



KNOT

Knutsen NYK Offshore Tankers AS
Vessels fit for various Offshore Projects
Our operation are based on quality and safe
operation.



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Snorre Silicate Injection Project

- Vessel type
- Hose connection System
- Connection & disconnection
- Station keeping capabilities
- Re-supply offshore



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Snorre Silicate Injection Project

- **REQUIREMENTS:**

- IMO TYPE II VESSEL
 - ABLE TO ACCOMMODATE THE REQUIRED QUANTITIES OF WELL FLUIDS
 - ONBOARD MIXING OF WELL FLUIDS
 - STABILITY AND DAMAGE STABILITY
- DP CLASS II VESSEL
 - MSC/CIRC. 645 – DP GUIDELINES
 - POWER SYSTEM
 - THRUSTER SYSTEM
 - DP CONTROL SYSTEM
- TAILOR MADE DP SOFTWARE/VIGDIS E-04 TEMPLATE
- TAILOR MADE CONNECTION SYSTEM FOR THE 3 inch SUBSEA HOSE
- STERN LOADING SYSTEM FOR REFILL OF WELL FLUIDS AND BUNKERS



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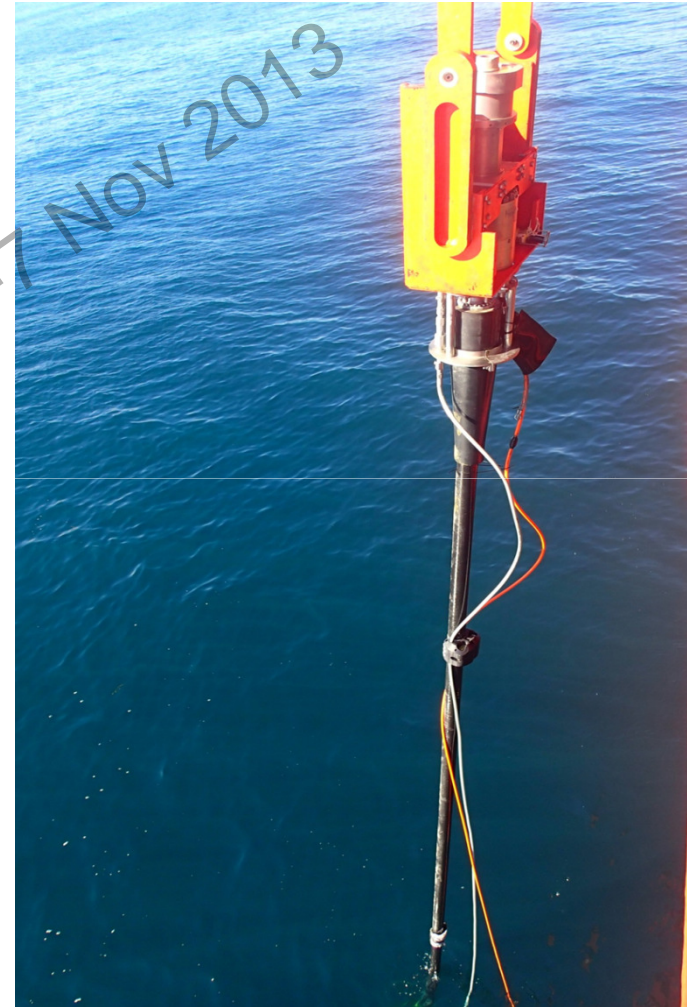




