

# encomara

 An Aurora Energy Services Company.



# Floating Production vs Floating Wind



## Floating Production

- Initially various concepts.
- Topsides design interface with hull
- Hull and Moorings delivered together.
- Riser system delivered by operator.
- Turret/hull design together (intrusive on hull)
- Must weather-vane at certain locations
  
- Disconnect for **Typhoons, Icebergs or Upgrade**
- Quick connect **earlier first oil**
  
- Disconnectable Turret integrates with mooring and riser system.
  
- Contractual interface models established.

## Floating Wind

- Too many concepts, now just a few.
- WTG design interface with hull
- Hull and Moorings **maybe** together.
- Riser (cable) separate **but uncertain**.
- Weather vaning on the top of the WTG
- **No Turret or Swivel**
  
- Disconnect for **Tow-to-Port or Repower**
- Quick connect **earlier and more first power**
  
- Squid vendor, being asked about mooring and cable system integration.
  
- Contractual interfaces transferrable.



Image courtesy of SOFEC  
Image source <https://jpt.spe.org/turret-mooring-system-experience-and-enhancements-atlantic-frontier>

# The Challenge

- Why disconnect a production / storage facility?
- FPSO – not unless Typhoon or Icebergs (Emergency Condition) and generally only if FPSO had propulsion.
- FSO – maybe if the FPSO had sufficient storage to allow round-trip for FSO discharge.
- FPU – highly unlikely as spread moored plus no or insufficient propulsion and impact on Class.
- Would an FPU expect to be disconnected at other than COP?
- **Therefore 'quick disconnect' spread moorings not a requirement.**
- From a technical standpoint, quick disconnect arrangement conventionally needs a central point for convergence of moorings and dynamic risers.
- BUT floating wind has same need for feasible disconnection, but on a **spread moored floater?**

Typical FPU

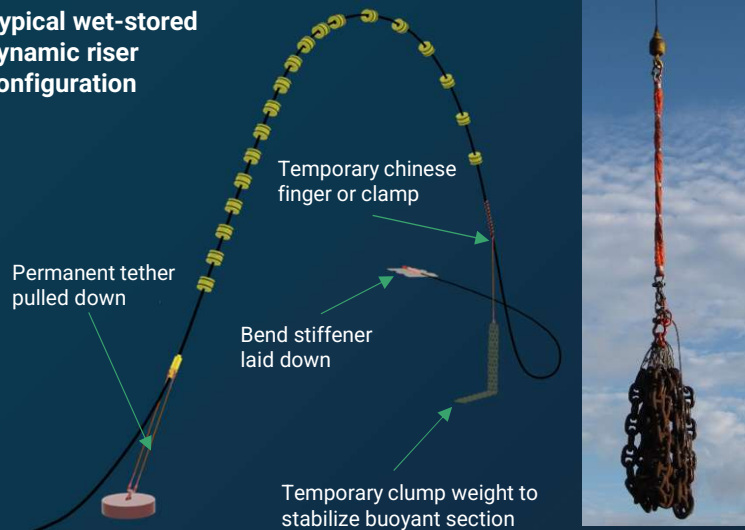


Scarborough FPSO (Credit Woodside Energy)

