

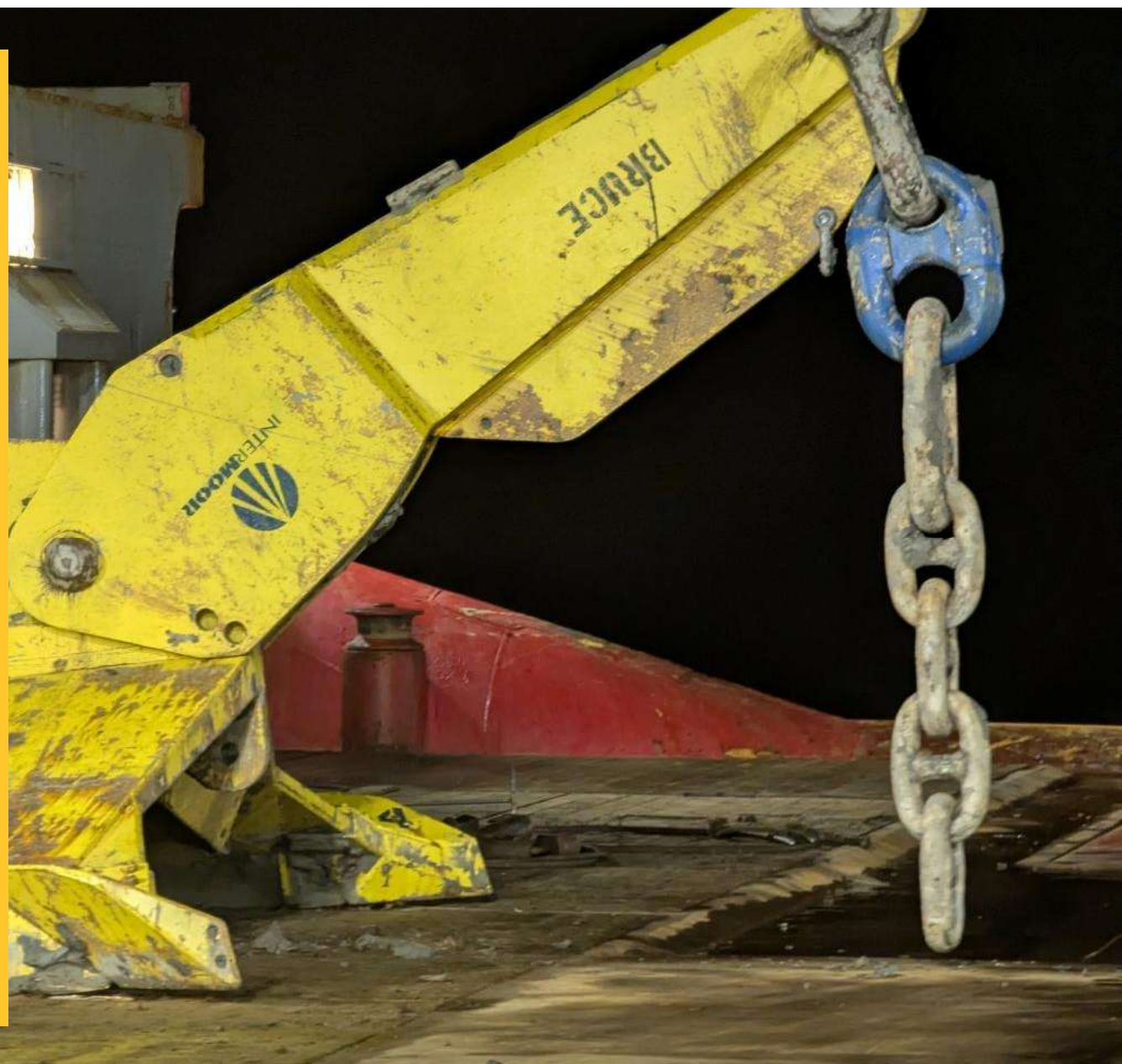
 **Intermoor**  
Moorings and Anchors

# Fullskala test av Dennla plateanker Troll

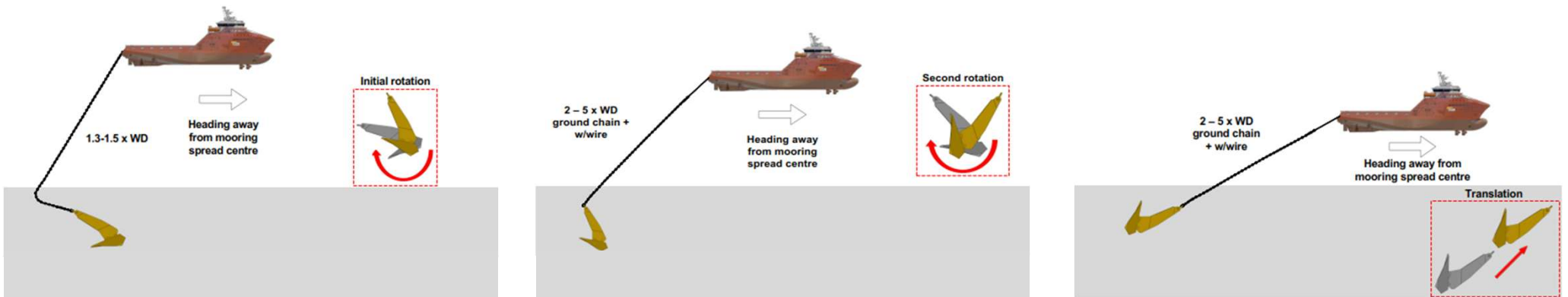
Marin Operasjoner i Praksis

21 April 2026

 **Acteon**

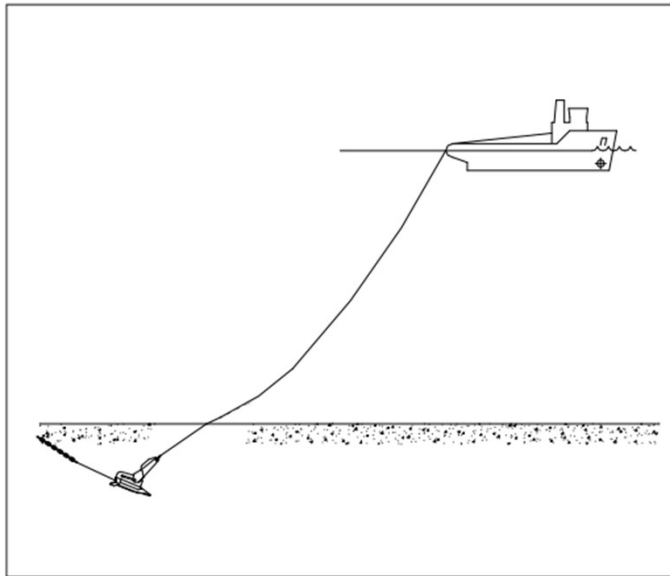


# Anchor retrieval

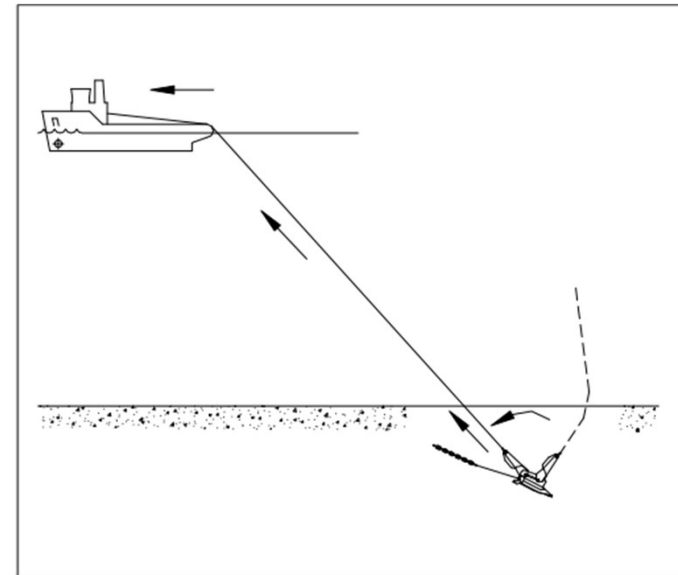


Figures from GOMO

# Anchor retrieval



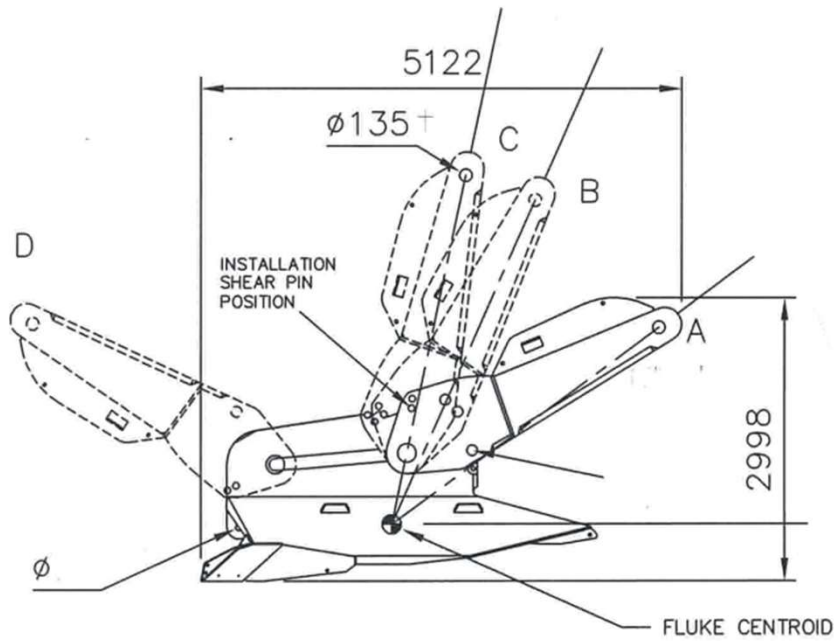
INSTALLATION



RECOVERY

# DENNLA Anchor

Drag Embedment Near Normal Load Anchor



# We act on energy

## Project lifecycle

### 1. Site investigation and characterisation

Geophysical surveys, geotechnical surveys and geospatial surveys.

### 2. Offshore construction

Positioning and construction support, integrated marine foundations and mooring solutions.

### 3. Asset integrity management

Offshore inspection, monitoring and digital solutions and mooring integrity management.

### 4. Life extension and decommissioning

Removal and disposal services, asset life extension and decommissioning engineering.

### Entire project lifecycle

Acteon supports offshore energy assets across the full lifecycle.

## Our business line brands



## We act on opportunity

Acteon helps energy operators harness the potential of the world's offshore resources. We engineer seabed-to-surface solutions that reduce complexity, drive efficiency and solve critical problems across the offshore asset lifecycle, enabling our clients to meet rising global energy demand with confidence.

## We act on experience

We deliver trusted solutions across the global offshore energy industry. Our track record spans hundreds of complex campaigns - from drilling and renewables to decommissioning - with a focus on engineering precision, safe execution and commercial performance.

