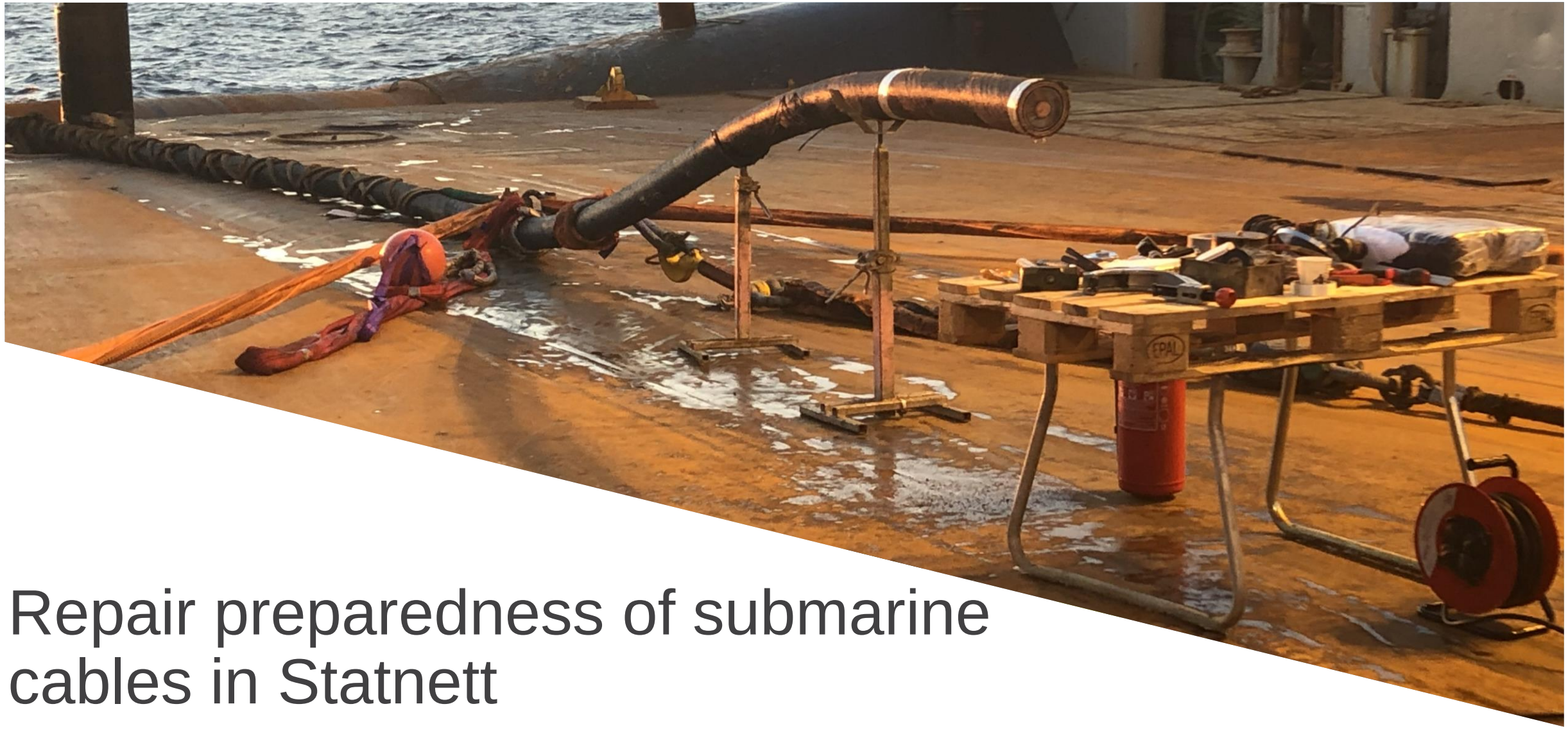


Repair preparedness of submarine cables in Statnett

SubOps 2023

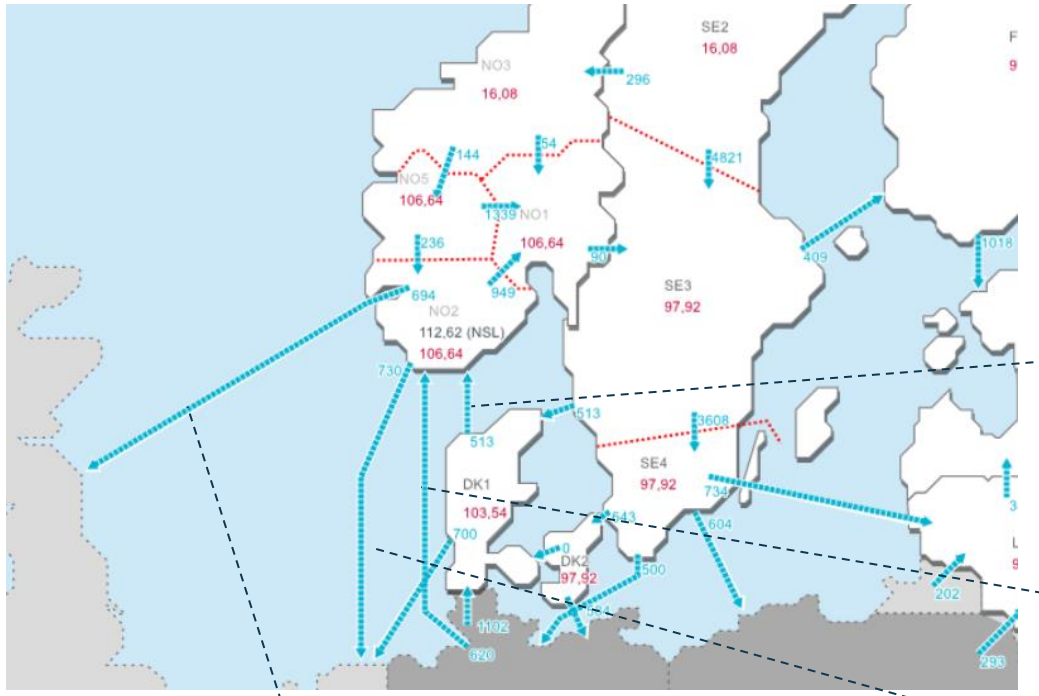
Haugesund 9-10 August 2023, Ole Petter Hobberstad

