

## Subsea Acoustic Positioning

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## Introduction

- What is acoustic positioning?
- How does it work?
- Why is it relevant?
- Case Study
  - Structure placement
  - LNG FPSO turret operations
- The Future

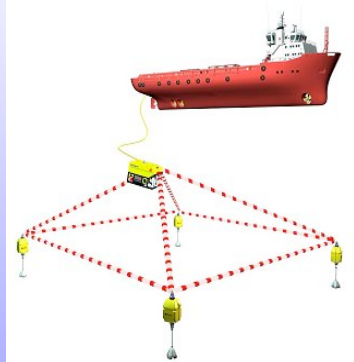
## What is Acoustic Positioning?

- Acoustic positioning is a method of locating an object within the subsea marine environment
- It allows for accurate, repeatable measurements to be made
- It can be used from the inter-tidal zone to the deepest ocean
- It offers a flexible solution
- It is not GPS

## How does it work?

- 3 key components:
  - » Speed of sound in water
  - » Distance
  - » Time
- 1 key equation:
  - »  $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$
- 3 types of system:
  - » Long Baseline (LBL)
  - » Ultra Short Baseline (USBL)
  - » Long/ Ultra Short Baseline (LUSBL)

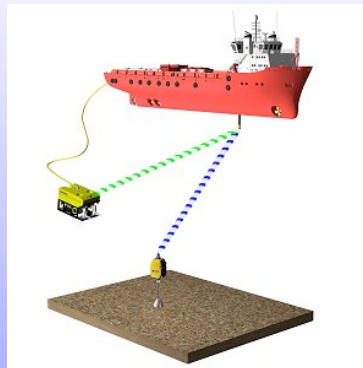
### Long Baseline (LBL) Positioning



### LBL Key Facts

- It requires a minimum of 3 beacons (ideally 4 for redundancy)
- Gives the maximum attainable accuracy independent of water depth
- It can cover a wide area of work (>5km baselines) in a variety scenarios
- It can be time consuming to set up

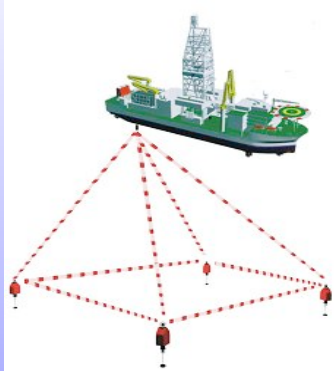
### Ultra Short Baseline (USBL) Positioning



### USBL Key Facts

- Uses a transceiver on the vessel to track all targets
- Is quick to set up (it can start tracking as soon as the beacon is active)
- Can produce a high degree of accuracy and is easy to use
- Needs careful design to ensure that it works correctly

### Long Ultra Short Baseline (LUSBL)



### LUSBL Key Facts

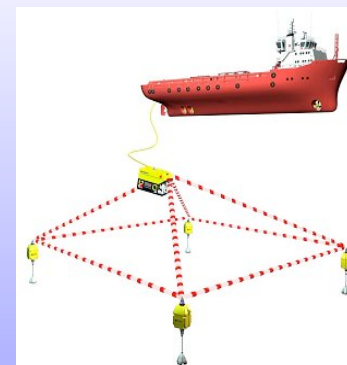
- Combination of LBL/ USBL
- Provide accuracy and redundancy
- Short deployment to operation for a large number of beacons
- Very useful for Dynamic Positioning (DP) vessels

### Glossary of key words

- Compatt (Computing and Telemetry Transponder)



### Long Baseline (LBL) Positioning

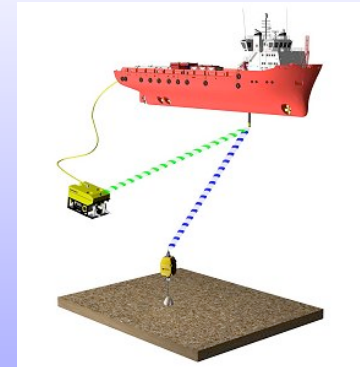


### Glossary of key words

- Transceiver (USBL head)

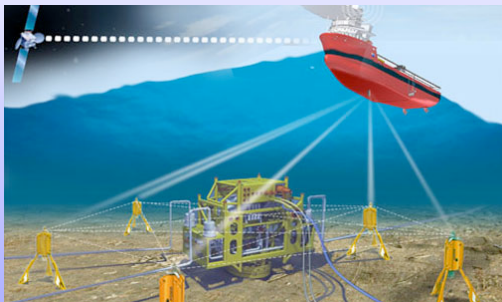


### Ultra Short Baseline (USBL)



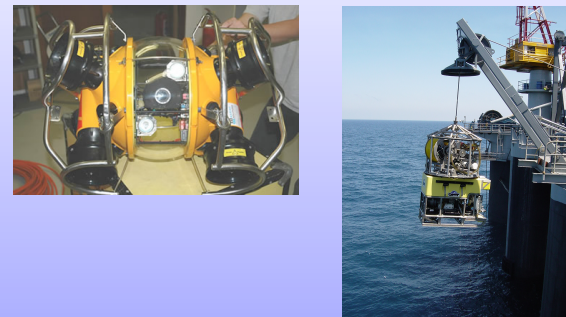
### Glossary of key words

- Dynamic Positioning



### Glossary of key words

- Remotely Operated Vehicle (ROV)



### Why is this relevant?

- Acoustic positioning forms basis for all subsea engineering and exploration tasks
- Risk mitigation
- Implications for project delays and/ or business interruption claims
- Mistakes cost money!