These numbers reflect decades of real-world delivery, deep technical capability and long-term partnerships with energy operators worldwide.

**100+**

**Renewable projects delivered**

Across the offshore energy project lifecycle

**800+**

**Drilling campaigns**

Executed in complex environments

**300+**

**Decommissioning projects**

Successfully completed

**100+**

**Locations**

Worldwide



BRUCE **ANCHOR**

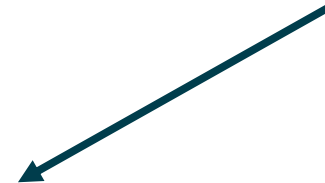


INTER**MOOR**



**Intermoor**

**Moorings and Anchors**



# Not a new product!

<u>DATE</u>	<u>COMPANY</u>	<u>ANCHORS</u>	<u>LOCATION</u>
Sept. 1994	JIP (Aker Marine)	Denla/Stevmanta Models	S.Pelto 10, G.O.M.
Nov. 1994	Petrobras	Denla MK1	Marlim, Brazil
Feb. 1995	Petrobras	Denla MK1	Marlim, Brazil
Aug. 1996	Petrobras	Denla MK2	Marlim, Brazil
Oct. 1996	JIP (Aker Marine)	Denla MK2	S.Timbalier 295, G.O.M.
Mar. 1997	Petrobras	Denla MK3	Salema Bijupira/Marlim, Brazil
Dec. 1997	Petrobras	Denla MK3	Voador/Roncador, Brazil
June 1998	DNV	Denla MK3	Onsoy, Norway
May 2000	Delmar	Denla MK4(Modified)/MK5	West Delta 36, G.O.M.
Mar. 2001	Shell	Denla MK4(Modified)/MK5	Vioska Knoll 784, G.O.M.
Dec. 2001	Unocal	Denla MK4(Modified)	Makassar Strait, Borneo
Feb. 2002	Unocal	Denla MK4(Modified)	Makassar Strait, Borneo
Dec. 2003	Unocal	Denla MK4(Modified)	Makassar Strait, Borneo
Mar. 2004	Unocal	Denla MK2	Makassar Strait, Borneo
Aug. 2004	Unocal	Denla MK2	Makassar Strait, Borneo
Apr. 2006	Shell	Denla MK3	Vioska Knoll 916, G.O.M.

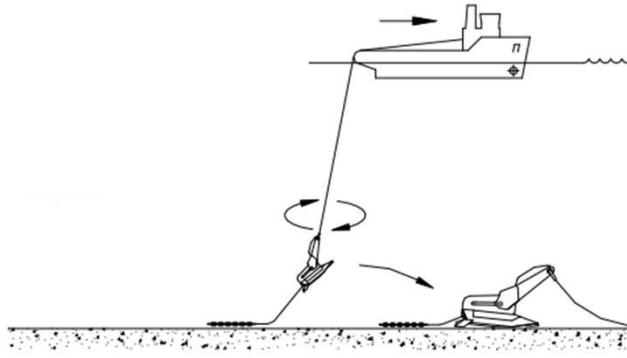
+20 years!!

