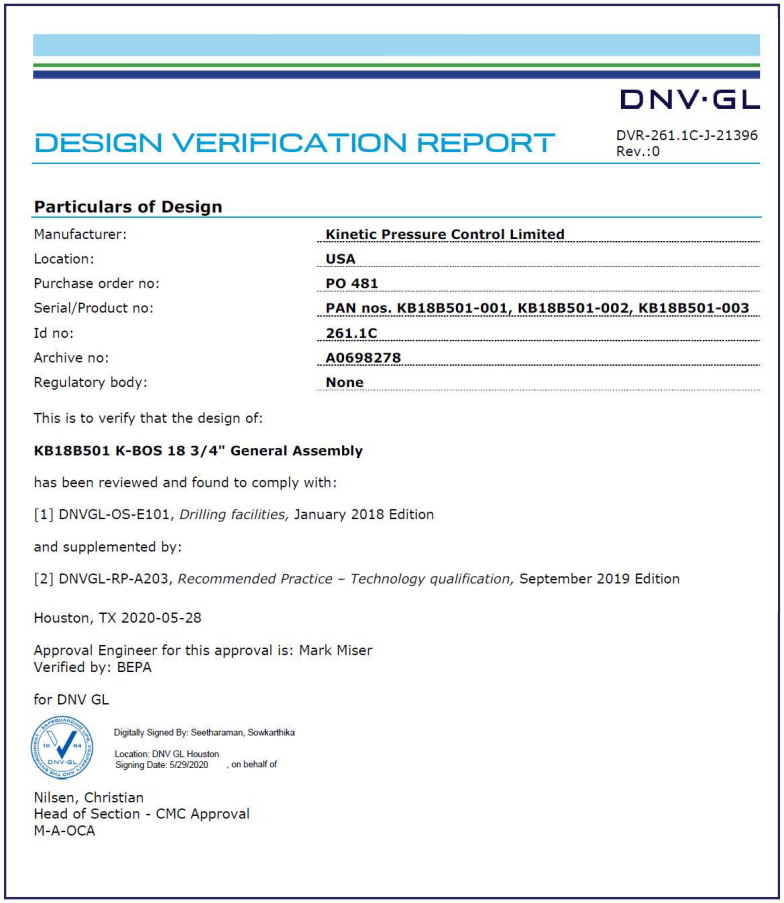
Regulatory Approvals

- Certified to DNVGL-OS-E101 w/ ref to API 16A (PR2) and API S53
  - DNV DVR & TQ 5-15M K-BOS – Completed
  - DNV DVR & TQ 13-10M K-BOS + SIL – Completed
  - DNV DVR & TQ 18-15M K-BOS – Completed
- BSEE / GoM Approvals:
  - Engagement since 2016
  - Witness key technical milestones 18-15M program incl subsea testing
  - APD Approved Oct 2021
- Aramco / Saudi Arabian Approvals
  - Deployment for Ultra high sour gas (up to 5,000 psi H2S partial pressure i.e. beyond limits of NACE) Completions, Interventions & Workover applications – June 2021
- Brasil – Petrobras, ANP, Army
- Further Engagement w/ NOPSEMA, PSA, UK HSE, Israel



DNV·GL

DESIGN VERIFICATION REPORT

DVR-261.1C-J-21396
Rev.:0

Particulars of Design

Manufacturer:	**Kinetic Pressure Control Limited**
Location:	**USA**
Purchase order no:	**PO 481**
Serial/Product no:	**PAN nos. KB18B501-001, KB18B501-002, KB18B501-003**
Id no:	**261.1C**
Archive no:	**A0698278**
Regulatory body:	**None**

This is to verify that the design of:

KB18B501 K-BOS 18 3/4" General Assembly

has been reviewed and found to comply with:

[1] DNVGL-OS-E101, *Drilling facilities*, January 2018 Edition

and supplemented by:

[2] DNVGL-RP-A203, *Recommended Practice – Technology qualification*, September 2019 Edition

Houston, TX 2020-05-28

Approval Engineer for this approval is: Mark Miser
Verified by: BEPA

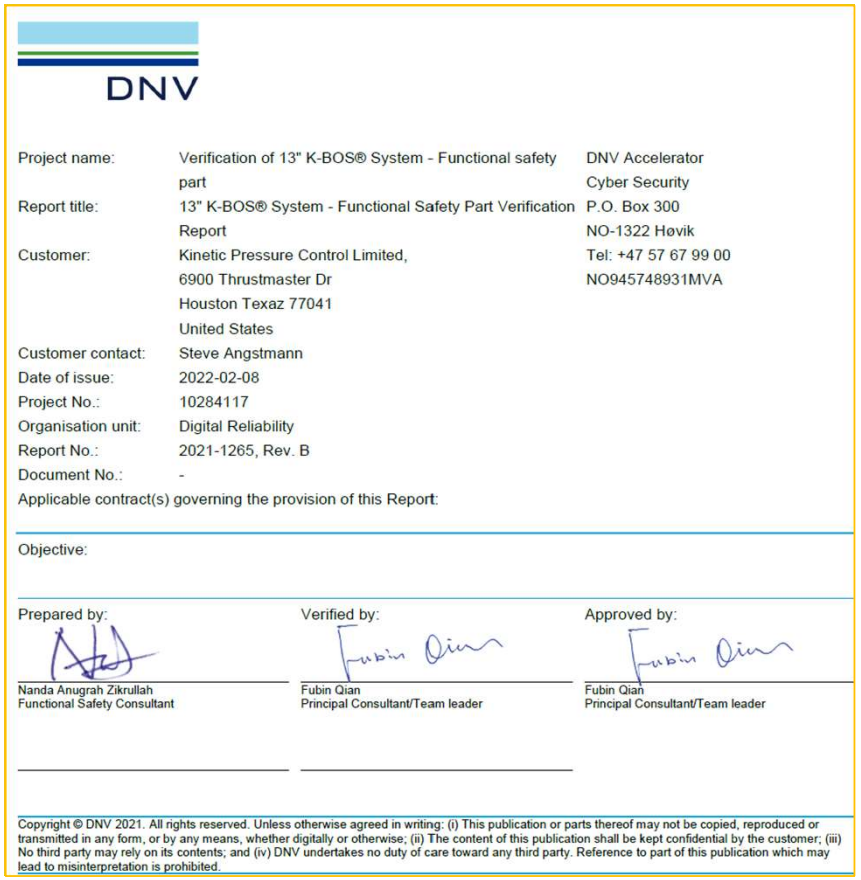
for DNV GL

Digitally Signed By: Seetharaman, Sowkarthika
Location: DNV GL Houston
Signing Date: 5/29/2020 , on behalf of

Nilsen, Christian
Head of Section - CMC Approval
M-A-OCA

K-BOS SIL3 Verification

- K-BOS system verified to SIL3
  - 13” and 18” have common critical components w/in applicable scope
  - System scope is from trigger to safety function (K-BOS activation)