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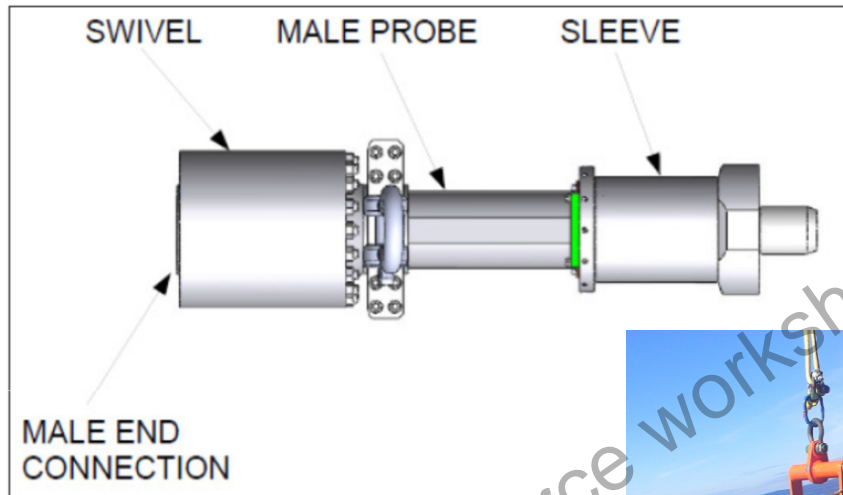
HOSE CONNECTION SYSTEM



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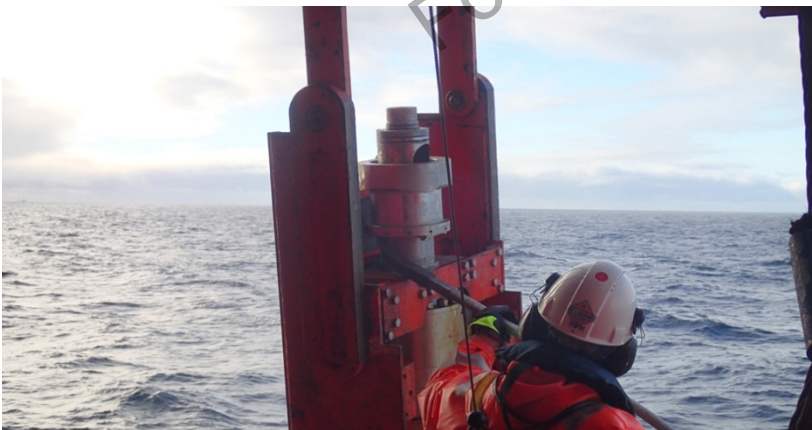
MALE SWIVEL ARRANGEMENT



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HOSE CONNECTION SYSTEM



The hot make hot brake (HMHB) system installed onboard Siri Knutsen, is a prototype in respect of being used on a surface unit. The entire feature, apart from the swivel/sleeve arrangement, has been tailor made to fit within the boundaries of the BLS opening area onboard Siri Knutsen.

The 3 inch Black Eagle hose arrangement comprises an H-line and an E-line, all bundled together.

The H-line allows for subsea camera surveillance.

The E-line allows for control of the FSV (fail safe valve); i.e opening and closing.

For emergency disconnection, the HMHB system has been integrated in the vessels Green Line System (automatic operation)



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HOSE CONNECTION SYSTEM



A tension cell is installed to monitor the dynamic forces exercised onto the BE hose.