# The shear pin

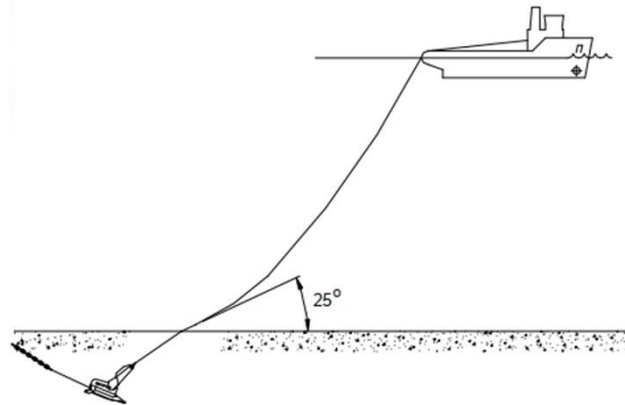


Shear pin

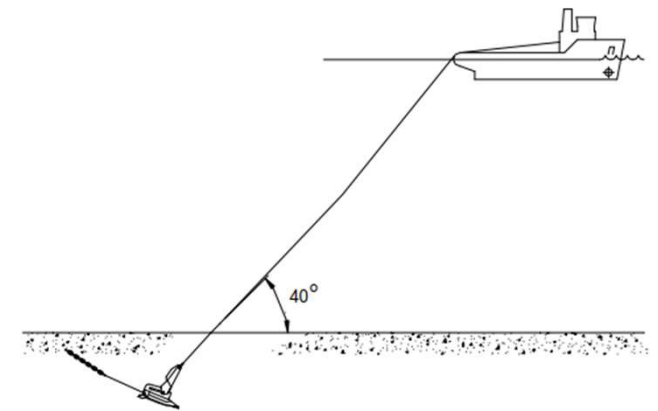
# The shear pin



INSTALLATION STEP 2



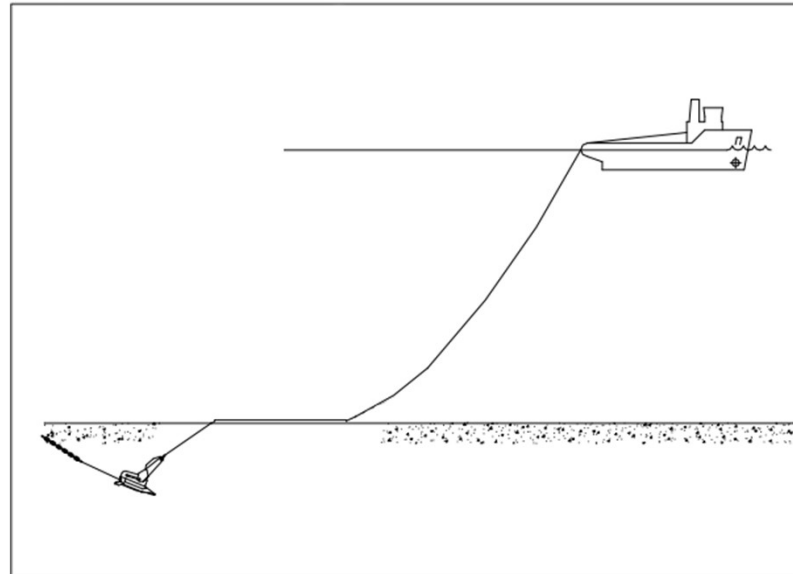
INSTALLATION STEP 3



INSTALLATION STEP 4

# Adapt to market necessities

Install as regular Drag  
Embedment Anchor



# Data

## Characteristics

- 12m<sup>2</sup> fluke
- ~10t weight
- 4x5m area when upright position

## Measurements

- Rotation of fluke and shank
- Drag and Depth
- AHV winch tension
- AHV position
- ROV points coordinates

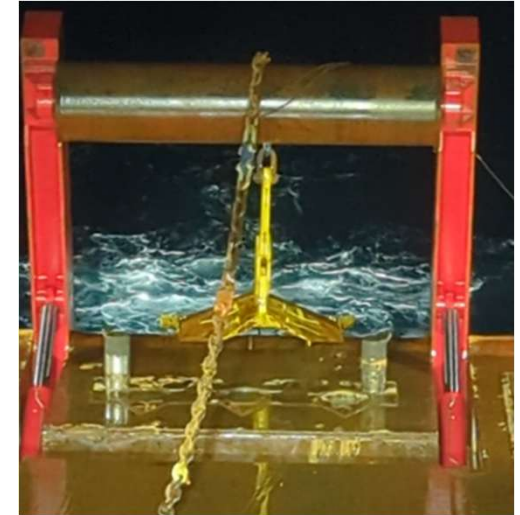


# The journey starts



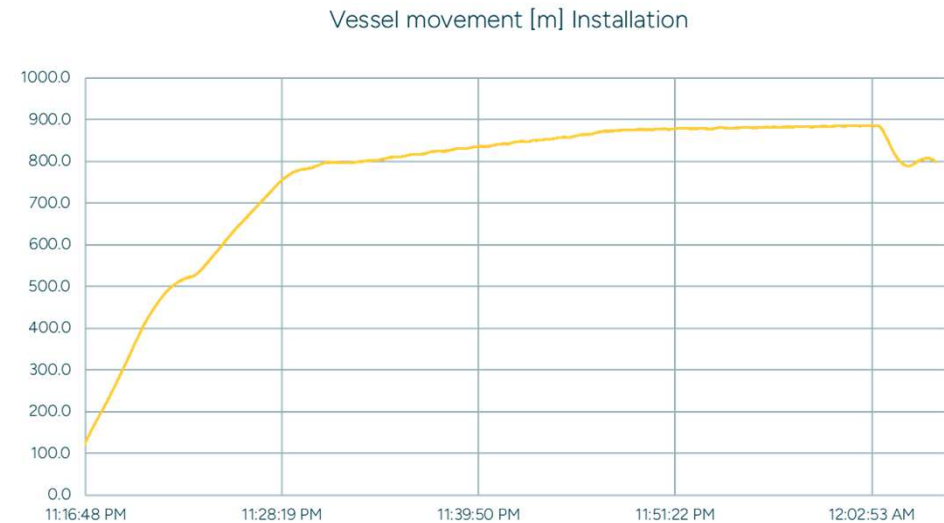
# Challenges

- Placing the anchor on deck
- Deploying the anchor
- Landing the anchor in the correct position
- Finding the markers under the mud
- Recovering anchor to deck



# No challenges

- Installing the anchor (up to 390t peak winch tension ~ 360t anchor tension)
- Breaking the anchor from the soil (in less than 45 min, using approx. 200t WT)
- The vessel held position during 15m tension test



# DNV's scope of work:

- Use offshore test data to determine anchor position and behavior
- Model anchor behavior using DIGIN analysis
  - Inputs: Soil profile, anchor and line configuration
  - Outputs: anchor trajectory, loads, catenary
- Calibrate DIGIN results against test data

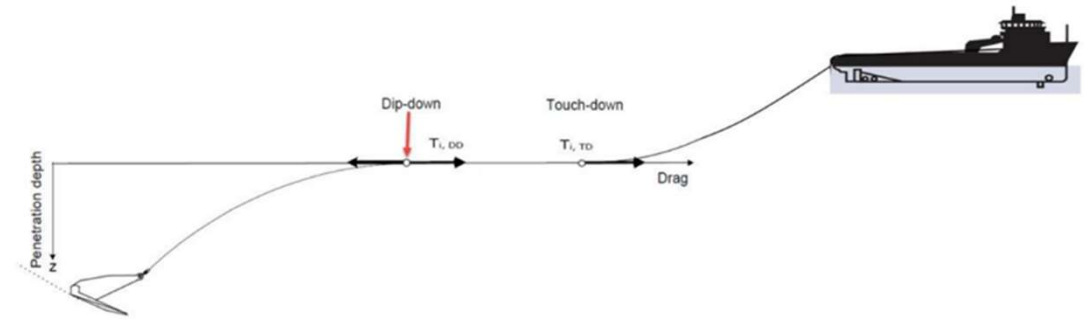
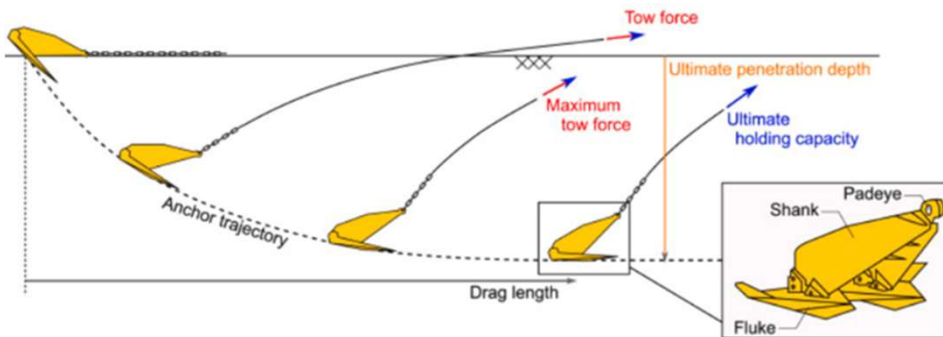
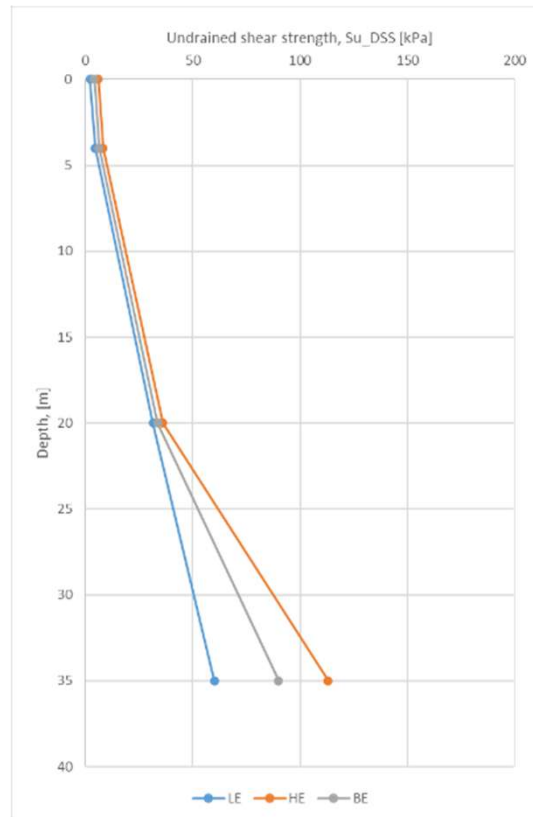