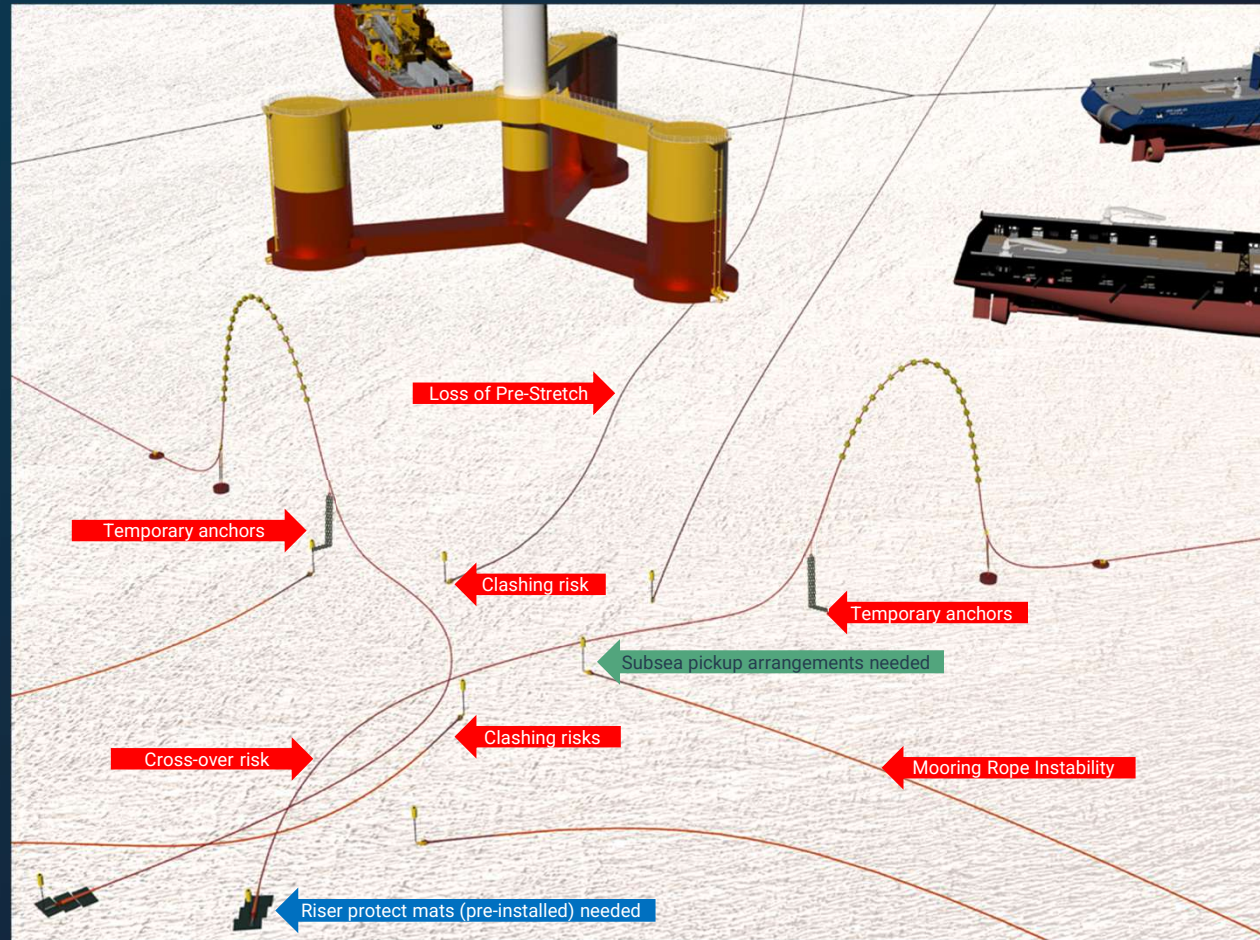
# The Current Plan – Wet-Storage.

Preparation for initial hook-up similar to an FPU.  
Cable wet-storage or post hook-up install.  
But for Tow-to-Port it is a full wet-store scenario.  
There is **no 'standard' method** of wet-storage.  
Bespoke and challenging especially when the dynamic riser and mooring design is frozen.

Typical wet-stored dynamic riser configuration



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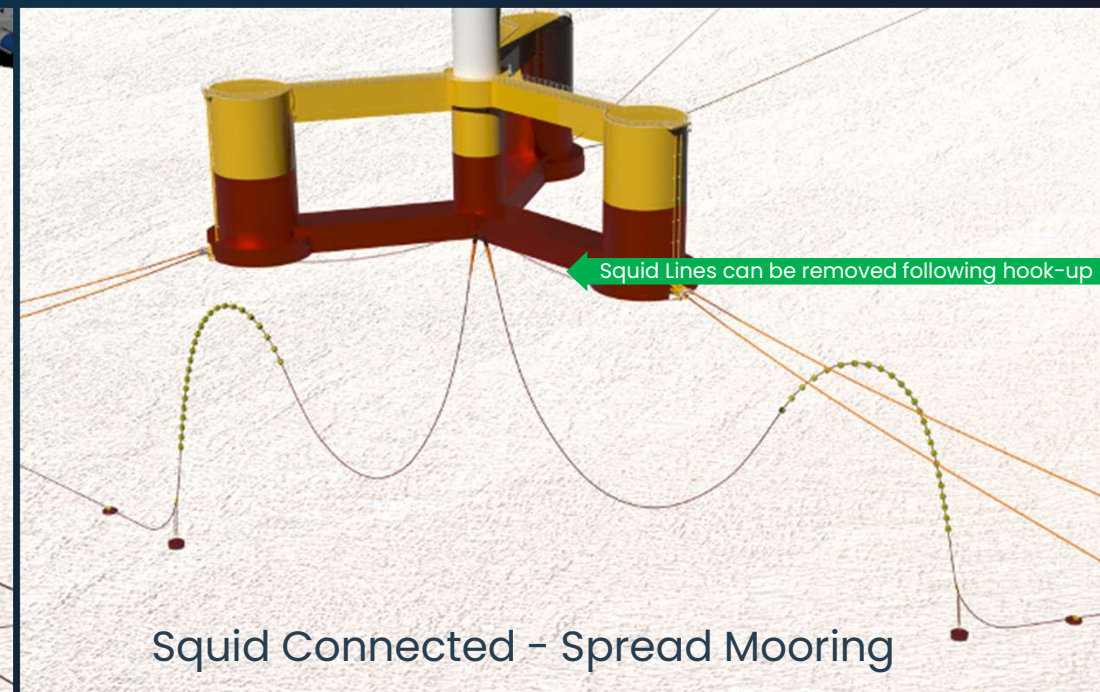
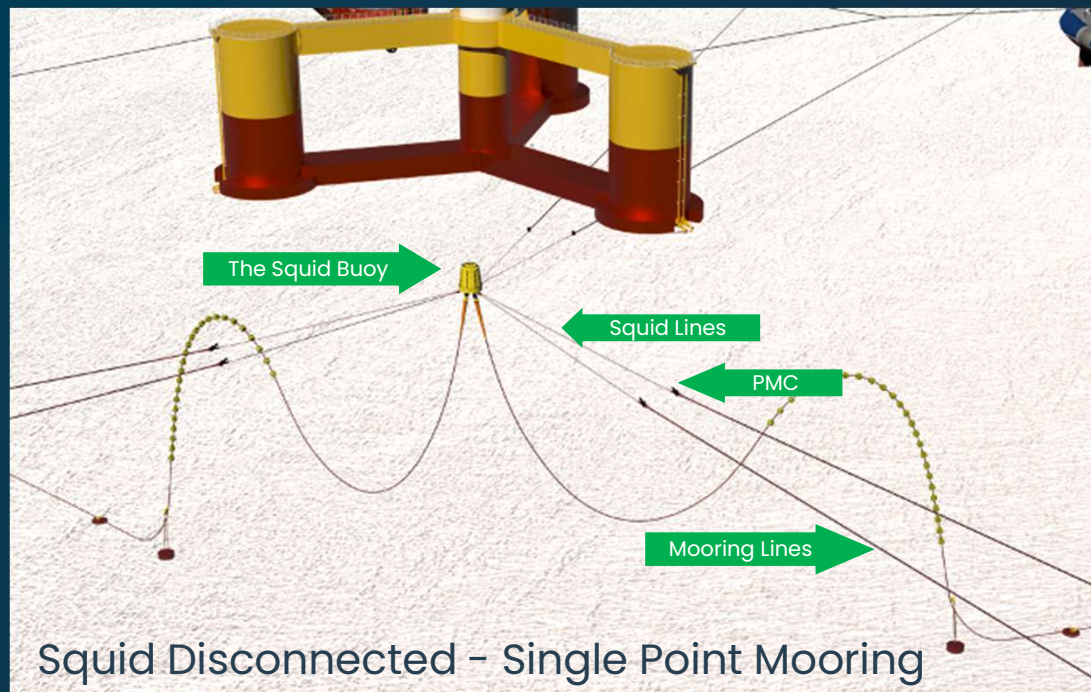