Statnett

Topics

- Submarine Cable assets, HVDC and HVAC
- Fault. Case from Oslofjord 2020
- Inspection and monitoring of cables in general
- Use of DTS and DAS for monitoring.
- Emergency preparedness. Frame agreements

Overview of Statnett HVDC cables 2023



Skagerrak 1,2,3 and 4 NO - DK

- Statnett and Energinet.dk
- Mass-Impregnated Cable
- Skagerrak 1 and 2 (1976/77)
  - 2 x 270 MW
  - 250 kV HVDC
  - 124 km
- Skagerrak 3 (1993)
  - 500 MW
  - 350 kV HVDC
  - 124 km
- Skagerrak 4 (2014)
  - 700 MW
  - 500 kV HVDC
  - 140 km sea + 100 km land

NSL 2021 NO-UK

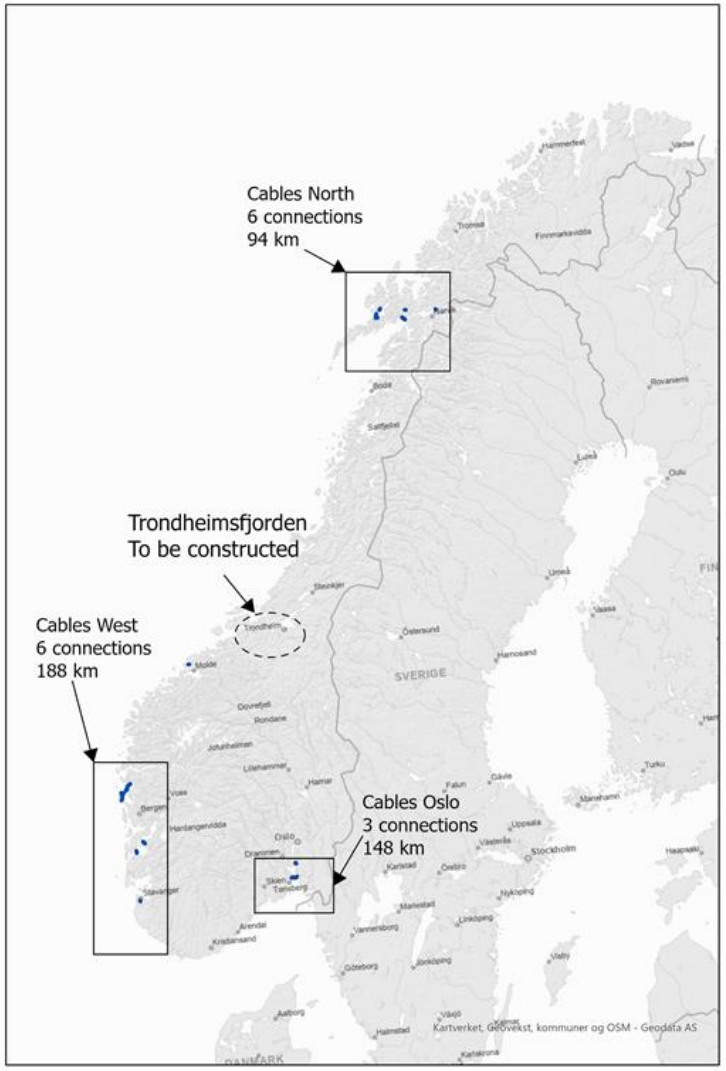
- Statnett and National Grid
- Kvilldal - Blyth
- 2 Mass Impregnated cables
- 1400 MW
- 500 kV HVDC
- 720 km
- in operation in 2021

NorNed 2007 NO- NL

- Statnett and TenneT
- 2 Mass Impregnated cables
- 700 MW
- 450 kV HVDC
- 580 km

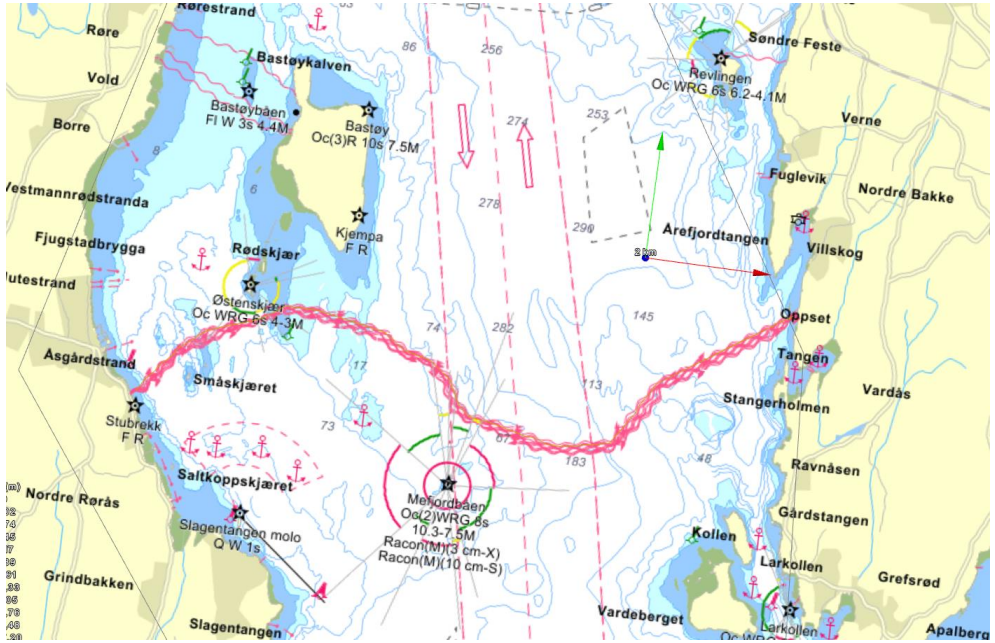
NordLink 2020 NO - GER

- Statnett, TenneT and KfW
- Tonstad - Wilster
- 2 Mass Impregnated cables
- 1400 MW
- 500 kV HVDC
- 623 km (516 km submarine part)