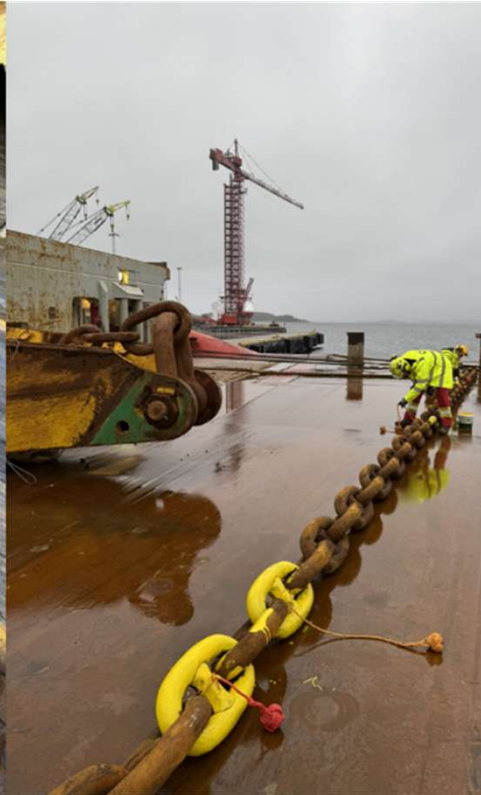
Figure 4-4 Illustration anchor position, dip-down and touch-down point

# The site and soil conditions

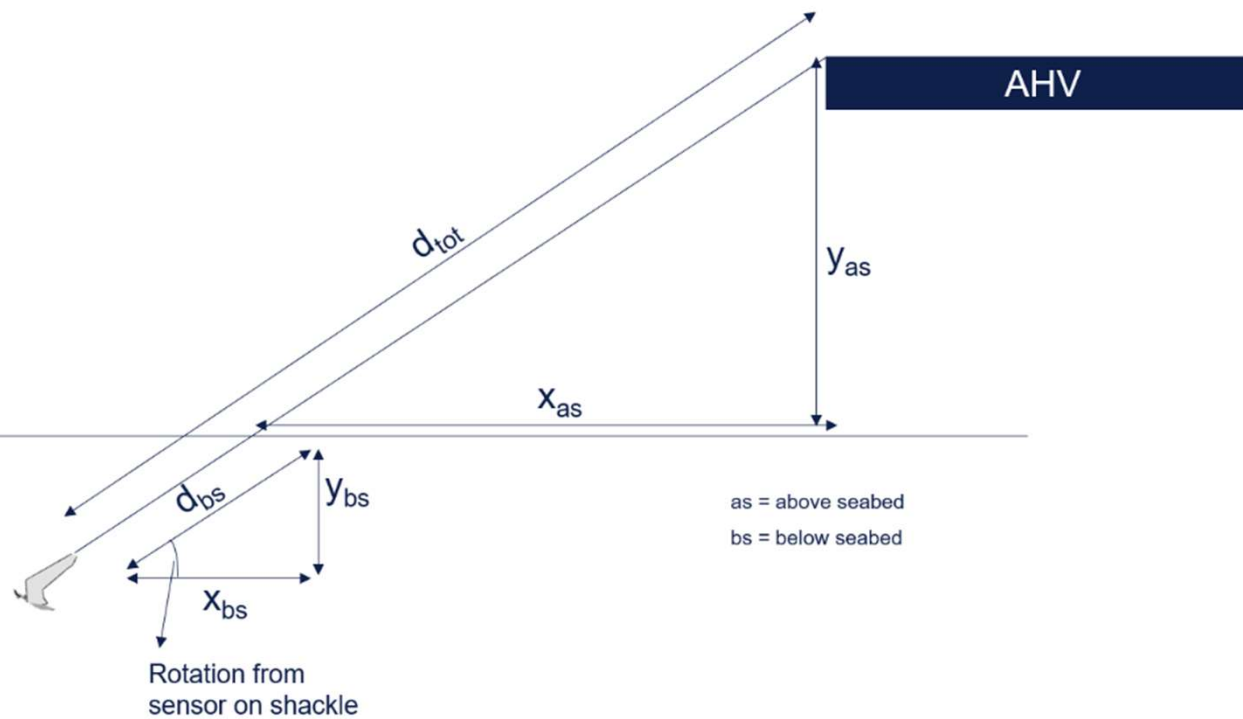
- 330m depth
- Troll W4
- NC Clay
- Homogeneous