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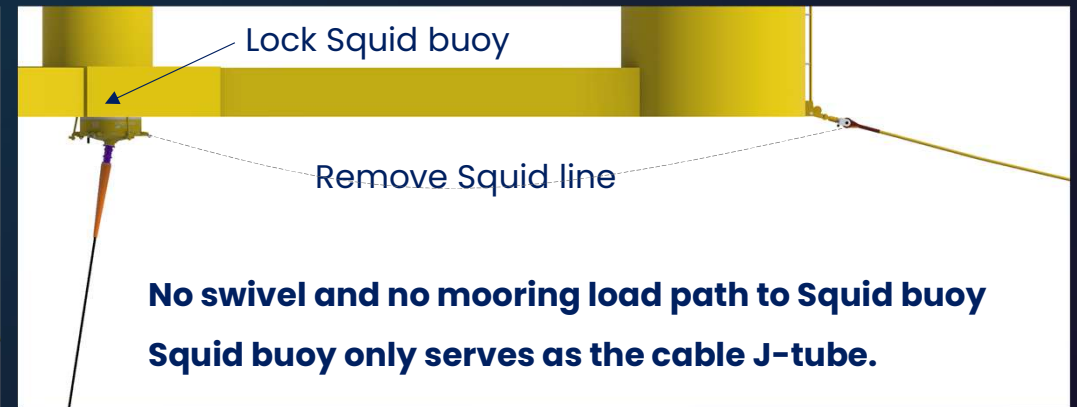
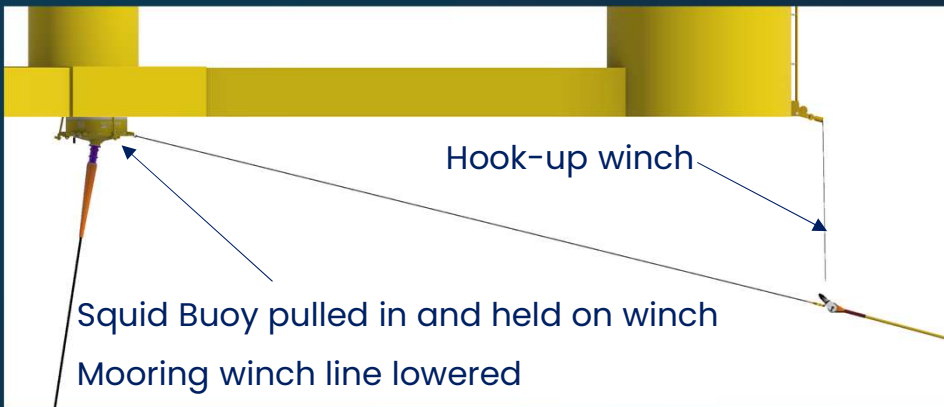
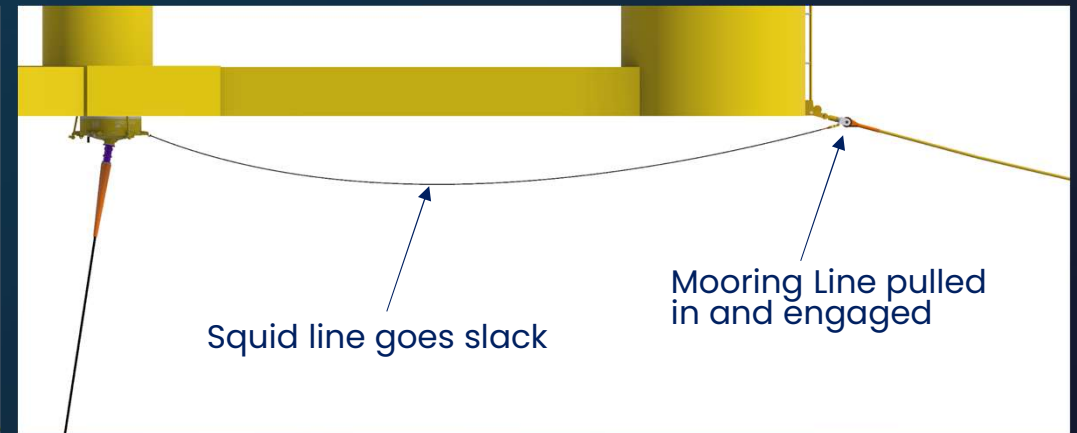
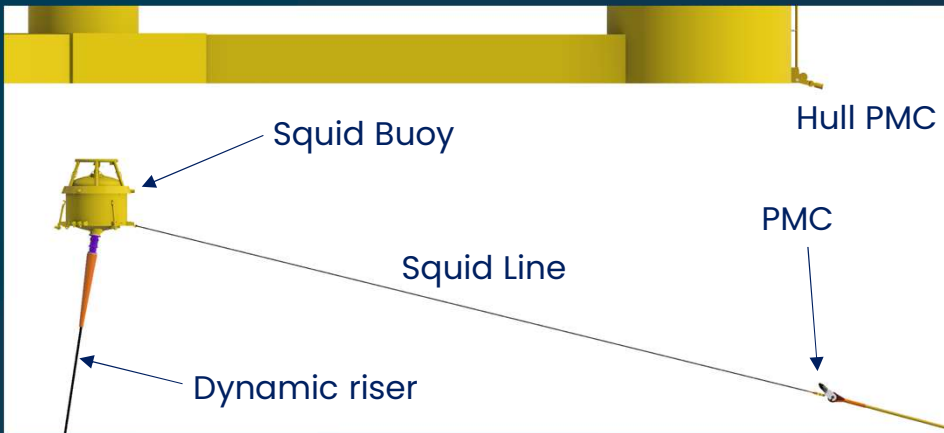
# The Squid™ Solution

