MCE Deepwater Development 2017 💳

# Reel-lay Installation of Steel Catenary Risers and Inline Sleds in High Surface Currents





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## **Problem Statement: Weather Window for Offshore Operations**

- The permissible weather window for an operation is determined during the project engineering phase by examining during what weather conditions (wave height, heading, period plus current heading and speed) are allowable while maintaining personnel, equipment, and installed product safety. Typical pipeline limitations are static and dynamic stress limits, and allowable installation fatigue damage at critical locations.
- Given the numerous variables, it is nearly impossible to completely map out the permissible weather conditions for installation to increasingly low percentage cases. High probability cases based on local metocean data are analyzed during the project phase, and analysis engineers offshore can update based on current conditions and future forecasts if needed. Leveraging new technology can validate analysis results real-time during offshore operations.





## 4D Nav – PipelayView



- Tightly integrated with Orcaflex continually updates the static configuration of the pipeline based on vessel position, survey data, and pipeline payout. Additionally, pipeline fatigue is computed real-time using actual measured vessel motion data as an Orcaflex input.
- Pipeline Exit Monitoring System Uses laser tracking to monitor the departure of the pipe from the tensioners down to millimeter precision, giving pipelay operators instant feedback on pipeline behavior at tensioner exit
- Instant validation of all engineering calculations for offshore operations



## Weather Conditions During Pull-In



- Loop currents can be an unpredictable source of very high surface currents in the Gulf of Mexico
- A single eddy can exist for many months, and surface currents can exceed 4 knots
- Surface currents during pull-in operation were 3.2 knots, peak current seen during offshore campaign was 3.9 knots. Predominant direction was from vessel towards host platform.



## Pull-In Operation: Overview of Analysis Steps

#### Pull-in Winch Connected to Flex Joint Pullhead



#### SCR Paid Out, Tension Taken Up on Winch Wire





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## Pull-In Operation: Overview of Analysis Steps

#### SCR Paid Out, Tension Increased on Winch Wire



#### Strakes Installed, Buoy Connected to Optimize Bending In SCR





# Pull-In Operation: Overview of Analysis Steps

#### SCR Paid Out, Buoy Retrieved



## Flex Joint Landed in Receptacle





## **Pull-In Operation: Operation Rendering**



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## Pull-In Operation: Offshore Operational Photos

#### Flex Joint Horizontal Lift



#### Flex Joint Loaded in Cruciform to Interface with HPHD





#### Flex Joint and Cruciform Moved to HPHD



## Cruciform Locked into HPHD



#### HPHD Moved into Firing Line for Welding



#### Welding Flex Joint to SCR



Connecting Platform Winch Wire to Pullhead



#### Strakes Installed on SCR



## Rigging Released and Buoyancy Attached



Buoyancy Clump Weight Released, Uplift Transferred to Flex Joint



Flex Joint Approaching Hang-off Receptacle at 3.2 knots current Flex Joint Landed in Hang-off Receptacle at 3.2 knots current

![](_page_12_Picture_4.jpeg)

HDG(T): 287.31 RGE South Main FL P: 5.30 DPT(ft): 86.7 SCR R: 4.50 ALT(ft): N/A

![](_page_12_Picture_6.jpeg)

SCR Lay Away at 79 degrees Tower Angle, Strakes Installed

![](_page_13_Picture_3.jpeg)

#### 2<sup>nd</sup> End of SCR Transferred from Reel to Lay Tower

![](_page_13_Picture_5.jpeg)

![](_page_13_Picture_6.jpeg)

## **Pull-In Results and Conclusion**

- All steps of the SCR pull-in operation were successfully analyzed and completed offshore safely, with no observed deviations from the analysis.
- The field went into production in late 2015, ahead of schedule and within sanctioned budget.
- Correlation on SCR shape due to current drag was very good between analysis and observation, and calculated fatigue life was always within safe limits.
- Skilled engineers being present during the offshore operation increases flexibility and improves the quality of offshore installation work.
- Integrated analysis methods and modern engineering tools add significant value to the offshore installation contractor field by safely increasing vessel uptime and productivity. Installed field integrity is verified real-time during installation.

![](_page_14_Picture_7.jpeg)