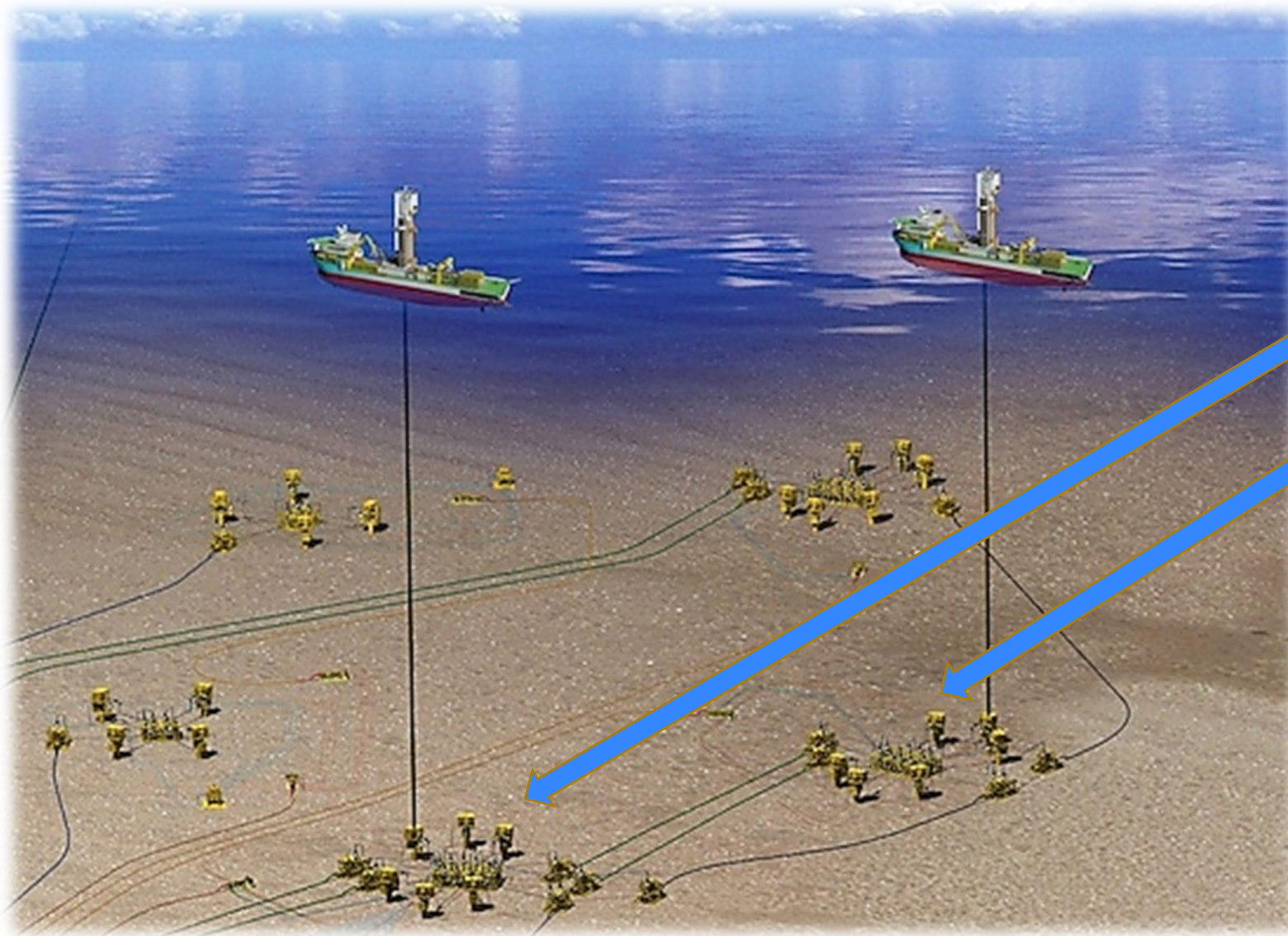


# Utilizing Novel Stimulation Methods To Access Wells Located