- Squid is a buoyant J-tube – moored to and supporting the moorings.
- Squid enables full pre-installation plus connection of cable bend stiffeners to their J-tubes.
- Fast hook-up, disconnection and reconnection in higher sea states.
- Minimise cable system handling and connection/disconnection for FOWT



# How does Squid Work – Moorings?

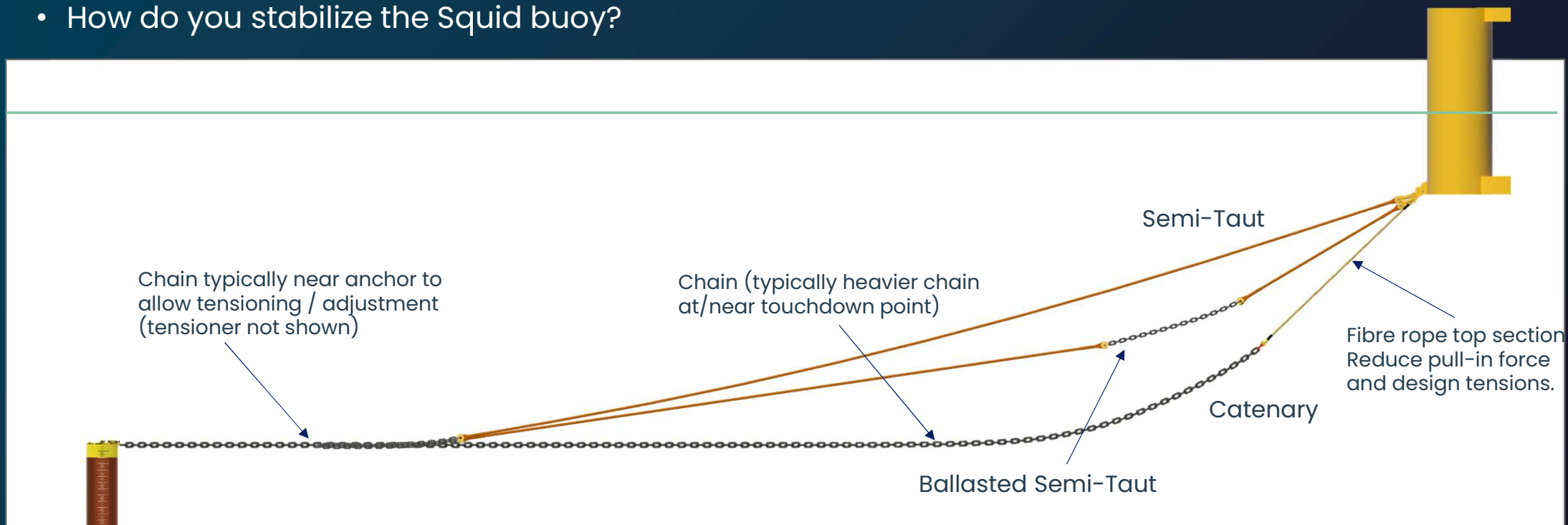
Moorings Hook-up – Disconnection is the reverse process.