DNV

Project name:	Verification of 13" K-BOS® System - Functional safety part	DNV Accelerator Cyber Security
Report title:	13" K-BOS® System - Functional Safety Part Verification Report	P.O. Box 300 NO-1322 Høvik
Customer:	Kinetic Pressure Control Limited, 6900 Thrustmaster Dr Houston Texaz 77041 United States	Tel: +47 57 67 99 00 NO945748931MVA
Customer contact:	Steve Angstmann	
Date of issue:	2022-02-08	
Project No.:	10284117	
Organisation unit:	Digital Reliability	
Report No.:	2021-1265, Rev. B	
Document No.:	-	

Applicable contract(s) governing the provision of this Report:

Objective:

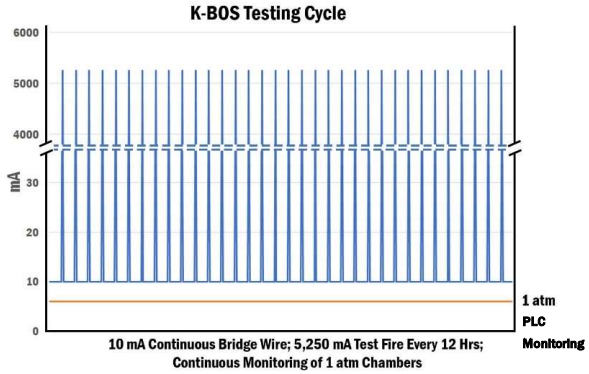
Prepared by:	Verified by:	Approved by:
Nanda Anugrah Zikrullah Functional Safety Consultant	Fubin Qian Principal Consultant/Team leader	Fubin Qian Principal Consultant/Team leader

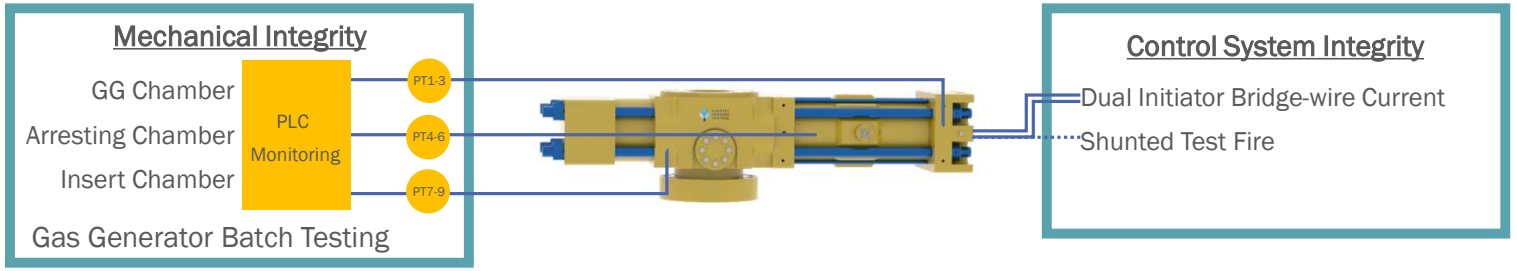
Availability/Function Testing

KINETIC PRESSURE CONTROL

- **Real-time monitoring system to confirm availability of K-BOS®**

Critical Failure Mode
Fluid Ingress / Leaks
Loss of Connection Continuity
Loss of Electrical System Capability
Shearing Energy
Alignment





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KINETIC PRESSURE CONTROL

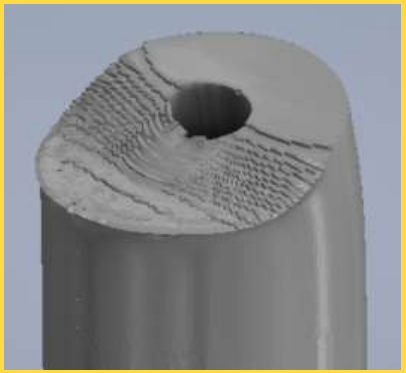
K-BOS® Value Case

18-¾” 15,000 psi K-BOS Overview

KINETIC PRESSURE CONTROL

K-BOS Summary

- Shear and Seal in <<1 second
  0 psi to 15,000 psi RWP
- Rated from 0F to 350F
  (Higher rating can be provided)
- Rated to 12,500 ft water depth
- Available in 3 retrofit variants: Cameron TL, Hydril & NOV NXT (or as E-SID)
- Compatible with Sour Fluids up to 500 psi p.p. H2S



Above: Predicted Model (left) vs Actual Result (right)

The K-BOS is rated to shear and seal on a 9.5” BHA
API 16A PR2 shear test results shown above: 9.5” OD Drill Collar 214ppf, MYS 120

Shown Above:
18-15M K-BOS Installed into a CSR BOP Cavity

K-BOS® - Capability Summary

KINETIC PRESSURE CONTROL

Requirement: "Any..."	% Time Across BOP	"Typical" BSR	"Typical" CSR	K-BOS	Regulatory Context
Drill / Work String	40-60%	100%	100%	100%	BSEE Regulations
Landing String (Incl. Slip Proof Area)		90%	95%	100%	
E-Line/ Wireline/ Slick Line	20-30%	80%	80%	100%	
Tubing (Incl. Control Lines)		80%	80%	100%	
Test Tree Shear Sub		100%	N/A	100%	
Upper Completions & Subsea Test Tree		0%	0%	100%	Process Safety / Well Integrity
Casing incl Joints	10-20%	70%	90%	100%	
Casing w/ Inner String or Drill-in Liner		0%	30%	100%	
Tool Joints	4-7%	10%	20%	100%	
BHAs and Tools (Excluding drill bits and >16" OD stabilizers)	2-5%	0%	0%	100%	
"Moving Pipe" Situations	<1%	0%	0%	100%	
Under Compression		0%	0%	100%	Well Control Situations
Under Side Load / Any Position in Wellbore		80%	90%	100%	
Full Flowing Conditions		0%	0%	100%	
DMAS / EDS		~50-90s / ~60-90s		<<0.1s / ~10s	

Color Legend: Unshearable | Shear Only | Shear and Seal

Ops Savings Value

- Eliminate ~60hrs/yr in flow checks
- Fuel and Emission savings during 300-1,000 hrs / year of reduced open-bus DP ops
- Eliminate CSR function testing

Risk Reduction Value

- 3 to 4 order of magnitude reduced probability of a blowout
- Eliminate from 300 to 1,000 hrs per year of unshearable exposure
- Strengthen reputation with regulators and community with leading technology

Enabling Technology Value

- **Enhanced DP Ops (Reduced EDS time)**
- Provides capability for large VIT configurations
- Potential for optimized completion & well test design vs. existing SSTT/control systems
- Sour Service: Meets and exceeds NACE w/o exceptions
- Reduced requirement for Emergency Response mitigations (capping stack, relief well rigs, etc.)