# Testing setup – sensors and chain markings



# Testing setup

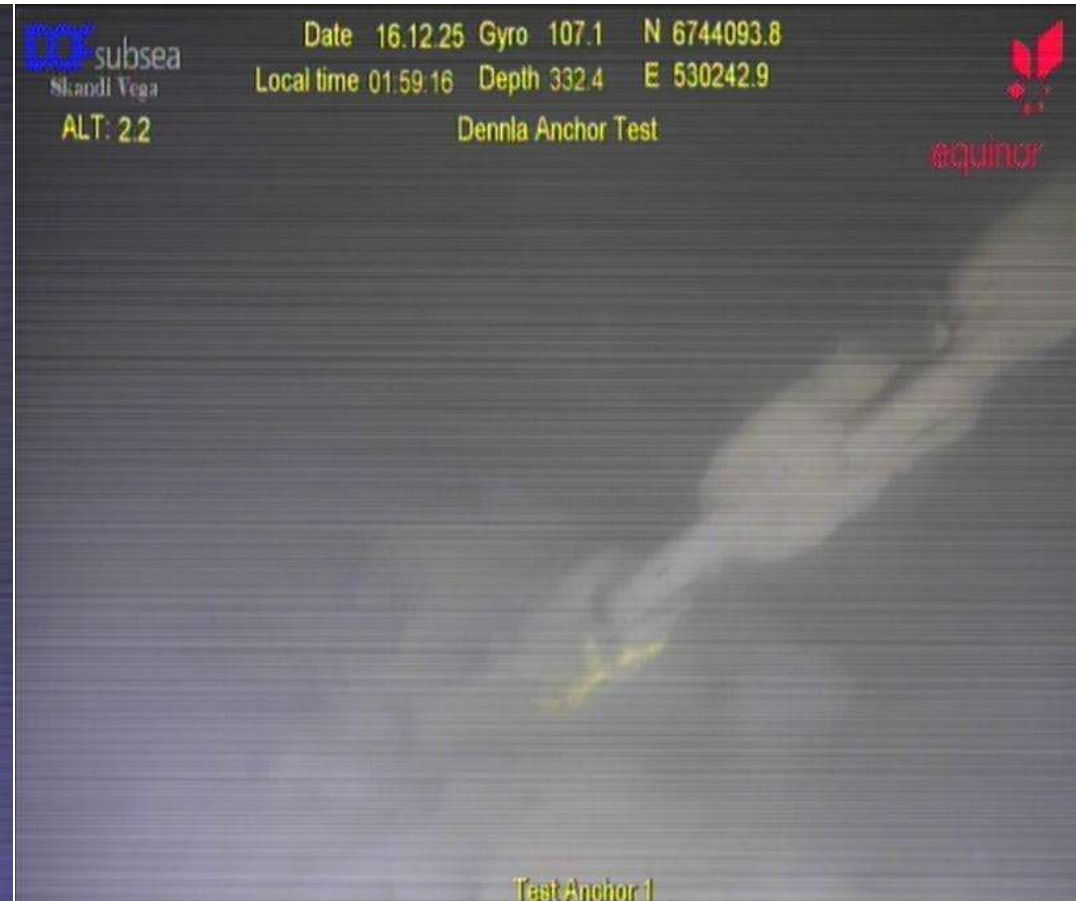


$y_{bs}$  = vertical distance below seabed  
 $y_{as}$  = vertical distance from vessel to TD  
 $d_{tot}$  = total mooring line length  
 $d_{bs}$  = length of embedded chain.

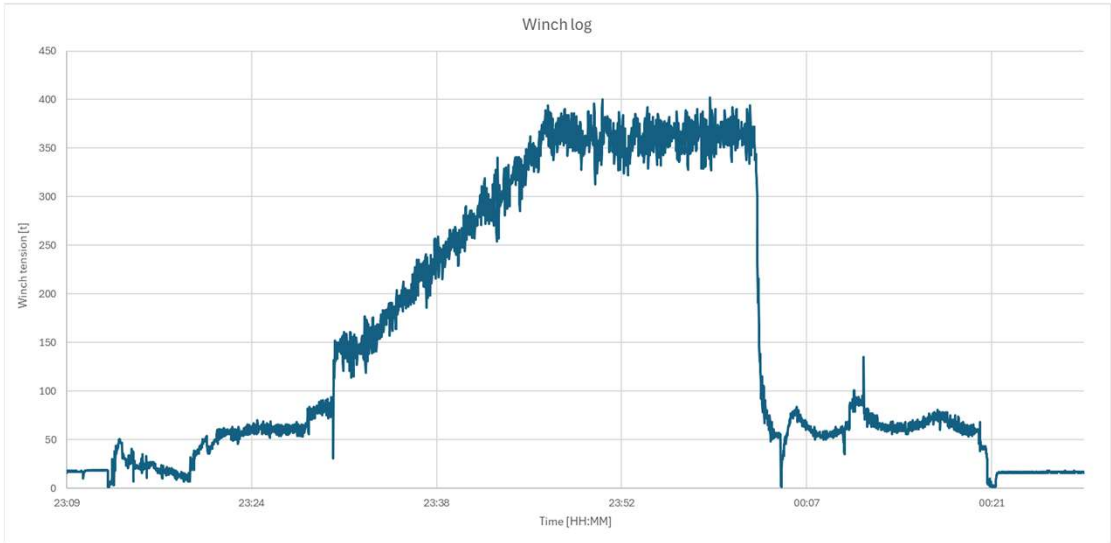
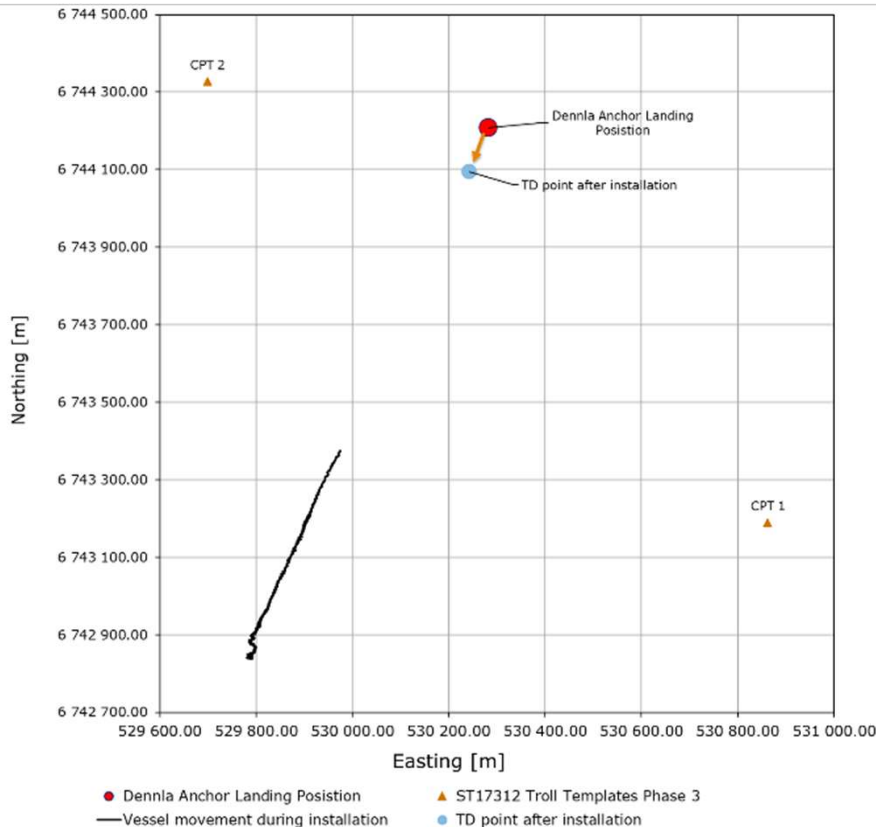
$$y_{bs} = y_{as} * \frac{d_{bs}}{d_{tot} - d_{bs}}$$