# Squid Compatibility – Mooring

Squid can work with any mooring – but we now get asked the following questions ...

- Where do we put / when do we use a tensioner?
- How do we pull-in the mooring lines and at what tension?
- Can we avoid rope touchdown – if not what is the mitigation?
- How do you stabilize the Squid buoy?

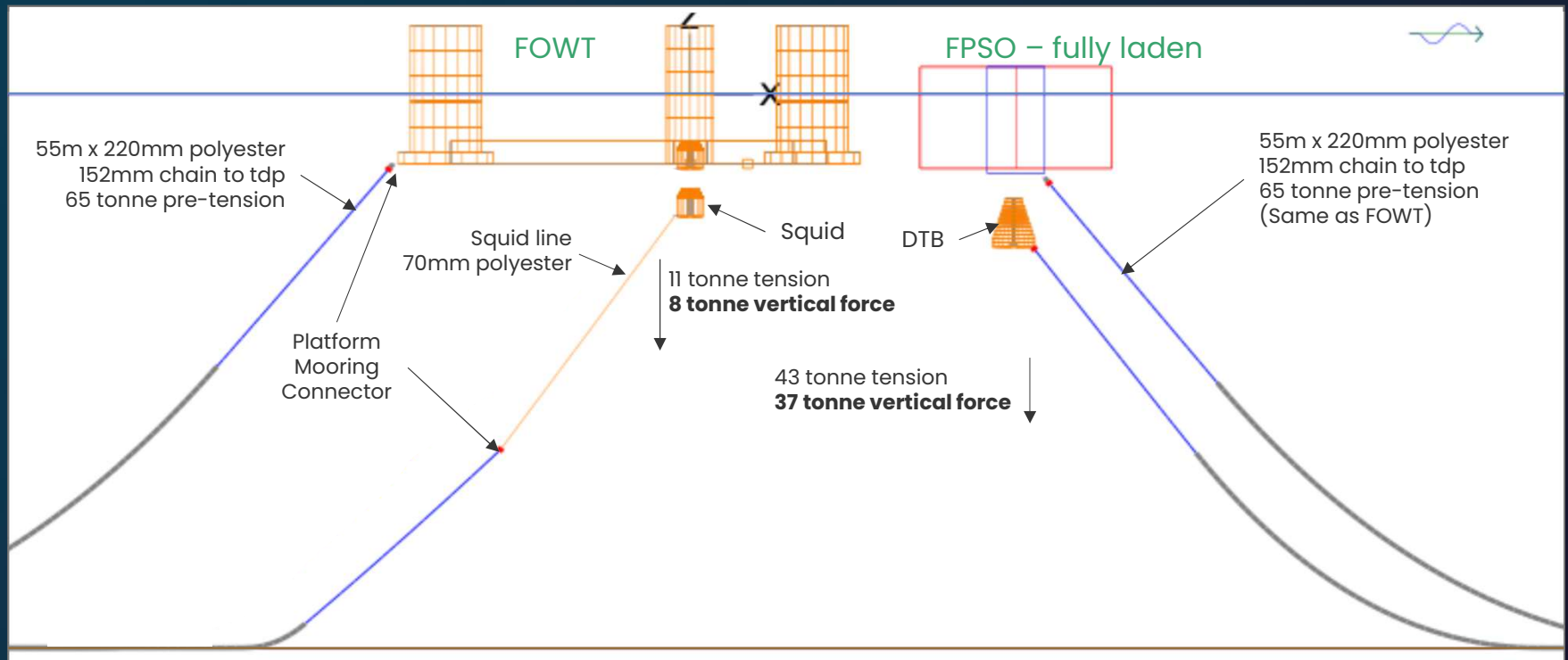


# Buoyancy Requirement – Moorings.

How does Squid buoyancy differ from a DTB?

Extra length of Squid line reduces the buoyancy requirement on the Squid by typically 20%.

Squid has no swivel and not in mooring load path when connected.