Underneath Deepwater Facilities

Presented by: Nathan Wolford

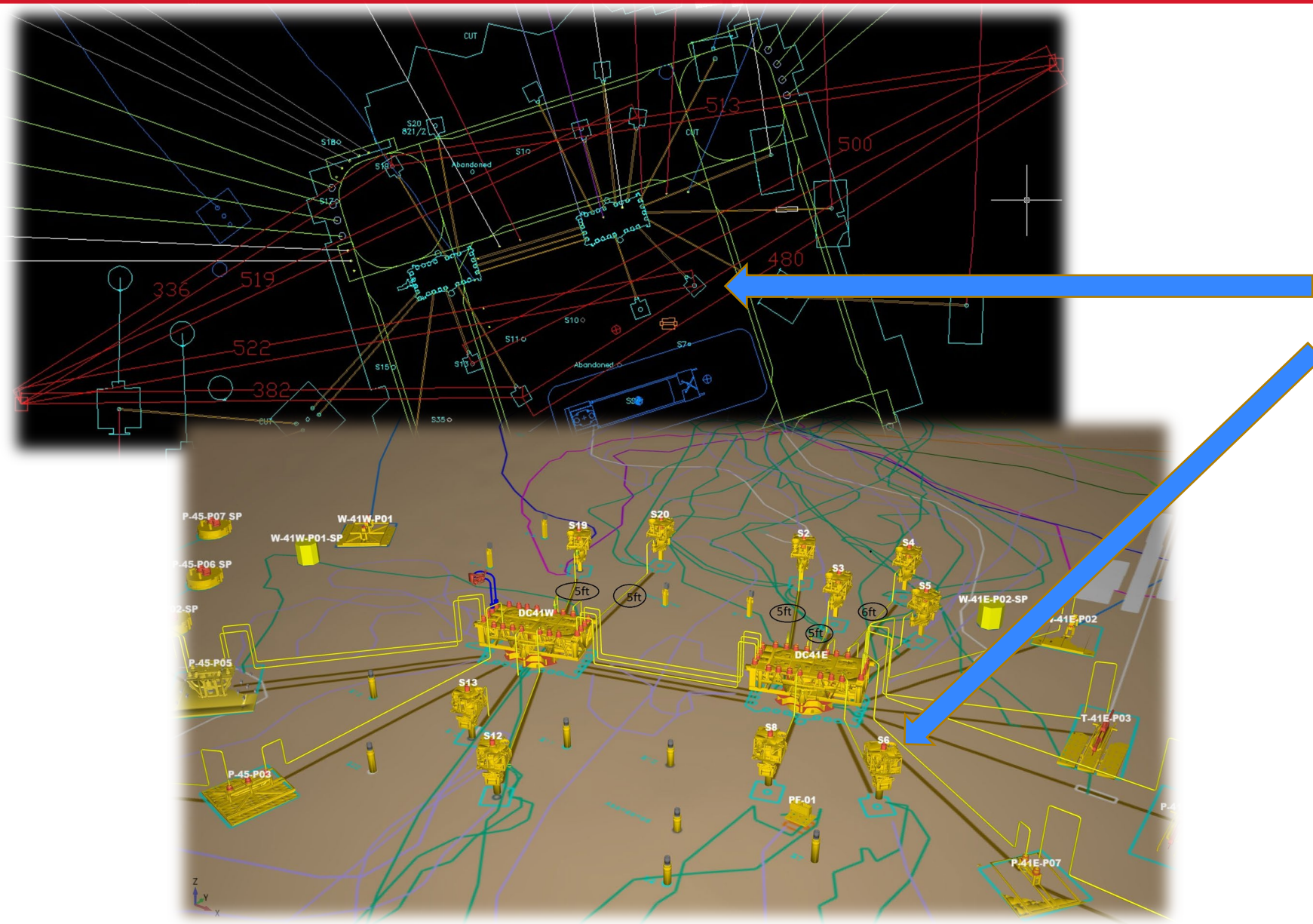