HVAC cables 2023 (fjord crossings)

- 15 crossings
- 430 km of cables

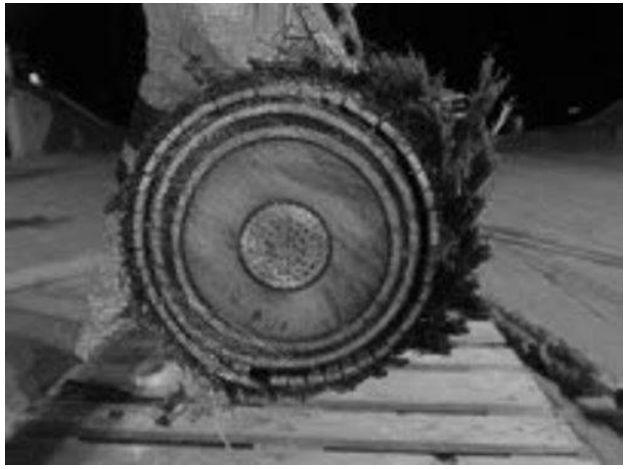


HV-AC/DC Cable types

Oil filled (SCFF)

Mass impregnated (MIND)

1 x PEX



3 X PEX

Cable fault Ytre Oslofjord 16.02.2020

Activities & events	Dates
YOF cable faults. Fault finding. Cable #6 leaking oil	16.02.20 00:49
Call off PRSI	16.02.20
Survey at fault area	17.02.20
Cut and seal. Priority to stop leakage on cable #6.	20.02 to 27.02.2020

Skipsanker ødela sjøkabel - oljelekkasje i Oslofjorden

Av Truls August Rålen

Publisert: 16.02.20 12:23 Del

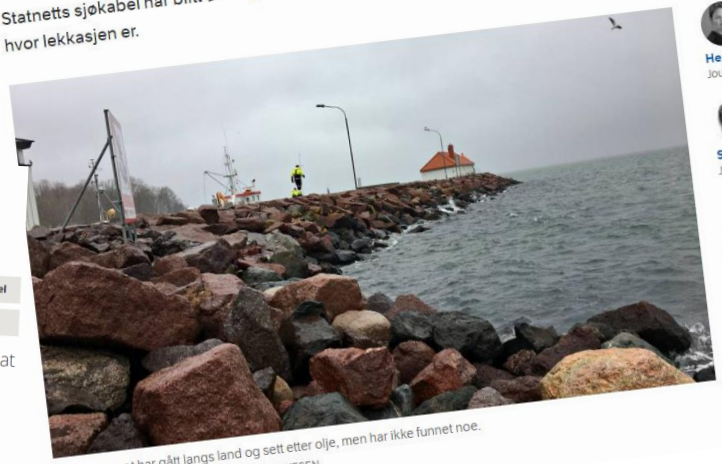
Artikkelen er over 2 år gammel

Søndag morgen melder Vestfold Interommunale Brannvesen på Facebook at en 13 kilometer lang sjøkabel i natt er blitt påført skader, og det er oppstått en oljelekkasje i Oslofjorden.

- Straks vi ble varslet om hendelsen tidlig søndag morgen informerte vi Horten kommune og Fylkesmannen, da lekkasjen er i et område

Olje lekker fra en sjøkabel i Oslofjorden

Statnetts sjøkabel har blitt ødelagt i natt og det lekker olje. Statnett vet ikke hvor lekkasjen er.



Brannvesenet har gått langs land og sett etter olje, men har ikke funnet noe.