# Buoyancy Requirement – Risers.

Subsea weight of pull-heads, bend stiffeners, and cable tension, plus marine growth allowance.

Target minimum buoyancy will evolve/refine as design matures – same as DTB's!

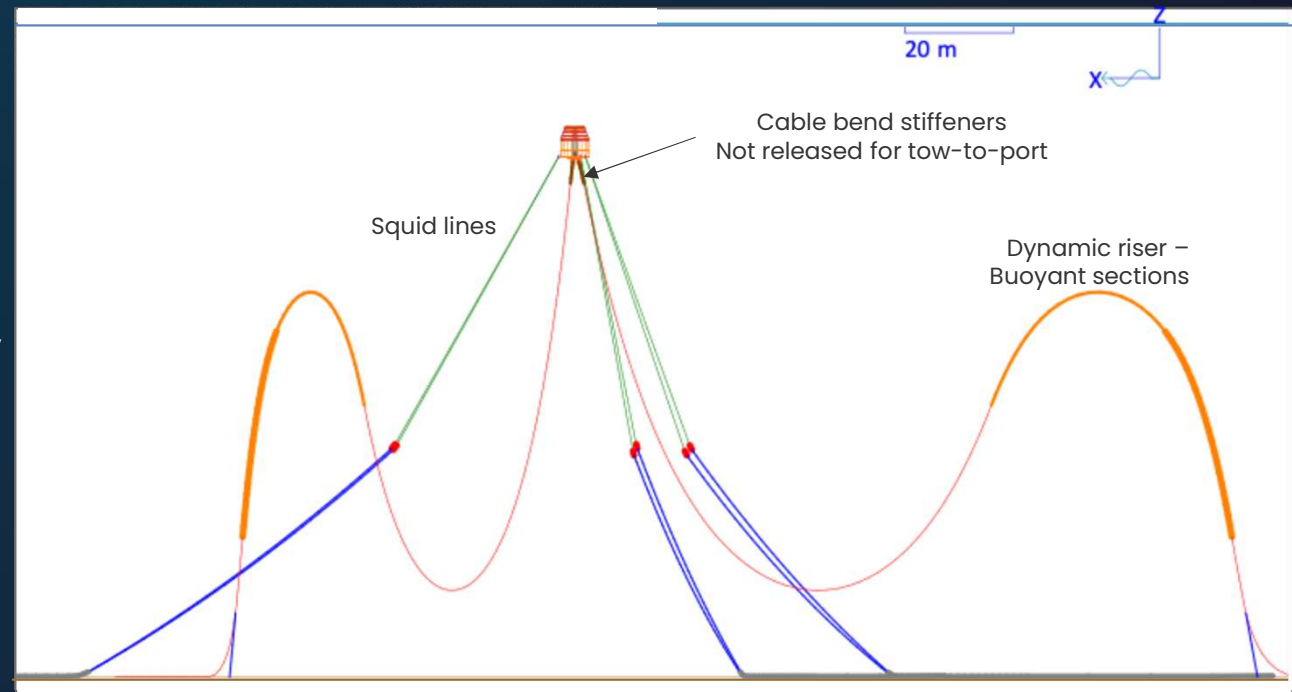
Unique to Floating Wind we will have different water depths across the field – design for worst to streamline buoy fabrication and ballast as required.

Then the balancing act of mooring & riser vertical loads vs buoyancy in the “Idle Motion Analysis”.

Adjustment of Squid line length gives flexibility to accommodate late design changes.

Vertical stiffness the key challenge for stability – use sinker chain under PMC's, vertically under buoy or temporary mooring line. All have been before!!