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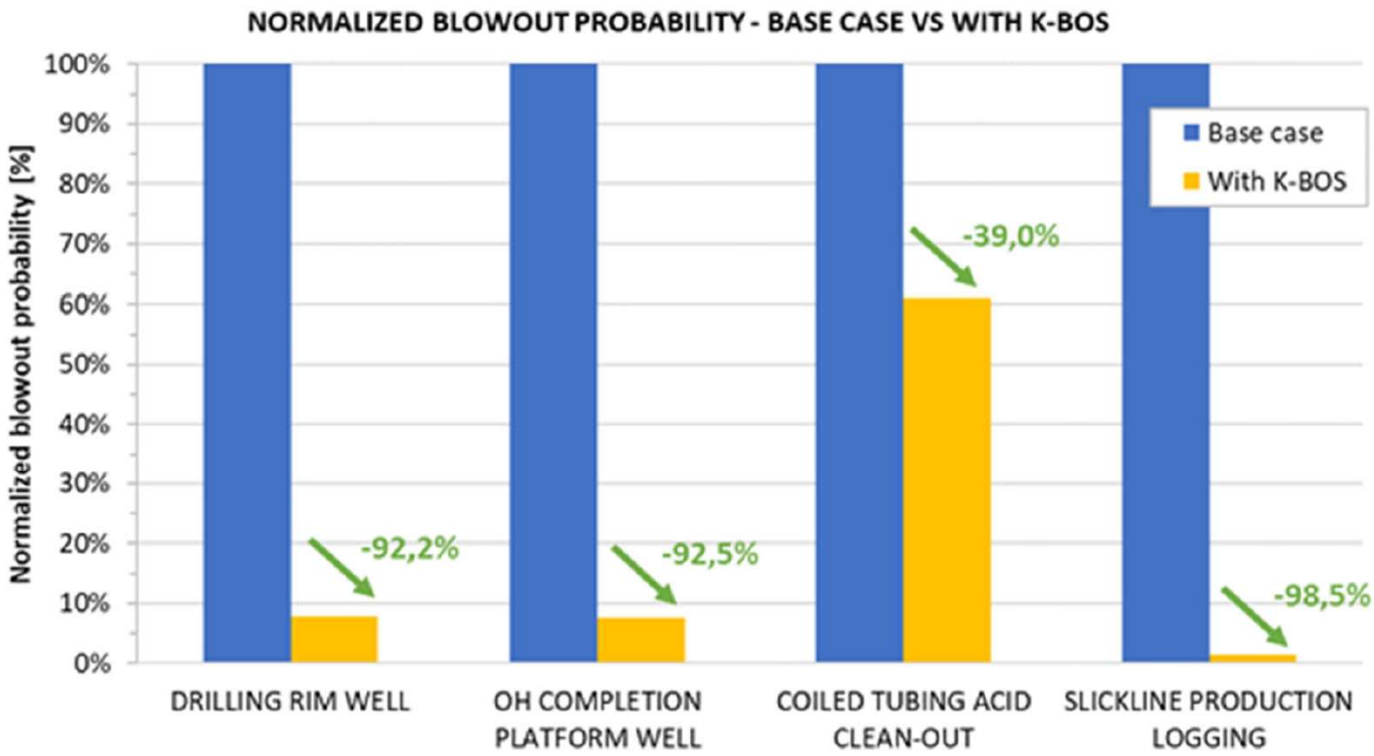
K-BOS Case Study – Land/Surface Drilling

KINETIC PRESSURE CONTROL

- Assumptions based on Kashagan Field
- Calculations using eWise™ via NCOC, Eni and Kwantis

- SPE – IPTC
  Session # 070 - Drilling and Completions in Challenging Environments 3: Wednesday Feb 23 2022 9:00 AM- 10:30 AM Meeting Room 7
- **Your Paper Number: IPTC-22152-MS**



K-BOS® Value Case: Well Design Enabler

KINETIC PRESSURE CONTROL

Application:

Well Design / Completion or Intervention

- Improved shear/seal capability and WC barrier enables:
- Larger/thicker-wall casing / production strings
- Completion components
  - Tubing + control lines; gravel pack equipment
  - Potential enabler for single trip completions

Value:

Improved well productivity

- Larger production casing
- Larger tubing (especially in HPHT wells)

- Simplify control system for MUX SSTT
- Reduce EDS time for
  Improved DP Operability in "completions mode"

Abandonment

- Opportunity for Optimized Rig Selection (e.g. rigless abandonment)

- Lower cost MODU w/ increased PCE capability
- Full-bore Barrier for isolation:
  - Pulling tubing/other components in open water

18-15M K-BOS - Shearing Capability Analysis

16" OD Casing Q125 136ppf
Kinetic Predicted Model vs Actual Shear Result

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K-BOS® Value Case: Multi-well Platform

KINETIC PRESSURE CONTROL

Threat

- Well control event: impact several wells/entire platform
- Proximity to hydrocarbon production facility

Applications

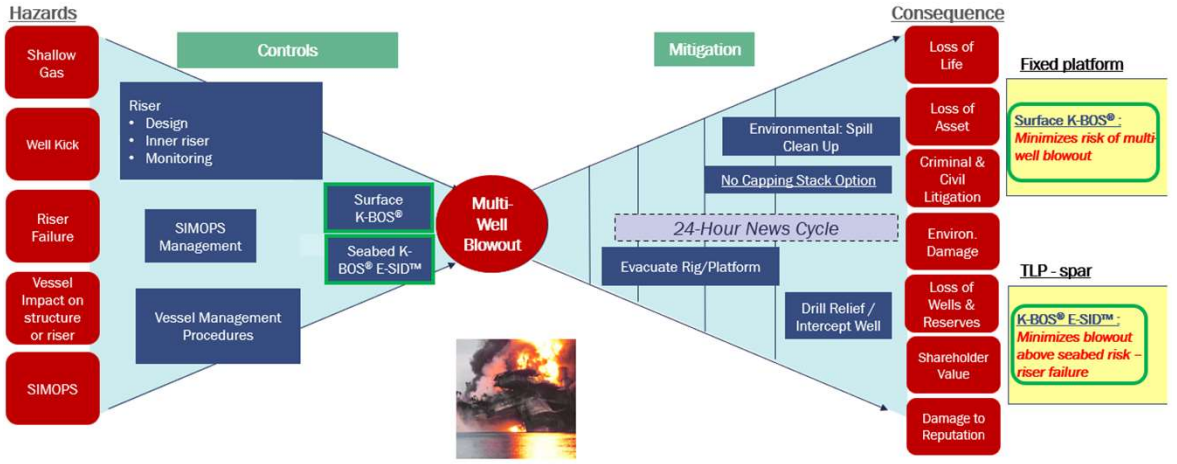
- Fixed platform; TLP/spar
- Drilling, Completion, Intervention, abandonment

Configurations

- Surface Well control
- E-SID above wellhead/base of drilling riser

Value

- Enhanced protection for well influx
- SIL-3 rated K-BOS system – option to link to ESD to minimize escalation.
- Additional seabed barrier for drilling riser on Deepwater TLP/spar