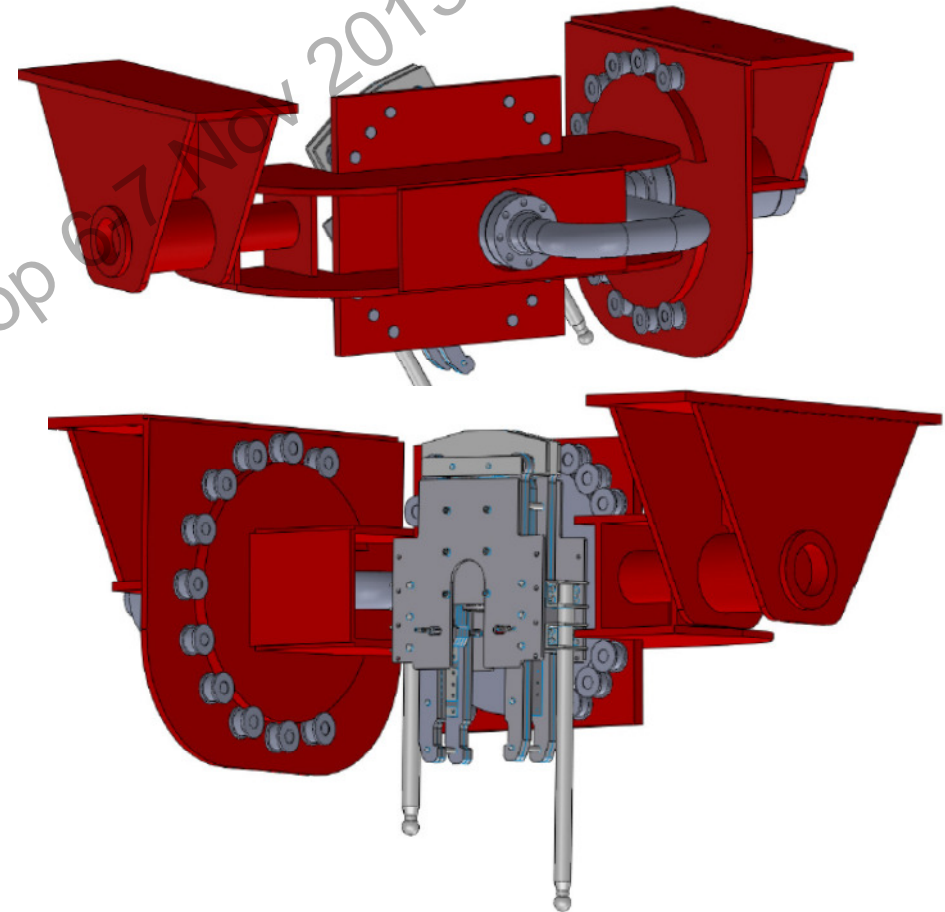
Max allowable tension is set to $>5T < 7T$.



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HOSE CONNECTION SYSTEM



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CONNECTION / DISCONNECTION CRITERIA

- Connection:
 - Relatively calm sea as crew has to work over sea during connection; bow door used as working platform.