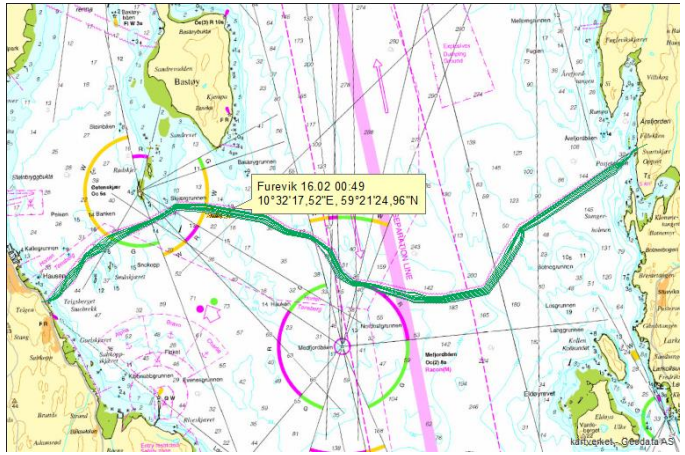
FOTO: VESTFOLD INTERKOMMUNALE BRANNVESEN

Hege Therese Holtung
Journalist

Sara Vilde Solås
Journalist

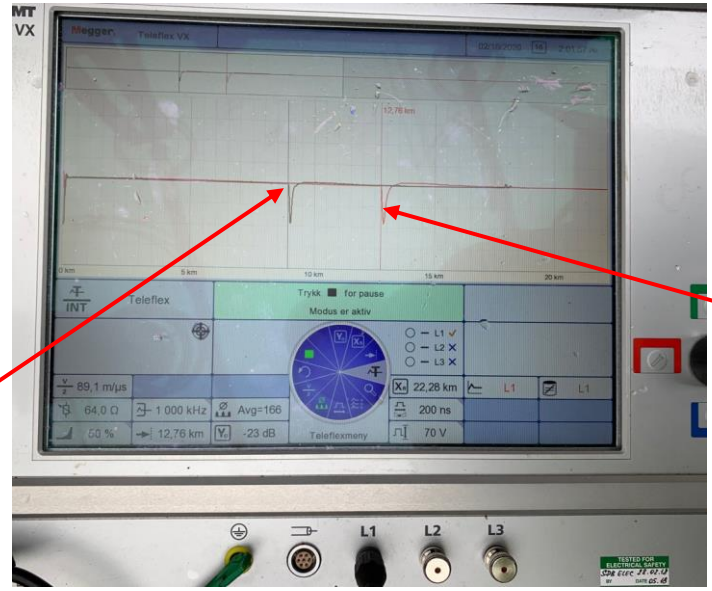
Publisert 16. feb. 2020 kl. 17:22
Oppdatert 16. feb. 2020 kl. 19:50

Artikkelen er mer enn to år gammel.



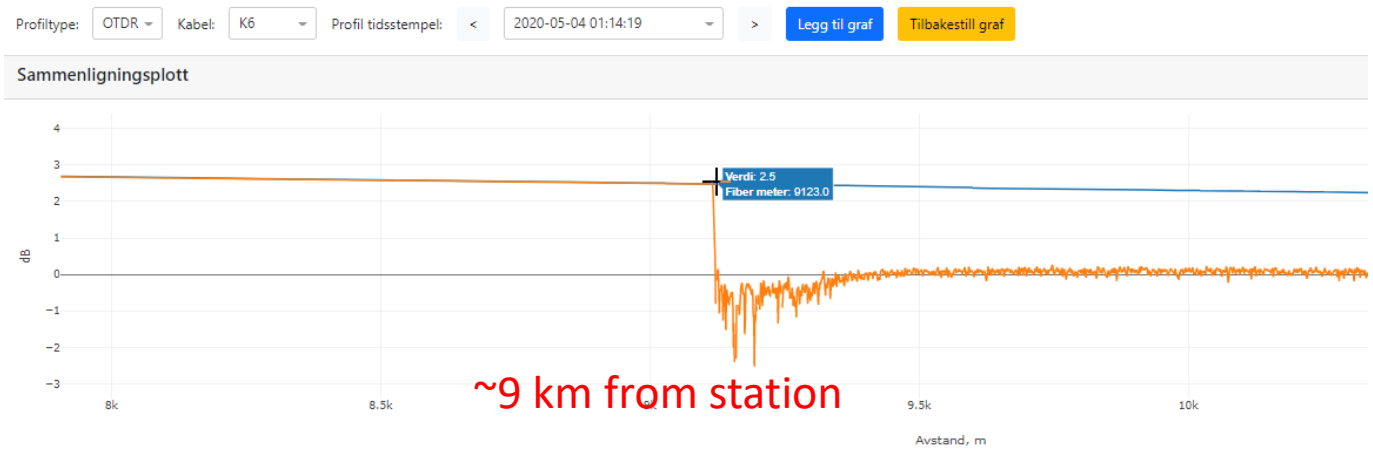
Fault finding. First steps

- TDR, Time Domain Reflectometry
- OTDR (Optical Time Domain Reflectometry)
- Fault at 3 of 9 cables (Oslofjord)