08/11/2022



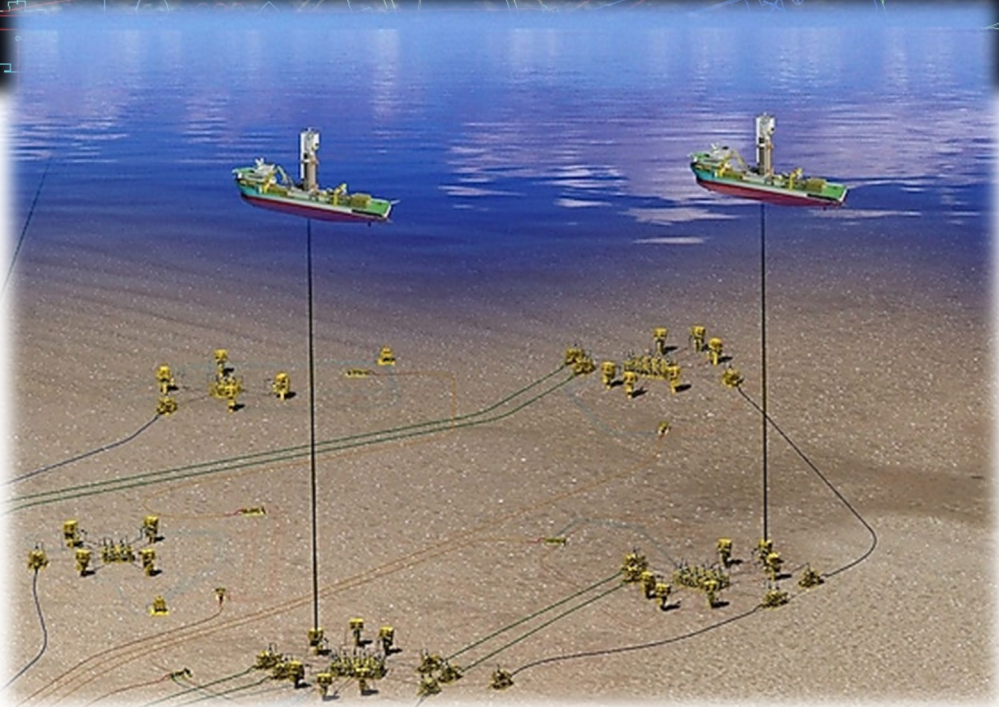
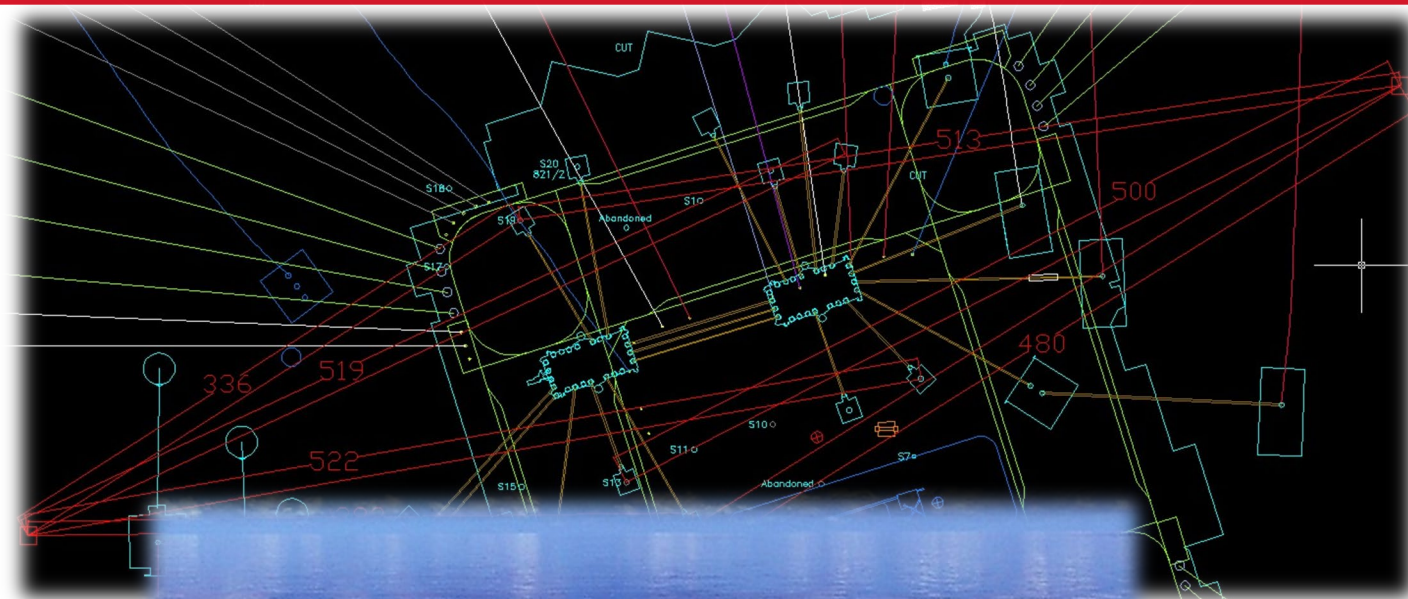
## The Ask:

How can we stimulate subsea wells within a drill center while a MODU is present?



## The Ask:

How can we stimulate subsea wells with a facility moored overhead?

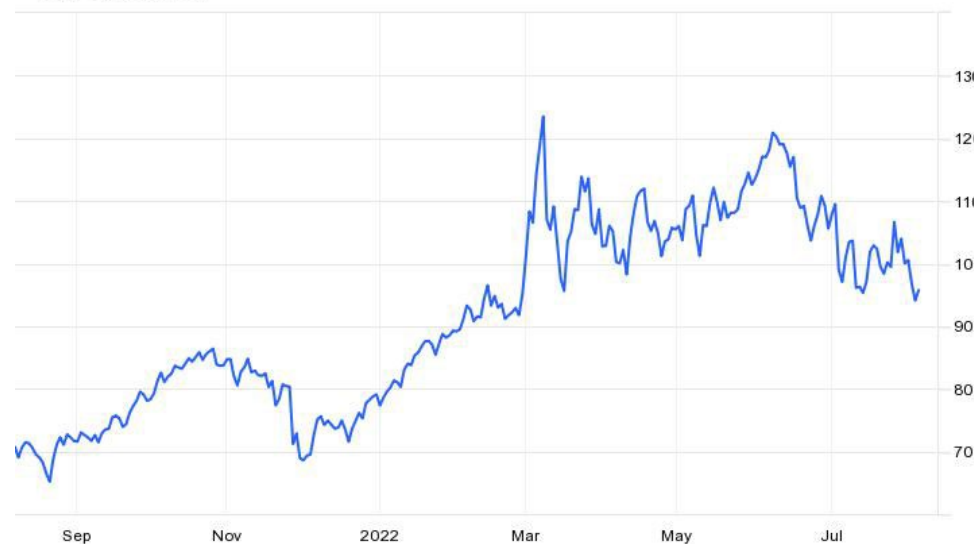


## Traditional Approach:

Facility deploys riser-based system

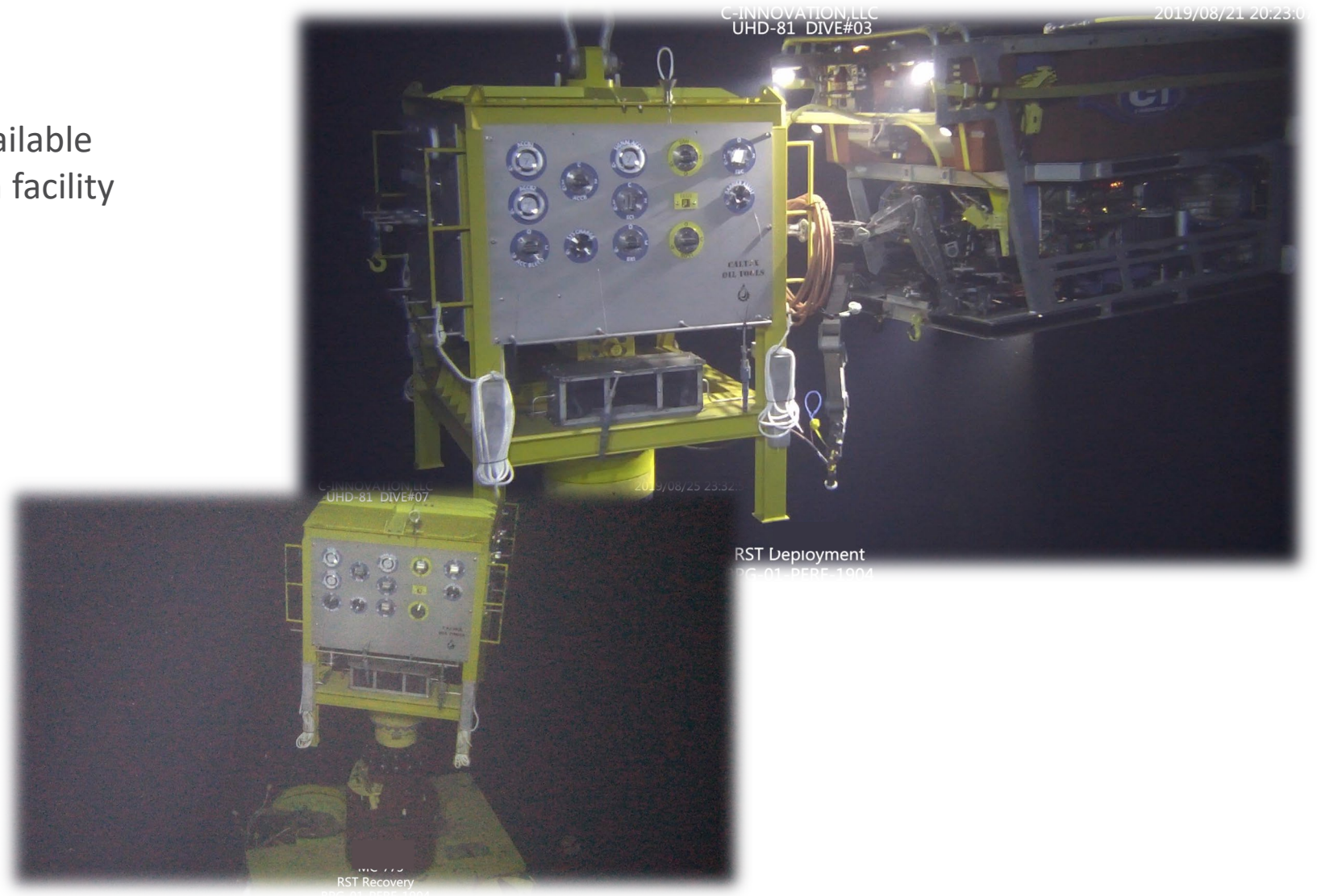
Wait until drill ship work is complete

Crude Oil Brent (UTC-5)



## Well Access

- How to install well control package?
  - Production facility
    - No facility subsea crane available
    - Desire not to interfere with facility operations
  - MSV Crane?
    - No vertical access
  - Buoyancy?
    - Safety concerns
- Required a modified strategy



## Well Access

- Modified tree cap (Vertical Tree)
  - Light enough for ROV installation with buoyancy
  - Installed from MSV outside facility footprint
  - Minimal facility impact