# Results – ROV fixes

- Observed embedded line length used to estimate anchor depth and drag



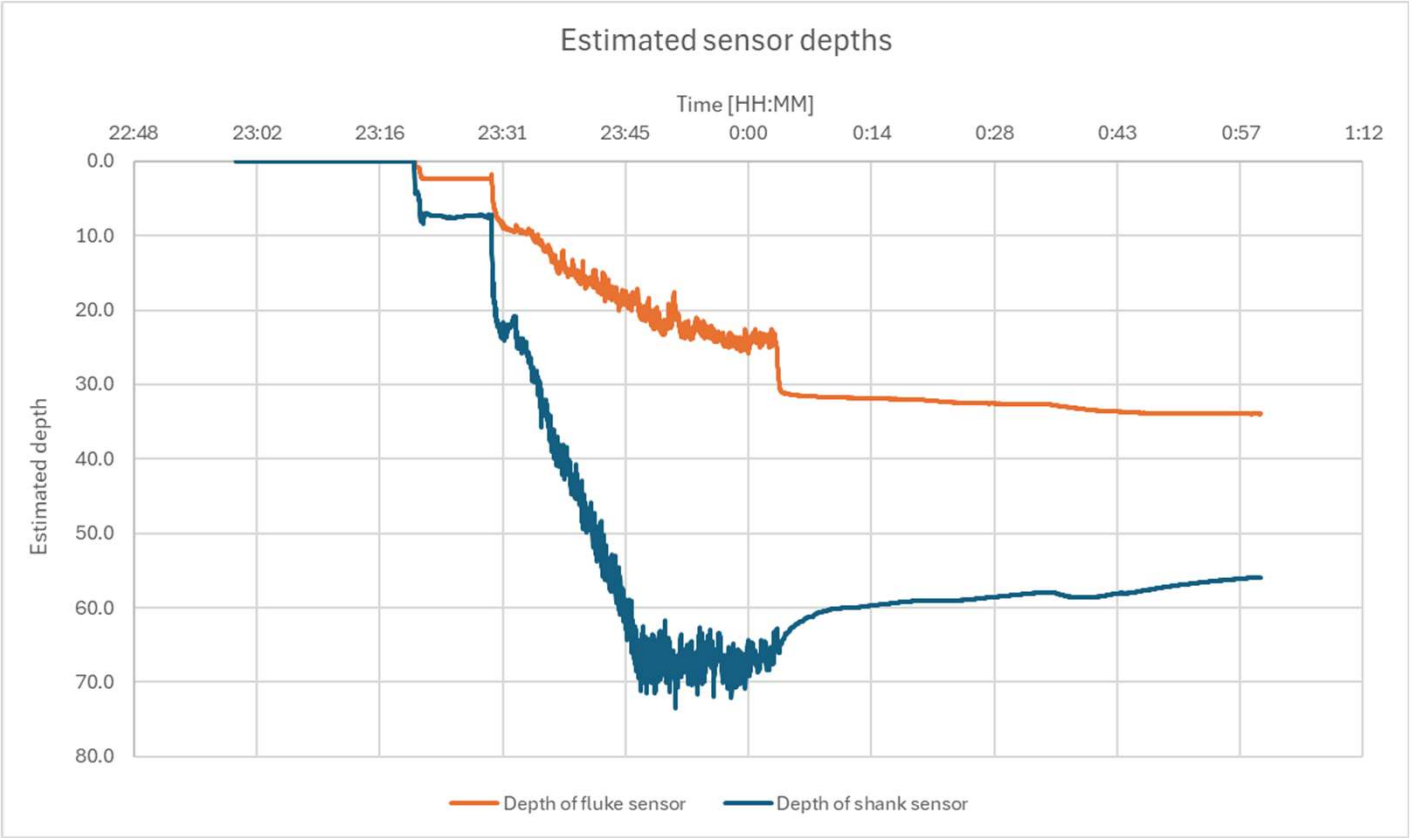
# Results – winch log and sensor data



Anchor drag has been calculated using the ROV fix of the anchor landing position, relative to the ROV fix at the 45 m chain mark.

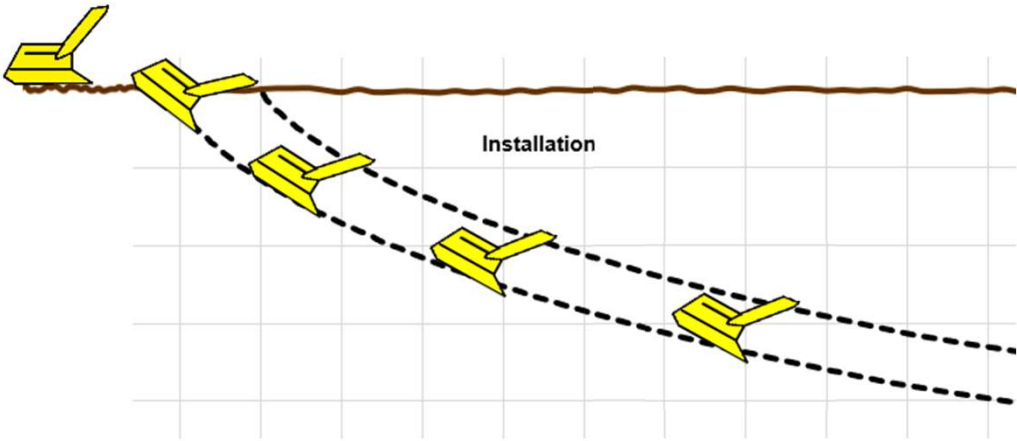
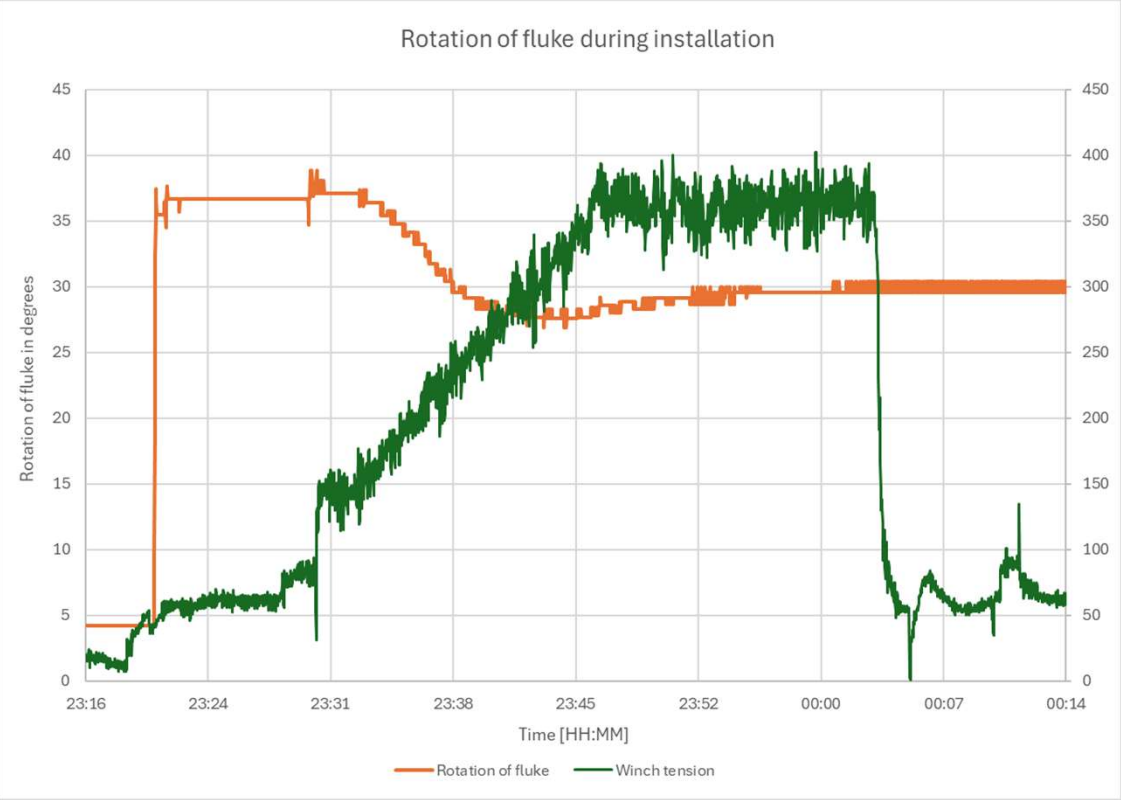
The estimated anchor drag is 71 m.