Fault ~9km

End reflection from previous measurments

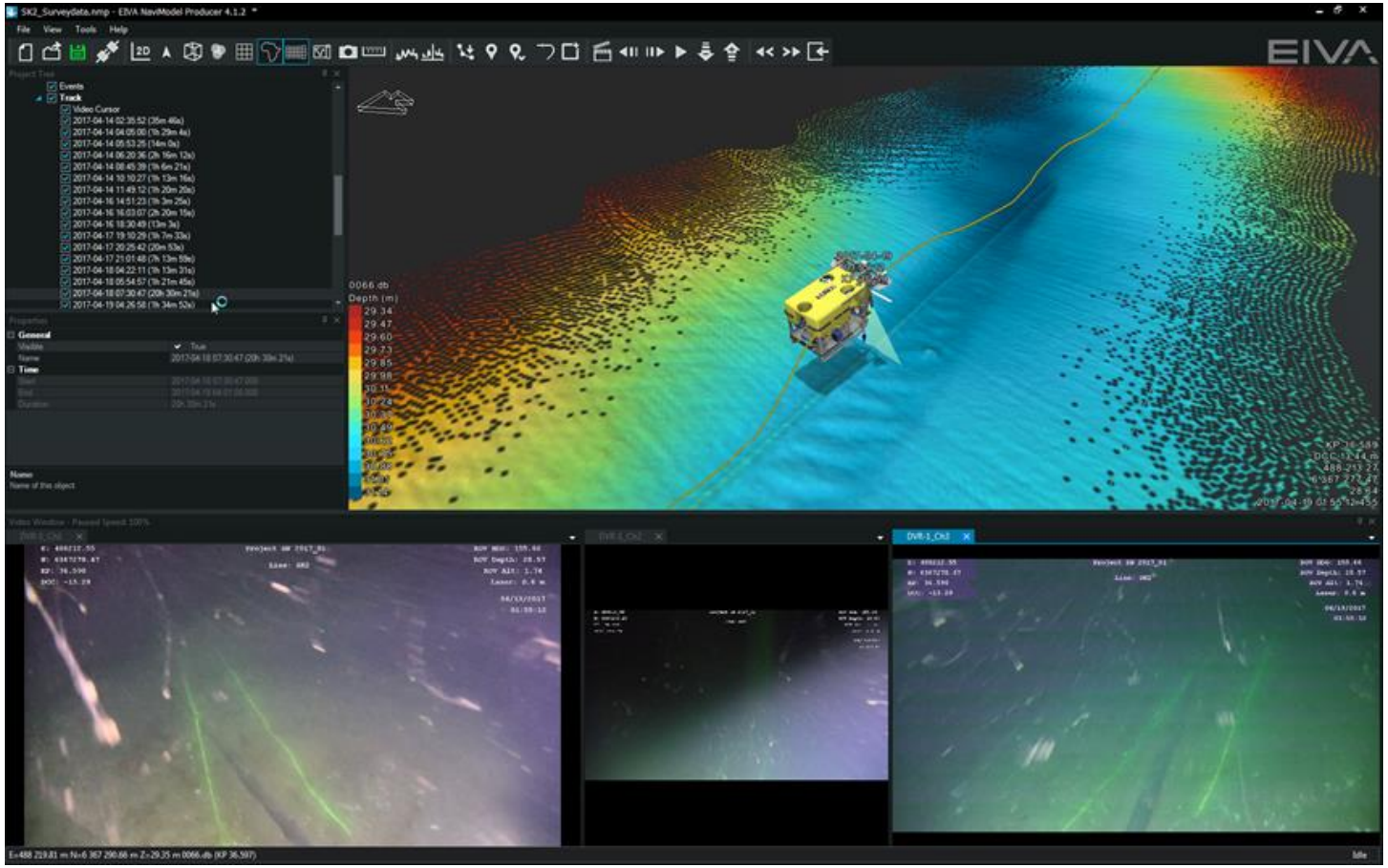


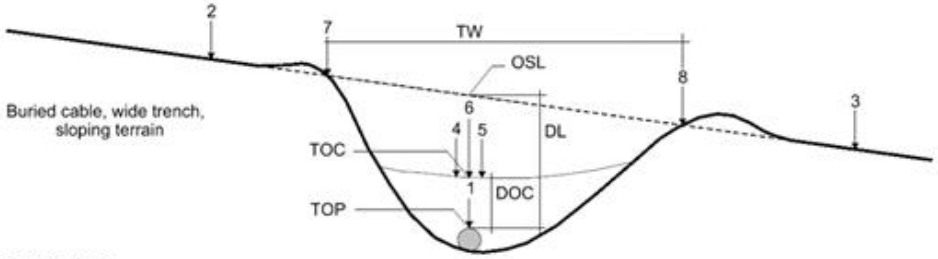
~9 km from station

OTDR before fault

OTDR after fault

Inspection, Depth of burial / Level of protection





DEFINITIONS:

OSL Original Seabed Level: Depth to a point on a line between Flag 2 & 3 horizontally positioned at Flag 1 from vertical reference level

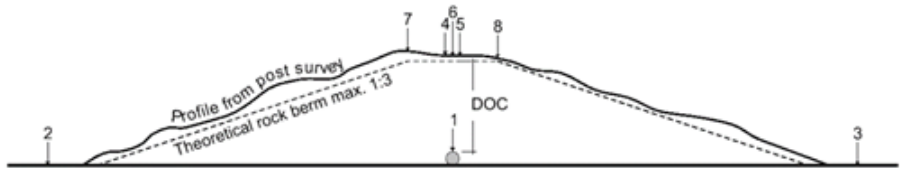
DL Depth of Lowering: Vertical distance between Flag 1 and OSL

DOC Depth of Cover: Vertical distance between Flag 6 and Flag 1. Positive if cable is buried, negative if exposed

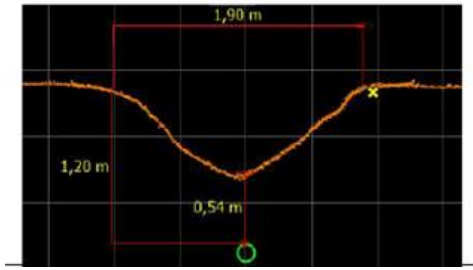
TW Trench Width: Horizontal distance between Flag 7 & 8

TOC Top of Cover: Depth to Flag 6 from vertical reference level

TOP Top of Product: Depth to Flag 1 from vertical reference level



Cable in rockberm
Flag 7 = Left "shoulder" of rockberm
Flag 8 = Right "shoulder" of rockberm

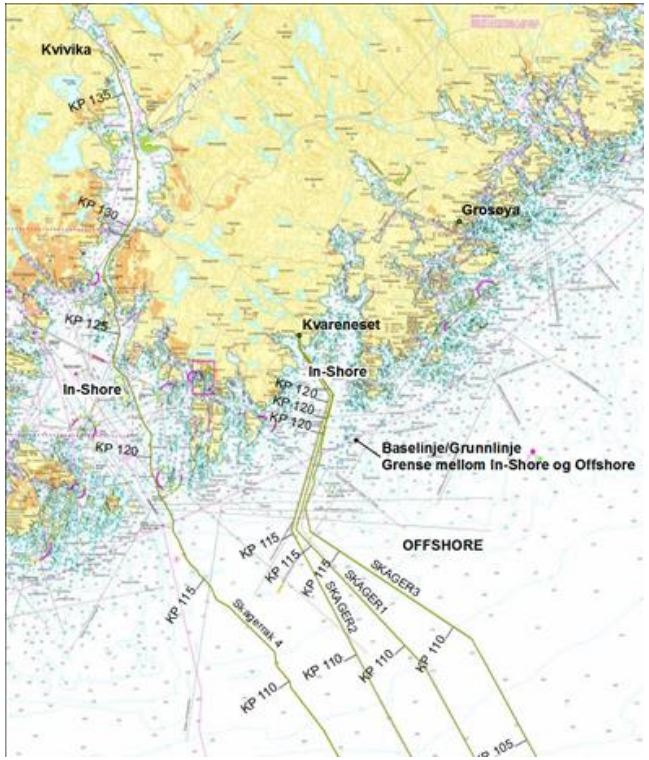


- **Explanation:**
- Depth of Lowering (DOL) = 1.20 m
- Depth of Cover (DOC) = 0.54 m
- Trench Width = 1.90 m
- SRI = Subsea Rock Installation