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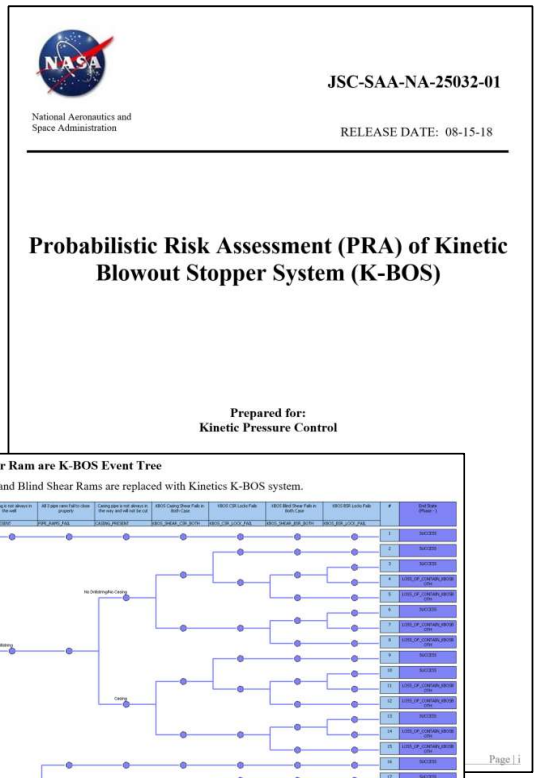
Ultimate Reliability - Subsea



National Aeronautics and Space Administration

JSC-SAA-NA-25032-01

RELEASE DATE: 08-15-18

Probabilistic Risk Assessment (PRA) of Kinetic Blowout Stopper System (K-BOS)

Prepared for:
Kinetic Pressure Control

2.8.4 **Both Casing and Blind Shear Ram are K-BOS Event Tree**

In this Event Tree, the hydraulic Casing and Blind Shear Rams are replaced with Kinetics K-BOS system.

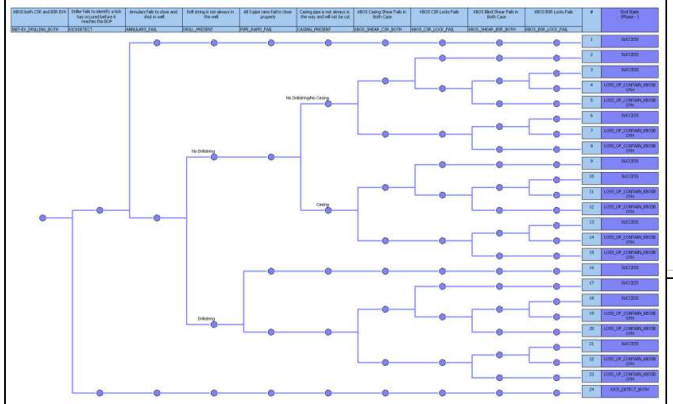
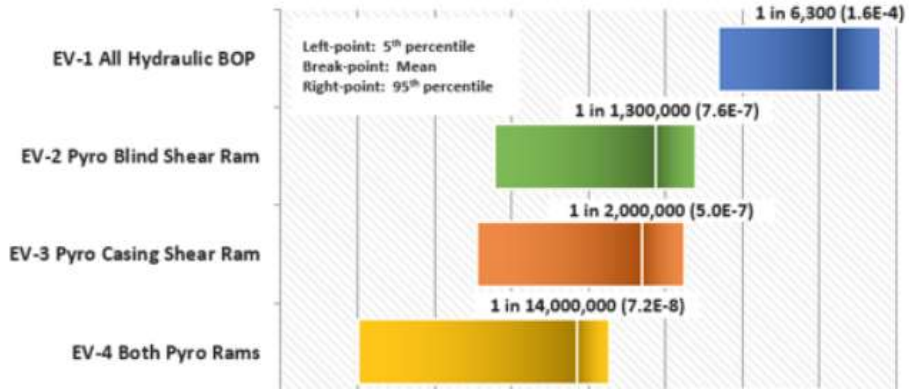


Figure 2-7: Kinetic Casing and Blind Shear Rams That Seal (EV4)



- Testing Mindset Change – Always background testing architecture
- Bottom line:

  1 to 4 order of magnitude reduction in risk (process safety)

  - From 1-in-900 (SINTEF (2000-2015) 24 surface offshore blowouts in 21,445 wells) to 1-in-6300 (traditional solution modelled above) to vs 1-in-1,300,000 to 1-in-14,000,000 with the K-BOS

  (Note: potential for 1-in-8,190,000,000 w/ K-BOS E-SID)

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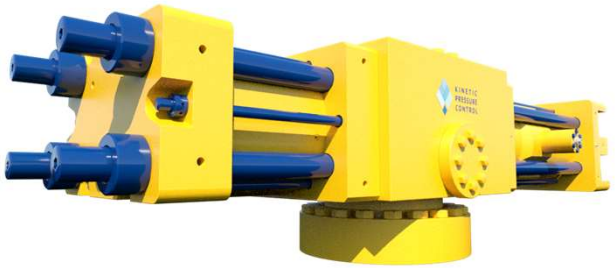
K-BOS Value Case – DP Ops Enabler



K-BOS Secures the Well in Milliseconds
- Rated to shear and seal *"Anything"*
- Well Control Certainty
- SIL3 Reliability

K-BOS Enables 9-Second EDS

9-Second EDS
- Enables DP Ops in North Sea 150m to 500m water
- Cost savings (AHTS/MPV vessels & systems)
- Faster Transit Time between locations
- Ops Gains + Reduced CO2

Assumptions: Kinetic K-BOS Enabling Innovation

- *Retrofit use of K-BOS to MODU BOP as ultimate shearing device & 9sec EDS enabler*
- *Optional upgrade K-POD controls (closed loop hydraulics) No discharge of fluid to sea. Facilitates removal of Subsea accumulators and existing pod system. Significant reduction if BOP COG and wellhead fatigue loading.*
- *Realise multi well abandonment campaign project savings from 5% – 7%*

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K-BOS® Value Case: "9-Second EDS" DP Operability Analysis

KINETIC PRESSURE CONTROL

Configuration

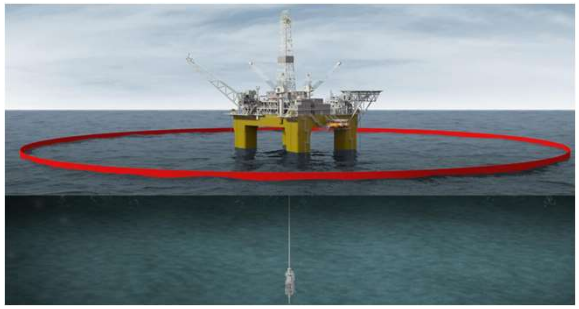
- K-BOS as BOP retrofit or seabed E-SID above wellhead
- EDS Optimized to 9-seconds