- Dis-connection:
 - If weather forecast predicts winds > 40 knots and $H_{sig} > 4,5$ m
 - Max dynamic forces allowed $>5<7$. Dictated by the Black Eagle hose properties.





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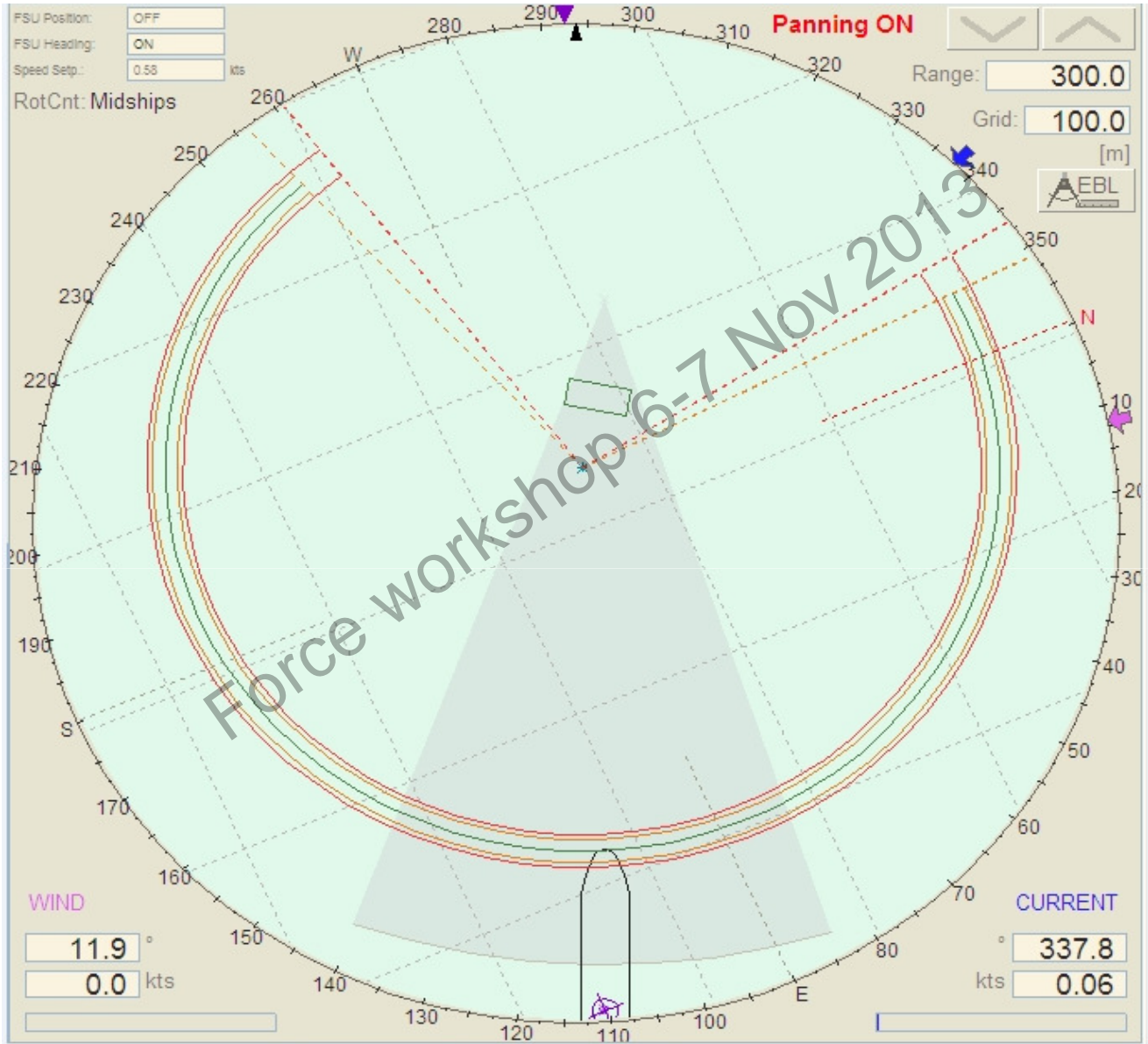
DP Operation