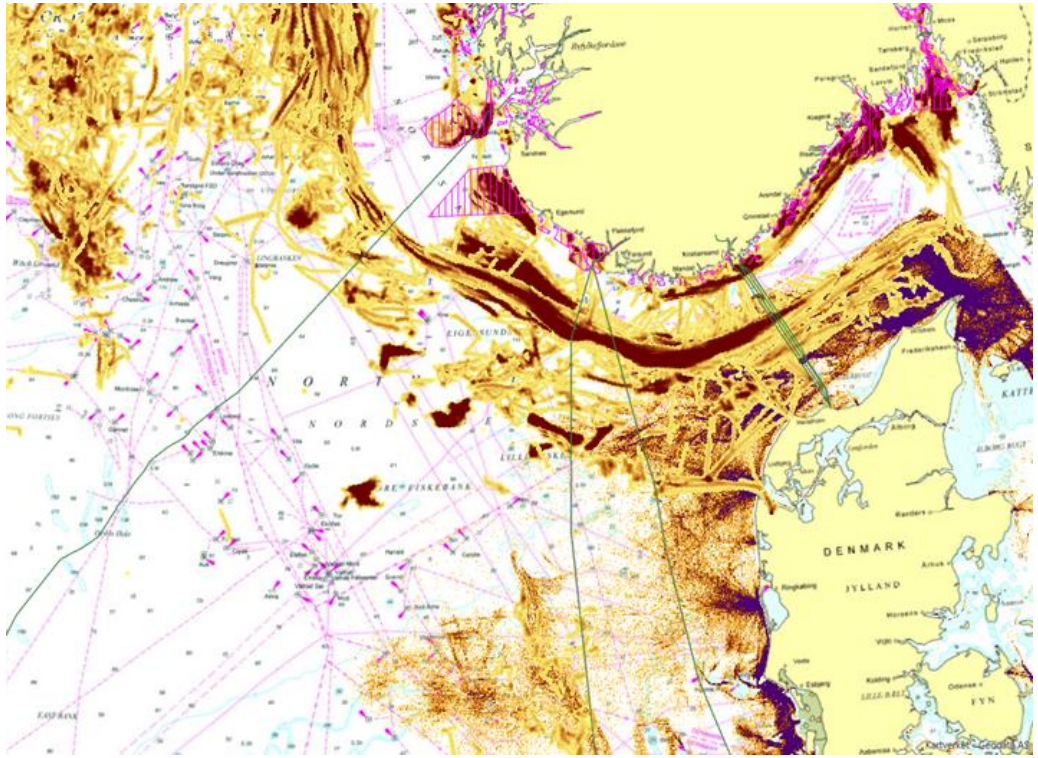
Long term inspection and maintenance program

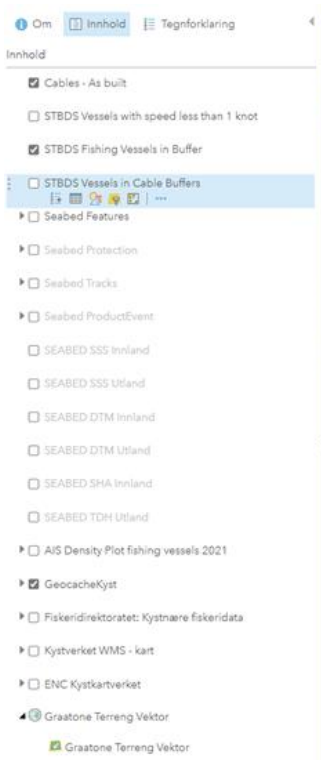
HVDC Cable	Inspection, level of protection
Skagerrak	Every 4th yr in-shore and near shore / full 8th yr
NorNed	Every 5th yr (priorities), full every 10th
NordLink	Every 5th yr (priorities), full every 10th
NSL	Every 5th yr (priorities), full every 10th
HVAC in-shore	Landfall every 5th yr, full every 10th

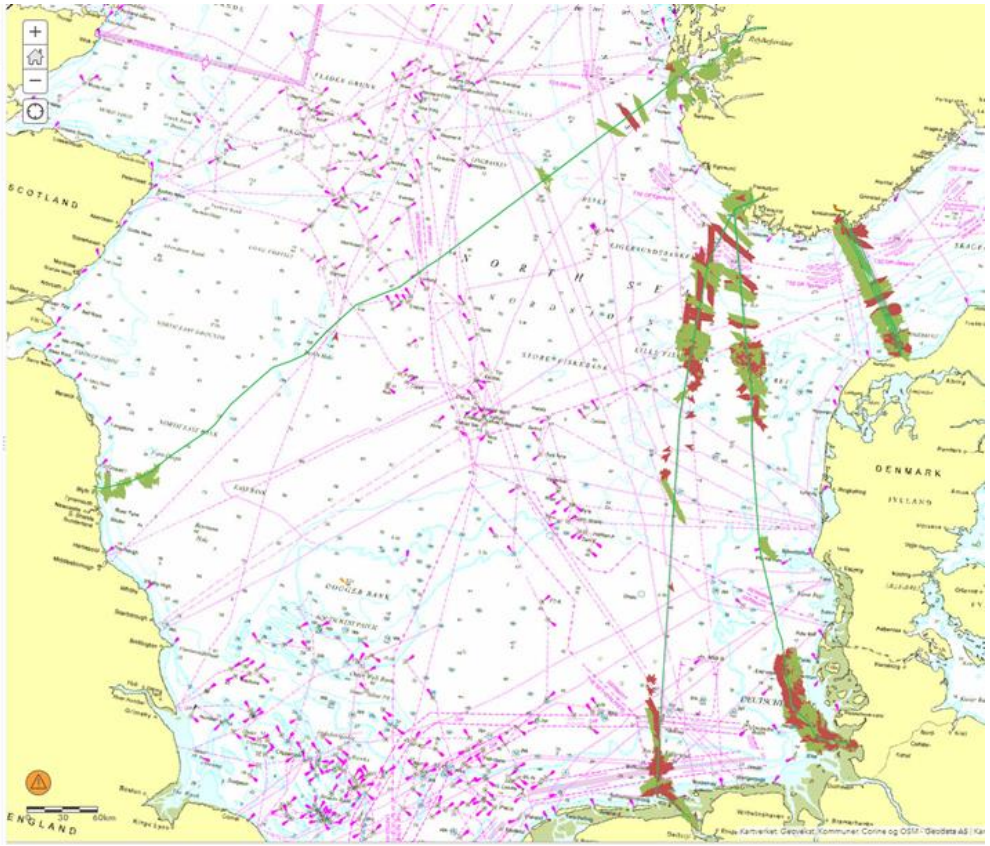
Post protection to be done the year after inspection