HDG 49.8°  
TMS 1780 m  
ROV 1837 m

C-Innovation LLC  
BPG-01-VENT-2110  
UHD 311 Dive # 3

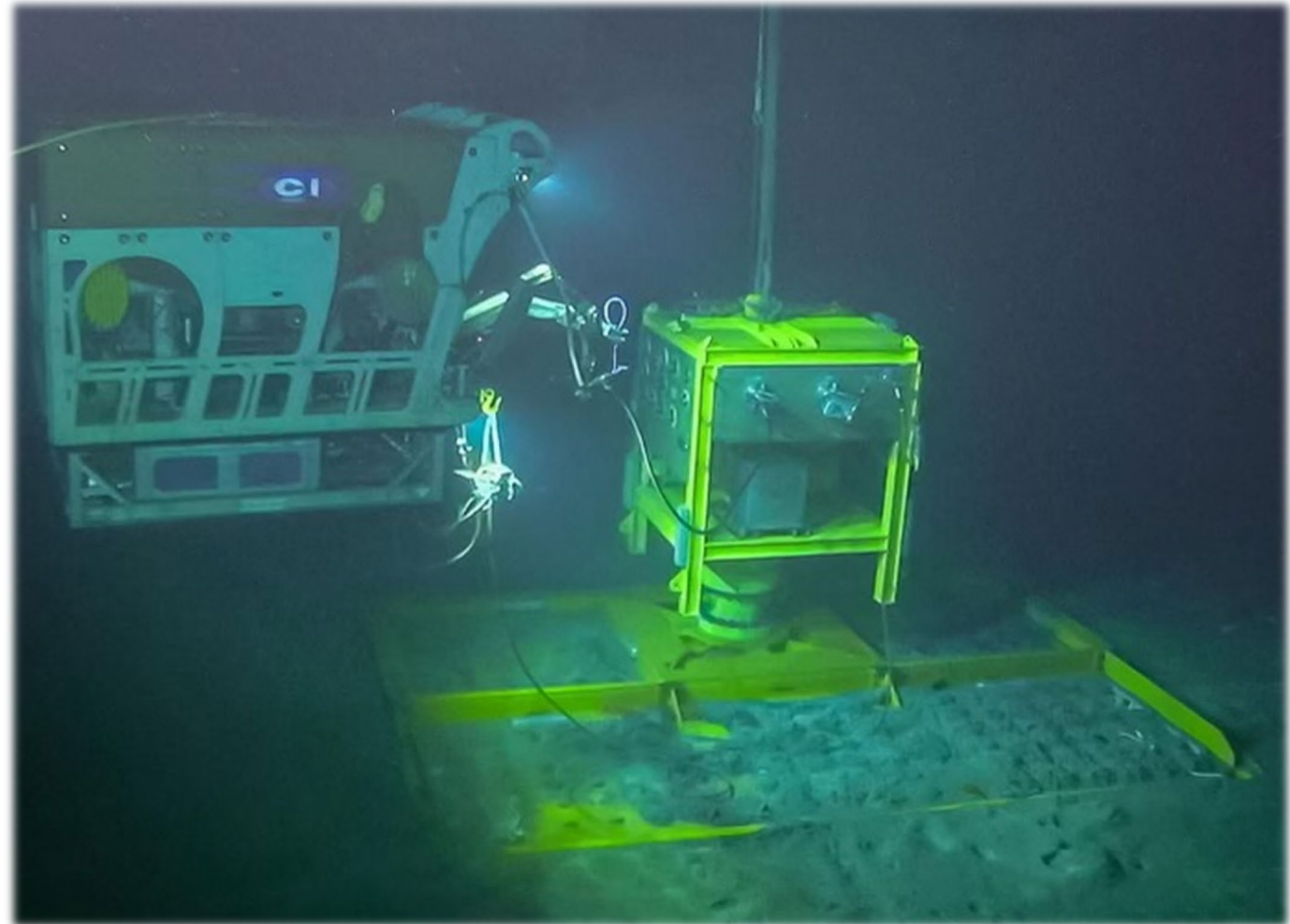
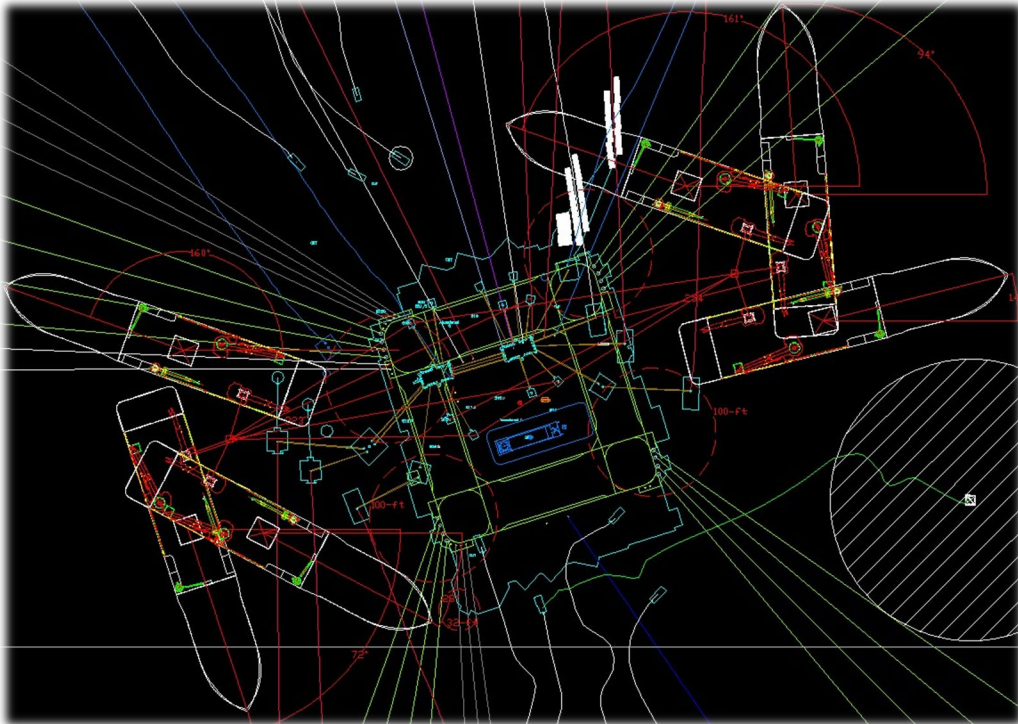
01-22-2022 09:53:00  
ALT 8.3 m