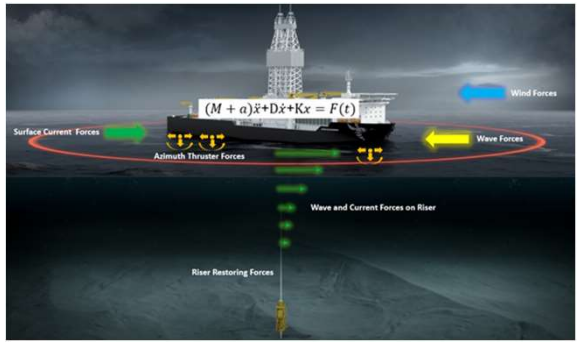
Applications

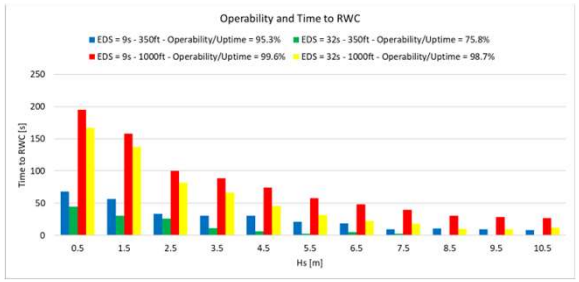
- Shallow water
- Harsh environment

Value

- Improved watch circle/time to disconnect
- Reduced stress/bending moment in foundation
- Single function EDS (shear/seal)
- Single function DMAS (shear/seal)
- Alternative to anchored rig, pre-installed mooring system
- Alternative to BOP tethering systems

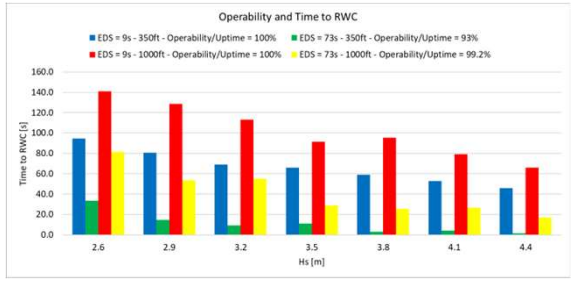






North Sea Results:

- 30% to 50% more time to react
- Vs 32 second EDS
- (0m RWC w/ 70 sec EDS)
- Including Winter Weather in Avg



GOM Results:

- 2 to 3 x more time to react @ 350ft
- >2 x more time to react @ 1,000ft

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Shallow Water DP Ops Optimization

KINETIC PRESSURE CONTROL

Example EDS Optimized for Shallow Water DP w/ K-BOS

"K-BOS Non-Shear EDS - 7 Ram BOP Stack"

Time	Function	Position
0	K-BOS (Shear and Seal)	Disarm
	Wellbore P/T Connector	Retract
	LMRP Connector Primary	Vent
	Stack Accumulators Dump	Isolate
	Stack Accumulator Charge	Isolate
	K-BOS/UBSR Autoshear	Disarm
	LBSR/UBSR Autoshear	Disarm
	HP Upper Blind Shear Ram	Vent
	HP Lower Blind Shear Ram	Vent
	Upper Blind Shear Ram	Vent
	Lower Blind Shear Ram	Vent
	Upper Blind Shear Ram Locks	Vent
	Lower Blind Shear Ram Locks	Vent
2 to 4	LMRP Connector Regulator Auto-Regulate	3000 psi
	Choke/Kill Connector Primary	Unlatch
	Choke/Kill Connector Secondary	Unlatch
	Upper Outer Choke Valve	Close
	Upper Inner Choke Valve	Close
	Upper Outer Kill Valve	Close
	Upper Inner Kill Valve	Close
	Middle Outer Choke Valve	Close
	Middle Inner Choke Valve	Close
	Lower Outer Choke Valve	Close
	Lower Inner Choke Valve	Close
	Lower Outer Kill Valve	Close
	Lower Inner Kill Valve	Close
6 to 8	K-BOS/UBSR Autoshear	Vent
	LBSR/UBSR Autoshear	Vent
	Upper Annular Preventer	Vent
	Lower Annular Preventer	Vent
	Upper Pipe Ram	Vent
	Middle Pipe Ram	Vent
	Lower Pipe Ram	Vent
	Test Ram	Vent
	Upper Pipe Ram Locks	Vent
	Middle Pipe Ram Locks	Vent
	Lower Pipe Ram Locks	Vent
	Upper Inner Kill Valve	Vent
	Upper Outer Kill Valve	Vent
	Upper Inner Choke Valve	Vent
	Upper Outer Choke Valve	Vent
	Middle Inner Choke Valve	Vent
	Middle Outer Choke Valve	Vent
	Lower Inner Kill Valve	Vent
	Lower Outer Kill Valve	Vent
	Lower Inner Choke Valve	Vent
	Lower Outer Choke Valve	Vent
	Wellhead Connector Gasket	Vent
	Wellhead Connector Secondary	Vent
	Wellhead Connector Primary	Vent
7 to 10	Stack Stinger Seals	Deenergize
9 to 12	Stack Stinger	Retract
	LMRP Connector Primary	Unlatch
	LMRP Connector Secondary	Unlatch
	Riser Recoil Disconnect Signal Upon LMRP Unlatch	Execute

Legend
Accelerated by 2 seconds
Accelerated by 1 second

"K-BOS Shear EDS - 7 Ram BOP Stack"

Time	Function	Position
0	K-BOS (Shear and Seal)	Close/Activate
	Wellbore P/T Connector	Retract
	LMRP Connector Primary	Vent
	Stack Accumulators Dump	Isolate
	Stack Accumulator Charge	Isolate
	K-BOS/UBSR Autoshear	Arm
	LBSR/UBSR Autoshear	Disarm
	HP Upper Blind Shear Ram	Vent
	HP Lower Blind Shear Ram	Vent
	Upper Blind Shear Ram	Vent
	Lower Blind Shear Ram	Vent
	Upper Blind Shear Ram Locks	Vent
	Lower Blind Shear Ram Locks	Vent
2 to 4	LMRP Connector Regulator Auto-Regulate	3000 psi
	Choke/Kill Connector Primary	Unlatch
	Choke/Kill Connector Secondary	Unlatch
	Upper Outer Choke Valve	Close
	Upper Inner Choke Valve	Close
	Upper Outer Kill Valve	Close
	Upper Inner Kill Valve	Close
	Middle Outer Choke Valve	Close
	Middle Inner Choke Valve	Close
	Lower Outer Choke Valve	Close
	Lower Inner Choke Valve	Close
	Lower Outer Kill Valve	Close
	Lower Inner Kill Valve	Close
6 to 8	Upper Annular Preventer	Vent
	Lower Annular Preventer	Vent
	Upper Pipe Ram	Vent
	Middle Pipe Ram	Vent
	Lower Pipe Ram	Vent
	Test Ram	Vent
	Upper Pipe Ram Locks	Vent
	Middle Pipe Ram Locks	Vent
	Lower Pipe Ram Locks	Vent
	Upper Inner Kill Valve	Vent
	Upper Outer Kill Valve	Vent
	Upper Inner Choke Valve	Vent
	Upper Outer Choke Valve	Vent
	Middle Inner Choke Valve	Vent
	Middle Outer Choke Valve	Vent
	Lower Inner Kill Valve	Vent
	Lower Outer Kill Valve	Vent
	Lower Inner Choke Valve	Vent
	Lower Outer Choke Valve	Vent
	Wellhead Connector Gasket	Vent
	Wellhead Connector Secondary	Vent
	Wellhead Connector Primary	Vent
7 to 10	Stack Stinger Seals	Deenergize
9 to 12	Stack Stinger	Retract
	LMRP Connector Primary	Unlatch
	LMRP Connector Secondary	Unlatch
	Riser Recoil Disconnect Signal Upon LMRP Unlatch	Execute