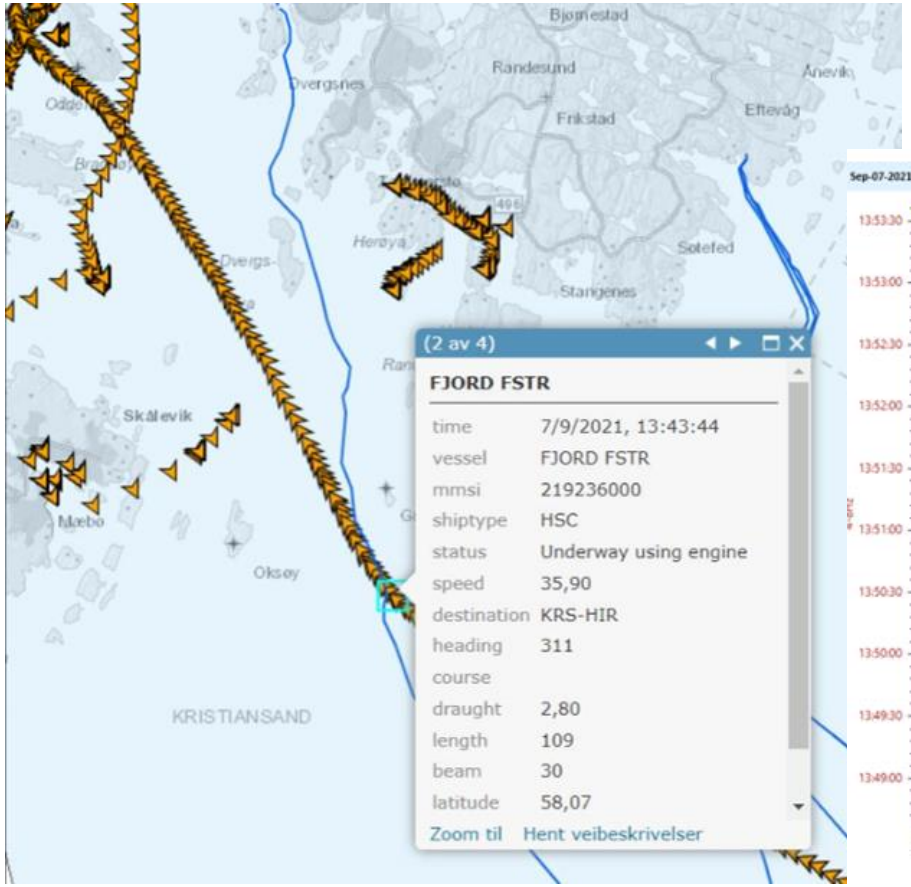
Maritime activity monitoring. Risk assesment