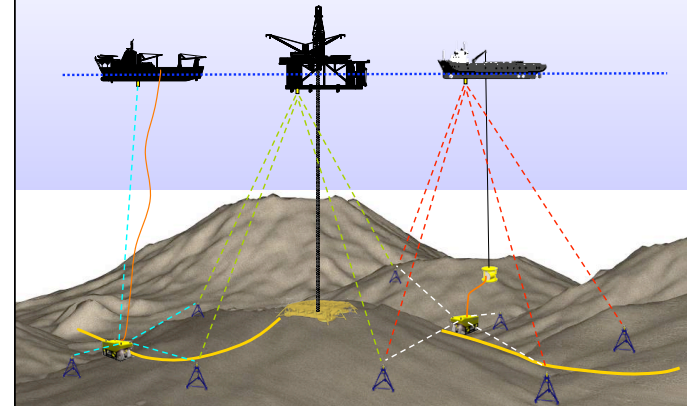
### Case study 1: Template installation



### The challenge

- **Location:** Offshore Northern Norway, 100km from land in 850m of water
- **The environment:** Different seawater properties
- **The structure:** 2 template weighed 1,150 tons each and needed to be position to  $\pm 2.5m$  and  $\pm 1^\circ$  of heading
- **Equipment required:** Largest crane barge in the world

### The acoustic solution



### The solution



### The results

- Positioned to within 10mm of the planned position
- Heading well within tolerance (0.03°)
- An industry first for the Orman Lange field and the offshore industry (2005)

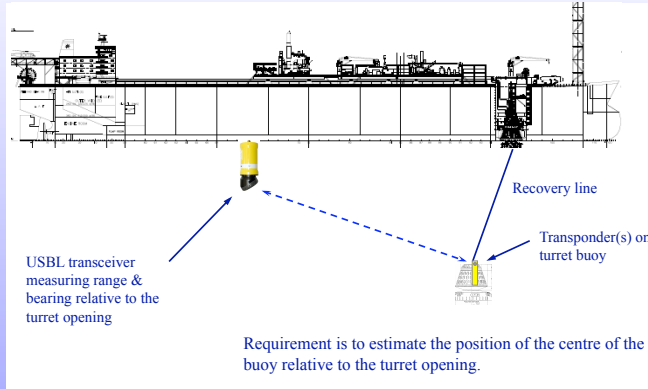
### Case study 2: LNG FPSO transfer



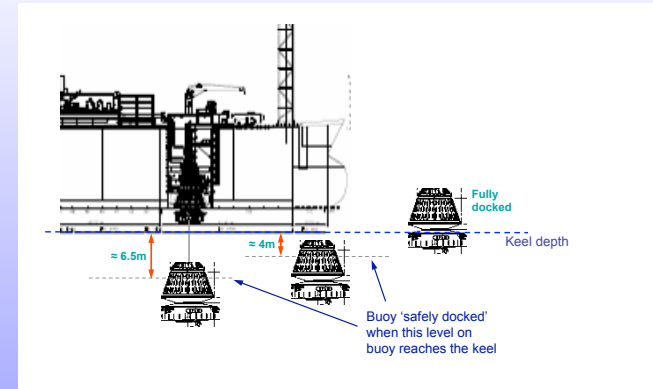
### The challenge

- New gas finds require offshore remote connection to well
- The turret needs to be located to within 1.5m of the bottom of the hull
- It has to be a repeatable and accurate process
- Low maintenance

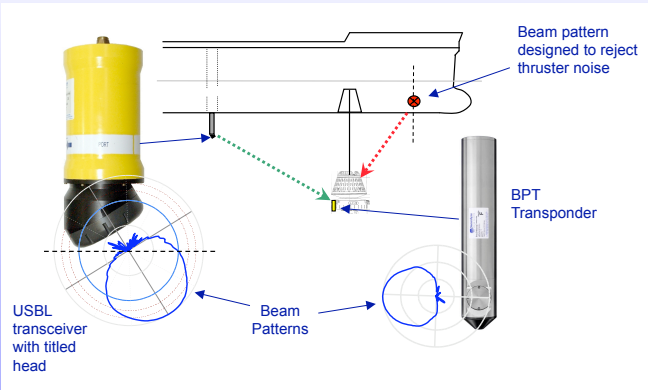
### The solution



### Turret docking process




### Solution Design



### Future developments

- Greater depths and technical challenges
- System integration
- Diversification of use



## Summary

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## Acknowledgement

- Concordia would like to thank Sonardyne International Limited for their assistance ([www.sonardyne.co.uk](http://www.sonardyne.co.uk))
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