Note: LMRP unlatch 5 gallon function estimated 2 seconds to complete

"K-BOS Shear EDS - 6 Ram BOP Stack"

Time	Function	Position
0	K-BOS (Shear and Seal)	Close/Activate
	Wellbore P/T Connector	Retract
	LMRP Connector Primary	Vent
	Stack Accumulators Dump	Isolate
	Stack Accumulator Charge	Isolate
	K-BOS/UBSR Autoshear	Arm
	HP Upper Blind Shear Ram	Vent
	Upper Blind Shear Ram	Vent
	Upper Blind Shear Ram Locks	Vent
2 to 4	LMRP Connector Regulator Auto-Regulate	3000 psi
	Choke/Kill Connector Primary	Unlatch
	Choke/Kill Connector Secondary	Unlatch
	Upper Outer Choke Valve	Close
	Upper Inner Choke Valve	Close
	Upper Outer Kill Valve	Close
	Upper Inner Kill Valve	Close
	Middle Outer Choke Valve	Close
	Middle Inner Choke Valve	Close
	Lower Outer Choke Valve	Close
	Lower Inner Choke Valve	Close
	Lower Outer Kill Valve	Close
	Lower Inner Kill Valve	Close
6 to 8	Upper Annular Preventer	Vent
	Lower Annular Preventer	Vent
	Upper Pipe Ram	Vent
	Middle Pipe Ram	Vent
	Lower Pipe Ram	Vent
	Test Ram	Vent
	Upper Pipe Ram Locks	Vent
	Middle Pipe Ram Locks	Vent
	Lower Pipe Ram Locks	Vent
	Upper Inner Kill Valve	Vent
	Upper Outer Kill Valve	Vent
	Upper Inner Choke Valve	Vent
	Upper Outer Choke Valve	Vent
	Middle Inner Choke Valve	Vent
	Middle Outer Choke Valve	Vent
	Lower Inner Kill Valve	Vent
	Lower Outer Kill Valve	Vent
	Lower Inner Choke Valve	Vent
	Lower Outer Choke Valve	Vent
	Wellhead Connector Gasket	Vent
	Wellhead Connector Secondary	Vent
	Wellhead Connector Primary	Vent
7 to 10	Stack Stinger Seals	Deenergize
9 to 12	Stack Stinger	Retract
	LMRP Connector Primary	Unlatch
	LMRP Connector Secondary	Unlatch
	Riser Recoil Disconnect Signal Upon LMRP Unlatch	Execute

Cyl./ WP	No. of Cyl.	Stroke (inch)	Volume of fluid to operate (in US gallon)			Hydraulic operating pressure (in psi)			
			Primary open	Sec. open	Close	Primary open	Sec. open	Close	Gasket retainer
5 inch/3 M	9	9.75	4.973	2.486	6.265	1,500	3,000	1,500	1,500

Figure 13 - Table of operating data 18-3/4 inch 10M collet 70 connector

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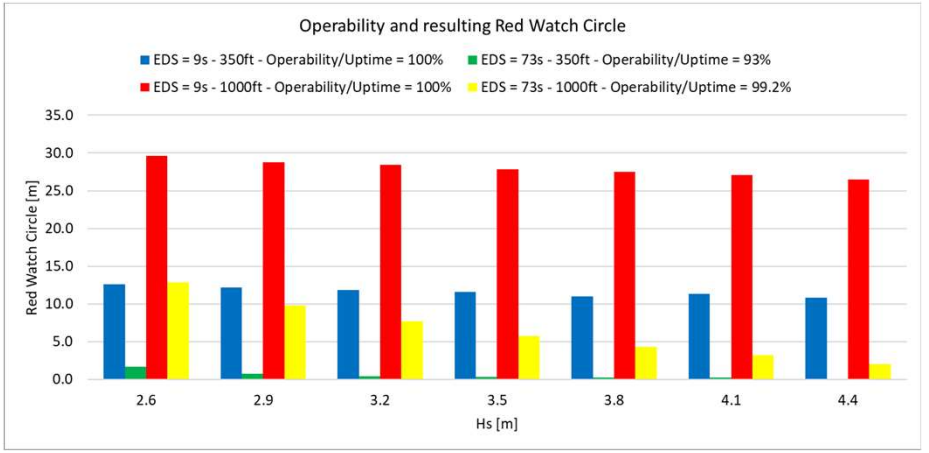
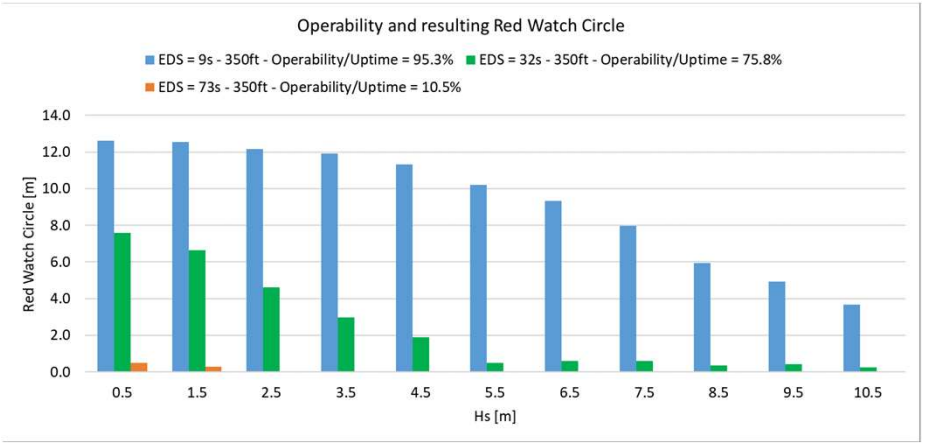
K-BOS DP Ops Value Case (Kongsberg Study Results)

KINETIC PRESSURE CONTROL

- GOM - DP Simulations as follows:
  - Gusto P10000 design at 350 ft, 1000 ft and 6300 ft water depth
  - Hs -Tp scatter diagram for GOM
  - Calculate Red Watch circle size (m) for EDS 68 s: **30 s: 9 s: 1s**
  - Calculate increased time gained (regain control) during Drift Off scenario for all EDS cases
  - Calculate uptime/operability for different EDS times



- North Sea Harsh Environment DP Simulations as Follows:
  - GVA 7500 design at ~350ft and ~1,000ft water depth
  - Hs -Tp scatter diagram for NS/HE
  - Calculate Red Watch circle size (m) for EDS 68 s: **30 s: 9 s: 1s**
  - Calculate increased time gained (regain control) during Drift Off scenario for all EDS cases
  - Calculate uptime/operability for different EDS times



K-BOS® Value Case:
"9-Second EDS" DP Operability Analysis

KINETIC PRESSURE CONTROL

K-BOS Value Case Study Assumptions

- Most deewater wells are still in production and P&A is not required
- Majority of P&A and Intervention Opportunities are in shallower waters less than 500m deep.
- Limited availability of moored rigs and cost of mooring spreads hurt economics of these activities
- DP Drillships on long-term contracts w/ 9-Second EDS enabled by K-BOS can operate reliably in water depths between 500-150m (per DP Operability Study by Kongberg)

Value Hypothesis:
DP Drillships with Existing 3 year contracts are able to work in shallow water realize an increase in operational efficiency within the same contract value by enabling work on shallow water P&A and intervention opportunties inbetween deepwater wells and as opportunity allows.