N 10232972.60 ftUS  
E 1158702.40 ftUS



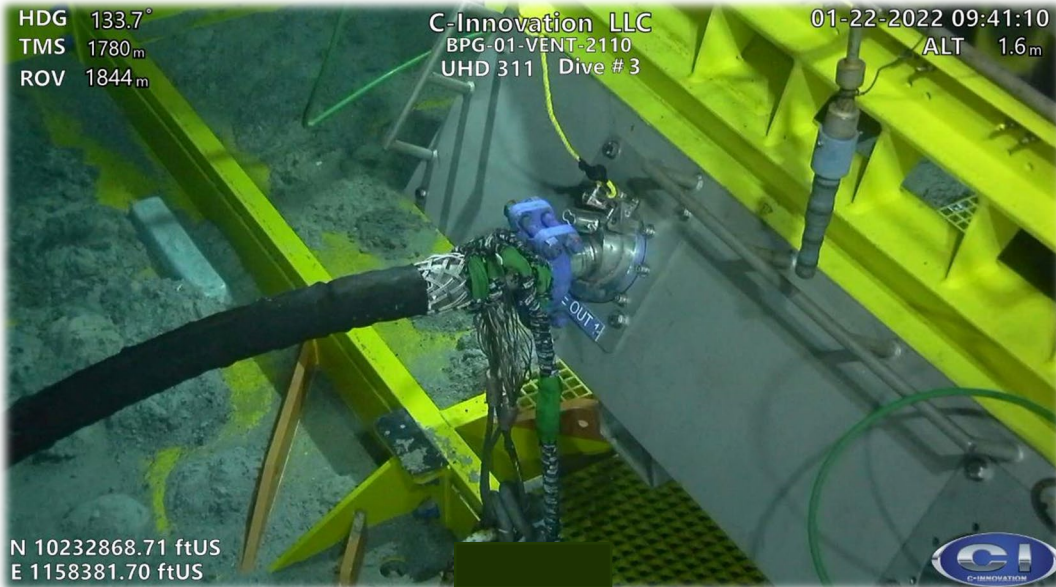
## Stimulation Tool

- Rigless Stimulation Tool
  - Modified to use on Mudmat
    - Soil and deployment analysis
  - Installed by MSV outside facility footprint
  - Placed on PSV
  - No facility impact