**This is the key design phase for Squid.**

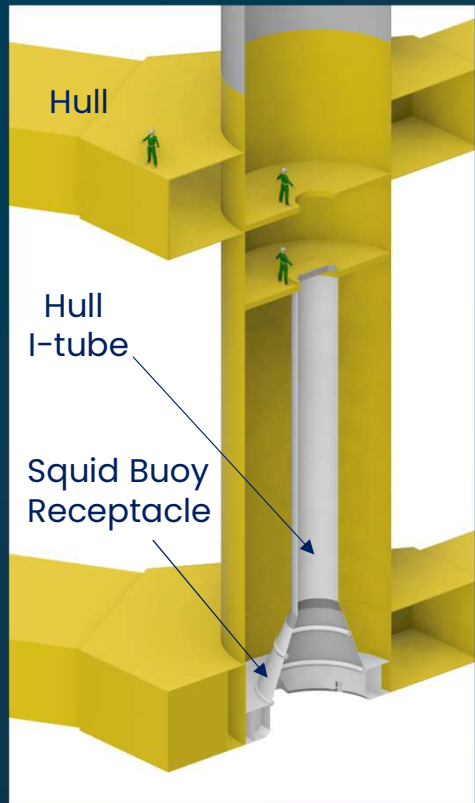


# How does Squid Work – Cable Handling?

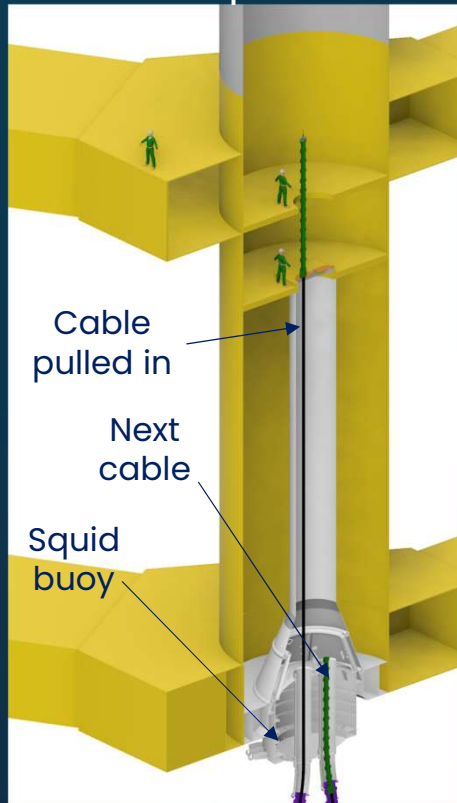
Whole power cable system is in Squid, and ready for short final pull.

Challenge for Squid is perception that a 'hole in the hull' is an issue and extra steel needed.

We therefore have to show the options and challenges that those face – ergo reason for Squid!



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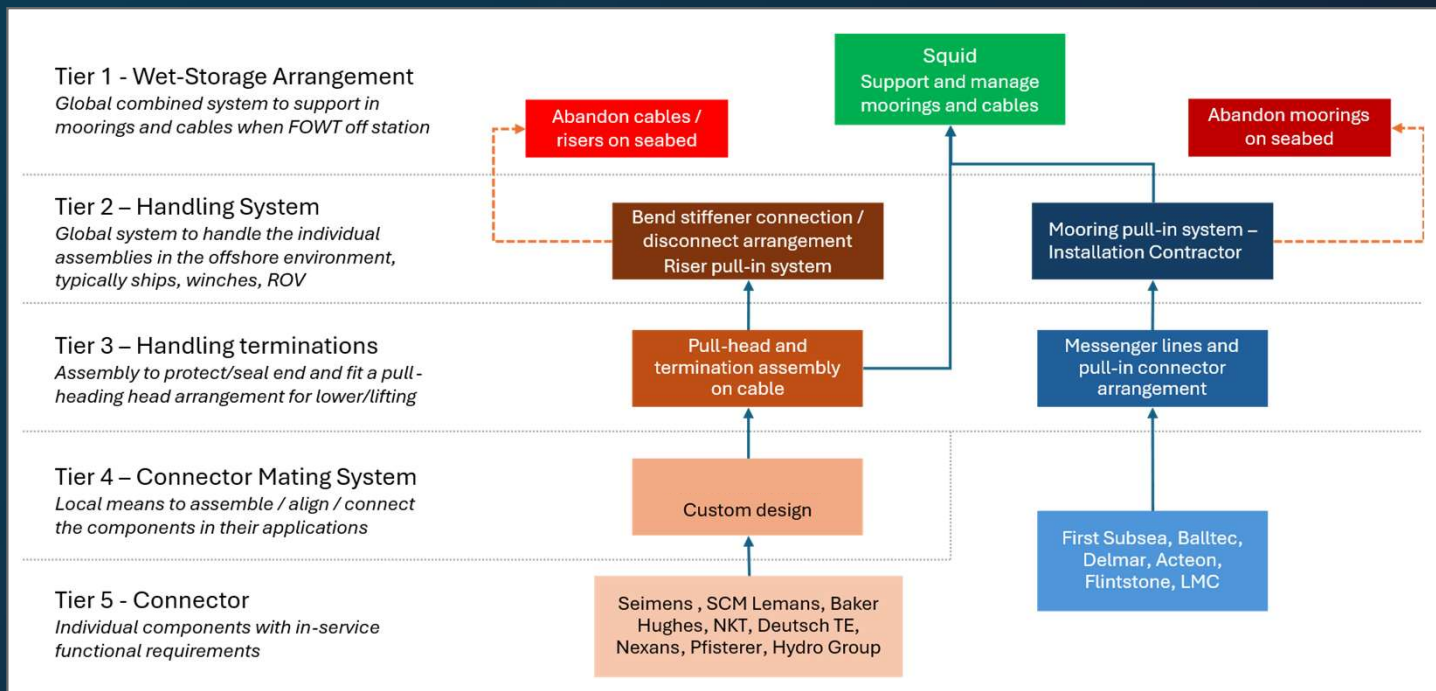
# Component or System?

Technical challenge is also a perception one.

Squid was too often termed a 'quick connector' in market / technology / innovation "assessments".

There's no one magic bullet, it's a system?

How do all the components fit together and work "in harmony"?