# Results – winch log and sensor data

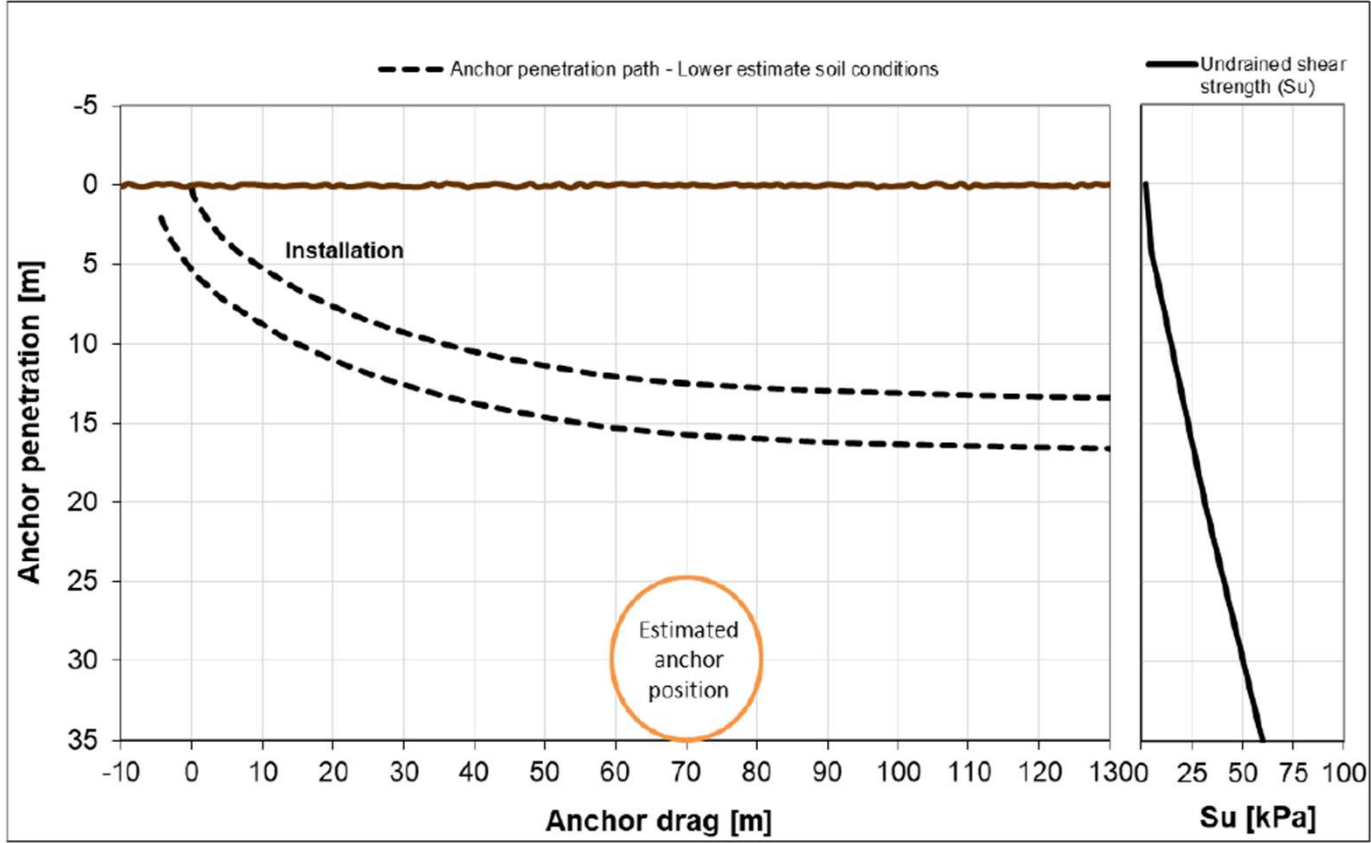


➤ Pressure sensor data provides an indication of the anchor depth

# Results – installation



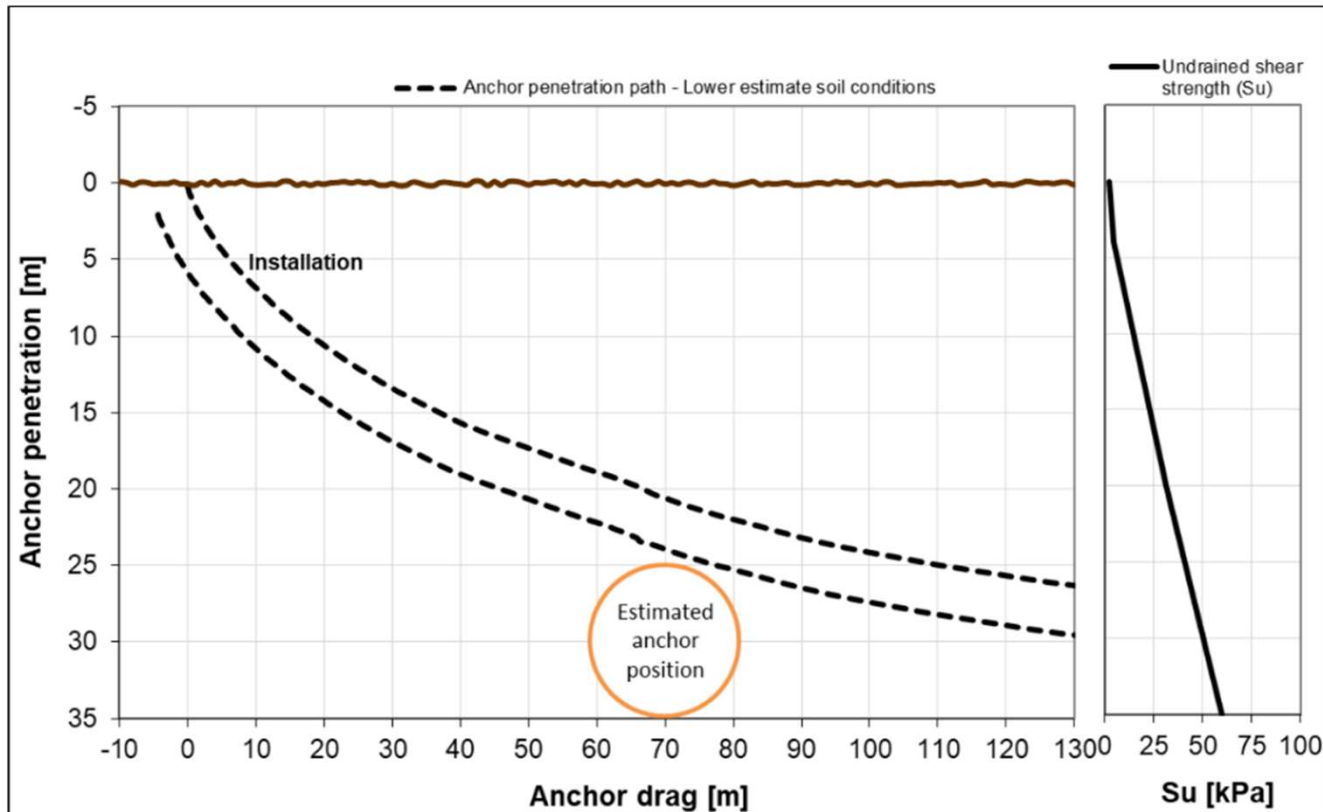
# DIGIN Results – Before calibration



Estimated position based on pressure sensors and calculated drag and depth

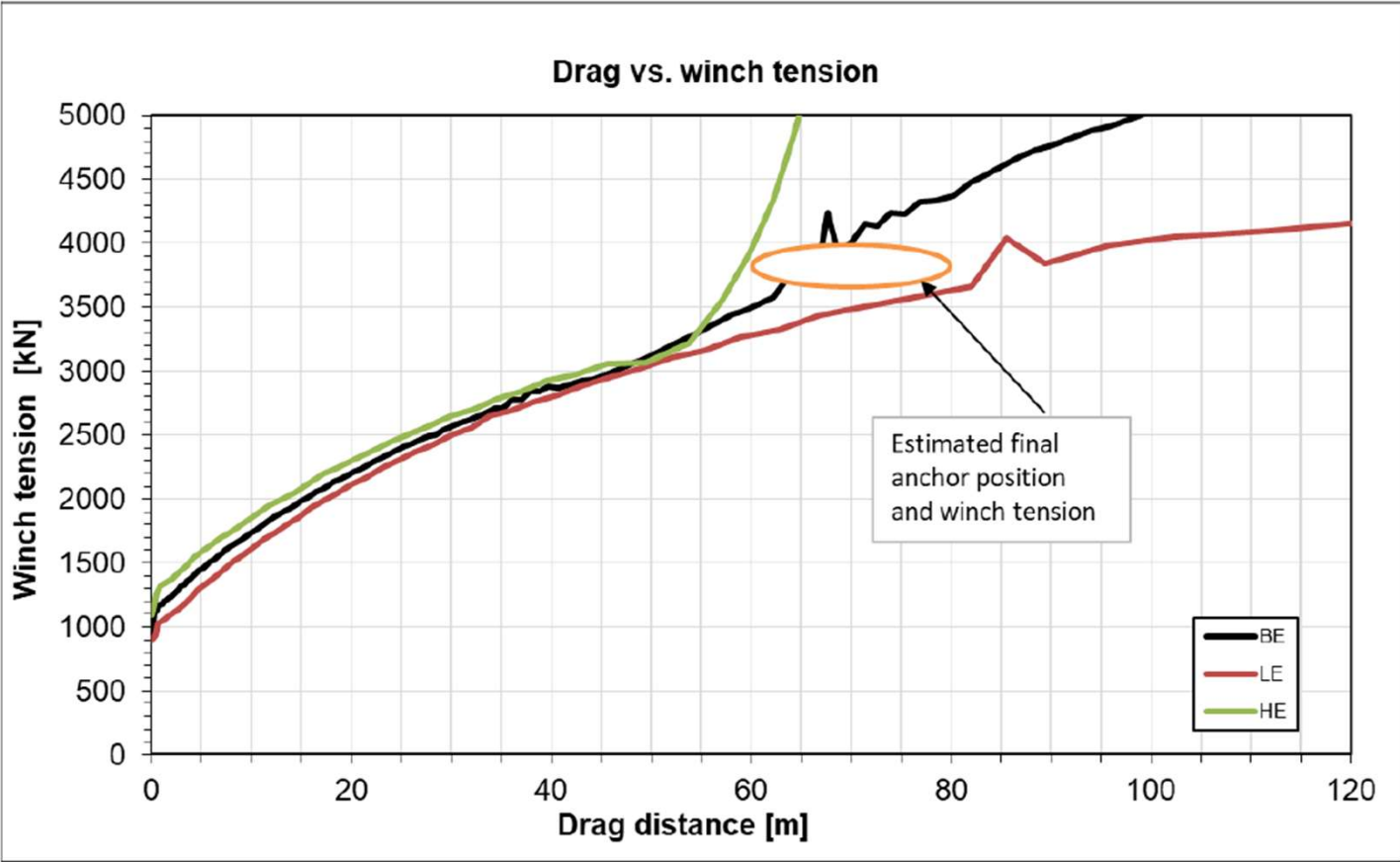
$$y_{bs} = 331.7 * \frac{30}{395 - 30} = 27.3 \text{ m}$$

# DIGIN Results – After calibration



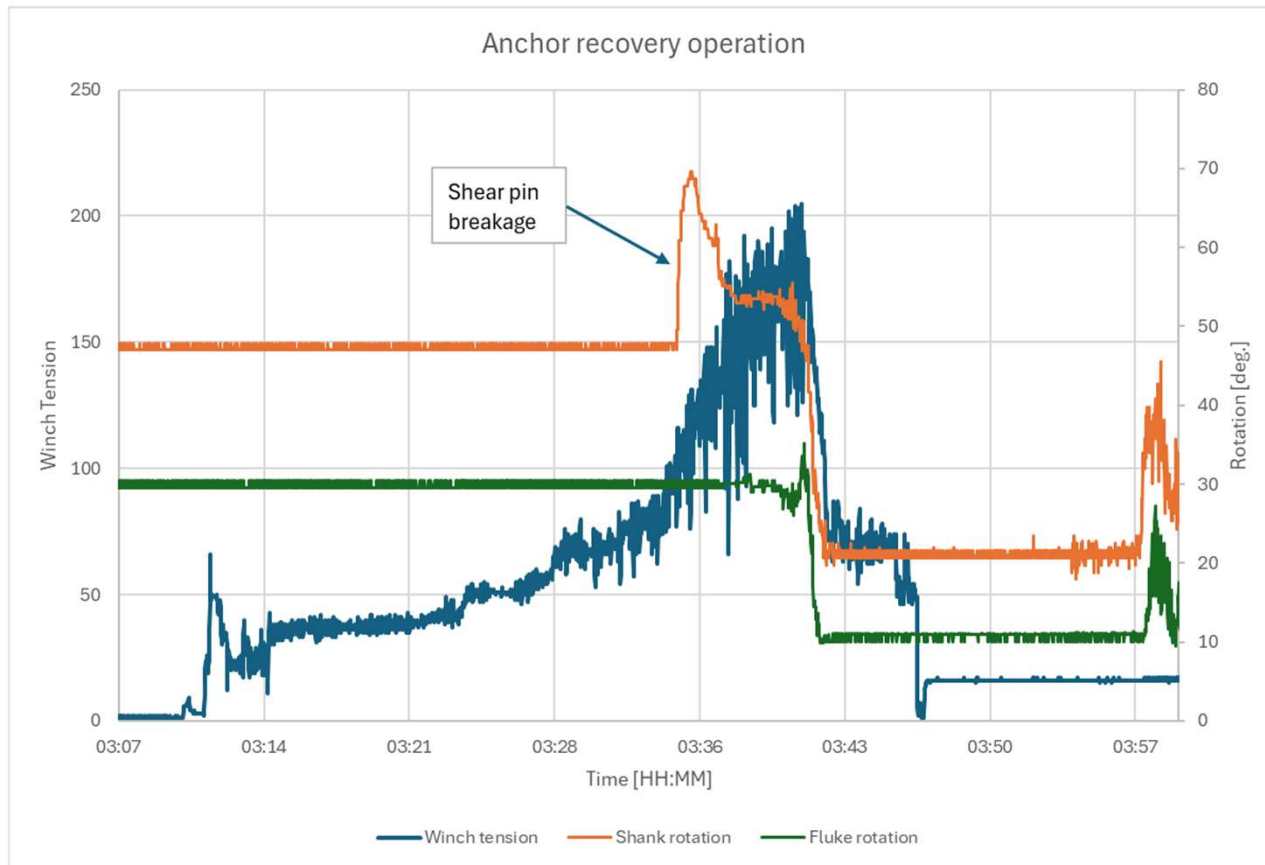
- Less anchor path curvature compared to typically used drag anchors.
- Need more tests for further calibration.

# DIGIN Results – After calibration

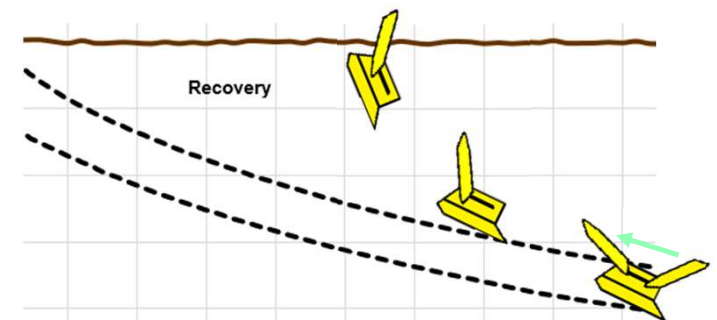


- High anchor resistance and deep penetration relative to anchor size.

# Anchor recovery



- Significantly faster recovery operations with reduced tension.



# Thank you for listening!



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