# “Well Service Jumper”

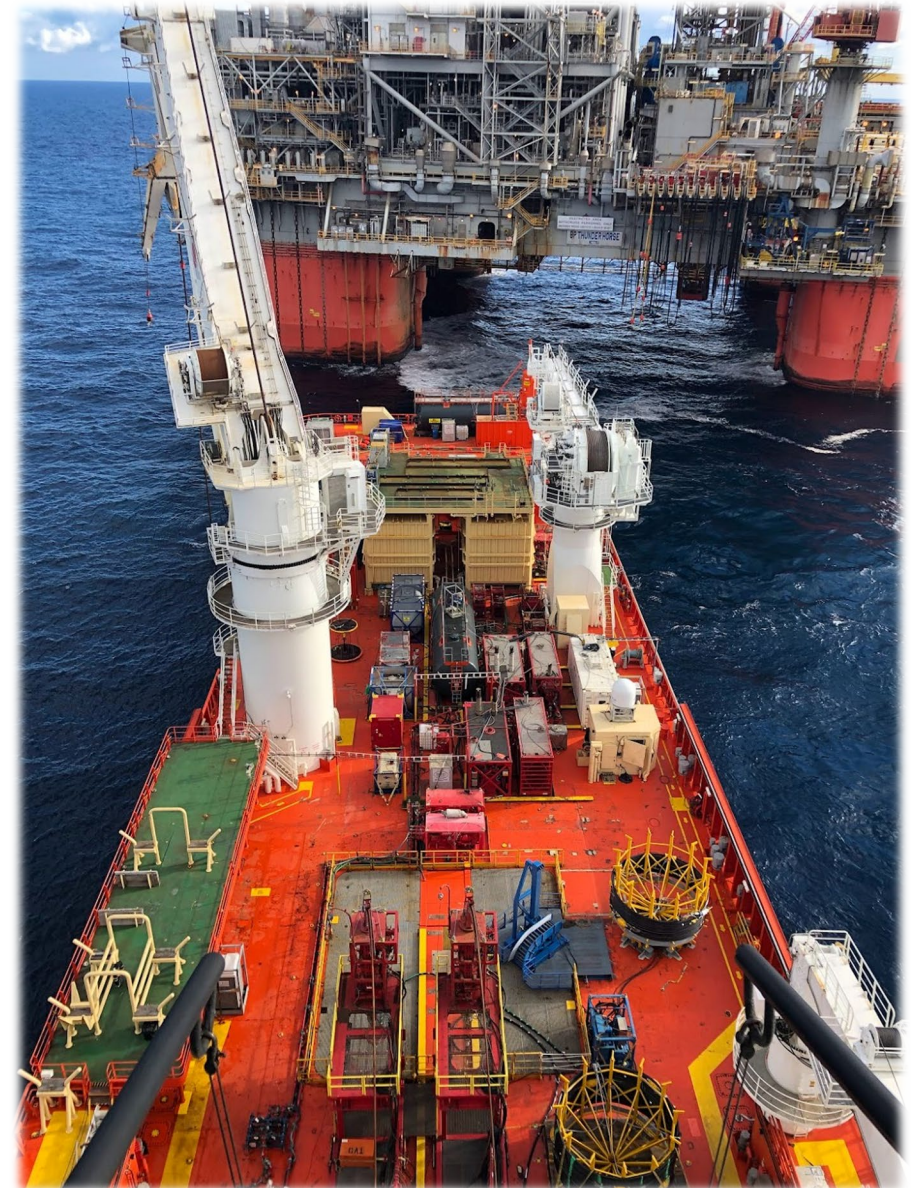
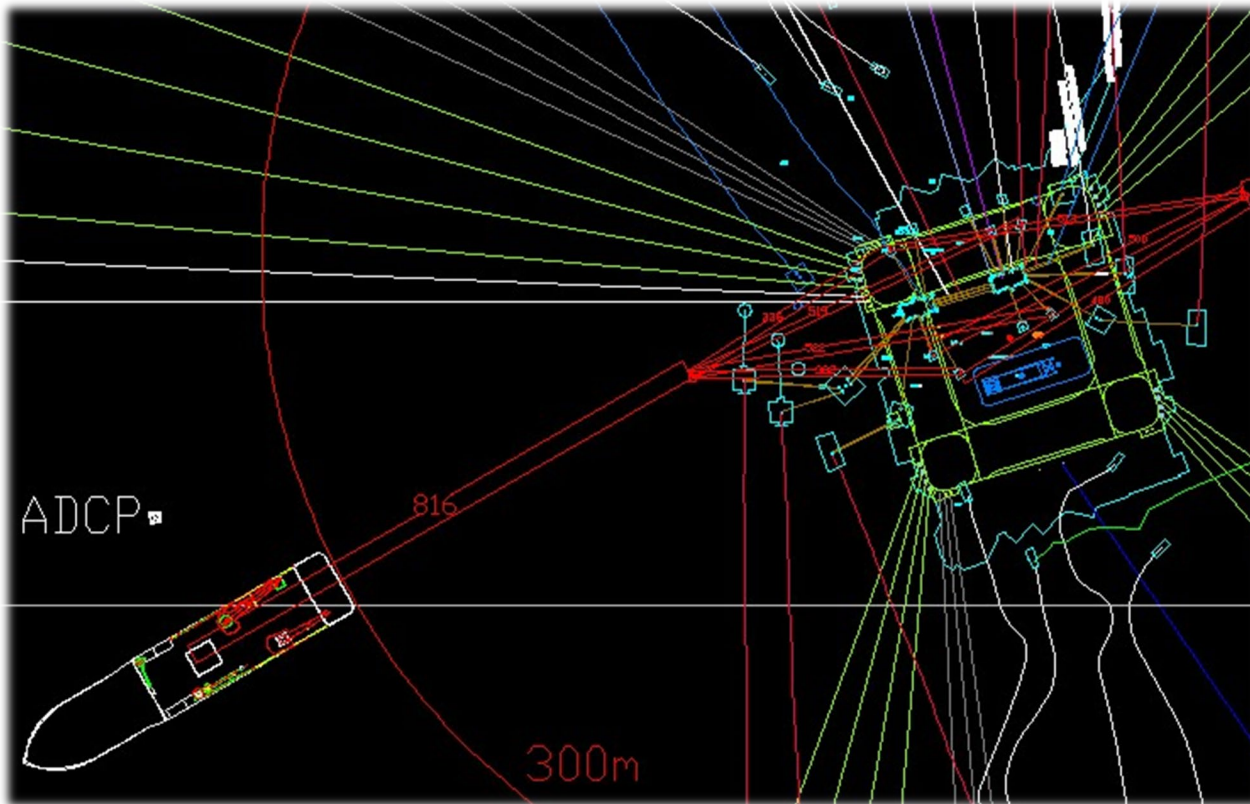
- 600’ length - Connection between Stimulation Tool and Tree Cap
- Installation using only ROV (under facility or drillship)
  - Buoyancy modules spaced out minimized ROV installation loads
  - Eliminate risk to existing infrastructure