USGOM		Assumed Operational Area
Rig Contract Duration	3	years
Rig Contract Duration	1095	Days
Avg Days per Exploration/Development well	83	days
Avg. Transit time between locations	2	days
Assumed Exploration/Development wells per contract	12	wells
Days Available in between wells per 3 year contract	104	days available, but not used for scheduled exploration or development work
Est. Avg. Shallow Water P&A or Well Intervention Duration	15	days
Potentail Additional Activities with same contract	6	Activities
Rig Contract Days Working without K-BOS 9-second EDS	90.5%	Assuming 12 wells
Rig Contract Days Working w/ K-BOS 9-second EDS	***96.7%***	***Assuing 12 wells, 6 P&A or Interventions and excluding Transit Days***
	6.2%	***Potential Operational Gains per Contract***

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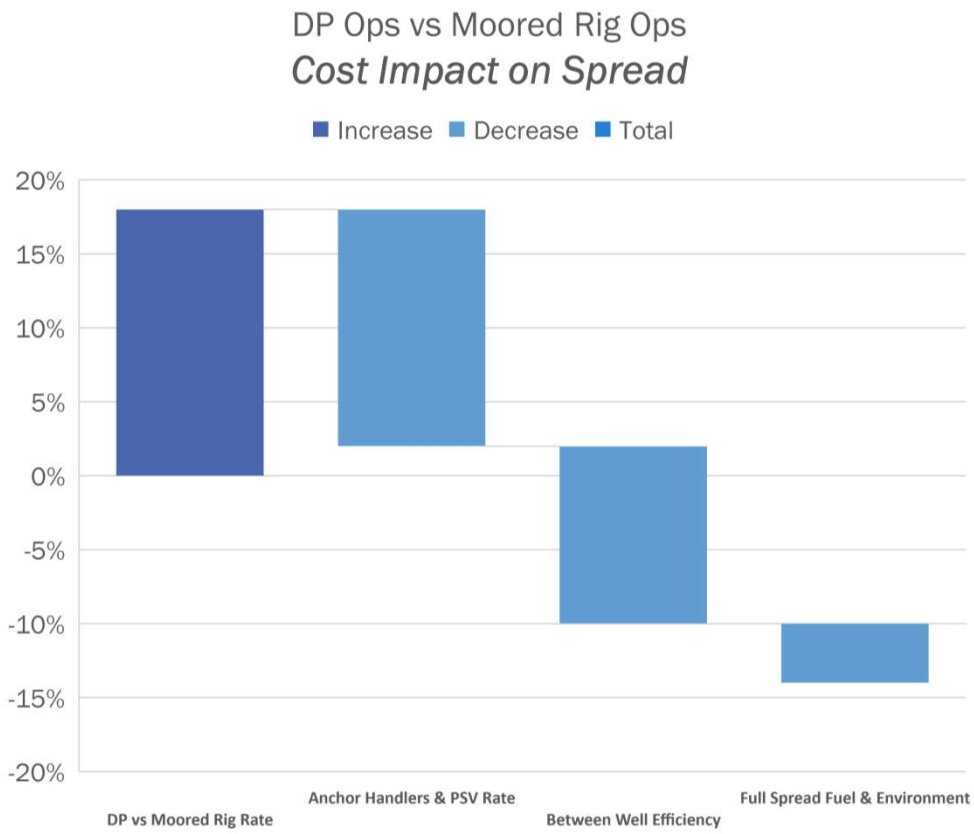
K-BOS Value Case – DP Ops Enabler – North Sea

KINETIC PRESSURE CONTROL

DP Ops vs Moored Rig Ops		
Criteria	DP	Moored
Rig Day Rates	Best Value	Lower Cost w/ upside risk in short supply
Rig Availability	Very Good	Limited w/ limited capability
Positioning install/remove	Install/remove transponders	• Install mooring; remove mooring (> 4 days per well for conventional mooring);
		• Anchor handling vessel (AHTS) rental; • specialized AHTS if pre-installed mooring system (PIMS) used; PIMS system rental
Fuel consumption	RIG Higher in bad weather	• Purely Moored – lowest rig consumption • Moored + Posmoor ATA – near comparable to DP rig
	Support vessels Near eliminated	• fuel cost and emissions for all support vessels, (mooring and pre-lay support, tow vessels as applicable)
Other	EDS risk Quicker transit between locations	• Seabed congestion; dropped object risk; damage to SS assets • Transit between location highly reliant on support vessels and often impacted by WoW



DP Ops result in 10% to 14% lower Full Spread Costs

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K-BOS® Value Case: Source Control/Emergency Response