- MT Siri Knutsen will operate in DP2 mode during the Snorre Silicate injection project.
- A dedicated DP SW program has been developed by Kongsberg Maritime
- Position reference systems (PRS) to be used, will primarily be HiPap (high precision acoustic positioning system) and DARPS/DGPS (differential absolute and relative positioning sensors)
- The UTM position of the hold down anchor will be used as origo and six corresponding transponders will be engaged around the Vigdis E-4 template for positioning purposes.
- The operational sector has been developed according to requirements set by Statoil.
- The approach procedure has been developed by KNOT by adoption of standard shuttle tanker procedures. The step-by-step procedure concerning pick-up of the BE hose, has been dictated by Parker/SS7 and adopted into the approach/connection procedure.



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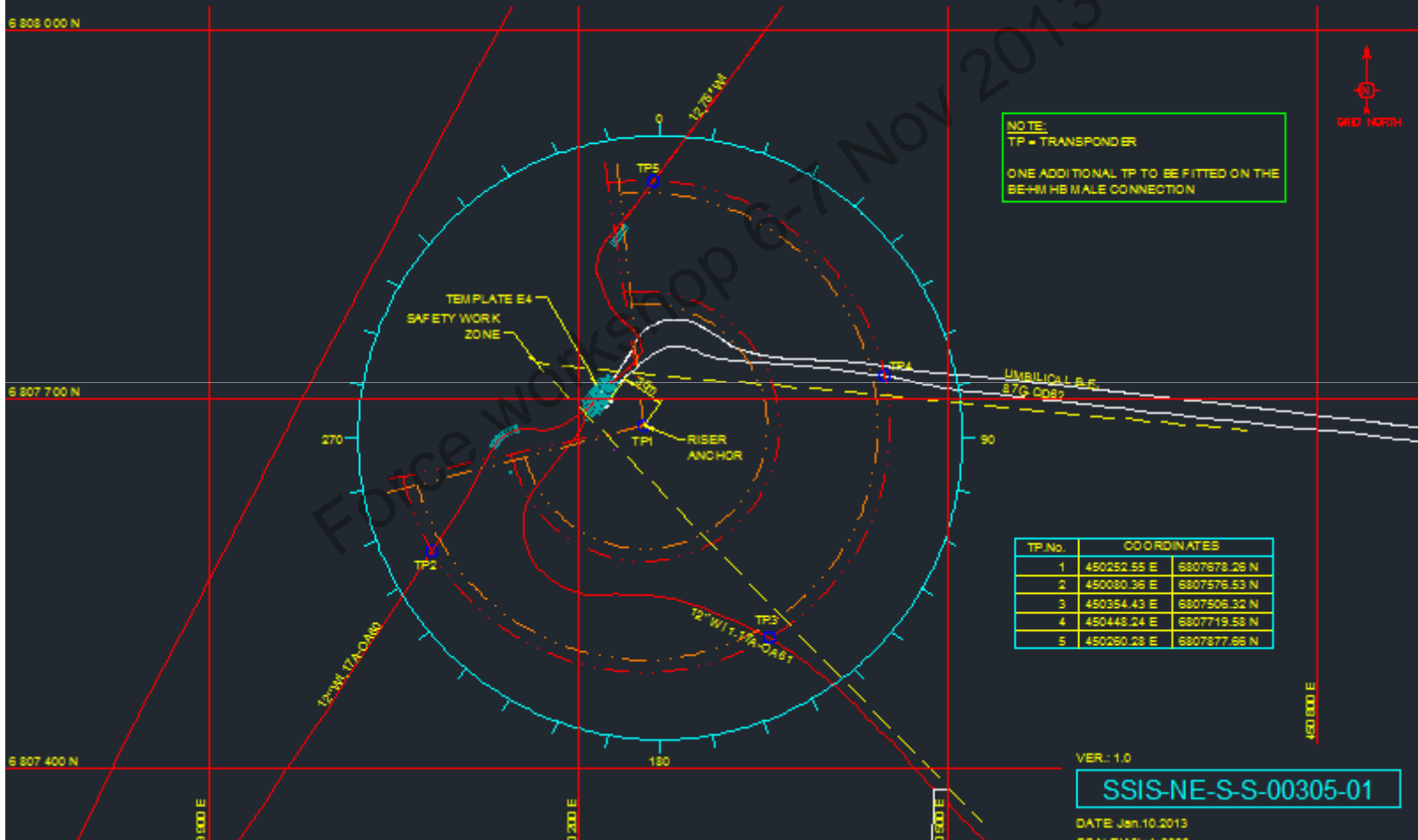




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STATOIL SUBSEA SERVICES IMR 2012-2016
 IMR 12-393 TRANSPONDER LAY-OUT VIGDIS TEMPLATE



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DP Operation

- Experience gained during the project:

The DP system has worked very satisfactorily throughout the project.

The vessel maintains the station keeping by VV-mode(weather vane) and Auto-Pos mode (at the extreme points of the operational area)

The vessel has operated in Hsig of 4,7m with winds up to 45 knots. Maximum continuous station keeping time is dictated by the dynamic forces exercised on the BE hose and that the environmental forces coincides from the same direction.

Continuous station keeping is hampered, especially if sea and swell are coming from different direction.

During this project, the vessel have operated on DP since 23rd of May and disconnected twice due to rough weather (July 28 / Oct 9) – downtime of 55H



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Re-supply of well fluids offshore

- A purpose made stern hose reel system has been installed onboard the Siri Knutsen for this purpose.
- Transfer of loading hose by transfer of forerunner/messenger by air gun.
- Two radius transponders and Artemis has been installed on top of the aft accommodation module for use as PRS in DP mode for the re-supply vessel.
- Re-supply of well fluids (silicate) took place offshore simultaneously during pumping operation. The re-supply service was rendered by Anneleen Knutsen (sister ship of Siri K)
- The transfer method was similar to tandem loading, but hawser less.
- Time used for transfer – 20H 18M (12 400 m³ Silicate and 1 400 m³ MGO)



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Stern Reel System



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NYK LINE
NIPPON YUSEN KAISHA

QUALITY IS OUR DELIVERY !



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