## Vessel Offset from Facility

- Extended pumping operations – large scale squeeze
- 1,000' offset requested
- Enabled weather vaning of intervention vessel



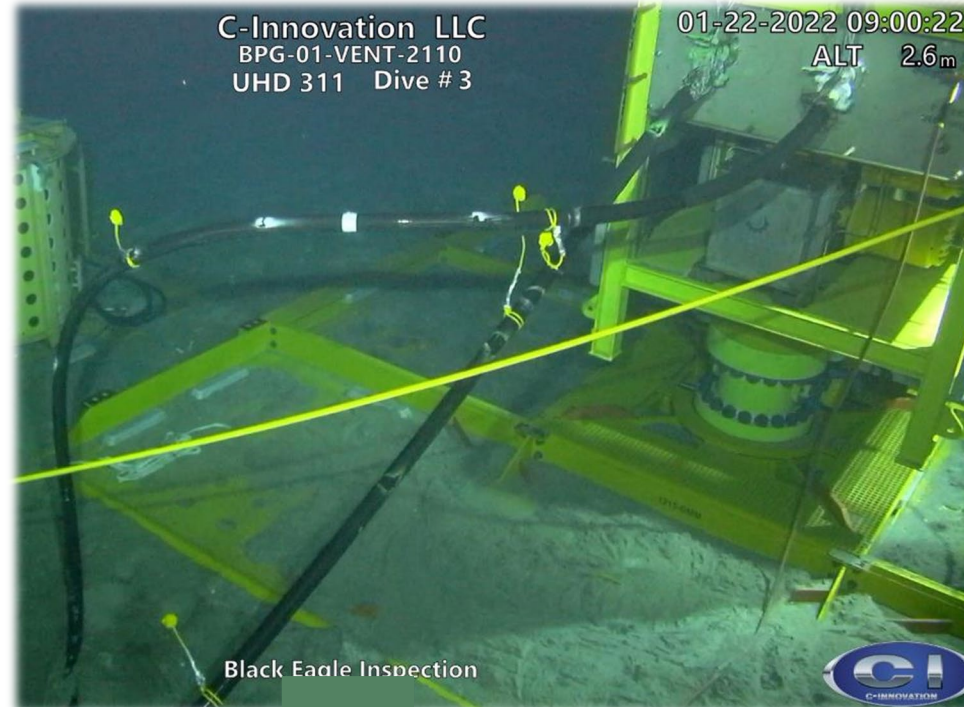
## Enabling Vessel Offset

- What conduit to use?
  - Coiled tubing on bottom
  - 1,000' high pressure hoses
  - Continuous or segmented?
- Spooling ahead of project mobilization
  - Purchase of deployment cassettes
  - Covers for hose connections
  - Development of levelwind chute and cantilever deck over moonpool
- Sparring of hoses and equipment
  - Hoses
  - Gaskets
  - Hardware



## Enabling Vessel Offset

- Deployment Methodology
  - Leveraged existing rental equipment available
  - Purchased cassettes for storage and deployment / recovery of high pressure hoses
  - Connected to coiled tubing at dock and pressure tested
  - Deployed offshore in a U shape with pennant wire
  - Crane handover followed by deployment to depth and connection to RST



## Enabling Large Pump Volumes

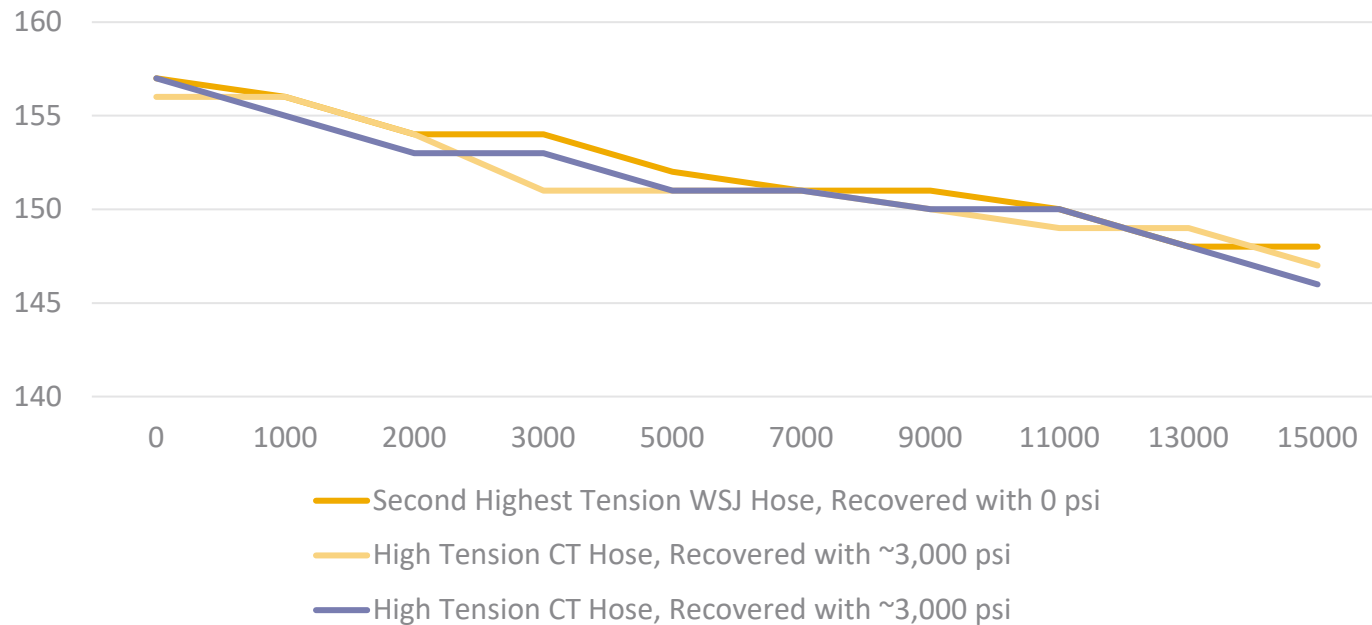
- Each well required a large pump volume
  - 20,000 bbls + acid / brine combos
- 55,000 bbl Scale Squeeze on Single Well
  - Two PSVs chartered
  - Each vessel is connected offshore for fluid transfer
  - PSV round trip and continuous mixing operations



## Lessons Learned

- Pressure test successful during initial spooling
- After recovery, hoses collapsed cassettes
  - Constriction force of hoses after recovery
- Testing at dock in Fourchon between campaigns

Hose Length (ft) vs Pressure (psi)



## Results

- 5 wells successfully and safely executed to date with additional wells planned for 2023
- Over 150,000 bbls of stimulation chemicals pumped over 5 wells
  - Campaign 1
    - Well #01 – 27,700 bbls
    - Well #02 – 55,329 bbls
  - Campaign 2
    - Well #03 – 17,782 bbls
    - Well #04 – 29,625 bbls
    - Well #05 – 21,939 bbls
- 2,400 hrs worked with 2.7 % overall NPT
  - Campaign 2 – 0 NPT
- Production Increase
  - 3 wells brought online
    - 14,716 bbls / day increase
  - 2 wells awaiting restart