KINETIC PRESSURE CONTROL

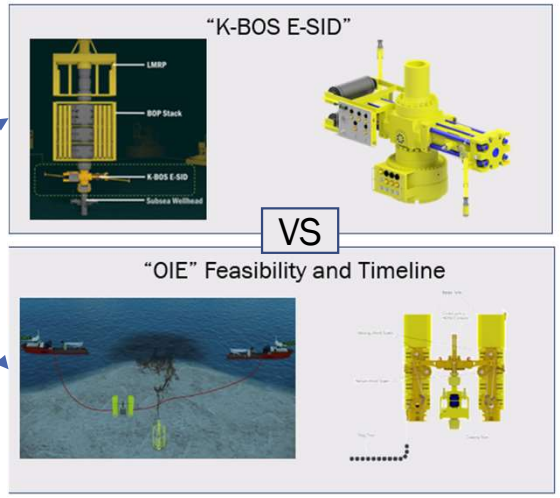
Configuration

- K-BOS as E-SID above wellhead

Applications

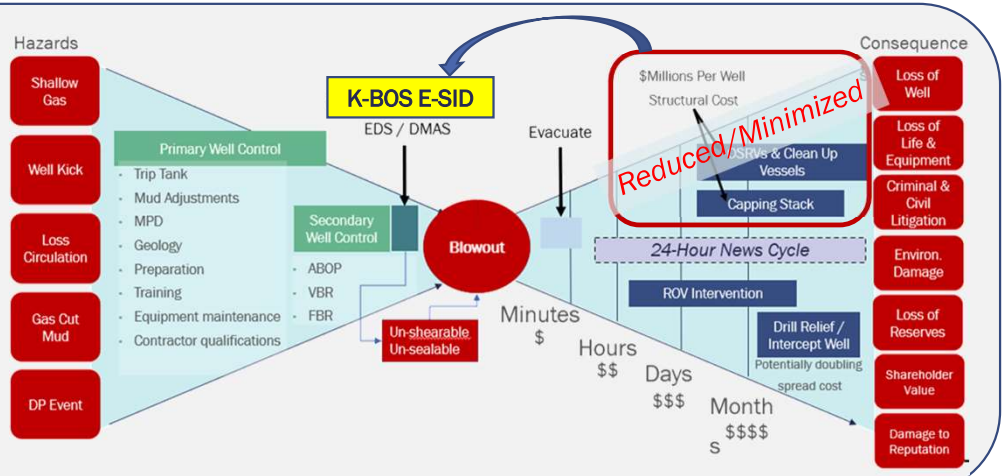
- Remote areas
- Environmentally sensitive areas
- Non-vertical Access (e.g. gas plume)
- Multi-well platform

"Non-Vertical Access"



Value

- Shut-in well in milliseconds
  - Short response timeline to secure well
  - Reduced spill to environment
  - Allows time to develop contingency options with no additional spill to environment (capping stack, well re-entry, relief well)
- Cost effective alternative to non-vertical access options
- Potential to reduce costs for cap/contain equipment
- Asset protection for multi-well platform



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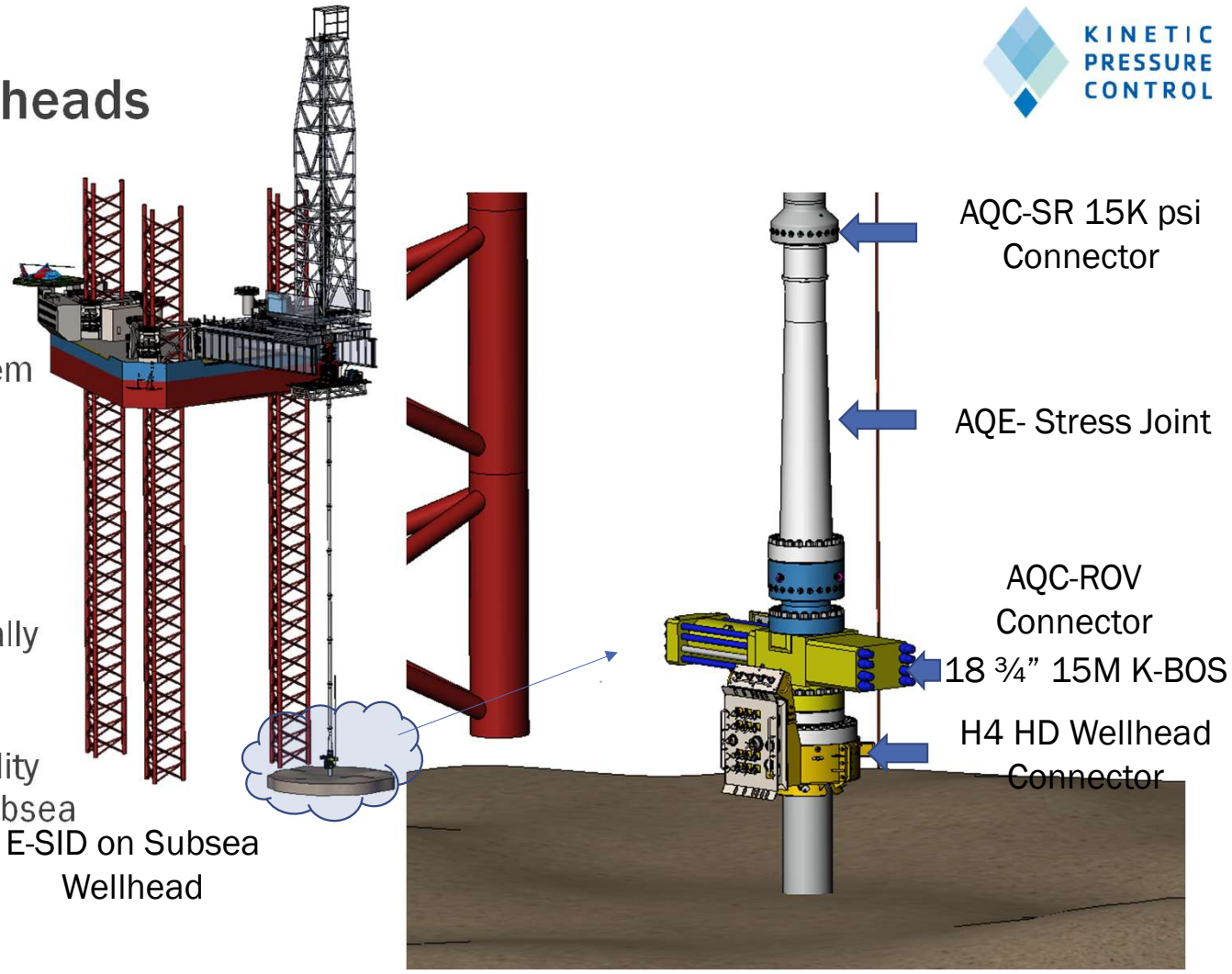
K-BOS® E-SID™ for Jack-ups on Subsea Wellheads

KINETIC PRESSURE CONTROL

- Jack-up
  - Lower cost and availability
    vs
    Moored Semisubmersible
  - Uses existing surface BOP system
- High-Pressure Riser
  - Primary Barrier (may only utilize single barrier sealing) Use of concentric connectors or
  - In event of failure, or leak typically no well isolation at seabed
- K-BOS E-SID at mudline
  - Enhanced Shear & Seal Capability
  - Secondary Barrier latched to subsea wellhead
  - Easy to run, multiple actuation options
  - Minimal rig independent surface controls



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K-BOS® E-SID™ Single Barrier/HP Riser Value Case

KINETIC PRESSURE CONTROL

Hazards

- Riser Wear
- Connection leak
- Fatigue
- Heat Check
- Well Kick

Controls

- Riser
  - Design
  - Fatigue design and monitoring
  - VIV suppression
- Connection design and make-up
- Seabed Barrier
- Operating procedures, Tool joint hardfacing

Blowout Above Seabed

Mitigation

- Environmental: Spill Clean Up
- No Capping Stack Option
- *24-Hour News Cycle*
- Evacuate Rig
- Drill Relief / Intercept Well

Consequence

- Loss of Life
- Loss of Rig
- Criminal & Civil Litigation
- Environ. Damage
- Loss of Well & Reserves
- Shareholder Value
- Damage to Reputation

Scenario 1

No seabed barrier:
- *Potential for riser failure above mudline;*
- *no capping option*

Scenario 2

K-BOS® E-SID™ : minimizes blowout above seabed risk

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Thank You. Questions?

KINETIC PRESSURE CONTROL

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