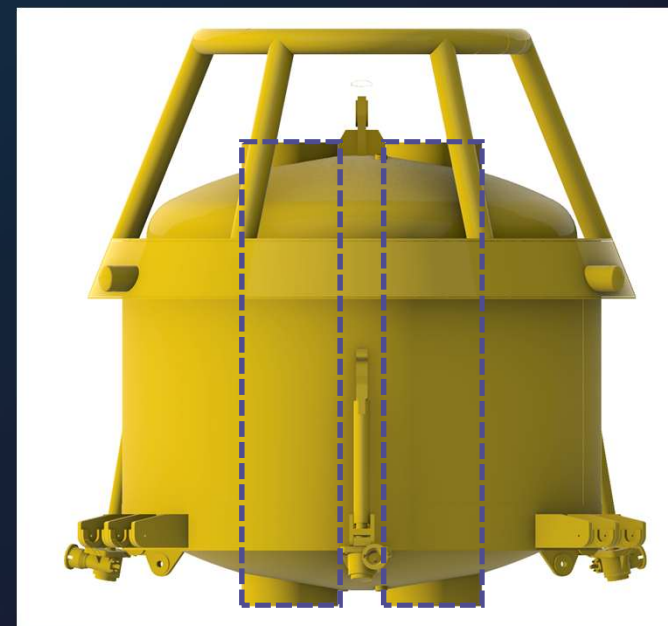


# Squid Buoy Design Philosophy

- Taken lessons from Oil & Gas, Squid has been developed with the 'product' approach.
- Maximising the standardisation, certified design approach and fabrication efficiency is key.
- Understanding how to adjust for different equipment / scenarios is vital with above boundaries.
- This is critical for the large-scale **commercial** fabrication need for offshore (not just floating) wind.

Key design challenges for the Squid were:

- Upper geometry to self-align into receptacle at different entry angles.
- Standard I-tube to fit largest pull-head, and I-tube forms part of structural strength and load path.
- Optimise Centre of Buoyancy/Gravity for motions.
- ROV operated permanent latching system, with multiple release options. Designed to support buoy under all conditions.
- Serial fabrication – simply the build must meet the functional needs?



# Squid Qualification / Development Status

- To legacy Oil & Gas – it's a smaller simplified DTB, to Floating wind – it's “new technology”
- By Q2 2026, Squid is scheduled to be fully qualified under ABS Rules.
- The trials will consist of:
  - Dry tests FAT, SIT, misalignment trials, test onshore to the design and operational geometry limits.
  - Wet-test pull-in and release of the Squid buoy into a barge in various configuration.
  - Objective to maximise the operational trials and tests possible at FULL SCALE.
- Imagery and details to follow but objective is to demonstrate Squid is ready to go.



ABS Product  
Design Approval  
(PDA)

*Imminent*

Squid build - now



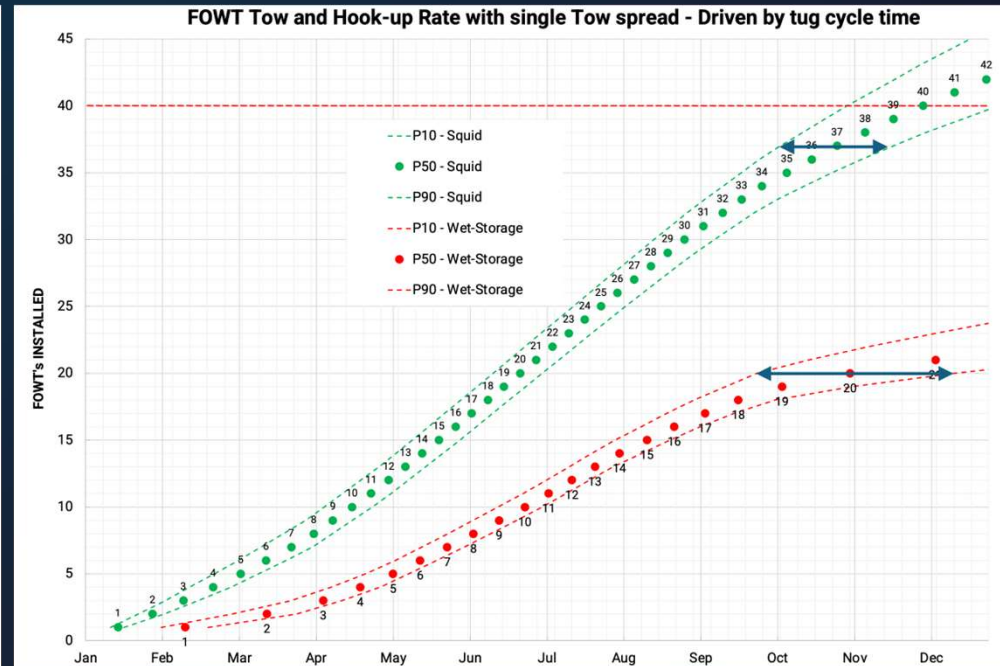
Full scale demo – Ardersier (June)



# Why Squid?



- Biggest challenge is to demonstrate why?
- To do so we had to 'build' a representative hull, moorings, dynamic riser.
- Then do a whole installation schedule for ALL phases.
- We then find we've done more detail than some wind farm have done!



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