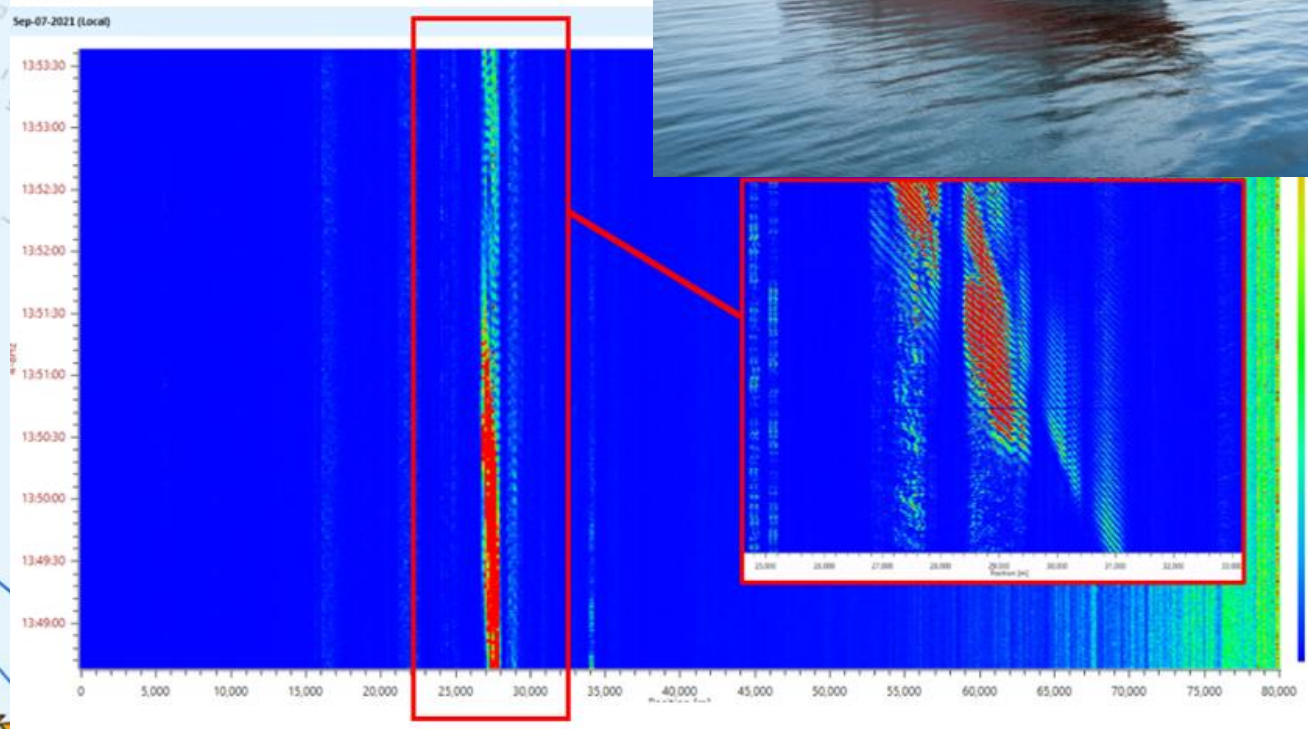






Skagerak 4, Distributed Acoustic Sensing





Submarine cable repair prepardness

Pipeline Repair Subsea Intervention pool – PRSI What and why?

- PRSI Pool is a cooperation between owners and operators established in 1987 for pipeline repair preparedness
- PRSI Pool launched cable repair services in 2021, based on the same principles as for pipeline repair
- PRSI Pool is organised as a non-profit membership club, members share net operational costs based on an agreed formula.
- PRSI Pool has a number of frame agreements in place to serve urgent need by the members, including vessels, divers, cable handling and jointing, engineering and fabrication.
- Equinor has the operating responsibility, and has on behalf of the members entered into necessary contracts to ensure the contingency preparedness is operational at all times

PRSI Cable membership gives access to:

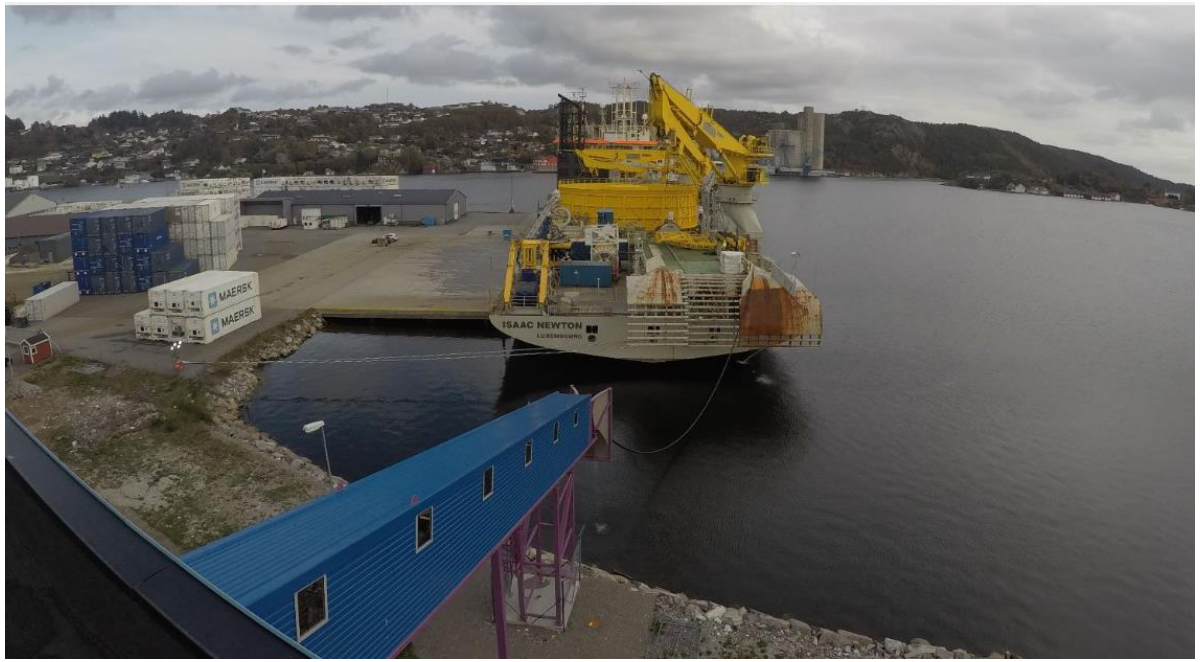
- DP2 offshore vessel mobilised for cut&seal operation within **7 days**
- DP2 offshore vessel mobilised for repair operation within **21 days**

- PRSI frame agreements:
  - Marin contractor: Subsea 7, Technip FMC
  - Cable handling services and equipment: DeepOcean
  - Cable jointing services and equipment: NKT

Frame agreements in addition to PRSI

- Nexans:
  - Jointing services and equipment for all cable systems delivered by Nexans
  - Cut & seal: 7 days mob
  - Repair: 21 days mob
- Prysmian:
  - Jointing services and equipment for NSL.
  - Cut & seal: 7 days mob
  - Repair: 21 days mob
- REN:
  - Vessel for cable repair in sheltered areas (fjord crossings).
  - Repair: 21 days mob

Cable storages



- Three turntables, capacity 8000 ton and 2 x 1200 ton
- Direct access to ISPS quay, vessel can be positioned long side while cable is loaded over the stern


Thank you for your attention!
Statnett